# THE ROLE OF URBAN FORM IN SUSTAINABILITY- THE CASE STUDY OF A RIYADH CITY NEIGHBOURHOOD

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In the name of Allah, the merciful, the compassionate

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## Abstract

This study seeks to evaluate the current urban form of Riyadh for its performance in sustainability. As the Riyadh plan is based on a modular grid of square super block neighbourhood units (2x2km), which were designed by Doxiadis in the late 1960s, the study is conducted at the neighbourhood level, investigating the role of the urban neighbourhood in sustainability.

The city is perceived as a source of social and environmental problems, which are reflected in their urban forms, and sustainable development as a concept has rejuvenated discussions around the city's form. This research argues that, in a city of neighbourhoods like Riyadh, the sustainability of neighbourhoods is an essential part of urban sustainability. If a city's neighbourhoods are not sustainable, then that city as a whole will not be sustainable. This study investigates whether Riyadh has been able to achieve this level of sustainability through its neighbourhood-based urban form.

This study has adopted a qualitative case study approach to investigate a neighbourhood named Almoroj, examining it according to four main sustainable criteria (Compactness, Climate Related Design, Sustainable Transport, and Diversity) with eight sub-criteria (accessibility, density, thermal comfort, green spaces, variety of travel modes, streets design and connectivity, mixed land use, and variety of housing, demographics and social activities) that highly contribute to achieving a sustainable urban form.

The results show that Almoroj is not fully sustainable and self-contained, and some criteria contribute to sustainability more than the others. The scale and independence of a neighbourhood unit are important, but are not enough to generate a sustainable city. While the urban form by itself is a crucial part of the solution, people's behaviour is also another important factor in the achievement of urban sustainability.

# Table of Contents

## Chapter 4: Research Methodology



## Chapter 5: Neighbourhoods and Urban Form in Riyadh

## Chapter 6 : Compactness



## Chapter 7 : Climate Related Design



## Chapter 8 : Sustainable Transport



## Chapter 9 : Diversity

# List of Figures

## List of Tables

## Abbreviations

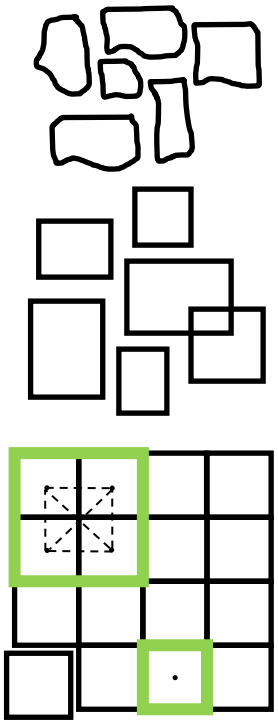
| | |
|---|---|
| **ADA:** | Arriyadh Development Authority and High Commission for the Development of Arriyadh |
| **MOMRA:** | Ministry of Municipal and Rural Affairs |
| **RM:** | Riyadh Municipality |
| **MEDSTAR:** | Metropolitan Development Strategy for Arriyadh |
| **Qiblah:** | Orientation towards Mecca |
| **KSA:** | Kingdom of Saudi Arabia |
| **Souq:** | Marketplace or Bazaar |
| **Almasjed:** | Mosque |
| **Imam:** | leader of prayers |
| **CCV:** | Community Class V |
| **TND:** | Traditional Neighbourhood Development |
| **TOD:** | Transit Oriented Development |

# Chapter 1: Introduction

## Contents

### Chapter 1: Introduction





## 1.1 Introduction

The main aim of this study is to examine the current urban form of Riyadh city in Saudi Arabia for its performance in social and environmental sustainability. As the Riyadh plan is based on a modular grid of square super block neighbourhood units (2x2km), designed by Doxiadis in the late 1960s, the study is conducted at the level of this neighbourhood scale, investigating the role of the urban neighbourhood in sustainability. Cities are perceived as a source of social and environmental problems, which are reflected in their urban forms (Newman and Kenworthy, 1989; Beatley and Manning, 1997; Haughton, 1999; Alberti et al. 2003), and sustainable development as a concept has rejuvenated discussions around urban forms (Jabareen, 2006). This thesis argues that in a city of neighbourhoods like Riyadh the sustainability of neighbourhoods is an essential part of urban sustainability. If a city's neighbourhoods are not sustainable, then that city as a whole will not be able to contribute to overall sustainability. This study therefore investigates whether Riyadh has been able to achieve this level of sustainability through its neighbourhood-based urban form or not.

This chapter presents an overview of the components of the research. The first section provides a definition of sustainability; it discusses the role of neighbourhoods in achieving sustainability. It also provides an overview of sustainable urban form design models and concepts. The second section presents a background to the research problems and urban issues in contemporary urban forms in Saudi Arabian cities. The third section covers the main research question, sub-questions and objectives, while the fourth describes the research strategy and approach. The organisation of the thesis is presented in the last section.

## 1.2 The Significance and Role of Neighbourhood Urban Forms in Sustainability

Sustainability is a significant element in modern urban design and planning of cities (Subeh and Al-Rawashdeh, 2012). According to the World Commission for Environment and Development (1987), a sustainable city is one that can meet the present generation's needs without jeopardizing the ability of future generations to fulfil their needs. However, making this definition operational and making it work in the actual situation of human settlements is much harder than would be expected. Despite the fact that sustainability is essential in the design of cities, it has not been granted adequate consideration in the development of neighbourhoods (Choguill, 2008). Sustainable neighbourhoods are perceived as essential elements of a sustainable city (Sharifi and

Murayama, 2013a). However, it is interesting to note that such findings are nothing new, as planners have been concerned about the sustainability of neighbourhoods for quite some time.

Madanipour (2001) asked how relevant the notion of 'planning by neighbourhoods' is today. He argued that the creation of urban neighbourhoods was a major consideration for urban planning and design in the past, but had been reduced in popularity following numerous criticisms focused on its social claims, such as the creation of communities. The quest to promote communities is, however, making a resurgence and is presently witnessed in political and social debates surrounding communitarianism and also in design proposals for sustainable urban neighbourhoods. Also referred to as "micro-urbanism" (Madanipour, 1996), this trend is aimed at promoting the design and developments that recreate smaller versions of the city in the form of small-scale and distinctive settlements and neighbourhoods. He (2001:176) significantly highlighted that:

> *"It may be said that the re-emergence of emphasis on neighbourhoods runs parallel to the rise of environmental awareness and search for sustainable urban form. The drive for sustainable urban development, therefore, appears to be promoting urban neighbourhoods and villages."*

Madanipour (2001:177), interestingly, wondered if there might be other reasons for the popularity of the return of the notion and promotion of the 'planning by neighbourhoods' trend, other than sustainability. Concluding that although it *"offers some obvious advantages…, it is by no means the only way of securing a sustainable urban form."* He also explains that planning by neighbourhoods *"can only be effective if accompanied by substantial investment in public transport and by structural changes in the urban development process, property markets and popular lifestyles"* (2001:178).

In discussing urban form and sustainability, issues of scale, therefore, become an important consideration. There is reason to argue that the neighbourhood remains an important setting for the experience of urban life and in the formulation of collective goals, action and communal support.

The majority of those who have studied sustainable communities agree that the degree of sustainability is relative to the geographical location of the community. For many, community is associated with a specific area. Perhaps that is the reason why the term neighbourhood has also

been used in association with a community confined to an urban area, which is usually measured in terms of accessibility for pedestrians (Barton, 2000). According to Barton (2000), the main notable aspects of neighbourhoods are as follows: firstly, neighbourhoods are often viewed by urban planners as, basically, a place for particular residential, commercial, civic, social and other essential daily functions; secondly, a neighbourhood has often been associated with specific memories, experiences and values for those who live in the local area and which are referred to as a sense of place; and lastly, neighbourhoods are often associated with a sense of community because of the varieties of human networks and relationships that form a community.

Within the context of the Western world, models of new urbanism that have been driven by examples of medieval European cities, with their typically low- to medium-rise structures and moderate densities, they have been elevated as a contrasting option to urban sprawl (Neuman, 2005). Different urban models, for example, the "Compact City" and "Neo-Traditional Neighbourhood", are often depicted as on a human-scale, functional, accessible by a variety of modes of transport, however these models should provide some open spaces that accommodate human needs without causing environmental damage (Haas, 2008). Recently, the most stimulating improvements in terms of the importance of neighbourhoods for planning and ecology have been related to the United States' 'new urbanism' movement. In their study on the impacts of urban sprawl, Duany et al. (2000) have put forth the case for compact, walkable, human-scale, and mixed-use neighbourhoods for building sustainable communities. One of the ideas connected to their work has been that of liveability and how individuals see social quality and the environment of a particular urban area.

Furthermore, it has been argued that the physical form of a neighbourhood is an important component in achieving social and environmental sustainability. Lynch (1981:47) defines the urban form as *"the spatial pattern of the large, inert, permanent physical objects in a city".* The urban form is composed of many elements which constitute an urban pattern. This urban pattern consists of undifferentiated types of elements that are repeated, and can be grouped conceptually: such as street patterns, public spaces, the layout of open spaces, parks, and block forms. One of the reasons why the urban form of cities is important is because it is seen as a major contributor to the high level of energy consumption, it also affects traveling behaviour, social integration, and consequently impacts the quality of air and soil in local open spaces, and the global climate (Cervero 1998).

The debate in Western countries about sustainable development in the area of urban planning and design mainly revolves around the idea of compact urban forms and it promotes the model of a compact city. Gauging progress toward such a desirable state of sustainability requires the aid of clear criteria so as to be able to assess urban efforts in the environmental, the technical, the social and the economic fields (Choguill, 2008). Adopting a human-scale model of urban form, which is relatively compact and diverse, dense and well-connected, along with a consideration of urban greening and climate sensitivity in the local context, should help to make a high quality sustainable urban form that is accessible and liveable, while also considering environmental protection (Haas, 2008; Neuman, 2005; Newman and Kenworthy, 1999; Jenks, et al., 1996; Grant, 2006). This type of urban form is more efficient and sustainable than any other type of development (Frey, 1999).

Nonetheless, while the important relations between urban density and a few parts of sustainability leave contradictory evidence (Neuman, 2005), the counter positions to minimized urbanism assert that higher densities could carry with them adverse conditions, for example, deficiencies in terms of building area, problems of traffic, social distress and an intensification of both air pollution and the impact of heat islands (Frey, 1999; Williams et al., 2010).

Significant measures related to the concept of sustainable development may incorporate absorbent urban blocks of generally small land plots, clear borders, in-depth analysis of municipal frameworks and transport administrations, and an urban outline that empowers a high level of social and financial interaction (Neuman, 2005). In addition, a variety of housing types and residences, attractive and friendly pedestrian streetscapes that improve local character, and a division of open spaces are important (Grant, 2006; Haas, 2008).

## 1.3 Issues in the Contemporary Urban Form of Saudi Arabia

Since the mid-twentieth century, towns in the Arabian world have started to lose their traditional physical characteristics and to embody modern forms. Radical changes in urban form have taken place in a way similar to these in many other developing countries. In Saudi Arabia and particularly Riyadh, the traditional urban form and the architectural style of housing have been

transformed into a modern style, and this represents replacement rather than adaptation. Historically, settlements were shaped according to needs to be harmonious with lifestyle and social life. Thus, local urban and architectural forms, which had responded to the physical and cultural requirements of the people, were neglected completely (Behsh, 1993). The spatial and physical characteristics of urban form and houses have changed; often they are not designed in harmony with Saudi social and environmental factors. Many social, cultural, and physical transformations have been led by modernization. Individuals' lifestyles have been changed as a result of leaving rural areas; and population increases in cities. However, the living habits that originated from cultural norms have not been easy to change (Ebn Saleh, 2002). In fact, this has caused certain challenges in urban development, as Western models are introduced without a particular relationship to the socio-cultural background and foundational principles of the traditional forms (Fathy, 1973; Al-Hathloul, 1981; Elaraby, 1996; Bianca, 2000; Al-Hemaidi, 2001; Eben Saleh, 2002).

Aina et al. (2013: 537) summarised the problems in the contemporary urban form of Saudi Arabia as follows:

> *"The contemporary urban pattern is mainly driven by economic considerations and formalized planning legislations. Urban development activities are evaluated mainly by economic efficiency and traffic considerations with the neglect of socio-cultural and environmental dimensions. The contemporary model of urban design encourages the extensive use of space and the fragmentation of functional spaces. In essence, the contemporary model contrasts the traditional model by being dynamic and mechanical while the traditional model is static and human in scale."*

According to Aina et al., (2013), the traditional urban models are not sufficient as a basis for the design of contemporary urban forms as the important variables in urban development are rapidly changing and it could be impracticable to conceptualize these changes according only to traditional concepts. However, the traditional urban form and its principles can still be learned from, and more efficient communities would be created if they were combined with modern technology and social values and lifestyles (Ebn Saleh, 2002). As stated by Liddell and Mackie (2002), sustainability principles that are applied to planning and design in Northern European cities tend to take on traditional forms.

The booming economy and increase in population have resulted in changes in the architecture of cities as well as in neighbouring areas to accommodate increasing numbers of people in cities.

The modern urban form is not in keeping with the local culture, traditions, and climate (Al-Hemaidi, 2001; Eben Saleh, 2002). In the Modernist style of architecture, functionalism and efficiency predominate, rather than cultural identity (Shiber, 1969). The influence of European and American lifestyles mean that the traditional urban fabric is no longer accepted, and the trend towards urbanization is preferred. For example, cars are not compatible with narrow alleyways, and traditional building elements such as courtyards are less acceptable (Hakky, 2012:155). Adolphe (2001) stated that the configuration of urban form affects the energy consumption of buildings and outdoor climate condition. While extremes in weather do not favour outdoor activities, this does not stop people from taking trips to the malls, shopping arcades or coffee shops in the evening but still, the green areas within Riyadh are not adequate and thus cannot contribute to environmental sustainability. Undoubtedly, Riyadh city's overreliance on the car coupled with the lack of alternate means of public transport, does not contribute positively to environmental sustainability. Instead of walking, the use of cars for travelling within the same neighbourhood for going to shops, schools, or mosques affects social sustainability (Al-Hemaidi, 2001). The pace at which life in the modern era is moving is proving to be a big hindrance to the sustainable development of neighbourhoods in Riyadh (Choguill, 2008).

After the discovery of oil, the Arabian–American Oil Company (ARAMCO) brought in a new type of housing to the eastern region of Saudi Arabia. The low density detached villa type (with a free standing structure) was introduced with new designs and new building materials and construction techniques. At present, the villa type has become the prevalent model built across the country, especially in Riyadh. Traditional dwellings were built with reference to the needs of the household, while the contemporary villa dwelling has been adapted according to municipal rules and regulations (Al-Hathloul, 1981). Thus, the basic ARAMCO design was perhaps more appropriate for western communities than in Saudi Arabia (Choguill, 2008). Moreover, new grid-iron urban structures were introduced and the outline of zoning was established to give neighbourhoods a new appearance (Eben Saleh, 2002). The city government developed the city by creating new neighbourhoods with very wide streets and low density rise buildings along them with no sense of urban communities, but rather with high congestion and traffic levels (Alhemaidi, 2001). According to Elaraby (1996), the recently adopted fusion of Western styles and characteristics in the design of many Islamic cities has had a negative impact on their urban spatial environments.

Many concerns about sustainability issues arise from the contributions of foreign architects, urban designers and planners to the growth of these urban areas and communities. They may lack suitable knowledge of the local culture and traditions, especially with regard to social and environmental performance. Local architects and planners were not trained enough in how to translate their knowledge into urban and architectural design; however, they had better knowledge than outsiders of local habits and culture.

At present, excessive use of automobiles, fossil fuels, and air conditioning have resulted in increasing the domestic use of energy (Almatawa et al., 2012). It has been said that Saudi Arabia is consuming about one-third of its total oil production, as the buildings are consuming about thirty percent of total domestic use (Alabadi, 2012). Water production is dependent on desalination by utilizing fossil energy; however, energy demand is largely influenced by the higher water demand (Siddiqi, 2011). High energy consumption and wastage of water leads to greater air and noise pollution in almost every city in Saudi Arabia (Alshuwaikhat and Aina, 2006). Nevertheless, immense growth in awareness of the importance of sustainable water and energy consumption has occurred in the Kingdom of Saudi Arabia (Elgendy, 2011; Taleb and Sharples, 2011; Almatawa, 2012), for in the future, this situation could be extremely threatening, unless each member of the community plays their part to avoid energy-dependent lifestyles.

The successful course of the environmental and economic growth of Western countries has encouraged many Asian and Middle Eastern countries to adopt the same patterns for their sustainable development. According to the general perception, urbanization is said to be an essential element in the development process as an inevitable feature in the creation of a modern state (McGhee, 2009). Many cities in the Middle East region are trying very hard to continue sustainable growth patterns in order to meet the requirements of fighting global climate change. They have adopted effective strategies to tackle the huge urbanization pressure because of rapid increase in population and expansion in the size of cities as well (Subeh et al., 2012). Elgendy (2010) and Mills et al. (2012) have highlighted the recent ambition of many Middle Eastern countries to launch government initiatives that will adopt urban sustainability to improve the quality of the built environment.

It is thus necessary to critically review the importance and impact of the new urban form on environmental and social performance, and more explicit sustainable criteria should be developed to make this evaluation possible. Sustainable neighbourhoods should be considered as an

essential feature for the development of urban communities everywhere. As has already been highlighted, the neighbourhood remains an important urban concept for the lives of many people, particularly for families. The problem is the need for a combination of the traditional social, cultural, and environmental paradigm, the development of modern technological progress, and sustainable design concepts to achieve a sustainable urban form. Therefore, it is felt that there are many gaps regarding the better understanding of sustainable urban solutions in the new urban form of the neighbourhoods and architectural housing forms in the Saudi urban context. It is not that Western methods or styles are simply rejected, but rather that some practice of integration should be attempted, based on local values, and context, and the success of modernization should then be evaluated. Hence, there is a need to evaluate the current urban form and the architectural characteristics of the city of Riyadh regarding its actual sustainability.

## 1.4 Urban Sustainability and the Importance of Understanding the Cultural Context

Urban planning researchers (e.g. Aina, 2005 and Choguill, 2008) have highlighted the importance of the infrastructural challenges of the move towards urban sustainability, emphasising the significance and need to consider the changes in life style and culture of the targeted residents for the achievement of sustainable development.

As many Middle Eastern states are taking the lead within the developing nations to promote more environmentally-friendly sustainable projects, Al-Hemaidi (2001) noted that some of the adopted sustainable projects in Saudi Arabia are raising critical challenges for the government to bring the required changes in the overall behaviour and attitude of people towards more sustainable urban designs in the affected areas.

The argument raised here is that the practical implementation of the fundamental principles of sustainability are compulsory, but they are not the only keys for a successful sustainable growth. It is therefore important to acknowledge that like all other countries worldwide, sustainable development is very much dependent on many physical and non-physical factors, and both are equally important and can be applied to any sustainable plan. The most common examples of the physical are the environmental, ecological and geographical factors, while the non-physical features include the various traditions, religious, cultural, social and historical aspects of the affected people in the place.

It can also be said that there is a demand for specific urban and architectural designs that can best fit the place and people of the Middle East region, considering the climate and cultural identity of the society. Islamic friendly styles, for example, should be incorporated and applied in basic design and planning solutions in the development of a new and sustainable urban plan or project. However, it is worth highlighting here that religion alone is not the only factor for consideration, as other regional and national social and cultural trends also play a significant role in this matter. It has been argued that these factors simultaneously create and reshape the modes of society by involving the social features of art and architecture. This is the case because culture plays the most significant role in shaping the way human beings interact with each other (Zahadi, 2012). Nevertheless, according to Chiu (2004), social and cultural sustainability overlap substantially and are often inseparable, hence they are generally studied together.

Despite the complications associated with the definition of the term culture, the identification of the common cultural aspects of a society is considered vital in understanding the mechanisms of how it works (Baumann, 2006; and Ali, 2009). Culture, according to Almarshad (2011), is a crucial player in influencing the effectiveness of the economic and political structure, particularly in the developing world. However, it is important to consider here that the culture of any society is subject to constant changes, and can in turn be affected by the ever-changing economic and political conditions.

According to Helmi (2015), although the discovery of oil and the financial growth of its revenues have boosted the Saudi economy, they have also caused a variety of social and urban complexities, *namely "the newfound wealth propelled capitalist practices such as rampant materialism"*. Thus, in the last century or so *"Saudi culture has changed from a nomadic harsh lifestyle – a simple and austere way of life well-integrated culture – into an urbane, complex, flourishing and urbanised society"* (Helmi, 2015: 147). It is clear to see how these transformations have been challenging the strong traditions derived from Arab culture and Islamic teachings in many ways. In most Saudi cities, Mandeli (2011, 158), also argued that:

> *"Redevelopment as a strategy for the central area has not only imposed spatial forms that encourage the creation of free-standing buildings and thus changed the character of the urban fabric, but has also encouraged the tendency towards individualism and segregation. This in turn has resulted in the commodification and homogenization of public space and reduced its significance as a facilitator of sociability"*

As in many developing cities, the invitation and implication of Western planners and urban planning regulations have had profound impact on the traditionally built environments and social life in Saudi's large cities. The effect of such modernising urban developments is observable in many urban social and cultural aspects, including in the public use of outdoor places and spaces, the relationship between neighbouring residents, and the isolation of where they live according to a set of different income-classes (Salagoor, 1990; Adas, 2001; Eben Saleh, 2002; Garba, 2004; Ali, 2009; Helmi, 2015). One further significant impact on the culture of Saudi society is the effect of inflow of immigration and migration to large cities, especially in the capital Riyadh, which has become a hub for different cultures. According to Helmi (2015: 151), these *"new sub-cultures have had an impact on the Saudi lifestyle, as evidenced by changing clothing fashions, increases in the value and level of education and awareness, and changes to the ethnicity of the Saudi society."* However, the Saudi society is still very much aligned with the Islamic Law, in most of its political and economic policies and laws, as well as in its cultural and social values that determine the behaviour and attitudes of people and how they interact and use space. For example, the consumption of alcohol is prohibited in all Saudi's public or private places.

It is also true that the social and cultural structure in Saudi is very strongly enforcing and oriented around the family, *"a force which continues to shape public and private architectural and urban space"* (Middleton, 2009: 83). Nevertheless, there has been a change in the modern structure of families in the Saudi society, from extended to nuclear families. After marriage the younger generation now favours living independently as opposed to together with the traditional extended family (Bokhari, 1978; Al-Omari, 1984; Altorki, 1991). However, according to Adas (2001), this does not compromise the levels of social and economic support that the new members of the established nuclear family receive. Moreover, the impact of advanced communication technologies play a vital role in changing the way modern family members physically and socially interact and frequently gather with the extended families (Ali, 2009).

In outside places, women in Saudi are obliged by Islamic rules, to cover up their body by wear a dressing veil called the Hijab. In both public and private environments, Islamic teachings influence the segregation and privacy between women and men, unless they share the connection of marriage or blood relationship (a Muhram). Apart from in this instance, openly mixed contact in public is not permissible by Saudi Islamic and cultural values (Kattan, 1991). Thus, in most public and private places, including mosques, restaurants, and community centres for example,

there are dedicated separate sections for women. In addition, by law it is prohibited for women to drive cars, ride a bicycle or travel a long distance without a Muhram.

Nonetheless, with the advancement of the Saudi economy, which have helped to enhance the living standards of the Saudi society, many female residents, particularly in big cities, have benefitted from many economic, social and educational improvements, all of which have changed the general attitudes towards women's contribution to the society and urban life.

Middle-class people, particularly women, prefer to use the most popular parks, open spaces, and shopping centres at the city scale, seemingly because of the quality of these places. Having a driver and servants has become a social norm among this segment of the society, and this has given them easier access to distant places, not only in their neighbourhoods. Moreover, due to the affordable spacious lots and houses and private facilities for the majority of the high-income residents, the use of open public places and spaces is limited due to the belief that they have their own eternal open space. However, for the less fortunate low-income families, as women are forbidden to drive in Saudi, they have limited mobility options to frequently visit the aforementioned distant public places beyond the boundaries of their houses. Hence, many of these people are found actively involved in using the nearby open public places and spaces.

Walking in public is generally undesirable for the majority of Saudi people, not only because of the harsh climate or weak urban design qualities, but also due to cultural influences, particularly for women, who if they walk or sit in the street, for example, without wearing a Hijab and in the company of a Mahrum, will most likely be subjected to negative condemnations from the major conservative public community. The majority of the created pedestrian sidewalks for walking are therefore deserted.

## 1.5 Research Aim, Questions and Objectives

The main aim of the research is to evaluate the current urban form of Riyadh city for its performance in social and environmental sustainability. This aim is supported by the following research objectives:

1. To identify the criteria of sustainable urban form
2. To investigate the urban form of Riyadh and its evolution

3. To examine the urban form of Riyadh according to the identified sustainable criteria to find out if Riyadh's urban form is sustainable.

The main research question is: *How sustainable is the current urban form of Riyadh?* This question is developed into a number of sub-questions:

1. What criteria and methods for sustainable urban form can be used to analyse the current urban form of Riyadh city?
2. What are the main characteristics of Riyadh urban form today and how have they been developed?
3. To what extent is Riyadh's urban form sustainable, according to the developed criteria and methods?

## 1.6 Research Strategy and Approach

Due to the fact that Riyadh was primarily planned with an urban form as a city of replicated neighbourhood units, the focus of this study is therefore the investigation of one neighbourhood unit. A selective case study approach has therefore been chosen with qualitative research methodologies mainly utilized in this study. However, a basic quantitative method was used to investigate the urban context and its services.

This research strategy is used to understand the urban form under investigation and to answer the aforementioned research questions on sustainability. The sustainability criteria developed for this research are to be based on the literature on the principles of sustainable urban form.

In the selected neighbourhood case study, the framework of investigation includes processes of the design, development, and use of the neighbourhood. The research methods used to understand the historical and social factors include interviews, observations, the analysis of archival documents, secondary data analysis and literature review, and a basic analysis of the urban character of the selected neighbourhood.

## 1.7 Organization of the Research

This research is divided into ten chapters. Following this first introduction chapter, subsequent chapters as follows:

**Chapters 2 and 3** form the study's literature review. **Chapter 2** is divided into two sections discussing the traditional urban form in Islamic Arab cities, and the theory of the modern urban form of Doxiadis, the Greek planner who planned the modern Riyadh's urban form. This includes the Ekistics science of human settlements, the Dynoplis model, and the Modulus, on which the Riyadh master plan was based. **Chapter 3** presents a literature review on the various approaches to achieving sustainable urban forms. Neighbourhood unit theory, the compact city concept, and the New Urbanism approach are covered in this chapter. Some design concepts and the criteria used in this thesis for sustainable urban forms are discussed in further detail.

**Chapter 4** deals with the research approach and methodology used. It describes the data collection methods analysed and how they were designed in relation to the research objectives. Each research method is then clarified, including the analysis of archive documents and secondary data, interviews, urban space analysis and direct observation. The selection of the field of study and the survey in Riyadh city are also explained and justified.

**Chapter 5** presents the findings from the archive documents of Doxiadis and secondary data of some sources related to Riyadh urban studies. This chapter provides an overview of the urban forms in Riyadh that include the old Riyadh, the traditional neighbourhood, and the first modern neighbourhood. Then, it discusses in details the Doxiadis master plan of Riyadh and the Modulus (2x2km) and the changes undertaken by Riyadh Municipality.

**Chapters 6, 7, 8, and 9** present the analysis of data concerning the urban form of the Almoroj case study neighbourhood that was collected during the fieldwork. Each chapter consists of a main subject matter related to one of the four sustainability criteria adopted concerning compactness, climate related design, sustainable transport, and diversity. Each criterion is further broken down into two sub-criteria, which are then defined and analysed in terms of stages of design, development, and usage in Almoroj. Finally, each of these chapters contains a discussion that covers the two sub-criteria.

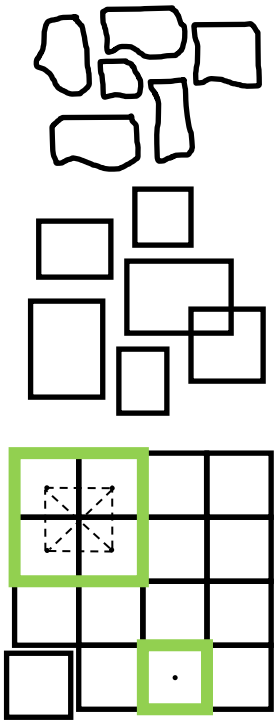
**Chapter 10** the concluding chapter, summarises the key findings from the previous chapters. It also highlights the significance of the research and its limitations. Finally, it gives general recommendations and suggestions for future research.

# Chapter 2: Literature Review (Part 1)

## Contents

### Chapter 2: Literature Review (Part 1)





## 2.1 Introduction

This chapter reviews the relevant literature to provide a theoretical foundation to understand the traditional and modern urban forms and concepts which have shaped Riyadh city in Saudi Arabia. The chapter is divided into two sections. The first gives a brief overview of traditional urban forms in Islamic Arab cities, looking at key elements in their design and trying to understand what sustainable aspects have been developed previously in this part of the world. This provides an understanding of how local needs were addressed in this urban built environment and how it responded to its local climate, considering the urban and architectural features as well as natural sources that were used. Most importantly, how the urban form related to cultural and social issues is discussed. The second section reviews the theory of human settlement of Doxiadis. Studying the concepts behind his master plan for Riyadh city, based on Ekistics theory and the Dynaplois and the dynamic concept of Modulus helps in explaining the emergence of the current urban form of Riyadh city.

## 2.2 Traditional Urban Forms in Islamic Arab Cities

Western influence arising from the colonization of Arab countries and other external influences such as globalization and rapid modernization have contributed to the transformation and internationalization of Arab cultures (Kiet, 2010; Miller et al., 2010). In turn, the transformation and internationalization of Arab cultures have resulted in the emergence of new planning and ideologies that have affected the patterns of urban spaces and cities. In contrast to modern Arab cities, which have been influenced by external factors such as Western imperialism, historical Arab cities demonstrated distinct forms and growth patterns largely influenced by common sets of geographic, social, and religious factors.

### *2.2.1 Design Principles of the Historic Arab Cities*

Rafik Ibrahim (2015:1) demonstrated that various elements, including religious and cultural beliefs, Islamic law (Sharia), and social factors such as divisions in the social hierarchy, were key influential forces inspiring the spatial development and design of historic Arab cities. Ibrahim (2015:1) stated further that other factors such as the religious importance of some places, the locations of existing trade routes and the availability of important natural resources such as water also played an important role in the development and design of Arab cities. Roberts (1979:27) and Singerman and Amar (2006:15) also reported similar findings

concerning the elements that influenced Arab cities. This section examines some of the key influential factors or forces that inspired the design of Arab cities.

**Religious and Cultural Beliefs**

Most Arab cities, as demonstrated by Ibrahim (2015), were guided by the social and cultural order of the Islamic religion. In particular, religious beliefs, values, and practices, particularly those relating to authority and organization, emphasized social gatherings while discouraging dispersion and nomadism (Saoud et al., 2002:2). Increased social concentration, on the other hand, resulted in the emergence of early Muslim towns and cities such as Rabat, Tunis, and Al-Fustat. Mosques took central positions because religion was the most dominant factor in society, meaning that they were mainly erected in the central parts of most cities as shown in Figure 2-1.

As seen in figure 2-1, the main land use focused on multi-functional core structures consisting of different layers of interconnected marketplaces (‘*souks’)* that enveloped or partially surrounded the central mosque. Starting with a large Mosque at the centre of the city, other social structures including civic and educational buildings, residential houses, and markets were integrated to provide a distinct form in most Muslim Arab cities. It is believed that the traditional urban forms demonstrated mixed land use and compact urban form. There were also environmentally friendly, being based on a human scale and therefore walkable.

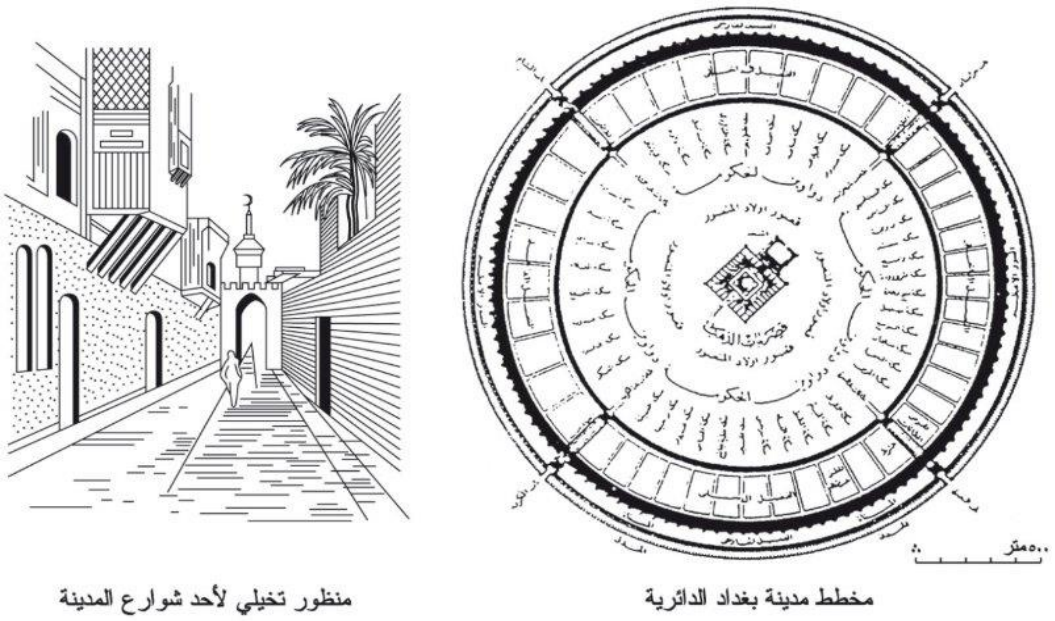



**Figure 2-1: Muslim Arab city with a large Mosque at the centre**
(Source: Ibrahim, 2015)

**Islamic Law**

As demonstrated by various researchers including Bianca (2000:137) and Hakim (1986:13), Islamic law also had a significant impact on the development and design of Muslim Arab cities. Ibrahim (2015) demonstrated that Islamic law concerning inheritance and the privacy principle mainly influenced the manifestations of residential units within the cities. In particular, residential units were influenced by a system of subdivision further contributing to the complexity of the urban form. The fragmentation of residential units into smaller parts resulted in the addition of new but distinct components, such as staircases, corridors, windows, and doors. Figures 2-2 and 2-3 show examples of common window features in Muslim towns.

These design patterns were particularly common in more densely populated neighbourhoods, as windows and apertures facing the outside world were strategically positioned above the eye-level, using semi-transparent or opaque materials such as slabs and blocks, In line with Islamic law, the design of housing features such as windows and other apertures was to be conducted in a manner that complied with the requirements of privacy without compromising their designated or intended functions.

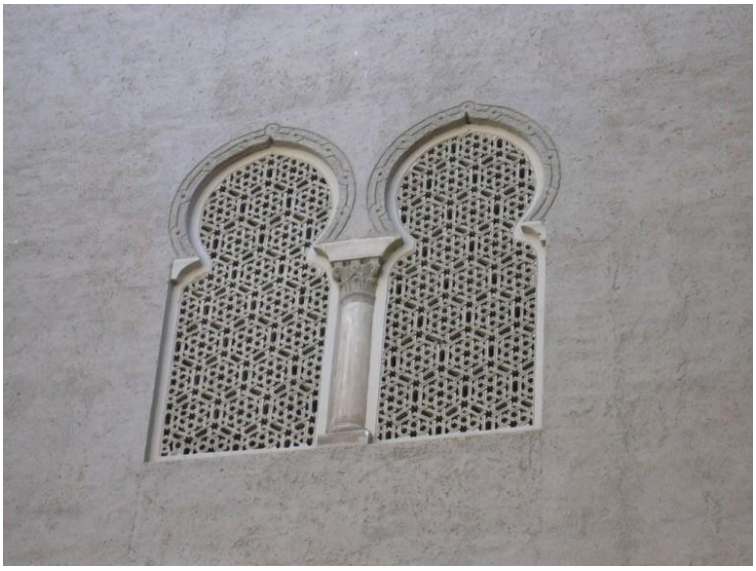


**Figure 2-2: Traditional Muslim window**

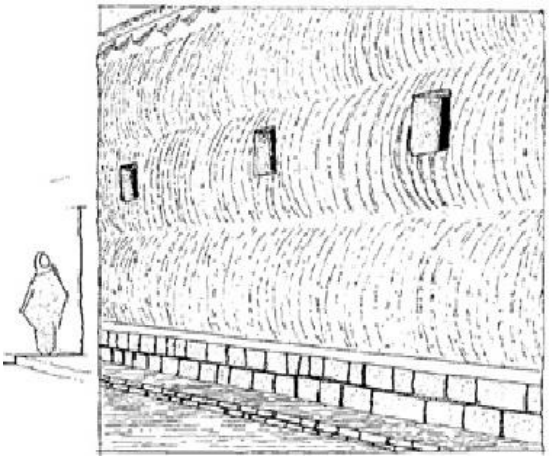
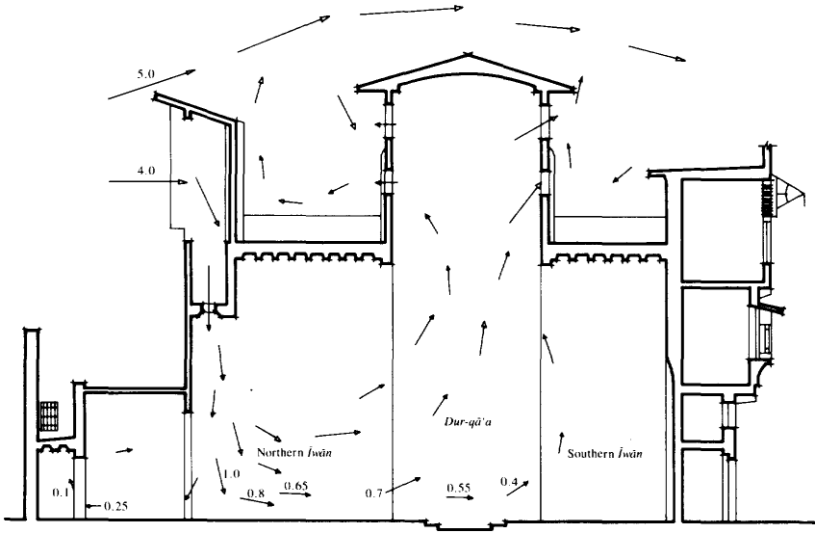


**Figure 2-3: Small windows constructed above eye level**

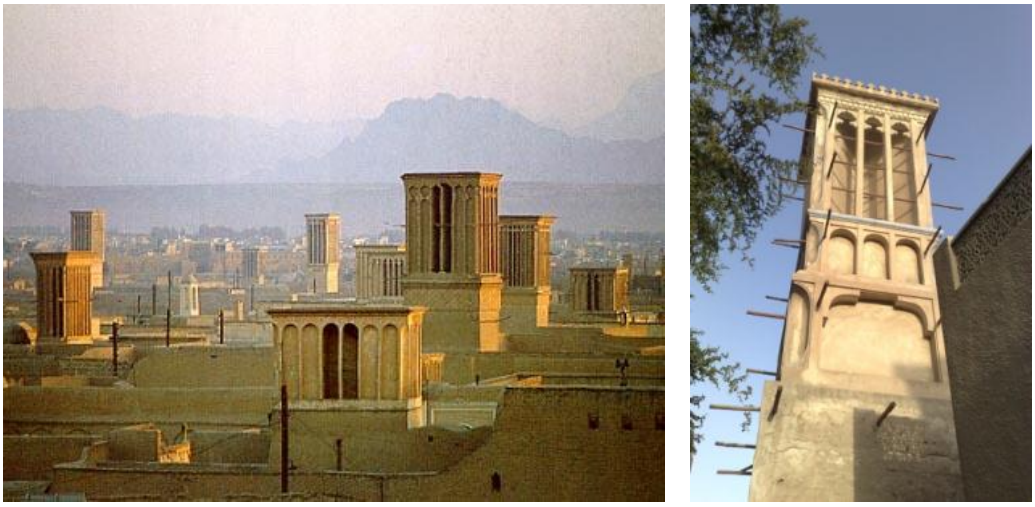
(Source: Alshleby,2015)

### Natural Context and Climate Related Designs

Most researchers agree that natural circumstances, especially those expressed in topography and weather conditions, were among the most important elements that influenced the design of historic Arab cities (Saoud et al., 2002; Ibrahim, 2005). In particular, the planning and design of most Muslim cities integrated the potential effects of these natural circumstances and the needs of people. For instance, various structures such as courtyards, gardens, narrow covered streets, and terraces were added to the designs of houses and buildings in most cities in order to cope with the hot weather that dominates Muslim environments (Saoud et al., 2002:4). Muslim architecture could also enhance natural ventilation by incorporating wind catchers into their designs as demonstrated in Figure 2.4. As demonstrated, the Malqaf (wind catcher) allows cool air to flow through the house in order to reduce its overall temperature.




(a)



**(b)**

**Figure 2-4: Malqaf (wind catcher), a design in Islamic architecture used for ventilating buildings. For example, the *qaah* of Muhib Ad-Din, Cairo (a). Wind Catchers: on the left is Yazd city, Iran, and on the right is Bastikia, Dubai (b).**

(Source: El-Shorbagy ,2010 )

**Figure 2-5: Aerial view of the courtyard of the Zaytuna Mosque**

(Source: Ibrahim, 2015)

Figure 2-6 shows an example of how Muslim architecture could incorporate structures such as courtyards in residential, religious, and other building designs. The benefits of these structures, as highlighted by Ibrahim (2015), could go beyond aesthetic considerations to include providing better ventilation and cooling effects in the prevailing hot weather in most Arab regions. In addition, as depicted in Figure 2-6, each house would also have courtyards to help enhance privacy of the family's social activities while also enhancing cooling effects in hot weather.

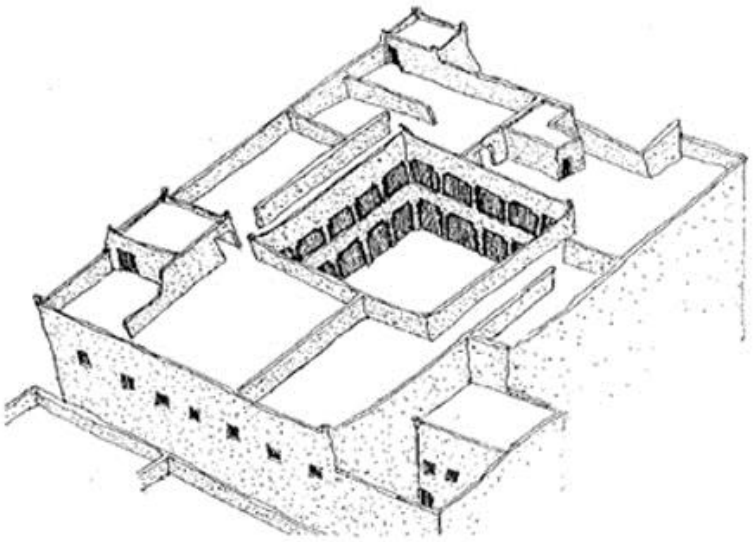


**Figure 2-6: Courtyards within a residential quarter**

(Source: Bahamam, 1987)

**Social Structure**

Ibrahim (2015) stated that considerable studies have cited social hierarchy as one of the critical factors that influenced the design and development patterns of most Muslim cities. Ibrahim (2015:1) demonstrated that palaces, camps, residences, and citadels of the ruling class were separate from commoners. The buildings associated with commoners, including residential houses of the working classes, traders, and local artisans, as well as community facilities and smaller religious institution, were generally woven together within the urban fabric (Ibrahim, 2015).

Figure: 2-7 provides a clear example of how social hierarchy influenced the design of major cities in the Arab world. The bottom right hand corner reveals residential houses and buildings largely occupied by the working classes. These residential houses or quarters occupied most parts of cities, mainly growing in the spaces left between the city's spines and pedestrian spines (Ibrahim, 2015). Structures such as Mosques and palaces of the ruling class were established in or near the centres of major towns. As such, the residential houses and those belonging to leaders, including religious leaders, could mainly also be found in the centre of major towns. Manifestations of the extended *family* structure also contributed to the incorporation of structures such as courtyards in the design of residential buildings. Equally, other social issues such as the need for private spaces, the separation of individuals based on gender, and close interactions between communities, contributed to the inclusion of courtyards and other structures in the designs of houses within major cities (Saoud et al, 2002).

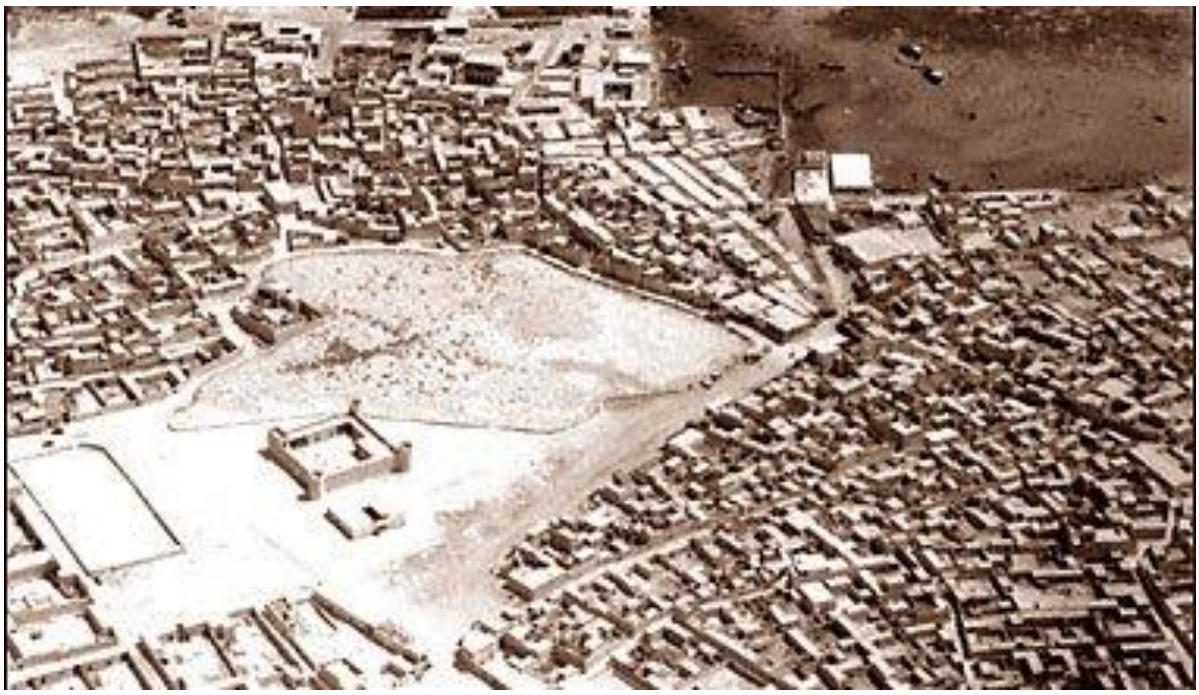


**Figure 2-7: The influence of social stratification in historic Muslim cities**

(Source: Ibrahim, 2015)

### *2.2.2 The Morphological Components of Historic Islamic Cities*

The common elements and factors discussed in the previous section played an important role in the formation of unique morphological components in most cities. Several studies have attempted to examine these morphological components that help to define conventional Muslim cities. Most authors agree that common features such as the Masjid-Jamaa (main mosque), Suqs (markets), citadel, residential quarters, street networks, and walls characterized the traditional urban form of Muslim cities (Roberts, 1979; King, 1989; Miller et al., 2010; Leichtman and Schulz, 2012: Saoud et al., 2002.) Saoud et al. (2002) provided a clear description of these morphological components using the typical historic Muslim town as shown in Figure 2-9.

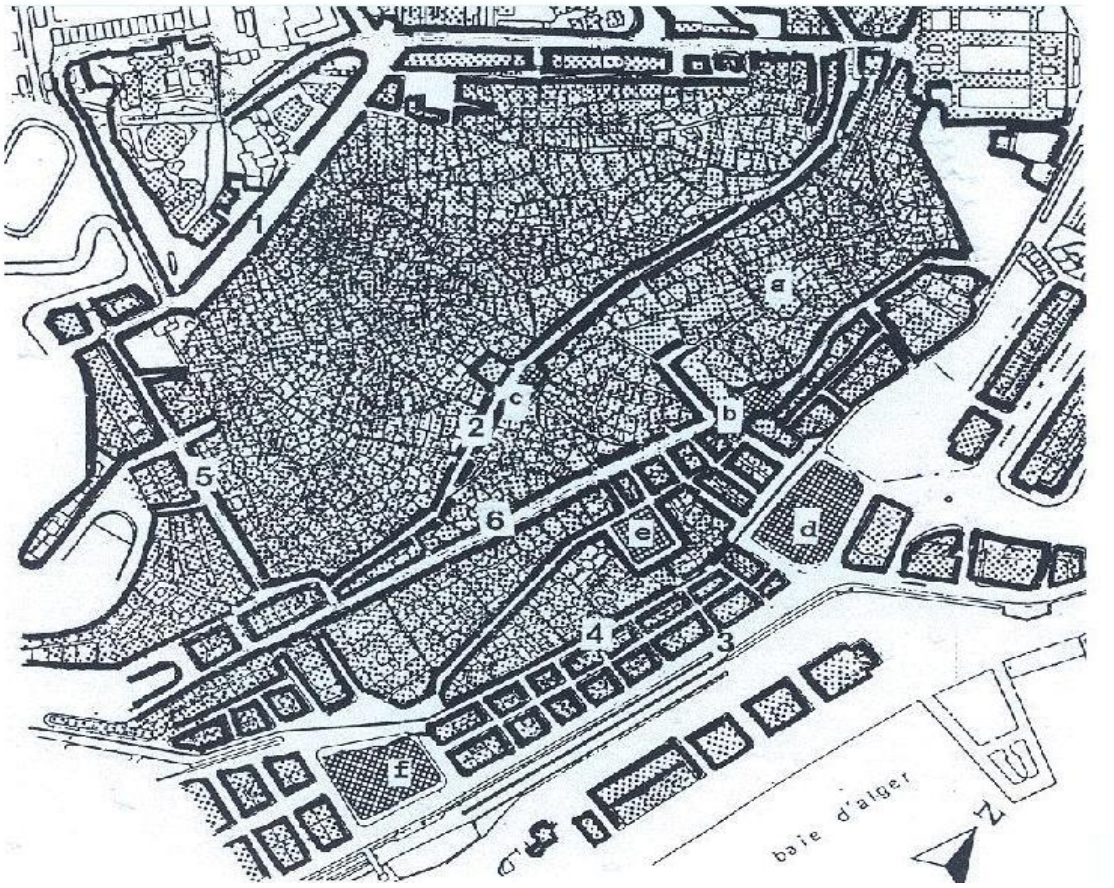



**Figure 2-8: A diagram of key morphological components of a Muslim city**
(Source: Saoud et al., 2002)

In the diagram 2-8, the main Mosque (1), often located in the central point, is the most recognizable feature in most Islamic cities. The mosques located in major cities could have common features such as relatively large size as depicted in Figure 2.9. Although considerable numbers of modern cities in the Muslim world do not incorporate this concept today, in the historic Arab world the incorporation of large mosques in the centres of large cities was common and provided the unique identity of Arab cities. Conversely, as highlighted by Saoud et al. (2002: 6), the *Suqs* (2) were mainly located near the main Mosque and provided economic activities in major cities (see figure 2-9). Sacred items including perfumes and incenses were some of the main products sold in *Suqs* located near major mosques. Gatherings for social activities such as trade, administration, social services, hotels, and exhibitions also took place in the central areas of major cities (Saoud et al., 2002).

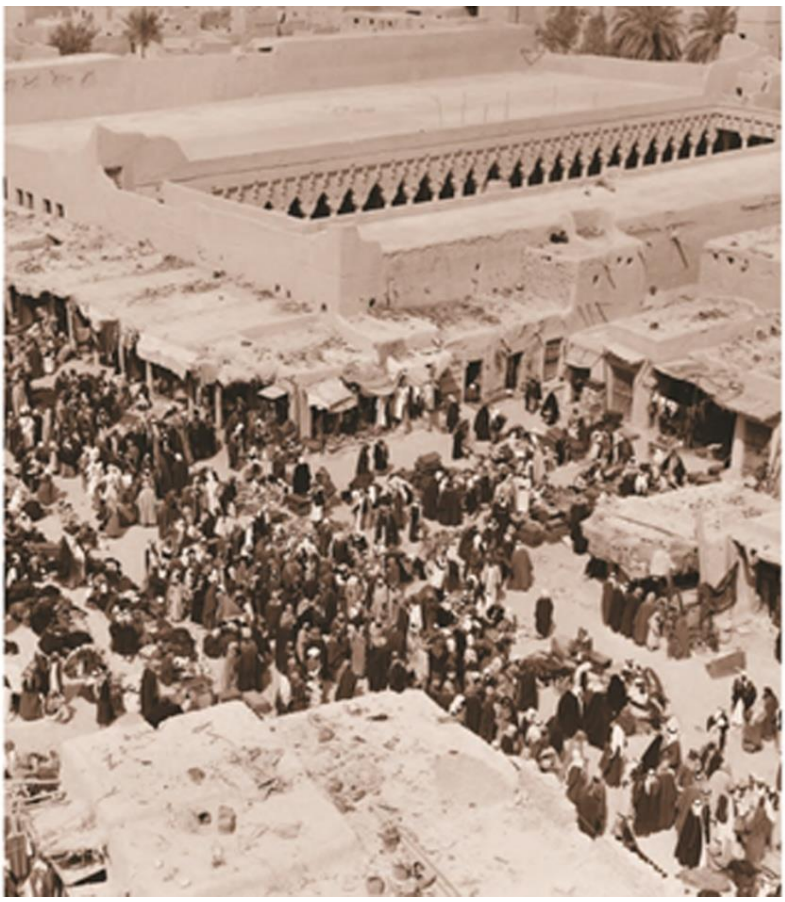


**Figure 2-9: Interactions in traditional marketplace in old Riyadh city (Suqs) in 1949.**

(Source, ADA, 1991)

The citadel (3), which represented the governor's palace, was also an important morphological component in most Muslim cities. These citadels were mainly located on high ground in the city, with each surrounded by its own walls and constituting its own district (Saoud et al., 2002). The citadels were mainly found on the edge of major cities near the walls. Residential quarters (4), comprising mainly of clusters of households, were mainly located around the central parts of the city. Each residential quarter could have its own mosque which residents from the neighbourhood could use for prayer. The street networks (5), on the other hand, provided connections between the residential quarters, with each being separated from others by a wall (6) as demonstrated in figure 2-10. The street networks in conventional Muslim towns comprised of walkable narrow shadowed paths as shown below.


**Figure 2-10: Streets networks comprising of narrow paths in traditional towns. In particular, the residential quarters are largely interconnected by narrow paths. Other structures such as cemeteries, on the other hand, were located on the exterior parts of the city**

(Source: Alshleby, 2015)

To conclude, based on the review of various discussions of traditional forms in Muslim cities, it is observed that various factors and elements played an important role in the planning and design of these traditional cities which to a great extent achieved sustainability. Factors including the environmental, religious and cultural beliefs, natural context, Sharia law, economics and social factors influenced the design of Muslim cities. Conversely, the analysis of the morphological components of most Arab cities reveals common components including the main mosque, suqs, citadel, residential quarters, and street networks.

Generally, the traditional urban form in Riyadh in particular and in Saudi Arabia in general is similar to the majority of traditional Islamic cities. The standard urban fabric can be characterized by the specific street pattern, usually including narrow size and an organic form. Housing plots are arranged homogenously on such streets. The majority of houses are centred on schools, markets and mosques. They open inward to courtyards. According to research by Bianca (2000:207),

> *"The formation of the urban structure is not subject to the purely quantitative division of large space into smaller fragments but based on an incremental or 'organic' aggregation process, originating in the definition of socially relevant micro-spaces which are then connected into larger units. The enclosure of voids by correlated solids, repeated in countless variations, is the generating principle of urban form".*

At the same time, Pacione (2001) emphasised the traditional Islamic city as the necessary ground for the need for public buildings. He also stated that the centring of the city on mosques is crucially important, as it provides a range of educational and welfare functions. Among the other important city buildings, this scholar mentioned the necessity of the *suq* or bazaar to satisfy basic daily needs, as well as the residential fabric that comprises of houses with courtyard and the irregular street patterns.

The design of the urban form responds and is sensitive to the local climate, such as with the use of courtyards. Small window openings allow a minimal access of direct sunlight. Natural resources were used; for example, for ventilation to give fresh and cold air in private and public spaces. It is believed that the scale of these cities was that they were walkable and accessible for most of people's needs and activities. Ben-Hammouse (2013) stressed that using green spaces in this kind of local climate would lead to unsustainability due to using too much water. According to research by Aina et al, (2013), the availability of good agricultural land and water could serve as significant environmental factors affecting the location of traditional cities. In this way, the city was developed in a relatively natural manner, according to general concepts of liveability, coherence and harmony, but without 'formalized' planning. It is also important to mention that the irregularity of the traditional urban fabric forms does not necessarily show a lack of order, but describes the harmonious and coherent integration of various elements to make a whole.

It is believed that some urban and architectural elements used in the traditional urban form, which support good social and environmental performance, have disappeared (Alhathloul, 1981; Bianca, 2000; Ebn Saleh, 2002). Rapid economic growth along with social changes has affected and influenced the old lifestyles and consequently changed the traditional living and built environment. However, some key elements of the culture have been kept. The review of traditional urban form in this research contributes to showing what elements have survived in the modern urban form and how these elements are persevered or addressed in a modern manner. Obviously, some old urban elements can be replaced by modern ones and which can be more efficient in some ways and suitable for modern lifestyles. The later analysis chapters relate to the old traditional urban and architectural elements and concepts and consider how one might learn from these.

### *2.2.3 Criticisms of Changes in Planning Islamic and Western Cities*

Further examination of the differences between the old and the new in the concepts of development, urban form, land use, planning, and architectural form is needed to understand

the future of Arab cities (Lapidus, 1969; Roberts, 1979; Saqqaf, 1987; Bianca, 2000; Ben-Hamouche, 2009). Western development derived from the industrial revolution and the idea of progress. The result has been the degradation of the environment as well as the rapid depletion of natural resources. Modern planning is seen as the perfect solution for furthering development in developing countries (Bianca, 2000). The western urban form that has been applied in most Arab cities does not take into account the environmental and social relationships within the built environment. One big issue is that Western planning focuses more on street design and land sub-divisions, thus causing a problem with the concepts of privacy and neighbourhood in Islamic cities.

According to Ben-Hamouche (2009), the flexibility of interaction between day-to-day decisions made by the government and private land-owners is poorly served in Western planning, and it was strong in traditional Islamic planning. Individuals were allowed to contribute to the organic forms of Islamic cities, and there was no predetermined plan with a rigid pattern to define future development. Therefore, individuals contributed to organic development to enhance the unity of urban form while Western planning produces a sense of uniformity according to rigid patterns.

The separation of functions is also one of the concepts of Western planning, such as designing specified areas for commerce, housing, civic and industrial use. The goal is to create more efficient urban system by dividing the city, or even neighbourhoods, into sectors rather than to fulfil peoples' needs and social demands.

Ben-Hamouche (2009) and Bianca (2000) stated that functional improvements are achieved by the division of uses, but this leads to losing many environmental and social qualities. There was a subdivision in the traditional city separating public and private uses, but this allowed each group of units to operate individually as a component of the whole urban plan. In residential areas, there was a great focus on privacy from the public sphere; and the functions were separated but did not interrupt the urban form because of the allowance for the combination of uses in the social unit. Mosques according to Western concepts are designed as buildings isolated from the social urban perspectives. They are not integrated into their social context as amenities for community gathering.

In traditional and modern planning, circulation networks and street systems reflect different approaches. Traditional Islamic cities were designed on a pedestrian scale, and streets were narrow internal corridors which were considered to be one component in the architectural structure. There was a clear hierarchy in the street system, with three streets types leading

from the public realm to private houses. Main streets were integrated with the main facilities used by the public, residential neighbourhoods were integrated with secondary streets, and clusters of private houses were integrated into narrow winding alleyways. The characteristics of space and social needs closely shaped the circulation system of the city. In modern Islamic cities, however, wide streets are laid out as new vehicular access channels, drawn within the organic urban form, and expanding beyond the old city system dividing the plan into separated blocks. Residential neighbourhoods have been exposed to the public, and social blocks have been disrupted. As a result, this Western plan affects the social and environmental quality of modern neighbourhoods. The manner of the separation of public buildings and even private houses lacks the old functional and physical qualities that made them a compact form (Eben Saleh, 1998).

As many Arab cities have been formed in a modern style, they were influenced by different modern approaches and movements. Riyadh city is one of the largest Arab cities that was influenced and planned in a westernized style, in particular by the Greek Doxiadis' central ideas. It is important to ask how a western designer managed to devise a master plan to deal with the challenges of urban expansion, rapid population growth, and other social, environmental, and infrastructural issues found in an Eastern city like Riyadh. Before answering this question, Doxiadis' ideas need to be discussed in further detail to understand his approach.

## 2.3 Doxiadis and the Theory of Ekistics for Human Settlements

Doxiadis formulated the science of human settlement after World War II, when Europe embarked on rebuilding and reconstruction programmes in an attempt to repair the damage that had been caused by intense bombing campaigns (Ball, 2013). The rebuilding period facilitated comprehensive housing and aggressive economic strategies aimed at addressing the ever-growing housing shortage. The post-world war era also marked a period of rapid urban expansion, which in return forced urban architects, including Doxiadis and CIAM, to come up with strategies to address the challenges associated with this period (Ball, 2013).

The International Congress of Modern Architecture (CIAM) was an organization founded in 1928 by several prominent architects in order to spread the principles of the modern movement that focuses on all of the main domains of architecture, urbanism, landscape, and industrial design, among others. The CIAM was a major proponent of the rationalist approach to urban design, using a rational model that provided a realistic portrayal of the problems

experienced in contemporary society (Sabit, 2013:13). The most important feature of this approach was the demonstration that all essential aspects of human practice can be conveyed satisfactorily through means of a 'guidebook' that comprises of formalized technical procedures, explicitly stated rules, and general, abstract principles.

Doxiadis was among the twentieth-century architects that stressed the increasing need for a new approach to urban design and planning capable of accommodating long-term planning needs as well as dynamic expansion and the functional organization of a city. His model of Dynapolis and the urban design theory of Ekistics not only built on CIAM's rationalist design model, but provided a new perspective addressing the crisis of urban expansion (Smith, 2007). Because the focus of this research is the Riyadh city plan based on Doxiadis' ideas, the following section provides an overview of his standpoint on the crisis of the expanding city as well as presenting approaches and models he developed to help address the crisis.

### *2.3.1 Background to Doxiadis' involvement: The crisis of expanding cities*

In his published writings, Doxiadis provided an interesting perspective with respect to the crisis of urban expansion. The main thrust of his perspective is the universality of the urban crisis, whether one is dealing with small or large cities, or with developing or advanced nations (Lang, 2004:31). Doxiadis presented an argument that, regardless of the nature or size of cities or nations, conditions have continued to deteriorate significantly (Doxiadis, 1968). He attributed the deteriorating conditions to the effects of accelerated urbanization in tandem with intensive demographic pressures in urban and metropolitan centres, which become congested due to high population growth.

In his book *Ekistics: Introduction to the Concept of Human Settlement*, Doxiadis (1968) cautioned that the crisis of expanding cities, as one manifestation of a heterogeneous world, often appears in varied forms. In particular, he demonstrated that the symptoms of the crisis may vary; and in some cities may appear in the form of grave traffic problems or waste of natural resources, while in others it may appear in the form of other social, technological, economic, or human problems. He supported his argument by acknowledging that living conditions for humans had been much better in the past, despite all the improvement brought about by the onset of modernity. Life was more homogeneous and better organized in the past, as individuals had not settled in a manner that made them lose all contact with each other (Doxiadis, 1968).

However, from the eighteenth century onwards, urban development started to upset the harmony that had once existed between Man and Nature. The epitome of this state of crisis, according to Doxiadis (1968), was the emergence of "Inhuman City" characterized by discontinuous and disconnected spaces where the ideals of safety, happiness, and freedom had been rendered impossible. Doxiadis further stated that architects and planners had failed to bring this crisis or disorder under control, as their attempts to incorporate variable rates and scales of expansion as well as spatial transformation in urban planning only resulted in uneven development or disorganization in the cities. In turn, this contributed to the destruction of the initial city centres.

In essence, Doxiadis summarised the main causes of urban crisis in four distinct causes: rapid population growth, increasing urbanization rates, non-systematic and unforeseen technological progress, and improvements in economic conditions in most countries (Doxiadis, 1968). For instance, populations had been increasing significantly since the early nineteenth century, resulting in the amplification of demands for urban functions. In turn, this resulted in the need for the expansion of commercial areas and service centres as well as for new functional elements in order to address the growing demand for services within the city (Lang, 2004). Correspondingly, the expansion of cities in order to accommodate these increasing populations resulted in continuous fragmentation of once simple cities into highly sophisticated cities with administrative units entirely independent from each other.

Doxiadis (1969) also demonstrated that the emergence of technologies such as automobiles also resulted in further disorientation in the form and size of the cities. Automobile usage not only accelerated the pace of urban life, but also increased the range of movement, which in turn resulted in the displacement of the city's pedestrian scale. According to Doxiadis, the unending construction of road networks in order to support growing volumes of traffic in cities has also been a major cause of urban crisis or imbalance (Smith, 2007). However, as demonstrated by Lang (2004), Doxiadis also blamed planners and architects for the crisis in urban expansion. He demonstrated that, despite their ever-increasing ambitions, architects and planners failed to come up with long-term predictions of urban features (Lang, 2004). They had forgotten to incorporate time into their planning, as they only provided short-term relief from urban problems such as congestion or traffic gridlock, but failed to provide future-proof solutions anticipating properly how people would choose to settle in years to come.

Correspondingly, the failure to incorporate time into the planning of urban centres resulted in confusion over urban density which in turn contributed to the over expansion of the city through the creation of too many satellite suburbs around it to achieve lower densities

(Doxiadis, 1959). However, since these satellite suburbs are detached settlements, they cannot be integrated into the expanding settlement because they do not relieve the central city from pressure but instead contribute to it over time, especially when the central city is attempting to expand. Doxiadis (1968) argued that the new form of settlement created various conditions, including rapid population growth, accelerated economic growth, and technological progress, refereeing to this as Dynapolis. Figure 2-11 shows the transformation of the city based on the three different stages of the past, the present and future projections.

Here, it is observable that, in the past, the increase in population density was mainly dealt with through extensions of satellite suburbs outside the city to ease density. However, further increase in pressure within the central part of the city results in rapid expansion towards the satellite suburbs, resulting in the absorption of satellite suburbs (Sabit, 2013). In the future, further expansion would result in the complete absorption of the suburbs into the main body of the city. Therefore, the city would continue to experience problems associated with rapid urbanization such as accelerated crime and congestion (Lang, 2004). Doxiadis demonstrated that a new dimension of urban planning must be incorporated in order to help address the crisis of urban expansion. He developed the theory of Ekistics to help explain how the problem can be addressed.

### *2.3.2 Doxiadis' main theory of ''Ekistics'' (the science of human settlements)*

This theory emerged after Doxiadis had observed that the issues facing human settlements could only be solved by developing a systematic, complete, and inclusive approach. Doxiadis, therefore, formulated the science of human settlements, widely known as Ekistics, in an attempt to solve the issues facing human settlements (Doxiadis, 1968; Smith, 2007).

Ekistics, as many researchers including Cuthbert (2006) agree, was Doxiadis' response to what he deemed the need to arrive at a proper conception as well as implementation of the concepts, facts, and ideas related to the crisis of urban expansion. Doxiadis (1968) defined Ekistics as the science of human settlement. According to him, the term "human settlement" mainly represents a community of people, and in particular, Doxiadis was concerned with the reality that people in different communities were often not happy with their cities or communities.

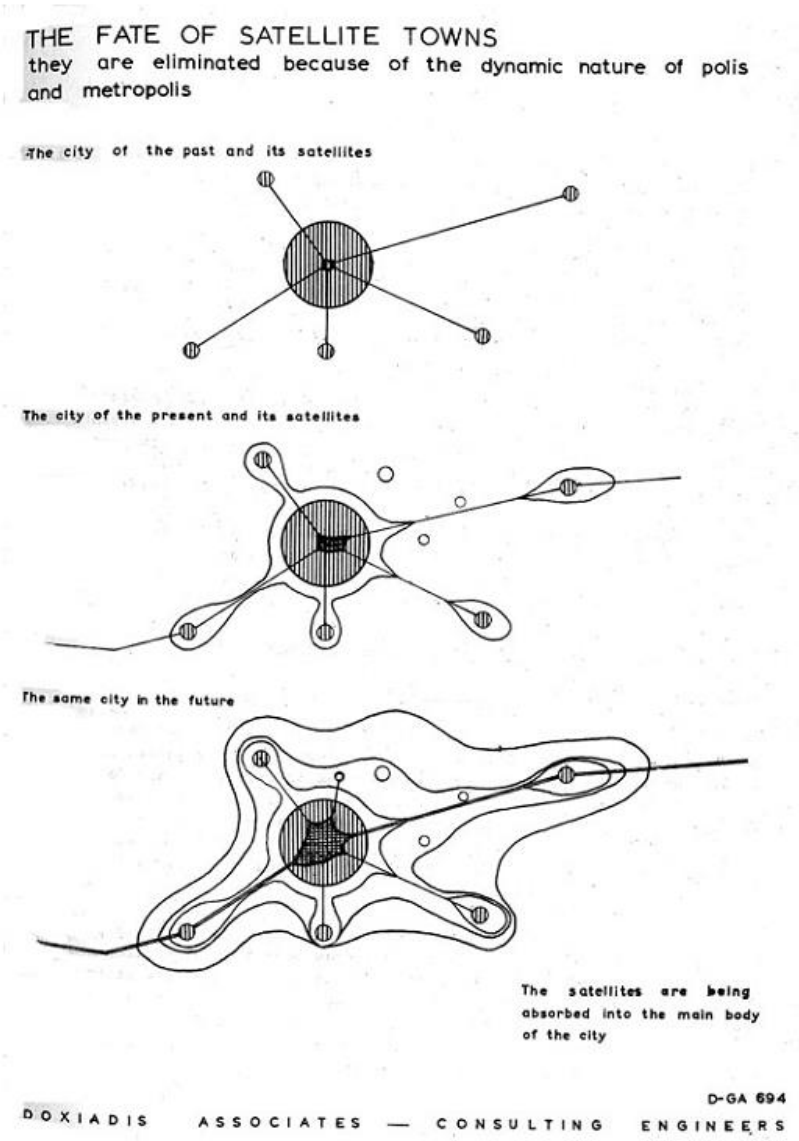



**Figure 2-11: Pattern of growth of a city**
(Source: Middleton, 2009:46)

Therefore, he sought to predict the possible causes of the evolution of human settlements through an assessment of the possible evolution of the various dimensions of human community that give rise to and facilitate the functioning of cities (Lang, 2004). To this extent, Doxiadis catalogued and analysed exhaustively the wide varieties of lifecycle processes, structural elements, and patterns involved in human settlements in different parts of the world. He also examined the various ways in which humans corrupt their environments to make them inhabitable. In line with his findings, Doxiadis identified three major areas of human settlements that could change over time, including the centre of the city, regions surrounding specialized places of activity, and circulatory arteries that facilitate movement.

Therefore, the theory of Ekistics mainly focused on the interrelationship between humans and the environment, and emphasized a study of human life as a whole by conducting systematic, comprehensive, and synthetic research into social, technical, political, and other aspects (Lang, 2004). Doxiadis (1968) argued that, in order to build a balanced world for humans, architects, and planners must use a systematic approach to handle all the problems involved while avoiding any unilateral vision that only considers a special target or certain factors. To this extent, Doxiadis mainly attempted to include all the disciplines concerning human settlements that had been researched separately into a single framework in his Ekistics in an attempt to overcome the confusions arising in each of the relevant disciplines.

The main disciplines integrated within the theory, as highlighted in the previous section, include the geographical, physical, economic, and social dimensions of human settlements, all of which the theory uses to construct a rational as well as scientific evidence-based approach to planning. One of the primary tenets of Ekistics, as an evidence based approach to planning, is the development of human settlements or cities based on hexagonal structures (Khan, 2005). In brief, the theory incorporates hexagonal structures to address the limitations of rectilinear urban planning which, as ascertained by Doxiadis, has failed miserably in the ability to handle efficiently various residential, industrial, and commercial zones in ways that support increasing populations of people and the growth of metropolitan settlements.

### *2.3.3 The Model of Dynapolis*

Doxiadis ascertained that the city was no longer static, meaning that the conventional planning models that had emphasized the static nature of a city were becoming ineffective in urban planning. While the static city of the past did not need the town accommodate growth and mobility, contemporary cities grew from a centre, which was gradually being chocked by growing traffic and over use. Correspondingly, in an attempt to incorporate the dynamic nature of the city into urban design, Doxiadis developed a planning model that he named the Dynapolis, he called the City of Future (Khan, 2005). He argued that the contemporary city had to be planned in a manner that avoided congestion and other issues associated with growth and expansion.

Dynapolis, in particular, signified a dynamic city that would change over time and allow its urban core to expand continually in a uni-directional manner in order to prevent congestion and do away with the monumentality and permanence of stationary city centres (Cuthbert, 2006). The residential areas and business districts would also grow along this axis, while industrial areas would be pushed to the edges. Khan (2005) also demonstrated that the logic of

functional separation is extended to the system of social ordering, such as when each residential sector was broken down into smaller communities arranged in a hierarchy.

Doxiadis envisioned the ideal Dynapolis as a parabolic settlement built around a central spine that would grow indefinitely and serve as the commercial and administrative life-line for the whole community. Since the city is not tied to an old core, it can expand as well as create a new centre and new neighbourhoods (Doxiadis, 1965). Figure 2-12 below shows the dynamic nature of the city based on a parabolic settlement.

As portrayed in Figure 2-12, Doxiadis envisioned the model of Dynapolis as a linear spine that would guide the development and future form of a city and its multiple centres. The linear model, as highlighted above, later forms a networked super-organism with a multiplicity of evolving centres that, once again, would follow lines of mobility, transportation, and communications in future cities (Khan, 2005). The model of Dynapolis has been enacted in a number of cities around the world, such as Riyadh and Islamabad in Pakistan, with the aim of relieving urban environments from the strains faced by conventional, compact cities.

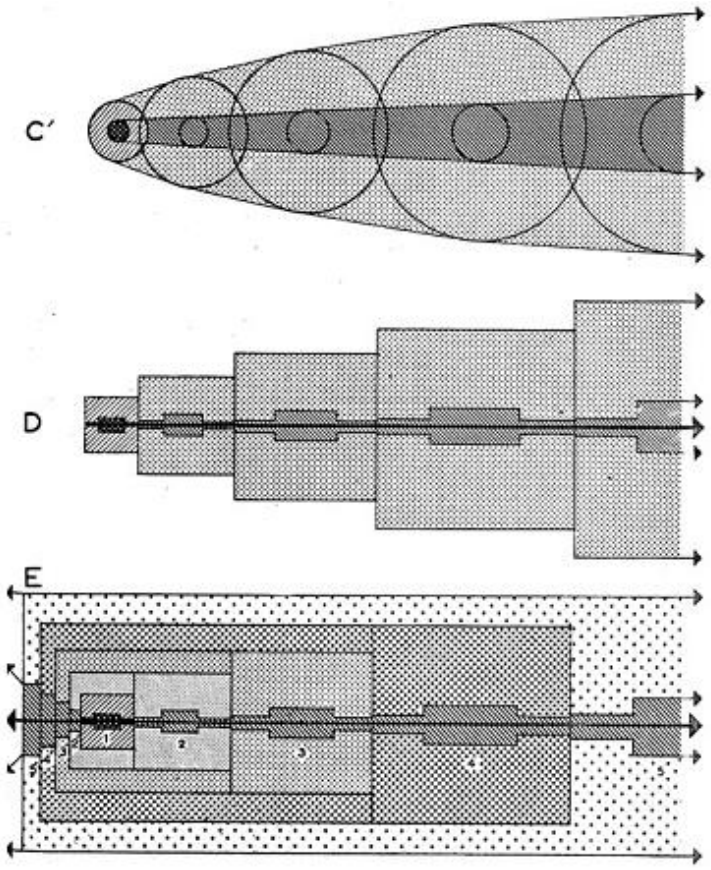



**Figure 2-12: The ideal Dynapolis as a parabolic settlement**
(Source: Doxiadis 1968:65-66)

### *2.3.4 The Ekistics Community Class Hierarchy*

Doxiadis (1968) wanted to develop a framework that would be helpful for the systematic analysis of settlements. From his point of view, this framework had to satisfy three important requirements, including the abilities to define precisely the entire human life-system, to represent the relationships between every part of human life; and to institute an approach to evaluating and measuring every part of the human life-system and the interrelationships between them. Accordingly, he developed a hierarchical scale which classifies human settlements by communities of different classes or orders, from community class I, corresponding to a single group of dwellings, to community class XII, representing Ecumenopolis or the universal city. According to Doxiadis (1968:32), Ecumenopolis is *"the coming city that, together with the corresponding open land which is indispensable for man, will cover the entire earth as a continuous system forming a universal settlement".* The classification of human settlements, in particular, was based on Doxiadis' belief that social life has an interconnected, hierarchical nature that not only depends on the complex interweaving of the entire structure of the city, but also on the ever-expanding regions of the city (Cuthbert, 2006).

### *2.3.5 The Five Ekistics Elements, Ekistics Units and Logarithmic Scale*

The Ekistic community class hierarchy developed by Doxiadis incorporates both populations and an area logarithmic scale named the "Grid of Ekistics," which is based on the five elements of Ekistics and fifteen Ekistics units. In the gird, the vertical axes indicate human life-systems or the five Ekistics elements including, nature human society, individual human beings, human-made structures and infrastructure networks such as railways, roads, communication channels, and pipelines (Cuthbert, 2006). The horizontal axes, on the other hand, indicate the 15 units of human settlements. These include individual room, dwelling, residential cluster, small neighbourhood, neighbourhood, small town, the city, big city, metropolis, urban agglomeration, megalopolis, city region, city continent, and global city (Khan, 2005). Based on these Ekistics elements and units, Doxiadis summarised the components of Ekistics community classes as shown in Figure 2-13 below.

| Ekistic unit | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Com. class | | | | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
| Kinetic field | a | b | c | d | e | f | g | A | B | C | D | E | F | G | H |
| population range | | | 3 - 15 | 15 - 100 | 100 - 750 | 750 - 5,000 | 5,000 - 30,000 | 30,000 - 200,000 | 200,000 - 1.5 M | 1.5 M - 10 M | 10 M - 75 M | 75 M - 500 M | 500 M - 3,000 M | 3,000 M - 20,000 M | 20,000 M and more |
| name of unit | Anthropos | room | house | housegroup | small neighborhood | neighborhood | small polis | polis | small metropolis | metropolis | small megalopolis | megalopolis | small eperopolis | eperopolis | Ecumenopolis |
| ekistic population scale | 1 | 2 | 5 | 40 | 250 | 1,500 | 10,000 | 75,000 | 500,000 | 4 M | 25 M | 150 M | 1,000 M | 7,500 M | 50,000 M |

**Figure 2-13: Components of Ekistics community class hierarchy**
(Source: Doxiadis, 1970)

Figure 2-13 and 2-14 highlights the different community classes within the framework developed by Doxiadis. Community Class I is the smallest and comprises of small groups of families of similar income level. A grouping of about three to seven families highlighted in class I comprises class II, which is also comprised of individuals with homogeneous status (Doxiadis, 1959). Conversely, community class III would mainly be comprised of an agglomeration of class II communities as well as public facilities such as primary schools and pedestrian roads. Community class IV would then constitute Class III communities characterized by different income groups, plus shops and a market, as well as amenities such as playgrounds (Doxiadis, 1959). Lastly, community class V (also referred to as the sector community) would comprise of different communities that reside within walking distance of each other, where the residential units in Class V are self-sustaining from commercial, economic, and cultural perspectives see also figure 2-15 and 2-17. This means that each community class is provided with its associated urban function, and this is based on the scale and population size of the community class.

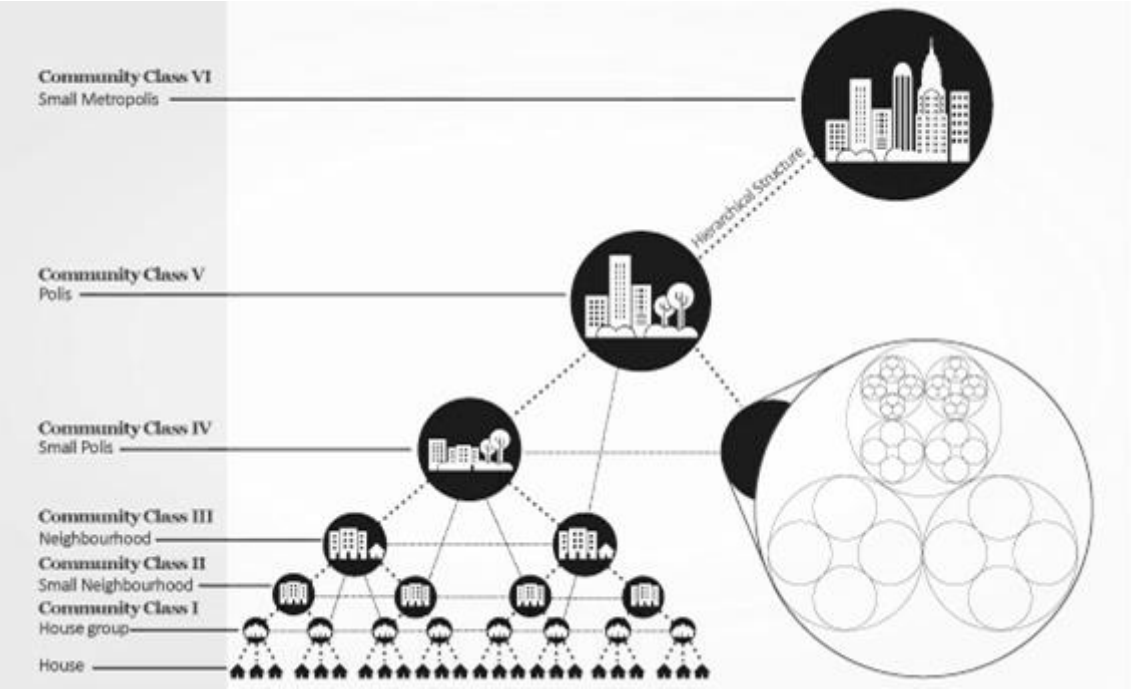



**Figure 2-14: The typical cell of human settlements**
(Source, Wallace,2015)

### *2.3.6 The Five Principles of Ekistics*

According to Doxiadis, the five principles of Ekistics form the basis of human settlements. Doxiadis argued that man has always demonstrated obedience to the five principles since the ancient periods, mainly because they are an extension of human biological characteristics.

The first principle highlights the attempt by man to make potential contact with various elements of nature such as trees, water, and other people (Middleton, 2009:29). The second principle concerns the maximization of the effort necessary for the improvement in the actual and potential contacts among people. Precisely, humans tend to select routes or give structures the shape that requires the minimum effort regardless of whether dealing with simple structures such as floor space or sophisticated structures such as a highway. The third principle relates to the optimization of human protective space. Therefore, this includes the attempt to perform various actions such as selecting areas distant from other persons, objects, or animals (Doxiadis, 1959).

Conversely, the fourth principle relates to the optimization of the relationship of people with their surroundings or environment, which consists of shells (buildings and houses), nature, society, and networks such as roads and telecommunications. He demonstrated that the fourth principle helps in the creation of order as well as aesthetic and physiological aspects of the community. Architecture and art are mainly influenced by this principle (Doxiadis, 1959).

Lastly, the fifth principle relates to the organization of settlements in order to achieve the optimum synthesis of the above four principles. This optimization is highly dependent on space and time as well as on the ability to create synthesis.

### *2.3.7 A New Dimension for the City: The Modulus*

Doxiadis argued that the modulus could be used to establish a new spatial unit for the Dynapolis model, stating that Community Class V (CCV) represents the modulus (Doxiadis, 1968). He demonstrated that the modulus spatial unit is self-contained embodiment of hierarchical structure of communities, "cells", which together facilitate the rational planning of a city. This scientific urban unite is based on well integrated system of public transportation, open spaces, residential housing areas, urban civic functions, and pedestrians networks within it is composed four classes. The interior of the modulus is defined by a design strategy that incorporates great flexibility. Figure 2-15 below shows the synthesis of the modulus as a unit structure at Class V.

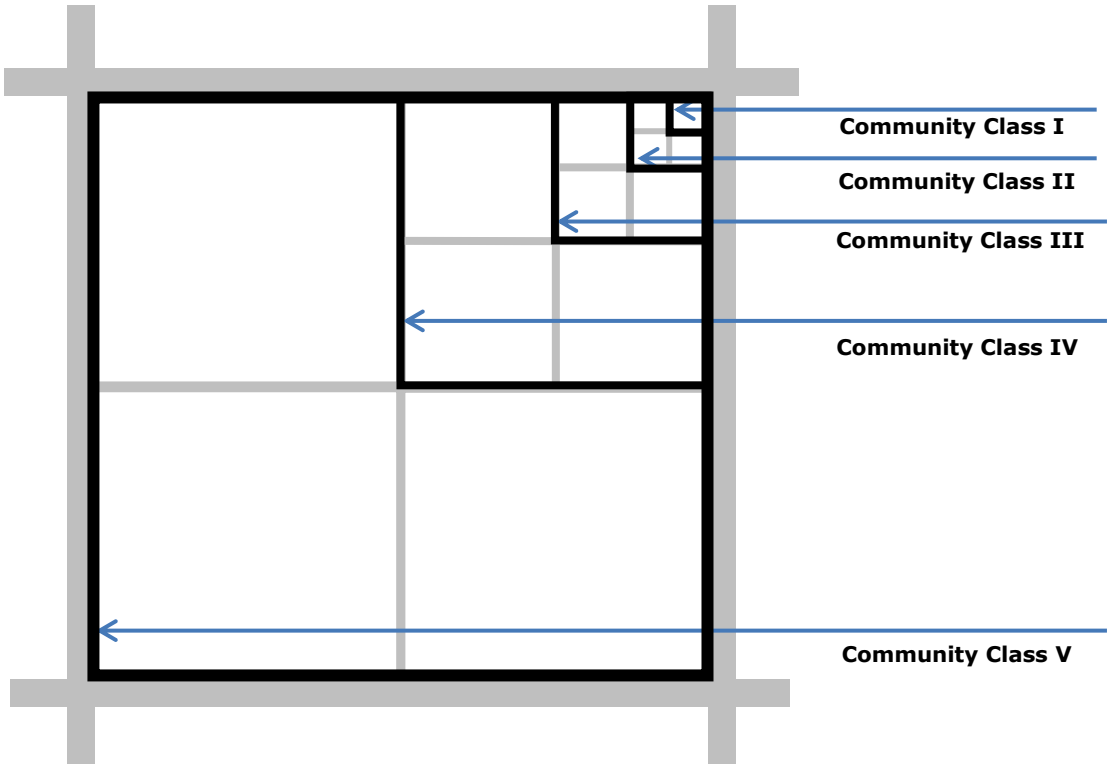



**Figure 2-15: Synthesis of community class V: the Modulus.**

As shown in Figure 2-15 the highest hierarchy consists of community class V, represented by the sector within the 2x2 km grid boundary. The sector is sub-divided into subsectors, which, correspond to class IV (Doxiadis, 1959:41). Equally, the sub-sectors in Class IV are further sub-divided into smaller sub-sectors corresponding to class III, which, in turn, are sub-divided

further to sub-sectors corresponding to community class II. The last sub-division divides class II into tiny sub-sectors corresponding to class I. The modulus, as highlighted in the diagram, seems to comprise of prospective community class areas divided up into sectors, most strictly rectangular and separated from adjoining modulus of exactly the same size by green spaces and high-speed roads. The modulus is also functionally solved by the adopted physical hierarchy of communities. Under each CCV, every smaller class were provided with the necessary diversity and amount of urban functions depending on the urban scale and size of population in each class.

According to Doxiadis (1969), the main goal of any urban community is to create new cells that are based on a human scale. His major idea was to permanently eliminate all kinds of roads used for vehicles, while encouraging more pedestrians. Doxiadis (1969:1) said that "*In future cities, new types of neighbourhoods need to be constructed which will be served but not crossed by automobiles, and where there will be no wasted land but as many green areas as possible*". In his designs, people living in the CCV have separate roads for pedestrian movement and vehicle traffics, a hierarchal network of gradually enlarged routs of pavements and streets, starting from the smallest CCIs to the large CCV. The road pattern for vehicles is designed in a way that they are connected to all houses within the community classes, without interfering with the pedestrian paths, through the use of cul-de-sacs (Doxiadis, n.d). These cul-de-sac roads/loops connected to collector roads only, in order to minimise car access to the modulus. It, therefore, appears that Doxiadis was somehow aware of the environmental aspects in his plans, both at the city and neighbourhood levels. The ecological considerations, as well as the social, are elaborated on in the example of Islamabad plan in Pakistan (point 2.4.9).

From Doxiadis' theory and ideas, it is clear that his work has helped to revolutionize urban planning and design, by providing comprehensive solutions to the crisis of urban expansion through his theory of Ekistics as well as through his planning model of Dynapolis. Most researchers, including Khan (2005), have argued that cities that incorporate Doxiadis' models are likely to prevent or minimize problems associated with urban expansion such as congestion.

### *2.3.8 Reviews of Doxiadis' Work and Plans*

Various critical reviews evaluate Doxiadis' ideas and work (e.g. Papaioannou, 1976; Pyla, 2008 and 2011; Kakridis, 2013; Sabit, 2013; and Pollalis, et al, 2014). Most of these studies has examined the extent to which his projects deemed successful in various international

cities. According to Pyla (2008) Doxiadis work on several urban master plans and housing programs, since the 1950s, made him the busiest and most well-known planning expert in human settlements worldwide, and his concept and journal of *Ekistics* spread to many countries.

In Greece and other western cities, Papaioannou (2013) appreciated the concept of Ekistics and added that the gradual development of this concept has proved to provide positive results eventually. To him, Doxiadis plans were able to achieve a great deal of the urban needs of human settlements in many global cities. Papaioannou attributes the success of the Athens's urban developments, to Doxiadis attention to the Human Community, arguing that the uniqueness of Doxiadis vision in considering hierarchical subdivision down to the small human units, which allowed his plans to be functioning smoothly, addressing the important urban social, cultural and economic considerations necessary to make the developed urban context liveable and habitable. However, it is worth considering here that was a Western city, and Greece is his country, in which he is part of and understand its social and cultural context very fully. It would be more appropriate to explore the success of his experience in a number of different global cities.

In Pakistan, according to Pollalis, et al, ( 2014:54) Doxiadis Ekistics concept was introduced in the planning of the new Defense Housing Authority (DHA) City Karachi (DCK), which was based on the following fundamental sustainable design principles, *"addressing the economic aspect of plots, the physical constraints of the site, the quality and efficiency of the urban environment, the self-sufficiency of the community, and reliable infrastructure networks"*. Pollalis, et al, also argued that this concept has *"provided a design framework through the Community Class system that proved critical for achieving integrated urban planning across different scales,"* and that is why the spatial framework of the Ekistics has *"played an important role on decoding problems and embedding sustainable solutions."* For these reasons, *"DCK was considered and designed as a self-sufficient urban entity, incorporating the attributes of a sustainable and livable metropolitan center"*. (Pollalis, et al, 2014:51).

To understand Doxiadis work further in Pakistan, Sabit (2013) studied the plans of Islamabad, which was also designed according to Doxiadis concept of Dynapolis. This was the first planned city in the country and one of the biggest towns to be newly designed in Asia in the late 1950s. In the 1958 city plan, Doxiadis created a framework model that was flexible for the adaptation of the needs of the changing world. Even after many years, it has been argued

that the city is still has contemporary relevance with its Dynapolis concept of the “city of the future,” as it contentious to expand towards the semi-urban area in the periphery of Islamabad, which consist of urban villages. These villages were intentionally included in the plan by Doxiadis so as to maintain the heritage of the region as well as making the region a backup for the food needs of the city. The concept of Doxiadis of linking city to villages has resulted directly in this fusion. These villages have now developed into towns. Hence, Doxiadis’ ideas are considered beneficial for dealing with continuous expansions (Sabit, 2013). In conclusion, Sabit suggests that since 1958 Islamabad is one of the most pleasing cities, though such claims are open to debate.

In Baghdad, in the mid-1950s, Doxiadis worked on an ambitious master plan for the city at the time and design a housing program for the young nation of Iraq. This opportunity allowed him to implement his ideas of the "Dynapolis" and establish his Associate practice. According to Pyla, (2011) Doxiadis envisaged the dynamic master plan of Baghdad as a city that can:

> *"Continually expand along one axis, to avert congestion, and for the business district to grow along this axis, controlled by zoning and the sitting of public buildings, road systems and green areas. Residential areas would also expand continually, along the core's flanks, echoing the open-ended logic of other 'linear city' concepts."* (2011:101)

Local architects who collaborated with Doxiadis became more conscious of the value of the local cultural roots, however, they abandoned his universalist *Ekistics* concepts, hence, Doxiadis commission was cancelled in May 1959 (Pyla, 2008). However, by the time Doxiadis left, his Associates had completed many neighbourhoods and residential units that are still known as “Doxiadis houses”. His abandoned plans become a starting point for enormous developments following his rectilinear grid ground plan. The certainty of Doxiadis’ predictions about the future along with his comprehensive claims, failed to account for many factors that had an impact in shaping Baghdad.

One of the highlighted criticisms of his plans in Baghdad was about the failure of his team to appropriately address local climate and its formal architectural vocabulary. In this regard Pyla (2008: 15) explains that:

> *"Critique could be extended to Doxiadis Associates’ studies of local climate and formal vocabularies. Climatic conditions were treated abstractly in terms of solar exposures, wind patterns, and rainfall data, never really becoming an integral part of material choices, spatial conceptions, or larger design sensibilities. Doxiadis Associates may have recognised the open-air courtyard and colonnaded upper gallery as typical of the region’s residential architecture, but the firm’s own reinterpretations in its standardized “house types” pushed courtyards to the side or to the back of each unit, thereby losing any of the traditional*

> *courtyards' climatic benefits and secluded qualities ... Similarly, Doxiadis Associates' attempts to reinterpret wooden window screens with reinforced concrete produced larger patterns of openings that were not nearly as effective in increasing wind pressure, in softening sunlight, or in providing a sense of privacy."*

Another criticism includes Doxiadis Associates' underestimations of population growth and the impact of unforeseen and disastrous circumstances such as war. Ultimately, Doxiadis' ideas consisted of the restructuring of the physical and social aspects of the disorganized urban conditions of Iraq at that time and these solutions are relevant to contemporary planning (Pyla, 2008).

More critical reviews on the work of Doxiadis can be seen in the example of his 1960s plans in Brazil. Rezende (2016:260), has stressed the criticism of the states' technical team about the plan of Doxiadis Associate on the ground that it *"used complicated tools to justify pre-established proposals."* Rezende here highlights the critical gap between the local planner and their role of diagnosing the urban context under development, noting that: *"the fact that the Greek team had developed the plan in Athens, amid occasional visits to Brazil or consultations with Brazilians in Greece, partly explains the gap between plan and object of study"* (2016:260). Rezende here has in fact reiterated the remarks of Madanadipour's (2010) intense study of Doxiadis' Action Plan of the Iranian capital city Tehran, in which he argued that these imported plans fail to solve and address the existed urban needs of the city in question.

In Doxiadis' plan for Tehran, according to Madanadipour (2010), there is contradiction *"between advocating the need for a thorough knowledge of context and proposing a solution that has almost nothing to do with that context."* He observed that there is a 'break' between the proposal of West Tehran and the city existed context, *"in true modernist fashion"*. To exemplify, Madanadipour has critically argued that *"rather than allowing the centre to grow along an axis, as he had advocated in his book, the new city is disconnected from the old, along the lines of new towns development."* As a result, he concludes that *"the city of Tehran was seen as a context to escape from, rather than to embrace"* (2010:497-498).

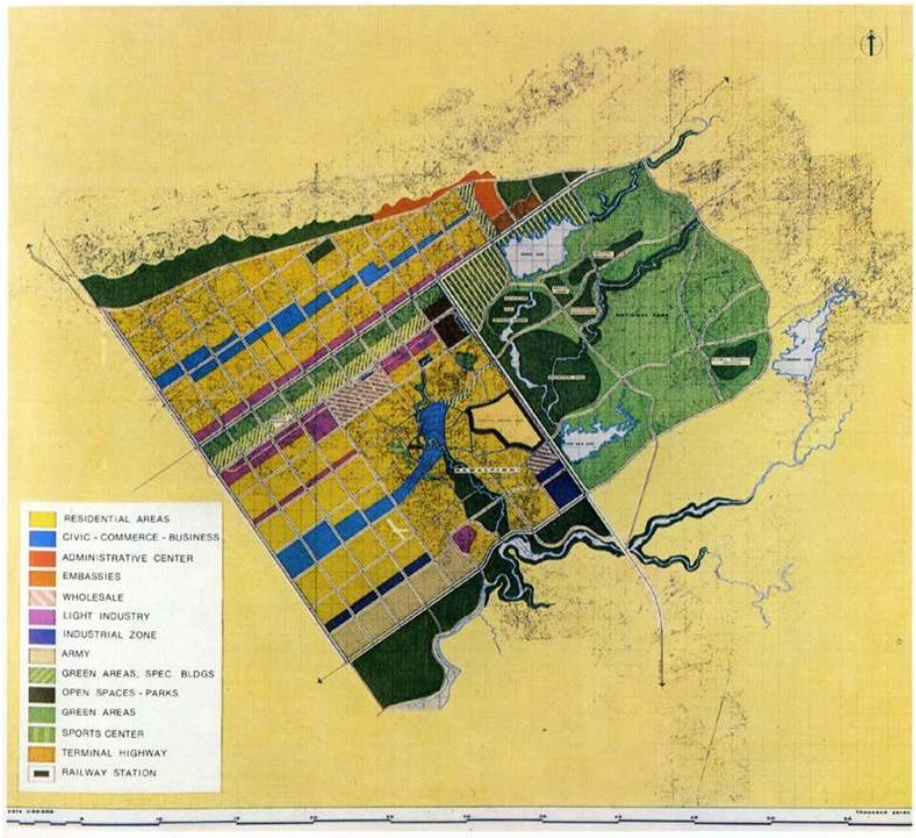
In both Doxiadis' plans in Brazil and Iran examples the aforesaid arguments presented how Doxiadis' plans were seen as a 'manual' that has the potential to be applied uniformly anywhere. Accusing the result of his Doxiadis Associates' designs to be the application of planning concepts that were established out of the real context, a "ready-made solutions," that contradicts his methodological viewpoint of insisting on studying the local context under investigation (Madanipour, 2010).

To conclude, from the reviews given of Doxiadis' work and concepts, it is found that there are some unenthusiastic and mostly constructive criticisms of the work that examined his ideas and plans in different cities. Despite the applicability and rationality of his models, approach, and urban planning methodology, some cases have proved to be standardized or incomplete according to local urban issues. Examples discussed, such as in Pakistani cities, shows how the city plan designed in relation to what is now considered as sustainable principles, however, in Iraq, Tehran, and Brazil, his work was considered as a pre-established solutions that is somehow thoughtless of some specific local social and cultural considerations and needs.

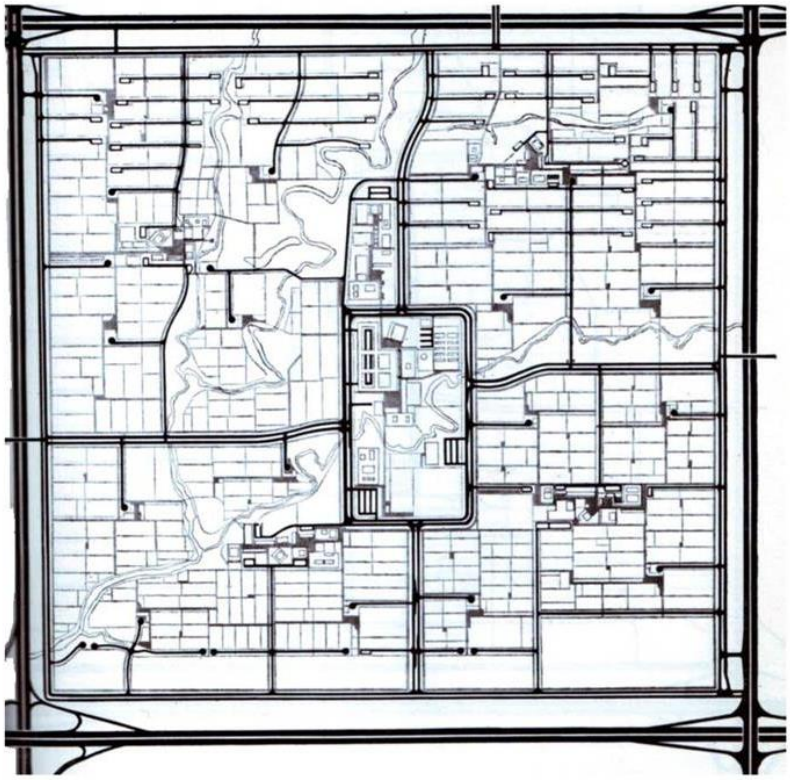
### *2.3.9 Doxiadis Work as Part of Environmental Discourse*

The concepts of Ekistics are very much part of the environmental discourse. Pakistan would be the best example of Doxiadis' plans in the construction of Islamabad based upon the concepts on Ekistics. Following this, a new project in Karachi called the DHA City Karachi (DCK) also relied on these concepts to address the requirements of sustainability. The sectors in this project have been made to work as independent urban units that have many central units so that they are self-sufficient in fulfilling everyday demands and the needs of society. (Figure 2-16 and 2-17). Along with this, the decrease in expenditure on energy was also considered. The strategic site and linear outline of the Central Business District CBD resulted in reducing the utilization of private cars. For the multi-purpose CBD land utilizations, each sector was also allocated community centres constructed in order so as to offer less walking distance. Also, the orientation of the street network is made in accordance with the usual direction of the wind to take maximum advantage of the available natural ventilation. The DCK strategy for energy has the objective to gain thirty per cent of overall energy needed from renewable sources of energy, including ten per cent from wind, five per cent from solar, and ten per cent biomass (Pollalis et al, 2014).

The natural topography, green landscape, and narrow valley of Islamabad was utilized in the design of the new master plan. It was designed in a way that would separate the north fields from the south. Despite the uneven altitudes of roads, the landscape of natural green spaces was respected in the designed new plan (Doxiadis, 1968). This was carefully crafted around the natural shapes of the existed greeneries, which when possible is located next to schools, parks, and playgrounds for the children, and generally for people in the community class V, ass can be seen in Figure 2-16 and 2-17.




(a)



(b)

**Figure 2-16: (a) Master Plan: Islamabad Pakistan 1960. (b)Typical sector community class V, Islamabad Pakistan. A community class V surrounded by highways and without through traffic in smaller units. A system of cul-de-sac streets are planned. A pedestrianized area is indicated and the key functions are placed in the centre. As a result, internal cohesion can be seen.**

(Source: Doxiadis, 1968:360)

Similarly, it has been kept in mind that water should be easily accessible. So according in the plan for water management strategy two small lakes have been constructed with two dams so that rainwater could be managed and distribution network has been worked out for sewage treatment procedures. The concepts of Ekistics and sustainability combine in the planning process for this new DHA city of Karachi. It incorporates all five elements of Ekistics including man, nature, shells, society and networks.

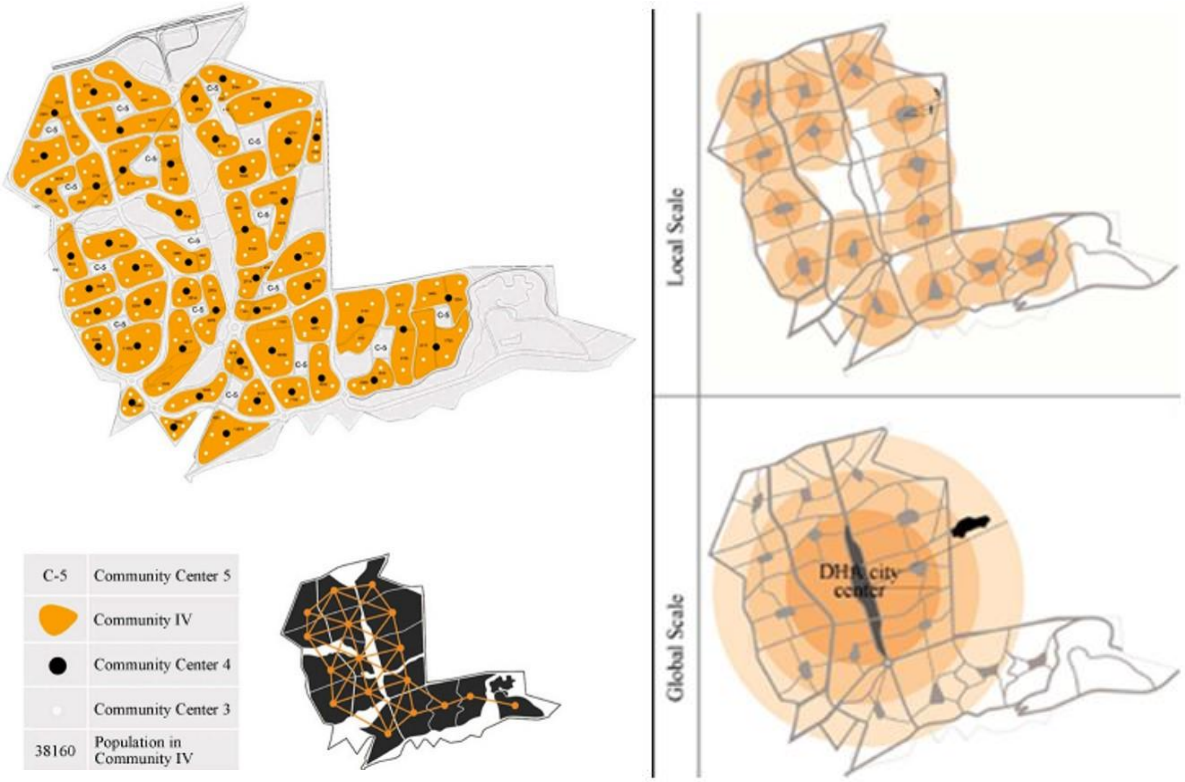



**Figure 2-17: Community classes and centre in the city of Karachi (DCK) in Pakistan.**
(Source: Pollalis, et.al, 2014)

The construction of DCK took into account economic factors regarding plots, the physical limitations of the site, the qualitative features of the urban surroundings, infrastructure networks and self-sufficiency for the community. Along with the above prospects, Ekistics gave a framework via the community class system that was helpful in attaining comprehensive urban planning on various scales. This multi-scalar approach took into considerations sustainability problems and consequently worked upon and search and for solutions to these problems (Pollalis, et.al, 2014). Socially, it is important to mention that Doxiadis also considered the economic distribution of different groups of people, in terms of their income, by utilising the physical confines of his modulus. According to his principle, it was important to adopt gradual integration between high and low income groups within each CCV as this would help to create contented comfort zones (Doxiadis, n.d).

Pyla (2002) described that how Doxiadis explains environmental awareness in architecture and how the subjects are interlinked so as be inseparable entities. The concept of Ekistics encompassed environmental aspects for the first time and studied the impact of 1950s and 1960s environmental awareness on the culture of architecture (Pyla, 2002).

Hardman (2006) and Pyla (2002) elaborated that Doxiadis was probably a pioneer of making plans from global perspectives. His suggestions provide solutions to sustainability. Fookes (2008) elaborated that the concepts of Ekistics are inclusive of concepts of Ecumenopolis and human community. He defined the dimensions and principles that strengthened his work in accordance with environmental concerns. His ideas can therefore be considered relevant to what are nowadays considered to be concepts of sustainable urban forms. The ideas of potential contacts, the use of energy and efforts and the idea of a balanced approach were all part of its importance (Fookes, 2008).

Mahsud and Zaib (2010) explained that Doxiadis work of Ekistical Urbanism is environmentally sensitive due to highlighting issues linked with sustainability and globalization. It is argued that his ideas are still currently helpful and, hence, can be applied in planning human urban settlements today, taking social and environmental preservation into account. Although his work is rarely explicitly referenced in the urban planning literature, many of his ideas have been integrated into mainstream academic and popular thought. The New Urbanism movement of the 1980s and 1990s, which suggested that small pedestrian friendly villages should replace typical suburban developments, echoes many of Doxiadis' suggestions (Calthorpe, 1993, Leccese and McCormick, 2000).

## 2.4 Conclusion

This chapter has presented a relevant literature review to understand the main elements and changes to traditional urban forms until the modern age. It first provided a background to traditional urban forms in Islamic Arab cities, looking at how local needs were considered in the built environment and it responses to local climate and socio-cultural aspects. Concerns about the modern effects of urbanisation and urban expansion were then presented while raising the increasing problem of sustainable growth. Doxiadis' theory and key concepts of human settlement were then studied to provide a better theoretical grounds to understand the motives behind his design and emergence of a master plan for Riyadh city late in 1960s.

Traditional urban and housing forms clearly responded to local environmental conditions and social demands. Moving towards modern planning, this situation has changed. New urban design solutions were introduced apparently imitating and globalizing Western practices and lifestyles. New technologies were also heavily involved in reshaping modern urban structures and life everywhere. Sustainable urban issues should have been taken into account in early modern urbanism as cities became more complex. Urban planners, architects and the general public are therefore required to work together in order to adopt new lifestyles in the plans. However, sustainability is a complex term and it has been developed in the urban planning and architecture fields.

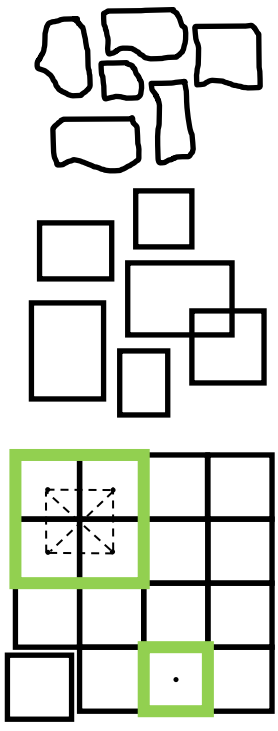
Doxiadis work has nevertheless had diverse applications in contemporary life and the most interesting aspect of his contribution is the continuation and revival of his ideas to fit modern-day urban complications. In short, his work remains relevant to date. The concepts of Ekistics have proven to have been of an effective application for the planning of several cities. Reviews by other authors demonstrate that Doxiadis developed a diverse and versatile set of ideas and concepts. The association of Ekistics with environmental discourse has profound benefits. Hence, Doxiadis was one of the most significant planners in history. His work and concepts have proven to be successful in many cases, such as in Islamabad. This study therefore attempts to test this reality in a different context, in particular, Riyadh city in Saudi Arabia. To do this it is important to firstly look at the frameworks developed in the literature in order to study sustainable urban forms. These new approaches might have been developed before, based upon Doxiadis' ideas, or later as shown in the following chapter. The next chapter will therefore continue the literature review on the studied approaches and concepts with regard to achieving sustainable urban forms.

# Chapter 3: Literature Review (Part 2)

## Contents

### Chapter 3: Literature Review (Part 2)





## 3.1 Introduction

This chapter continues the presentation of the study's literature review. It focuses on the theories, approaches, and design principle and concepts used for sustainable urban forms, looking into why and how they were established and studied, since the early 1900s, and in what way they have been applied where they were first developed and then in the context of the Middle East and Saudi Arabia.

After the notion of the garden city of Howard (1898), the neighbourhood unit theory was established by Perry (1929) and was then developed and subsequently criticised by researchers and planners such as Stein and Wright (1929) and Mumford (1954). These original theories have had an impact on new approaches to modern sustainable urban forms. The compact city is one of the most influential concepts in this discourse and has been widely accepted in the UK and some European countries. This concept is reviewed in this chapter to understand how its application helped to achieve sustainable urban forms. Another important movement is New Urbanism, which has been mostly used in the United States, and it is known for achieving sustainable neighbourhoods and developments. This chapter will also look at the main principles of New Urbanism and its benefits when implemented.

The urban situation in the Middle East and Saudi Arabian context is then discussed. Modern concerns and examples of sustainable urban forms are also presented in this section of the chapter. Finally, the literature on the modern approaches to defining the principles of achieving sustainable urban forms are discussed in order to develop suitable criteria that can be adopted to examine sustainability in the case study of the present research.

## 3.2 Historical and Modern Urban Dynamics and the Development of Sustainable Urban Forms

Massive industrialization in the mid-nineteenth century altered the urbanism and architecture of human societies. Industrial technology began to influence every aspect of life. Improvements in transport and communication made life easier and people were able to easily travel long distances in less time. This brought about tremendous increases in urban space and the rapid decline of rural communities. People started coming to the cities for better employment, and agriculture and family sizes declined. Three main factors are considered critical in influencing rates of urbanization. These are the natural increase in urban population, rural-urban migration and reclassification from rural to urban areas. What complicates the

situation is the rapid rural-urban migration resulting in the swelling of populations in urban regions (NRC, 2003).

In the developing world, rural-urban migration contributes the most to population growth in the urban regions compared to in the developed world (McGee, 1998). In fact, the populations of cities such as London have remained static for years. Urban problems are very often related to uncontrolled growth, particularly in the developing world, however, in some developed cities urban population are declining (Iimi, 2005). According to Priemusa (2004), urbanization occurs when the rate of population growth is highest in the urban core regions compared to the surrounding regions. Similarly, suburbanization can be indicated when growth is highest in the area surrounding the urban core. Furthermore, de-urbanization occurs when there is a decline in the core population followed by population decrease in agglomerations and re-urbanization occurs when the population increases in the core but decreases in the overall agglomeration. So, in essence, the urban population is shaped by centrifugal forces that propel people to move out of the core towards the periphery and centripetal forces that cause people to move from the periphery towards the core (Colby, 1933).

The factors that can influence the dynamics of modern cities can be highly diverse (Bentley, 1999). It should not be forgotten that modern cities have emerged from human needs or requirements. Urbanization is just a response to these inherited needs. According to Rogers (1999), modern architecture and planning is nothing but the outcome of interaction between different economic entities present in modern social systems. Other factors outside the purview of planners and architects also contribute to shaping the urban set up, such as climate and the nature of building materials. For example, the architecture of Scandinavian houses is designed according to the cold climate rather than the aesthetic sense of the designer. Another critical factor that plays a critical role in shaping the modern urban form is technology. New technology, created the need for massive urban built forms such as train stations and airports. Massive improvements in transportation brought about by technology enabled people to travel far and wide and to disperse, leading to scattered urban forms. The role of both governments and civic society in bringing about change in urban settings cannot be ignored. Through the implementation of massive building projects and social policies, modern societies are creating unique architecture which is the mark of their current time (Downton, 2000). Furthermore, it can be observed that the functionality of architecture can change without any alteration to its

shape. In creating modern urban forms, the role of planners and administrators seems limited. Factors such as climate create the avenues for human intervention.

Different researchers have talked about different forces that can help in giving shape to a city. Gottmann (1978) introduced factors such as demography, economics, the impact of technological innovations and cultural diversity which, according to him, influences the dynamics of a city. By the 1990s this classification underwent considerable change and incorporated additional factors such as globalization and the formation of continental trading blocs, the shift to the informational economy, the impacts of transport and information technology, the new role of urban promotion and boosterism, and the impact of demographic and social changes (Hall, 1993). All of these factors can be broadly categorized as social, economic and political forces. The role of these forces is clearly evident in developing economies where there is a lack of suitable management and control. The power of decision making resides with stakeholders and landowners and they have the capacity even to change the direction of development or to stop it completely.

Political economy can have a definitive bearing on modern urban development. To ensure continuous development, the best road forward would be to consider the perspectives of different school of thoughts involved in the development process. Building a consensus for development that suits all interests is highly manageable and sustainable. However, if decisions are made by only considering the interests of the political economy, development and massive urbanization will remain concentrated in the urban centres only. This could lead to negative situations such as the destruction of heritage buildings and the occupation of city green spaces. Town planners can play a role by creating avenues that would encourage people to move out of city centres towards the suburbs.

There have been concerns about the effect of urban growth on the social, environmental, and economic conditions of urban dwellers because of the way cities have been developing to date. Thus, sustainability has become an important part of urban development (Jenks, 1996). Sustainability has been a part of urban planning since the 1970s, however it entered the mainstream literature only after being proposed in the 'Brundtland Report' in the World Commission on Environment and Development's *Our Common Future* (1987). However, in fact, the notion of sustainability has been given important focus in the urban planning theories since the original *"Neighbourhood Theory"* (Howard, 1898; Perry 1923; Stein and Wright 1928; Mumford, 1954; Fisher, 1984), and until the relatively recent return of the idea of the

*"Neo Traditional Neighbourhood"* concept or "New Urbanism" and compact city concepts (CNU and HUD, 2000, Rogers, 1999), standing against the *"unsustainable urban sprawl"* (Arbury, 2006).

It is significant to note that the concept of sustainability has been an essential part of urban development objectives in developed countries; however, it is still a relatively new notion in many developing countries (see Appendix B for a brief review along with a few examples of sustainable developments in the Middle-East). It is also notable to that, however difficult it may appear, the development of more sustainable urbanisms *"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"* (White, 1994:109).

## 3.3 Neighbourhood Unit Theory

### *Definition of the Neighbourhood*

According to Sharifi (2013), while the literature does not provide a general definition of the neighbourhood, most scholars agree that its boundaries can be defined both subjectively and objectively. From the subjective standpoint, local residents define the neighbourhood's mental borders; that is, the perception of residents could be used to map neighbourhood boundaries.

Friedmann (2010:154) stressed the important of the pedestrian scale, defining the neighbourhood as *"the area that neighbours acknowledge as their home or, as sociologists would say, as their primary space of social reproduction".* Nonetheless, although common definitions tend to emphasize the significance of the pedestrian scale, most researchers agree that residents often define their neighbourhoods' borders differently, meaning that definitions of neighbourhood tend to be individually based (Minnery et al., 2009).

According to Dover and King (2008), from an objective standpoint the definition of the neighbourhood often includes objective measures such as networks of walkable streets, mixed uses, discernible edges and centre, walkable size, and civic centres. Alternatively, administrative boundaries including existing districts or wards may be used to define neighbourhoods. Nonetheless, it is important to note that the borders of administratively defined neighbourhoods, on many occasions, do not coincide with neighbourhood borders defined in line with factors such as function, cognition, or aesthetics (Minnery et al., 2009). In essence, many communities and cultures have used the term neighbourhoods differently;

however, it is important to acknowledge that notable definitions do not specify population size or the universal civic functions that neighbourhoods should fulfil (Choguill, 2008).

### *Historical Background*

The idea of sustainability is very important to the various contributions that have been put forward by people like Howard and Perry following the developmental phase of neighbourhood theory. There are different types of sustainability analysis specifically for higher level cities that mirror these sustainability criteria, including consideration of all important factors ranging from economics to the environment (Choguill, 2008).

The onset of urban modernization can be traced back to the late nineteenth century in Britain. However, it was Howard's concept of garden city that grew popular and realized this growth as a means of creating employment and the expansion of amenities (Howard, 1898). What other people saw as the overcrowding of cities, he saw as a means to attract both urban and rural economic activity. There would be a constant generation of employment as the urban cities would draw a workforce while the rural communities would enhance agricultural activity to keep up with urbanization. The garden city as proposed by Howard was built upon a concept that there should be satellites in the outskirts of cities that were already developed along with small industry with a population ranging up to 30,000 inhabitants per 2,400 hectares, that would be further divided into small neighbourhoods of 6000 people who were then surrounded by agricultural land. This would increase the forces of attraction to those developed areas (Stoa, 2014). This was a way to create more employment in rich and self-contained communities that had enough space to accommodate facilities like parks and boulevards. Howard believed that the garden city would be self-sufficient as long as it reached its full potential, and the practical example was the town of Letchworth in England. He urged people to consider the spatial arrangement of activities in the urban sector, the neighbourhood design and the design of the town in relation to the other places around it, and thus brought forward the idea of neighbourhood for the first time.

In 1929, the *Regional Plan of New York and Its Environs* promoted the idea of neighbourhood units with the help of a monograph by. Perry (1929) "*The Neighbourhood Unit, a Scheme of Arrangement for the Family-Life Community"* was a monograph written about the neighbourhood unit. Examination of the historical roots of the term shows that it was coined in 1923. The *American Sociological Society* and *National Community Centre Association*

both used the term, but formally the term was first used in 1929. Perry suggested that the neighbourhood is a collection of different social, physical and institutional forces in an area. Perry's experience with the Russell Sage Foundation seems to have helped him in providing a definition for the neighbourhood unit (Glenn et al., 1947). The Russell Sage Foundation subsequently used this definition widely in their residential plans to make strong neighbourhoods. Perry's concepts about family life and community were applied widely but also received a lot of criticism for being a device for social engineering. Although the neighbourhood unit is a social practice, it is widely considered to be a physical design which is used to facilitate people's interaction with other residents of an area. Physical standards are used by neighbourhood units to accomplish the mission of interaction between the residents of an area; for example, by designing open areas, school systems, commercial areas and to enhance the safety of residents from automobiles (Raman, 2010).

Residential units within the idea of neighbourhood unit have all the necessary facilities such as schools, churches and areas for recreational activities by the residents. The design of neighbourhood units ensures that residents can get all the facilities needed within a geographical limit of half a mile (Figure 3-1). The design ensures that major arterial streets do not obstruct the path of the residents when they try to approach nearby commercial areas. Streets with traffic are discouraged in these designs, so that pedestrians can walk freely without any sort of distraction due to vehicular movements on their way. The architectural designs offered by Perry suggested that 160-acre neighbourhoods should be developed in such a way that allows 10 units per acre. These units will be sufficient to support the inhabitants of that area. His design suggested that 10% of the whole unit would be reserved for parks and recreational activities for the residents. Perry's design added many new concepts for instance, he suggested that schools are the focal point of the neighbourhood, and all schools must have a playing area for students, and the centre of the unit must have all useful commercial centres and churches.

Perry's concept is basically similar to the self-contained block of a city, because it encompasses all the basic facilities of urban life. The word unit is added to this idea because of the self-contained and compact nature of the concept. The central school should be built so that children can reach it within a short distance of a quarter of a mile. The size of these schools should support the children of 5,000 to 9,000 residents in any neighbourhood unit.

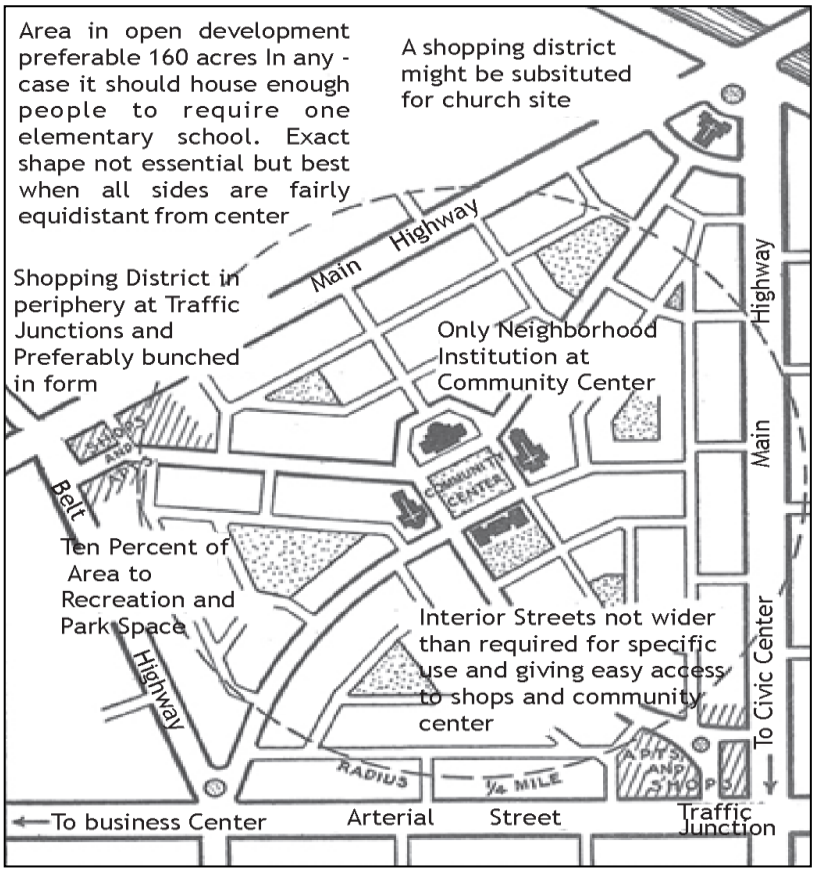



**Figure 3-1:Perry's concept of a neighbourhood unit**

(Source: Meaffy et al., 2014)

Lawhon (2009) summarised that Perry's neighbourhood unit is surrounded by the following physical settings:

- Major traffic routes and especially arterial streets should not pass through any neighbourhood unit. Streets in residential neighbourhoods should provide the perimeter for the neighbourhood.
- The street pattern of the neighbourhood unit should be constructed in such a way that it uses cul-de-sacs. This surface with light duty and curved layout will lead towards safe and low traffic rates in the residential area and keep the environment quiet and soothing for the residents.
- The population of any neighbourhood unit should not exceed the limit set by the school in the area. The school must support the population in any unit.
- Schools in the area should be the focal point of neighbourhood units and other institutions in the neighbourhood unit which have central importance for the residents should be at the centre of the neighbourhood unit.

- Perry ensured that the radius of the neighbourhood unit should be restricted to a quarter of a mile because this has been used to calculate the distance from school for a child's home in order to ensure that the school is within walking distance.
- Shopping centres should be constructed at the corners of neighbourhood units or they must be constructed at the intersection of major streets in the area.

After introducing his ideas, Perry located four sites where his ideas could be practically implemented in the city. Perry (1933) thought that such areas needed rebuilding and that his ideas could be implemented in these areas. In his later publication Perry realized that the idea of creating neighbourhood units is impractical in areas which are part of already built areas. He modified his plan and asked for government intervention, to take private land for public benefits.

Stein and Wright adopted the intellectual base developed by Howard and Perry. They adopted the idea of neighbourhood but, based on super blocks and bounded by major streets, added play areas and meeting points as integral parts of their construction plans. These super blocks would form a self-contained neighbourhood and groups of neighbourhoods would make a city. In the Radburn neighbourhood, they planned construction based of their idea. Radburn was planned in 1929 and was built in three years. Stein and Wright limited the maximum number of people in a neighbourhood unit to 25,000 inhabitants. They introduced new ideas in the construction of residential areas and employed almost all of the principles advocated by Perry. Their plan was to deal with a large population, which required a large and well equipped school system for the residents. Neighbourhood planning was conducted in such a way that ensured the residential units became accessible via minor roads and walkways that also linked the units to shops, schools, parks and major roads on the outskirts of the residential areas, keeping cars away from pedestrians. Groupings of the residential units were formed around cul-de-sacs that doubled up as service roads. The cul-de-sacs also created access from one house to another and from homes to garages (Patricios, 2002; Mumford, 1954).

In addition to this, another significant Radburn innovation came in the landscaping of homes. This innovation came with changes in the general look of the home. The gardens were landscaped in order to highlight the appearance of the neighbourhood, and the houses were inverted because the main entrance, living room area and bedrooms were placed to face

gardens located at the back of the residential units. This diverged from the traditional arrangement where these areas faced the roadways (Birch, 1980). This innovation is also credited with the promotion of social interaction among neighbours through the introduction of sports facilities, playgrounds and community centres. These facilities were placed under the control of the residents who automatically became members in the community association. This innovation, however, limited the maximum number of people in a neighbourhood unit (Gatti, n.d).

In order to represent sub-divisions within urban and rural areas, the term neighbourhood is widely used. Any locality where people live is commonly termed a neighbourhood. According to Mumford (1954), neighbourhoods are a *"fact of nature".* When people are sharing a place and living together they form a neighbourhood. There are many different reasons, for people to live together and share a geographical area, such as sociological, psychological and economic factors, when people share any geographical location they are used to form communities. Every community or neighbourhood has its own value system and physical appearances which distinguishes it from other communities and neighbourhoods. When these communities and neighbourhoods are in the form of a cluster they form villages and ultimately cities (Mumford, 1954).

Mumford (1937, 1954) supported Perry's idea of neighbourhood planning. He suggested that this idea was widely accepted at the time and it supported the feeling of belonging among residents. As mentioned above, Mumford considered a neighbourhood to be a social fact. The size of a neighbourhood was an issue that Mumford raised. The absence of social interaction would be recognised beyond a certain population. Therefore, the neighbourhood was important for Mumford in terms of preserving social values. He further suggested that the conscious design or planning of neighbourhood is essential, arguing that when neighbourhoods are we planned and well-designed they will help create well integrated urban areas and cities. In order to implement his plans, he gave practical suggestions. Mumford thought that instead of centralized forms of power there should be neighbourhood units that could be created in different sections of the city. The idea of centralization leads towards greater inefficiency. Neighbourhood units can be created according to geographical boundaries and the number of inhabitants in the area. When these types of units are created they will help people in giving people a sense of belonging and those who feel detached from the system will be engaged. Neighbourhood units are essential for the formation and transformation of cities because these units are playing a vital role in the social and

organizational life of the area (Mumford, 2014). Likewise, Unwin (1920:21), had also suggested that there should be clear distinctions and definitions of different parts or sections of an urban area and how they play their roles in the formation of the city to enhance the feeling of unity among inhabitants.

The subject of neighbourhood organization and planning has attracted the interest of many commentators. In one of the discussions by Fisher (1984:128-141), he made the point that the size of the community is inversely proportional to the level of members' involvement with each other. The larger a community, the lower the rate of involvement of people with their neighbours. The discussion then focuses on how people can be perceived as being *"neighbourly"*. It was also noted that, the longer the residents stay in a unit, the higher their interaction levels would be. Common factors that would bring people together include the raising of families, age, sharing common values and common needs. Older people were perceived to be more friendly and interactive than younger people. The sharing of common values like religion or common factors like having children provided the grounds upon which neighbours bonded (Fisher, 1984:131). Thus, what was previously considered non-essential in neighbourhood theory has by now become an essential foundation in the formation of sustainable neighbourhoods.

***Criticisms of the Neighbourhood Unit***

Proponents of the idea of neighbourhood units use physical design as an opportunity to promote socialization. Those who are convinced about the neighbourhood unit concept adopted the idea to provide better health and educational facilities to citizens and to provide better safety measures to the public (Meenakshi, 2011).

According Mumford (1954), Perry's treated the residential zone as a nuclear entity and tried to incorporate all basic facilities in it. Perry designed his neighbourhood units in such a way that they can facilitate family life, especially for women and children. His design was to ensure that people of all age groups have open access to cultural and social activities such as schools, cinema, churches and recreational facilities. When all these institutions are easily accessed, they facilitate regular use by all family members, compared with when being scattered all over the city rather than near the residents' own area. Use of these institutions on a regular basis is very important for any society (Mumford, 1954).

Considering that a neighbourhood unit is a self-contained area is not accurate, because it is thought that the inhabitants of these units are considered more conscious about their surroundings as compared to people living in other parts of the city (Gallion, 1984). Also, the cellular nature of neighbourhood units is very useful in managing the rapid expansion of the population as they lead towards more systematic approach in the development of residential zones.

Since the 1920s, Perry's concept of neighbourhood units has been widely used in residential plans in the United States (Banerjee and Baer, 1984; Lynch, 1994; Fulton, 1996). Hence the Federal Housing Authority added the idea to their guidelines for modern construction. However, in practice, many important features of Perry's design have been neglected such as 10% free space for parks, play areas for schools and no traffic routes through the centre of neighbourhood units. Perry has actually set the foundations for the reorganization of modern neighbourhoods. Dahir (1950) suggested that the influence of Howard and others cannot be ignored in his work of Perry but that Perry gave the whole design a name and added substance to the efforts made by the earlier practitioners. Perry has helped giving the world a sound scheme for the development of residential areas. The American Institute of Architects used the idea of neighbourhood units in their strategy for a developing a better America. Acceding to Gallion (1984) this reveals the importance of Perry's idea in the modern age. He suggested that construction and development organizations all across the world have widely accepted the idea of neighbourhood units and implemented his principles in planning strategies and practical designs. Miller (2001) wrote that hundreds of projects in the United States alone have been based on the principles suggested by Perry. In New Urbanism, many ideas about neighbourhood units have been included as basic working principles. Many neighbourhoods have been developed according to the principles of Perry, such as in Ohio, New Jersey, Radburn and Maryland. Many countries in the world have considered the idea of neighbourhood units an idealistic approach.

However, despite the advantages and interest in the concepts, the neighbourhood unit idea was subjected to a number of criticisms, especially after World War II. For Bauer (1945) Perry's concept was a discriminatory approach, more towards the privileged, especially when it comes to the affordability of housing. The idea of the neighbourhood unit in this sense is not practical. Webber (1963) noted that critics have not only criticised Perry's neighbourhood unit but have also widely challenged the sociological theory of Cooley, McKenzie, Park and others. Likewise, Dyckman (1959) identified practical difficulties in matching the capacity of

schools with neighbourhood unit residents because populations are growing and changes are occurring everywhere. (cited in Brody, 2013). In a comprehensive study, Banjree and Baer (1984) argued that residents of many areas do not consider their area or surroundings to be neighbourhoods and so there is a need for to change the term from neighbourhood unit to residential environment. They concluded that planners have to address this change of terminology in new developments. Banjree and Baer (1984) pointed out that, in that era, socio-economic status was very important for social interaction and for the creation of a stable neighbourhood. Lawhon (2009) added that several critics had attacked the concept of 'physical determinism' in Perry's idea, which implies that the designed physical settings determine the social outcomes of its users. However, other researchers (i.e. Patricios, 2002) argued that Perry's approach provides more opportunistic designs for more social activities of users.

Critics have widely challenged the concept of neighbourhood and stated that a neighbourhood is divided into different groups of people. They further argued that when people are divided into different groups there will be class distinctions among citizens. On the other hand, some have romanticized the concept of neighbourhood to the extent that they think in the modern age this is the best solution to deal with the rapid growth of human populations. Schools at the centre of the neighbourhood unit are another impractical suggestion when other important community services are available at a large distance. The utility of Perry's meeting points in recent times has also come under scrutiny, as the maintenance of all facilities in his approach rise another important question mark. Economic feasibility is very important for any development plan, and the feasibility of neighbourhood units is also a point of debate (Meenakshi, 2011). Moreover, Perry's fixed size and population in the urban neighbourhood at his time is not applicable in the current era. Now there are less social, physical and institutional forces compared to the early twentieth century, as the apparent change of lifestyles, for example the reliance on the use of automobiles, especially to commute to and from schools, gave more freedom to enrolling in far distanced schools and not necessarily the nearest. However, physical design concepts of Perry can still be employed to create a good place to live (Patricios, 2002).

To conclude, it was shown how the neighbourhood unit concept has placed its own historical importance in many global societies. However, critics of the neighbourhood unit idea focused on the social and environmental elements of the theory and led to further complicated, but

practical, improvements in the social, economic, and environmental aspects, presented in the next sections.

## 3.4 The Concept of the 'Compact City'

### *Definition and Background*

The concept of the 'compact city' forms an integral part of every modern urban design and development project. In principle, a compact city is a city with a high density of population and more open space for people to enjoy, with balanced land use and the proper utilization of public conveyance systems. It simply supports efficient transportation that reduces travel time and diminishes traffic, allowing for the efficient use of the available land and to enrich society and bring about social cohesion. The vehicular emission rates in compact cities are therefore kept within acceptable limits and energy consumption is highly cost-effective in more efficient urban transport (Newman, 2000).

The idea of a compact city was first proposed by Dantzing and Saaty (1973), and towards the end of the 1980s planners started to realize that an efficient city transit system is necessary to make a city liveable (Marcotullio, 2001). Ideas of compactness and mixed-use started gaining importance in the early 1990s because of their suitability from ecological and environmental perspectives. Compactness and mixed-use can be realized at every developmental level. The concept of the compact city has been recognised as the answer to the problem of unsustainability in Europe and the UK (Jenks et. al, 1996).

According to Hillman (1996), Thomas and Cousins (1996), and Frey (1999), compact cities have environmental, social and fiscal advantages over regular cities, resulting in excellent energy savings. These include:

> *"Less car dependency, low emissions, reduced energy consumption, better public transport services, increased overall accessibility, the re-use of infrastructure and previously developed land, the rejuvenation of existing urban areas and urban vitality, a high quality of life, the preservation of green space and a milieu for enhanced business and trading activities".* (Thomas and Cousins, 1996:56)

The compact city concept has therefore been considered facilitating schemes that can put an end to *"the evil of urban sprawl"* (Beatley, 1995:384). Nelson (1995:1) defined the term urban sprawl as:

> *"…unplanned, uncontrolled, and uncoordinated single use development that does not provide for a functional mix of uses and/or is not functionally related to surrounding*

*land uses and which variously appears as low-density, ribbon or strip, scattered, leapfrog, or isolated development".*

The compactness of the built environment is the most effective strategy to achieve sustainable urban form, as it minimizes the transport of water, people, and energy (McLaren, and Hillman 1991) and provides accessibility to facilities and services. Its role in achieving sustainable urban forms has been encapsulated in four major ways in contemporary discourse (Williams, Burton, and Jenks 2000; Pratt and Larkham 1996). Firstly, it protects rural urban areas (McLaren 1992). Secondly, it focuses on quality of life, such as social interaction and easy access to facilities and services. Thirdly, it lessens energy consumption by combining heating and power systems with high densities of buildings, and finally it offers a variety of travel options and the curtailment of car use, thereby leading to reductions in greenhouse gas emissions.

While a sustainable city is exemplified by compactness, diversity, density, and high integration (Dumreicher, 2000), compactness can help prevent commuting which is one of the most harmful aspects of city life (Sherlock1990). A sustainable city should therefore incorporate an urban form that is workable, with an ideal size that minimizes the need for private cars as well as affording a rich urban life. This, therefore, calls for the regulation of existing urban structures that will help prevent urban sprawl rather than developing new urban structures (Hagen, 2000). Similarly, intensification occurs through the development of undeveloped urban land, the redevelopment of existing buildings, conversions, sub-divisions, and extensions (Jenks, 2000), and uses urban land in a more efficient way with a focus on a high density of development and activity which can help to achieve compactness.

Moreover, urban sprawl has had negative impacts on urban lifestyles for the last fifty years and has been viewed as *"... excessive land consumption due to under-valuation of open space, congestion due to increased commuting, and socioeconomic segregation due to exclusionary housing markets"* (Carruthers and Ulfarsson, 2002:315). Urban sprawl is also not cost effective and makes significant contributions to public health problems (Nozzi, 2003; Kelly-Schwartz, 2004; Sturm and Cohen, 2004).

Consequently, much expectation developed around the concept of compact city. In 1987 the World Commission on Environment and Development made sustainability part of the political agenda, and the compact city concept was soon considered to be the answer for sustainable urban development. Many, including Beatley (1995:384), believed that

*"sustainable communities* [...] *are places that exhibit a compact urban form"* and, according to the CEC (1990), the European Union became one of the leading supporters of this concept. However, many, like Thomas and Cousins (1996:56), were also sceptical about the concept and believed that:

> *"*[These] *claims are at the very least romantic and dangerous and do not reflect the hard reality of economic demands, environmental sustainability, and social expectation. The overriding problem with the compact city is that it requires us to ignore the causes and effects of decentralization, and benefits it may bring".*

This slowly became a reality check when the need for housing and urban services could not prevent urban spread into the countryside. Also, plans like the reduction of car use and intensification of existing urban space could not be controlled. This was one of the leading problems, particularly in developing countries, with urbanization spreading rapidly. There was definitely a role of urban planners in assessing the situation in a better light and using appropriate solutions to handle the density of land use.

Jacobs (1961), in her influential work *"The Death and Life of Great American Cities",* proposed a dense and vibrant design to improve urban communities in the cities. She stated that by achieving a diverse urban neighbourhood, the experience and perception of people towards their urban lifestyle can be socially enhanced. The diversity of activity in an area is an important factor in actualising sustainable cities, as it encourages people to walk, and its lack encourages people to drive. Jacobs (1961:230) noted that:

> *"In dense, diversified city areas, people still walk, an activity that is impractical in the suburbs and in most grey areas. The more intensely various and close-grained the diversity in an area, the more walking. Even people who come into a lively, diverse area from outside, whether by car or by public transportation, walk when they get there".*

According to Jacobs (1961), diversity is not only necessary in any urban system but also makes it more liveable. While the terms diversity and mixed land-use possess some similarities, diversity is a *"multidimensional phenomenon"* (Turner et al., 2001:320) that fosters further desirable urban attributes, including greater disparity of housing types, building density, household size, age, culture, and income (Congress for the New Urbanism and U.S. Department of Housing and Urban Development, 2000).

> *"If development is not diverse, then homogeneity of built forms often produces unattractive, monotonous urban landscapes, a lack of housing for all income groups, class and racial segregation, and job-housing imbalances that lead to increased driving, congestion, and air pollution"* (Wheeler 2002:328).

Consequently, the social and cultural context of the urban form is characterised by diversity and development encourages social interaction among different income groups and a mixture of housing types.

Rudlin and Falk, (1999) and the Urban Task Force (Rogers, 1999), amongst many, believed that such urban forms will lead to the better distribution of urban services and quality of life. Rogers (1999) demonstrated clearly (see Figure 3-2 below) the difference in urban capacity between a compact city compared to a normal dispersed city. A dispersed city tends to have large areas characterized by low density development highly remote from the urban centre or 'hub'.

Meanwhile the lower density areas of a dispersed city are occupied mainly by residential accommodation, and the hub often contains core functions important for supporting urban life, including civic services, public transport, and retail and commercial facilities. Conversely, in a compact city, urban areas are often organized in concentric density bands, with higher densities manifested near public transport nodes such as underground stations and bus stations and lower densities manifested in less connected areas. The main advantage of the compact layout is that it helps establish clear urban boundaries as well as reducing car use and containing urban sprawl.

According to the Task Force (1999), the plan of the physical surroundings is what will decide the endorsement of sustainable lifestyles and social inclusion in towns and cities.

> *"A well-designed, compact and connected city is a flexible structure which relates the parts to the whole. A clear articulation of public space not only connects different quarters, neighbourhoods and communities to each other across the city, it also links people within localities to their homes, schools, work-places and basic social institutions"* (Rogers, 1999:54)

When the main importance of the public realm is recognised, the accomplishment of well-designed urban districts and neighbourhoods takes place. Also, the spaces between buildings define the design form of the city and its connectivity. To join together urban neighbourhoods and communities, the shape of public spaces and their links are vital. Similar to the compact city, when the framework is successfully well designed and incorporated, it connects people and places. However, just like in modern urban developments, when the framework is not well-designed and incorporated, it creates estrangement and social isolation.

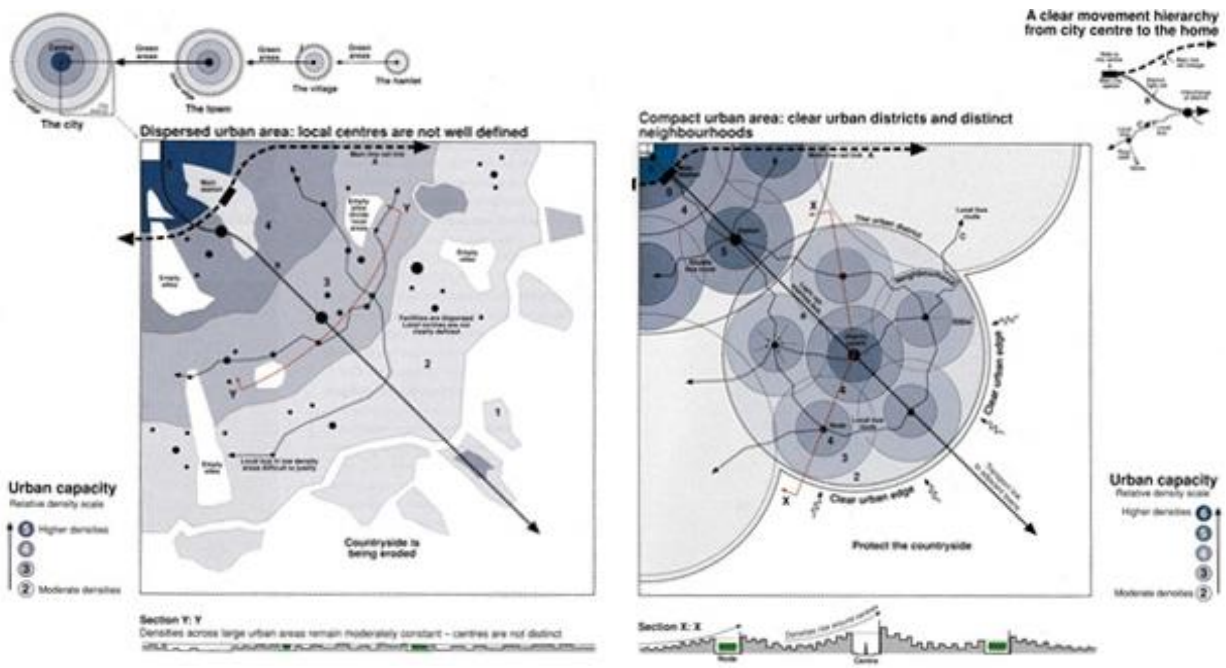



**Figure 3-2: Urban structure of dispersed and compact cities**

(Source: Rogers,1999)

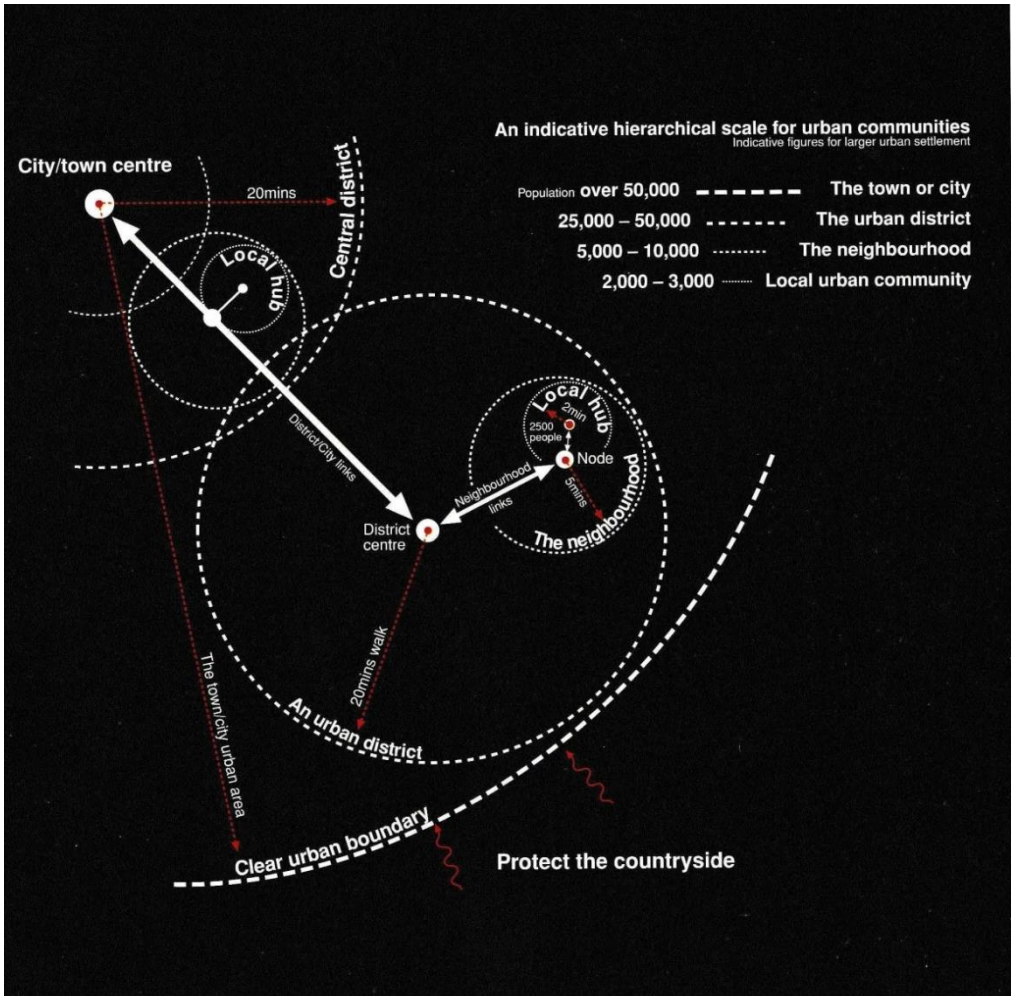



**Figure 3-3: Linking urban neighbourhoods and communities**

(Rogers, 1999:55)

Figure 3-3 above shows in detail the organization of movement, within urban neighbourhoods and it demonstrates how the different essential facilities of the neighbourhood, district and community are to be linked, in order for it to be sustainable. They have to be linked with the help of public routes and streets, as the arrangement of the city is a support for movement and communication. The diagram further shows the distances which people are willing to walk, in order to reach facilities that are situated in their local area or a city area. For example, people will walk to their home, school or local bus stop, if it takes them five minutes (400m), before choosing a car. A range of commercial and social facilities should be constructed in the urban district; and these amenities include civic spaces, colleges, leisure centres and parks.

Another important sustainability factor for a compact city is the pattern of density. Density denotes the quantity of people or dwelling units in urbanized areas, but the pattern concerns how density is spread across the city. In a compact city, people are more closely located to each other, thereby leading to higher levels of interaction which, according to Cadman and Payne (1989) enriches the quality of life in a community. It also significantly reduces travel distances and time.

It is contended that the quantity of people living in a given area determines the viability of the urban character, and higher density cities are more sustainable than lower density ones. For example, Sherlock (1991) asserted that, when density is high, all opportunities are in close proximity and if density is low the vitality and diversity of a city is also lost. To Rogers (1999), a high-density population can support the profitability of public transport systems and sustain local facilities such as power generation units. According to Burton (2002), 'Friends of the Earth' suggest that a net residential density of 225 to 300 people per hectare is helpful for sustainable urban developments. Similarly, the (DETR, 1998) noted that avoiding development below a density of 20 houses per hectare can lead to significant land savings. According to Scoffham and Vale (1996), the density of urban development generally refers to how congested an urban location feels. This leads to the conclusion that a regional culture has significant effects on the perception of density (Rapoport, 1975). However, the challenge in obtaining absolute values for the density of a compact city is effectively overcome through research which focuses on gathering the empirical data showing the relative perceptions of density and thus investigating their differential advantages (Burton, 2002).

Higher density development also translates in to lower power consumption and supports sustainable housing. The rate of consumption of energy, urban land, infrastructure and

transportation is dependent upon the type of dwelling and density (Walker and Rees, 1997). Clark, et al (1993:146), however, asserted that sustainable development suggests a *"self-support economy"* and necessitates *"more land for out buildings and outdoor activities . . . and a general reduction in net residential densities."* Robertson (1990) advocated the revival of the decentralized city, returning to rural and countryside values. 'Decentralized concentration' is an innovative concept that essentially means high density development along public transport routes (DETR, 1998). This also means the creation of high-density sub-centres that evenly concentrate the flow of traffic (Rydin, 1992). A favourable density is one that consists of settlements that range from small to medium-sized. The settlements should not be too core-centric and properly planned and dispersed over a wider region. Social interaction is promoted by high density that provide compactness, just as Newman and Kenworthy (1989:33) affirm that energy can be saved through policies on:

> *"Increasing the urban density; strengthening the city centre; extending the proportion of a city that has inner-area land use; providing a good transit option; and restraining the provision of automobile infrastructure."*

Transit use is also strongly related to density (Transportation Research Board of the National Academy, 1996). Lower density areas, for example, are usually characterised by poor transport systems which encourage car use. The mode of allocation of facilities may promote this, but it is environmentally detrimental (Freeman, 1984). The density of areas strongly determines travel options; residents of high density areas travel by transit or bicycle, and by walking more than driving. The housing forms that are ideal for a high-density compact city can be an arrangement of blocks that have equal access to the ground and views of open space (Martin and March, 1972).

Moreover, observation shows that the physical characteristics of a city often have a great impact on the lifestyles of its inhabitants. Travel behaviour, economic viability, social equity, energy consumption and sustainability in general can be greatly influenced by the physical attributes of the urban environment (Jenks, 1996). Although many designs and guidelines for urbanization have been available since the 1960s (Jenks, 2000; American Public Health Association, 1960), optimal density and better access to local facilities have become fundamental criteria in urbanization. However, there are also some negative impacts of the intensification and density of urban forms. Some of these are claimed to be the lack of privacy, stress, and other social implications (Frey, 1999; Gillham, 2002; Bruegmann, 2005). Nevertheless, despite these impacts density is still considered as the guiding principle to

achieve urban compactness. This concept should focus on issues like the importance of layout and achieving accessibility (Vicuna, 2012). The notion of the compact city plan was an active part of urban development policies in the early 1990s in the UK and other European countries after being popularized by the Brundtland Report (1987). There have been concerns about whether or not the compact city concept can really live up to the promises made and if intensification will be acceptable to the general public (Breheny, 1997).

An intensified city is an urban setting that has undergone compaction at different levels. The concept also includes the creation of unique urban villages in the UK and developments under label of urbanism in the USA (Urban Villages Group; 1992; Breheny et al, 1993). However, in a European setting, the main drive for setting up compact cities has been to accelerate growth rather than build new urban settlements, because of low population growth rates in the region (Barrett, 1996).

According to Arbury (2009:17), surveys in the USA by the National Association of Home Builders (NAHB, 2000) *"... show that most people want to have their own homes in their own lots"*. At an individual level, everyone seeks a large house and good automobile access, but this contradicts with the ultimate goals of compact city. The presence of such high demands of large houses and cars, particularly in the sprawl, has resulted in causing traffic jam problems and pollution.

There is a lack of proper definition for the compact city concept and its suction to urban sprawl. As stated by Burton (2002:219), "*in seeking to provide empirical data to advance the debate, research on the compact city is hampered both by a lack of consensus on its meaning and by the absence of recognised indicators for measuring it."* A compact city concept means a lot more than mere increases in density (Burton, 2002) and induces factors like advanced mixed-use developments with a special focus on better sustainability, a better quality of life, accessibility, and walkability (Elkin, 1991; Goodchild, 1994; Rogers,1999).

Jabareen (2006) studied the literature in his matrix of various urban forms or models identified, and these are (the neo-traditional development, the urban containment, the compact city, and the eco-city) for their sustainability, using seven design concepts that he believed were repeated in sustainable urban form theories and which contribute most to sustainability: compactness, sustainable transport, density, mixed land use, diversity, passive solar design,

and greening. His findings show that the compact city model receives the highest score for sustainability.

Climate sensitive design has also contributed to the achievement sustainable urban forms, particularly in urban areas where there is generally a problem of microclimates as opposed to the countryside (Barry and Chorley, 1998). This is because built-up urban areas have more exposed surfaces than do flat rural areas, and these surfaces can absorb much sunlight. This has prompted scholars to identify various climate-sensitive design measures that can help in reducing demand for energy and ultimately improving urban microclimate and achieve a sustainable urban form. For example, Owens (1992) highlighted that the position, layout, landscaping, design and orientation of urban and building forms stand as important featured elements of solar energy, to avoid the need for the cooling or heating of spaces in buildings. Along the same lines, Yannas (1998:34) identified the following design measures: (1) the density and type of built form, regarding airflow, sunlight, and exposure of surfaces; (2) the ratio of the street's width to height and orientation, regarding processes of cooling and warming; thermal and visual comfort conditions, regarding building heat and the usage of transitional spaces; (4) urban materials and the finish of surfaces, regarding absorption and storage of heat; (5) vegetation and bodies of water, regarding evaporative cooling processes on building surfaces and/or in open spaces; (6) limiting traffic to improve air quality.

Urban structure has a strong relationship with energy system use at all urban scales, from the city to individual buildings. As argued by Owens (1992) and Yannas (1998), the design measures do not only use the sun's energy for the heating and cooling of living spaces, but also strongly affect the form of the built environment and can encourage walkability and social interaction. Consequently, a sustainable urban form considerably influences energy usage and thermal comfort. As has been regularly mentioned, buildings play an important role in energy use worldwide and policies for ecological design and mixed land use will lead to energy efficiency.

Green spaces are also one of the most important contributory elements to achieving sustainable development. According to Jane Jacobs (1961), *"Parks are volatile places… and do add great attraction to neighbourhoods that people find attractive for a great variety of other uses. They further depress neighbourhoods that people find unattractive for a wide variety of other uses, for they exaggerate the dullness, the emptiness".* People actively use green areas to spend free time, to play games and to discover nature. Also, the land helps to

regulate the general level of underground water and to absorb the water from the ground, while trees are among the most effective methods for clearing pollution from the air and to provide shade. Moreover, urban green spaces also provide a range of economic, cultural and environmental advantages (Haq 2011). They maintain the long-term protection of nature through increasing air quality, property values, quality of life, aesthetics reducing the cost of energy which can be spent on the cooling of buildings (CABE, 2005). According to Nicol and Blake (2000), more than 80% of the United Kingdom's population live in urban areas. Green areas in urban spaces contribute necessary outdoor opportunities for citizens.

A review carried out by Williams (2000) found that in order to appreciate the real benefits of a modern compact city, it is important to count the evident positive aspects on the ground. This, accordingly, is only possible where there is a thorough understanding of the challenges associated with implementing the strategies. There has to be cohesiveness between the planners and the city administrators. Incorporation of all the elements will help in the planning process and will also aid in their implementation and the enrichment of city life.

## 3.5 The Concept of New Urbanism

New Urbanism refers to the Western movement that emerged in the twentieth century mainly as a reaction to unplanned urban sprawl. It is a concept that aims to replace this suburban sprawl with highly planned civilized and familiar places that people appreciate (Duany, 2000). Considerable numbers of studies on the theory, fundamental principles, and the advantages of new urbanism, including its social and environmental benefits, have emerged in recent years. The following section provides a brief review of this literature.

### *Definition and Theory of New Urbanism*

Both Hirt (2009) and Haas (2008) agree that the New Urbanism gained prominence in the early 1990s as a reform movement that promotes qualities that urban reformers have always sought, including vital, just, beautiful, and environmentally benign human settlements. The breakthrough planning concepts of these urban reformers included proposing a future that integrates the best of the past with modern conveniences and realities. New Urbanism, as defined by Haas (2008), refers to an urban design movement that aims to promote environmentally friendly habits through the creation of walk-able neighbourhoods which contain, large numbers of housing and job types. He demonstrated that the New Urbanism

emerged as an attempt to reconcile competing ideas about urbanism which have undergone significant evolution for more than a century.

In essence, New Urbanism, as a movement or concept, encourages urban planners and architects to consider locating commercial and retail facilities in neighbourhood centres, away from traffic junctions. To this extent, planners would not only be able to improve the sustainability of urban centres, but would also enhance the liveability of neighbourhoods. Therefore, New Urbanism, which embraced the Neo-traditional movement, is different from earlier movements such as that of Perry because it espouses mixed use development and medium–high densities as well as incorporating the participation of citizens in the planning process (Sharifi, 2013).

Unlike traditional movements, which emphasized a fixed size (Fainstein, 2000), the Neo-traditional concept highly flexible, emphasizing the changing needs of individuals through the placement of facilities within walkable distances in the catchment area. New Urbanism, therefore, plays an important role in establishing sound integration between the city different urban scales (Sharifi, 2013).

***Principles of New Urbanism***

The basic principles of New Urbanism were developed in the early 1980s. These principles were mainly grounded in the ideas of notable personalities in urban planning, including Jane Jacobs, Kevin Lynch, Clarence Perry, and Christopher Alexander, who found a new appeal in traditional values (Vanderbeek and Irazabal, 2007). These basic principles mainly consist of traditional design principles that are proportional to human scales in cities (Rahnama et al., 2012:198). The ten basic principles include walkability, connectivity, mixed housing, mixed land use and diversity, quality architecture, traditional neighbourhood structure, and transect planning. Other principles, as highlighted by Rahnama et al. (2012:198) include increased density, sustainability, smart transportation, and quality of life.

Firstly, in respect to walkability, New Urbanism promotes street designs that are friendly to pedestrians, such that most needs are met within just a 10-minute walk of work and home. Conversely, according to the principle of connectivity, Rahnama et al, (2012) demonstrated that urban centres should have interconnected street grids capable of dispersing traffic and encouraging walking. A demonstrated by Rahnama et al. (2012:199), while increased density,

as a principle, promotes residences, buildings, services, and shops close together in order to promote convenient walking, sustainability promotes the effective use of eco-friendly technologies and respect for natural systems. Smart transportation, on the other hand, lays emphasis on a network of quality public transport systems that connect towns, cities, and neighbourhoods, while quality of life emphasizes design principles that provide places capable of enriching uplifting, and inspiring people's spirits (Katz et al., 1994:1). The following section discusses smart transportation and mixed land use in the context of sustainable urban forms.

Smart transportation denotes the creation and design of places in a way that promotes the utilisation of different transport modes like walking, bicycles, cars, or subways to reach destinations. It has been considered a significant way to achieving sustainable urban forms (Newman, 1999). This transcends recent experiences in various cities where car use, which often generates traffic congestion, is predominantly relied upon. Jordan and Horan (1997:72) defined sustainable transportation as:

> *"Transportation services that reflect the full social and environmental costs of their provision; that respect carrying capacity; and that balance the needs for mobility and safety with the needs for access, environmental quality, and neighbourhood liveability"*.

These types of transportation services make life easier, less costly and safer (Newman 1999), as each of the strategies encourages people to walk and to use bikes and buses. The strategies of utilising smart transportation can only be accomplished by increasing the number of street intersections with short blocks, the densities of residents and of jobs, the distance from the central business district, and regular public transit activity. For example, increasing street intersections, by creating short blocks and mid-block pass-through crossings, which provide disparate routes for users, and allows for an effective flow of circulations (Jacobs, 1961 and Owen, 1992).

Measures should be incorporated in policies for sustainable urban development to reduce urban mobility and allow more eco-friendly transportation. This becomes necessary, as Crane and Crepeau (1998:18) maintain, as *"many times, these transportation benefits have been advertised as facts rather than hypotheses, and have even been utilized or at least recommended as tools for decreasing the negative environmental impacts associated with car travel."* Additionally, urban transportation systems can conserve energy, as revealed in *The Transit Metropolis*, in which Cervero (1998:46) contended that *"compact, transit-oriented*

*development shortens trips, thus encouraging non-motorized travel. And conversion of low occupancy auto trips to mass transit cuts down per capita fuel consumption."*

Mixed land use and diversity, on the other hand, is a principle that describes blocks, neighbourhoods, and buildings that provide mixtures of offices, apartments, shops, and homes. Neighbourhoods should also be able to welcome people of all cultures, races, income levels, and ages. Mixed housing, however, is a basic principle of the new urbanism that promotes the close proximity of different ranges of housing sizes, types, and prices (Rahnama et al., 2012:198). While quality architecture and urban design emphasize aesthetics, beauty, and comfort, as well as institution a sense of space, traditional neighbourhood structures, on the other hand, emphasizes neighbourhoods with definite edges and centres. By mixing land uses, new urban design offers an alternative to contemporary developments that segregate uses and separate homes from schools, shopping and jobs, rich from poor, and owner from renter (Duany, 2000; Calthorpe, 2001). The disadvantages of contemporary design include loss of social interaction among people of disparate incomes, ethnicities, and household structures and the decline in air quality and in attachment to place due to dependence on cars (Talen, 1999). Mixed uses minimise the footprint of paved areas required for automobiles, which produces more opportunity for the protection of sensitive area, and leads to less need to use structural protection controls. The placement of businesses and civic uses next to residential uses increases pedestrian accessibility, which lightens pressures for parking (Cervero, 1997; Saelens, 2003; Khattak, 2005). Demand for parking can be further minimised by locating land uses with different peak-hour parking times near each other, for example movie theatres next to daytime offices. This allows joint use of the same parking spaces (Olympia, 1994). Mixing complementary uses also generates multi-purpose trips wherein a single parking space can service several trip purposes. Additionally, this design concept promotes compactness in urban forms.

There has recently been a decrease in the proximity of schools and colleges to residential areas. This increases travel times and the usage of cars (Elkin, 1991). With the objective of minimising car travel and to encourage the mixed use of transport options, planners should endeavour to make town centres highly accessible through other transport modes instead of the private car. Mixed-use will not only reduce travel time but will make cities safe and more environmentally friendly.

Another principle that assists in shaping more sustainable communities is greening. Greening is a significant design concept for sustainable urban forms. The aim of greening is to integrate

nature into city life by landscaping (Elkin et al, 1991). Greening makes urban places sympathetic and more attractive and helps achieve sustainability. Also, greening urban spaces can improve urban environments, and has many benefits such as regulating climate and air quality, reducing energy consumption through paved surfaces, reducing the erosion of soil, recharging groundwater supplies, and improving the image and quality of urban life. Also, it is educational and has health benefits, as contact with nature enhances our psychological, spiritual, and emotional wellbeing, thus providing community cohesion and safety, social inclusion, equality and diversity, participation, philanthropy, and empowerment. Finally, urban green spaces have further important environmental functions such as biodiversity, and nature conservation, as well as economic, aesthetic, social, and psychological benefits (Von Stulpnagel et al, 1990; Plummer and Shewan, 1992; DoE, 1996). These basic principles have played an important role in promoting the new urbanism movement. Figure 3-4 demonstrates Duany and Plater-Zyberk's version of the neighbourhood unit as influenced by the new urbanism principles.

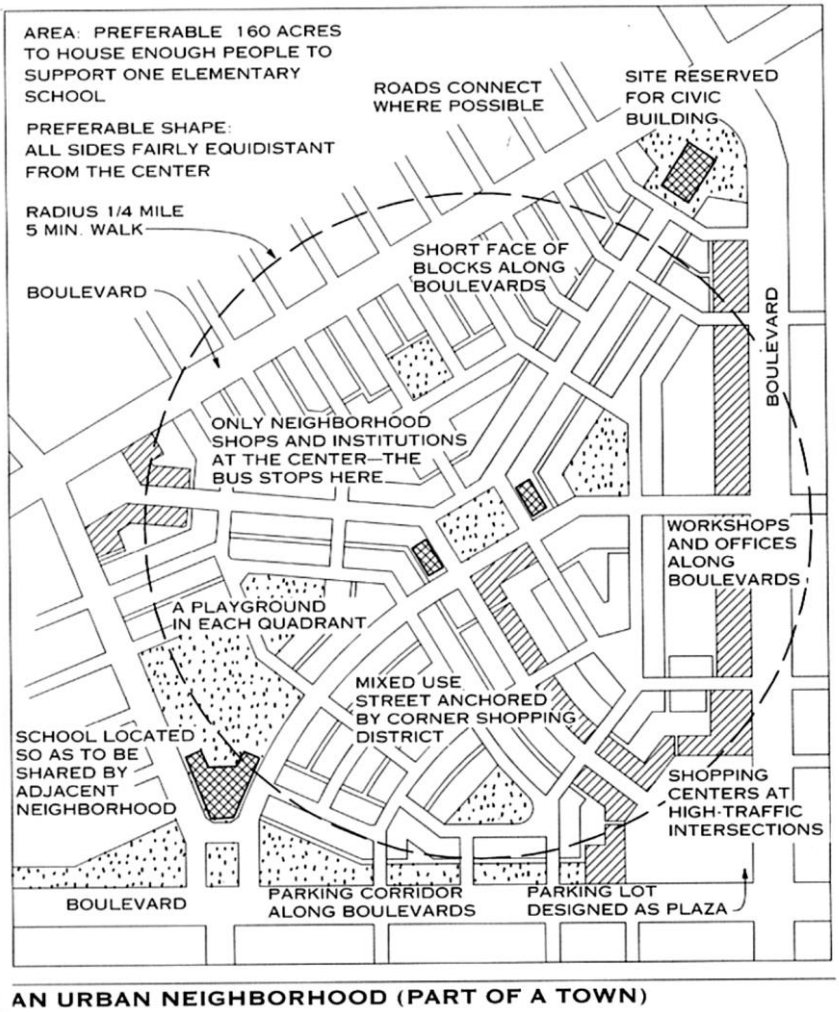



**Figure 3-4: Duany and Plater-Zyberk's version of the neighbourhood unit**

(Source: cited in Sharifi, 2013:61).

The impact of the neo-traditional movement is largely reflected in the updating of Perry's neighbourhood unit as provided by Duany and Plater-Zeyberk, which recommends various measures including the replacement of highways with boulevards, as illustrated in Figure 3-4. The updating also shows that an enhancement of integration with surrounding neighbourhoods could be achieved through the alignment of internal streets with the streets of the adjoining neighbouring areas (Farr, 2008). New urbanism seeks mainly to bring back the necessary amenities that make communities function, such as: easy access to work, play, and schools; culturally diverse housing; and efficient transportation. As such, the main benefits that people would derive from the new urbanism are functionality and convenience, as people can easily move from one place to another within a short time (Vanderbeek and Irazabal, 2007:42).

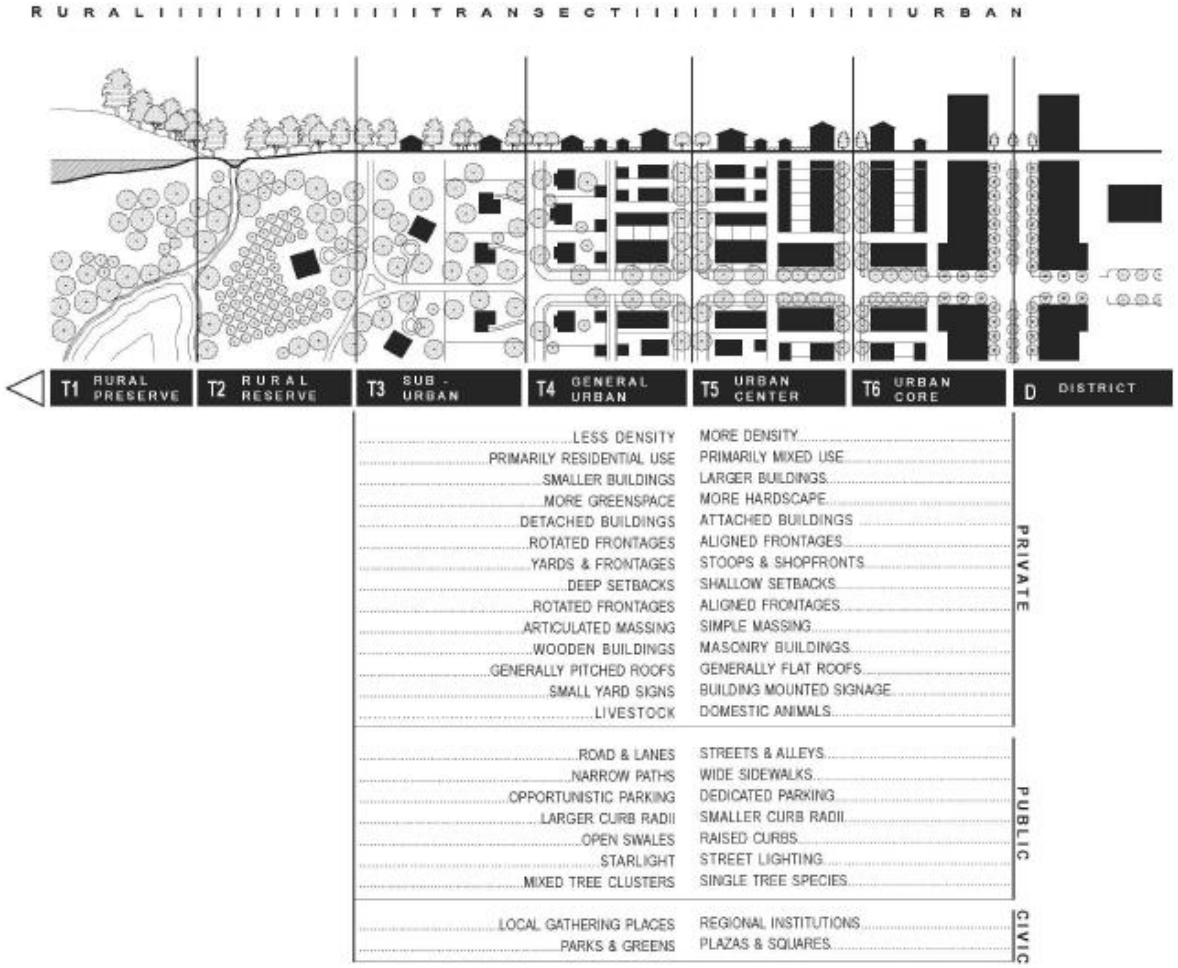



**Figure 3-5: Outline for the New Urbanism movement**

(Rahnama et al, 2012:197)

Figure 3-5 shows an overview of how planning strategy based on this design movement helps to enhance convenience in urban areas. It is also clear that basic principles such as increased density and diversity also play an important role in promoting a natural social environment in which individuals interact closely. In addition, as seen in figure 3-4 and 3-5, New Urbanism includes the design of neighbouring units that promote a friendly atmosphere for individuals who can walk conveniently from one place to another without necessarily using vehicles. Besides this, this type of design is critical for the provision of both security and comfort to residents as well as convenience and satisfaction to pedestrians. New Urbanism also has considerable benefits to the environment because it enables people to traverse natural surroundings using friendly technologies (Vanderbeek and Irazabal, 2007).

### *Criticism of New Urbanism (Neo-traditional Planning)*

The New Urbanism movement, both as an ideological and as a practical plan, was a response to the negative impacts of contemporary planning that has contributed not only to unchecked suburban sprawl, but also to the inequalities of urban social life and the decay and deterioration of the urban environment of American cities (Ellis, 2002; Hirt, 2009). Its aim was to recreate the best of the past's traditional urban forms for today's cities by seeking the restoration of the civil realm in urban planning (Haas, 2008). However, in spite of the promises of its advocators, the concept of New Urbanism has also been subject to criticism.

According to Williams, et al. (2000), and others like Ellis (2002) and Robbins (2008), apart from some of its design principles, like the design of street patterns and architectural vocabularies to be relevant to the local urban context, most of its other urban features were considered as universal. These universal features can be widespread for any new urbanism example, including all the physical recommendations for intensity, density, mixed land uses, and building types, which should all be attractively presented to secure high quality of urban environment with lower car use.

The concept of new urbanism has been criticised, by Robbins (2004), on the grounds that most of its adopted projects are often incomplete. In addition, some land use such as industry, is usually excluded, and diversity of functions and demographics is limited (Ellis, 2002; Grant, 2006; Robbins, 2004). Furthermore, new urbanism requires high levels of quality for the built environment that achieves homogeneity and style, therefore ensuring affordability in housing values seems to be problematic. According to Robbins (2008), it was found that 50% of the USA population could not afford New Urbanism projects.

Some urban researchers have even doubted the actual benefit of New Urbanism changes to the quality and improvement of the urban life in which it has been applied (Breheny, 1992a, 1996; Gordon and Richardson, 1997; Dieleman and Wegener, 2004; Arbury, 2005; and Thomas and Cousins, 2010). For example, Arbury (2005: 54) insisted that where such urban *"policies had been implemented, follow-up studies began to show that the predicted benefits were not happening as they should have been".* Silver (2006) argued that notable critics highlight the failure of new urbanism to learn from some of the mistakes of past urban movements. Put succinctly, neo-traditionalists, like the earlier movement planners, tend to focus more on physical forms, believing that better communities can only be created through urban design. The neighbourhood unit plan proposed by new urbanism, however, has not been able to reduce the problems of socio-economic segregation in major cities, especially in America (Fainstein, 2000; Silver, 2006). Consequently, it seems that there was a belief that the creation of liveable and socially cohesive communities can be achieved mostly through physical environmental determinism (Silver, 2006; Vanderbeek and Irazabal, 2007).

Other criticisms acknowledge the significant differences between new urbanism and modernism in respect to their origins as well as the political and cultural context in which they have been deployed (Vanderbeek and Irazabal, 2007). In this regard, according to Mohamed (2013), unlike historical origins for new urbanism examples in the Western cities, those traditional origins in the Islamic-Arab context *"represent a model of compact development that responded for quite different considerations from those in the developed countries; in particular cultural needs and climatic protection."* He added that despite the few new urbanism examples in the developing world, built examples in the developed world *"have been perceived by many as beautiful and walkable but not necessarily up to the expectation of or to make a real difference to environmental sustainability."* To exemplify, Rahmana et, al. (2012: 202), explained that despite the positive results gained form some American and European projects fostering new urbanization plans, the attempt to carry out similar projects in the context of a different developing country, Iran, which has a history of rich urbanisation, was *"faced with unfavourable results of zoning, inefficient street systems, lack of open space, low quality of architecture, low quality of social life, unbalanced between growth of housing and employment."*

Finally, the reviewed criticism in the literature of new urbanism shows that the pressure for planning concepts of neighbourhoods based on traditional urban styles in modern-day cities is considered more as a vision for better future development rather than one based on an

examination of the real wider aspects and factors of urban development. However, such a return to traditional elements in the New Urbanism movement echoes the importance of the urban concerns of identity and homogeneity in contemporary urban planning.

## 3.6 Design Principles of Sustainable Urban Form

Proceeding with research in the areas of urban planning and configuration has improved the level headed nature of discussion on urban manageability and added clarity to the idea of sustainability. The 'sustainable city' has been described generally as a condensed, green and participatory type of urbanism, characterized by contained, dense and well-connected urban forms with a mix of land uses and buildings. It is somehow against the idea of sprawl growth that is relied upon to support ecological, social and financial maintainability (Roseland, 2000; and Neuman, 2005; Haas, 2008). Models, for example, of the 'compact city' and eco-city that have been created in rich Western nations as a distinct option for urban sprawl are not so pertinent in the settings of developing nations, unless they respond to local urban issues, neighbourhood conditions and individuals' desires in these countries (Jenks, 2000). Some indicators of sustainable urban forms include, for example, density, diversity and connectivity, all of which may be measured at more than one urban level (Talen, 2003).

Urban design is considered to be necessary in order to improve patterns of sustainability by considering the vital principles of continual future progress. A large number of studies in this regard provide findings which support the importance of urban design in encouraging sustainability. Research by Selman (1996) and Carmona (2001) pinpoint the major characteristics of sustainable growth that must to be incorporated within urban design. These features are based on trusted policies that maintain diversity, equity and public justice, social and environmental balance, and transportation capacity. Furthermore, research by Atkinson and Ting (2002) has presented a strategy for a framework for the transformation of sustainable urban design with the following characteristics: the acknowledgement of basic environmental and ecological designs and limits, and social restoration and regeneration to seek a better quality of life, to practically employ integrative and holistic strategies, and plan for the recognition of the importance of sustainability. According to Adhya (2010), an ideal sustainable urban design is expected to offer appropriate answers to the main questions related to the aesthetics of the basic urban form. In addition, it is concerned with the functionality of the environment and the sustainability of various social and economic processes.

Different researchers have asserted that high density, compact, and mixed-use urban forms are more sustainable than low-density urban forms. Focusing on social sustainability, Dempsey et al. (2009) developed a definition of social sustainability at the neighbourhood scale. It is important to understand what is meant by social sustainability, and there is a consensus that there is no single definition, and it is argued that it encompasses a range of dimensions. In reference to city form, social sustainability is based on two broad concepts, which are social equity and the sustainability of community.

Social equity refers to the fair distribution of resources and allowing all residents to participate socially, politically, and economically equally in society (Pierson, 2002: Dempsey et al., 2009). It is related to the nature and levels of access to facilities and services in a given area. While accessibility is a broad concept, it can be narrowed to mean the number of key local services and facilities, education, recreational opportunities, job opportunities, and decent affordable housing within the neighbourhood. It also means reaching facilities by walking, public transport, and cycling (Dempsey et al., 2009). Some facilities in the neighbourhood, such as (employment opportunities, hospitals, recreation and cultural facilities as well as secondary schools) have been excluded because, in order to sustain them, there must be large support groups available and such facilities are not offered at neighbourhood level. Some researchers have identified services and facilities that are usually offered in a neighbourhood, including commonly used vital services, as properly denoted in the *Poverty and Social Exclusion Survey* (Gordon, 2000) and others that are not put to use on a regular day-to-day basis (Barton, 1995; Winter and Farthing, 1997). The following services, for example, are used on a regular day-to-day basis are: doctor/GP surgery, post office, chemist, supermarket, bank/building society, corner shop, primary school, restaurant/café/takeaway, pub, library, sports/recreation facility, community centre, facility for children, and public open/green space (Dempsey et al., 2009).

The sustainability of community refers to society itself as a local community, and it includes social behaviour and social interaction between the residents in a neighbourhood (Dempsey et al., 2009). The sustainability of a community involves relationship between the neighbourhood itself and the people who live within in it, including physical and social aspects such as being healthy, stable, and safe places. Five unified dimensions of community sustainability are common as regards the shared aspects of social life, which are social interaction, participation in collective groups, the stability of the community, a sense of attachment place, and safety. These dimensions are factors in measuring access to services at

the neighbourhood level. Table 3-1 below highlights the influence of the built environment on social cohesion (Raman, 2010).

Other important factors that can bring about social cohesion in a neighbourhood include good quality housing, proper civic amenities such as playgrounds for children, and privacy (Putnam, 2000). In an urban setting, Friedkin, (2004) indicate that factors such as 'nearness' and 'strength of relationship' are essential for social cohesion. According to Levitas (1986), Hillier and Hanson (1984), and Jacobs (1961), the physical environment of a neighbourhood can have a strong influence on the behaviour of its people and on demographic characteristics.

**Table 3-1: Built environment and social cohesion (Source: Raman, 2010).**

| Indicator | Claimed Influence of Built Environment |
|---|---|
| Sense of safety | Good visibility, street lighting and accessibility of spaces can positively influence sense of safety, while presence of vandalism and graffiti has a negative influence (Jacobs, 1961; Hillier and Shu, 2000). |
| Participation, sense of belonging and sense of Community | Good physical quality and maintenance of built environment can positively influence these aspects (James, 2009; Carmona *et al*., 2003). |
| Friendliness and community spirit | Good visibility and close proximity of social spaces can positively influence perceptions of friendliness and community spirit (Lynch, 1972). |
| Social network | Physical proximity can positively enhance social ties (La Gory and Pipkin, 1981). |
| Social interaction | Layout could create opportunity or barriers for social encounters (Hillier and Hanson 1984; Abu-Ghazzeh, 1999). |

There seem to be no specific criteria for sustainability that can be generalized for every urban form in the literature reviewed. Every urban form is different, even in the same city, with multiple and often dissimilar urban circumstances and problems.

> *"... different urban forms contribute differently to sustainability. Moreover, different planners and scholars may develop different combinations of design concepts to achieve sustainable development goals. They might come with different forms, where each form emphasizes different concepts. However, all should be forms that environmentally contribute beneficially to the planet for the present and future generations"* (Jabareen, 2006:48)

The need for sustainable development has motivated scholars and practitioners in different disciplines to find the most constructive forms for human settlements that meet the requirement of sustainability. However, there is a lack of theory to evaluate a given urban

form regarding its contribution to sustainability or to compare different forms regarding their contribution to the sustainable development agenda.

## 3.7 Concepts of Sustainable Urban Forms and Framework for Evaluating Sustainability

The discussion so far has considered, the literature studied concerning three subjects: firstly, traditional urban forms; secondly, Doxiadis' approach to the planning of cities; and thirdly, the neighbourhood unit and current theories of sustainable urban form as mentioned in chapters 2 and 3. This study has identified four criteria to evaluate the sustainability of current urban forms. Each one of these sustainability criteria is to be studied under two sub-criteria, and therefore, there are eight sub-criteria in total. The four criteria are: compactness, relating to accessibility and density, climate-related design, including thermal comfort and greening, sustainable transport, with a variety of travel modes, street designs and connectivity, and diversity in mixed land use and a variety of housing, demographics, and social activities. The justification for formulating this framework for evaluation of the current urban form, is based on various reasons given in the following discussion.

The literature review on traditional urban forms reveals that old Islamic cities adopted strongly formed sustainable design concepts, of which the old city of Riyadh is an example. The four identified sustainability criteria were the main visible principles of traditional urban forms, and they strengthened and enhanced the sustainable life of the traditional communities. It is worth mentioning that Doxiadis, as a later modernist, was also aware of environmental and social issues clearly addressed in his plans. Thus, Doxiadis’ plan was also an attempt to introduce elements of sustainability even if the language used at that time was not the language of sustainability. Therefore, the criteria identified were clearly detected in the discussion of Doxiadis' approach and theory. These sustainability concepts are also emphasized in contemporary of theories of sustainable urban forms. Nevertheless, they need to be carefully studied and evaluated in a rational way in terms of the current modern urban form of Riyadh. The adopted criteria in this research are the result of the early studied three sources, and therefore feasible to be used in the evaluation of the qualitative case study of the modern urban form. There are also a wide range of possible sub-criteria which could be studied; however, these eight are the most relevant design concepts and key lessons discussed in the three of literature mentioned above to contribute to achieving the sustainability of urban forms.

Table 3-2 summarises and compares the main principles and elements of urban form trends discussed in chapters 2 and 3, considered at the neighbourhood level. The aim is to develop evaluative criteria for this thesis. The terminology of the design concepts adopted in assessing sustainability in this study is discussed in relation to the literature studied in the following discussions.

From the discussed reviews on Dioxides' work and ideas, it is seen how his concept of Ekistics has been acknowledged by some urban scholars (e.g. Pollalis et al, 2014) for following the fundamental principles of sustainable design, in some physical, economic and environmental aspects (i.e. in his plans of DHA City Karachi). Although the terminology used to identify these sustainable qualities was different from modern day criteria, an attempt is made in this research to put a thematic name for what is thought to be relevant to the one found in the literature wherever appropriate.

There are many specified design principles and indicators that Doxiadis used to shape his urban plans in the examples reviewed (in chapter 2). From the analysis of his concepts, specifically in the model of Dynaplis, it is been found that these identified four criteria were somehow considered and sometimes briefly explained in his theory and in practice. For example, pedestrians were given great attentions in many urban design aspects such as sidewalks and often set as one of the main principle in his plans. The logic of urban functional hierarchy within communities provide a logic of walkability and accessibility to facilities and services. A compact and independent urban unit such as the Modulus within the Dynoplis plan is a spatial urban space that defines the city growth. A connected public transport system that facilitates the mobility in the city is significant. Also, his hierarchy of urban centres and infrastructures, such as in the streets system, shows his considerations of the self-sufficiency of the community and its social impact within the formed spatial hierarchy at the neighbourhood. Diversity and mixed land use therefore seemed to have been taken account of as in his recommendations each urban community should provide all the necessary urban functions and facilities for its residents. In addition, Climatic and ecological concerns seem to have been generally factored in many of his plans.

Finally, it appears that most of Doxiadis plans shows awareness to provide good level of environmental quality of urban living for human settlements. The summery of these derived principles from his work has resulted in assessing the developed criteria for evaluating urban sustainability in this research (Table 3-2).

**Table 3-2: Rationale for the criteria developed in this thesis compared to traditional principles of urban forms**

| Urban Form Movement | Elements and Principals | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Traditional Urban Form** | • Walkable<br>• Accessible | | | • Mixed land use<br>• Diversity | | • Dense<br>• Compact | | | | • Climate sensitivity<br>• Natural sources ( e.g. lighting) | | | | | | |
| **Neighbourhood Unit**<br>Perry's principle Modified from Lawhon (2009) | • No major roads pass through the neighbourhood units.<br>• Light duty, cul-de-sacs, and curved layout of street patterns in neighbourhood unit for a safe, low traffic, quieter residential area.<br>• A central school should be at the heart of the neighbourhood unit. A park and open spaces adjusted to a school.<br>• The neighbourhood unit population should not exceed the limit set by the central school.<br>• The radius of the neighbourhood unit should be a quarter of a mile, ensuring easy walking distance for pupils to reach the central school.<br>• Shopping centres should be located at the corners of the neighbourhood unit or at the intersections of major streets. | | | | | | | | | | | | | | | |
| **Compact City**<br>Burton, Jenks, Williams (2000)<br>Richard Rogers (1999)<br>Fery (1999)<br>Thomas & Cousins (1996) | • Better public transport services<br>• Less car dependency<br>• Increased overall walkability | | | • Mixed land use<br>• The rejuvenation of existing urban areas and urban vitality<br>• Enhanced business and trading activities<br>• Diversity of housing<br>• High quality of life | | • High density<br>• Urban integration<br>• Compact<br>• well-connected design<br>• Accessibility<br>• Re-use of infrastructure and previously developed land | | | | • Reduced energy consumption<br>• Low emissions<br>• Reduce use of cars<br>• Preservation of green space | | | | | | |
| **New Urbanism**<br>(CNU & HUD,2000)<br>Cited in Rahnama .et.al. (2012) | Walkability | Connectivity | Smart Transportation | Mixed Use & Diversity | Mixed Housing | Increased Density | Traditional Neighbourhood Structure | Quality of Architecture & Urban Design | Quality of life | Environmental sustainability and greening | | | | | | |
| **Sustainable Urban Form**<br>Carmona (2001)<br>Jabareen (2006) | • Sustainable Transportation | | | • Mixed land use<br>• Diversity<br>• Human needs | | • Density<br>• Compactness | | | | • Passive Solar Design<br>• Greening<br>• Resilience to climate change | | | | | | |
| **Criteria developed for this study** | **Sustainable Transport**<br>i) Verity of travel moods<br>ii) Street design and connectivity | | | **Diversity**<br>i) Mixed land use<br>ii) Verity and types | | **Compactness**<br>i) Accessibility<br>ii) Density | | | | **Climate Related Design**<br>i) Green spaces<br>ii) Thermal comfort | | | | | | |

*- Verity and Types of housing, demographics, and social activities.

**Table 3-2: The study's framework of criteria for evaluating the sustainability of urban forms**

| Identified sustainable Criteria | Sub-Criteria | Study Stages |
|---|---|---|
| Compactness | 1. Density<br>2. Accessibility | a. Design<br>b. Development<br>c. Current Use |
| Diversity | 1. Mixed land use<br>2. Variety of housing, demographics, and social activities | |
| Sustainable Transport | 1. Variety of travel options<br>2. Streets design and connectivity | |
| Climate Related Design | 1. Greening<br>2. Thermal comfort conditions | |

The first criterion of sustainability is compactness and this includes two sub-criteria of accessibility and density. These have been chosen because traditional urban forms were apparently compact. Services and facilities within old cities were highly accessible. It was also observed that the old city of Riyadh was dense, with clusters of houses and other buildings. Doxiadis based his main ideas on compact and self-sufficient cells that are related to each other which he called community class V or the Modulus. These Moduli are relatively dense urban forms that include easily accessible urban functions. The concepts and theories that are related to sustainable urban forms discussed in this chapter are, for example, the compact city and the new urbanism, and it is stressed that high density and accessibility are important elements in achieve compactness. This is considered the most effective strategy for achieving a sustainable urban form. With reference to the literature, an urban form with a size that eliminates the use of cars, is dense, accessible, walkable and provides a rich and liveable urban life is required to achieve a sustainable city (Williams, Burton and Jenks 2000). It has been suggested that high density cities achieve sustainability more than lower density urban forms because the latter encourage the use of cars and have poor transport systems. The idea of compactness with high density contributes significantly in terms of saving energy and encouraging social interaction (Newman and Kenworthy, 1989). Good distribution and provision of facilities are important contributors to social equity, sustainability and being environmentally friendly.

The second concept is climate-related design, with the two sub-criteria of thermal comfort and green spaces. Thermal comfort was taken into account in designing traditional urban forms. The old architectural and urban design techniques were highly responsive to the local climate. It was noted in the discussion earlier that climate was taken into account at the micro-scale of the building and the macro-scale of the neighbourhood. For example, narrow shaded alleyways and courtyards of houses were common urban and architectural features. Green spaces were not widely associated with traditional urban forms due to the relatively hot climate. This does not mean that there was no use of trees or visits to these places.

For example, local climate resistant plants such as palm trees were used as design elements in some cities for shade and as wind defences. Thus it is important to consider such greenery in the design of more sustainable modern urban forms. Doxiadis' concepts and plans were concerned with climatic issues, he paid attention to the local climate and environmental conditions, for example sunlight, wind, and green spaces, particularly at the level of the city and neighbourhood, as discussed in detail in his plan for Riyadh city. The contemporary theories of urban sustainable form have focused on climate sensitivity, design, and green spaces, and this was a significant criteria found in the review of the literature, particularly in developed countries. According to the literature, climate-related designs have many social and environmental benefits in that they reduce energy consumption, encourage social activities and promote walkability. Some elements should be considered to avoid the need to cool or heat buildings, such as design layout, seating, landscaping and orientation as they are good as featured elements of solar gain. Green spaces are important elements that affect the form of the built environment and can improve urban environments, regulating air quality and climate, creating shade and comfortable urban spaces and ultimately improving the quality of life.

The third criterion is sustainable transport and is another main feature of the traditional urban form. The advanced technology of public transport had not been introduced at that time, but, the old city was based on human scale and where facilities to meet the daily needs of people were within walking distance. It was also recognised that Doxiadis' theory and plans introduced the connection of public transport in human settlements as well as pedestrian movements at the neighbourhood level. According to his plan, urban functions should be within walking distance and he clearly relates walkability to type of function; for example, primary schools should be closer to households within residential areas than secondary schools need to be. Walkability, connectivity, and a variety of travel modes including public transport are significant factors theories of that sustainable urban forms believe as needed to achieve social and environmental sustainability.

With reference to the literature, urban areas and cities should be designed with various transportation modes such as walking, cars, bicycles and buses Newman (1999). Car-based cities are most likely to have air pollution, extensive use of fossil fuels and create a more fragmented urban form. Some strategies encourage people to walk and cycle are good pedestrian-friendly designs, increasing the street intersections with short blocks and connected sidewalk pavements to increase the overall connectivity, and can improve urban environments.

The fourth criterion of diversity was emphasized in all the studies reviewed. The traditional city was designed based on people's needs, desires, and preferences. Public facilities and services were provided and distributed according to social and cultural life and needs, and they were all within walking distance with easy access. So, the concept of mixed land use was implemented in the traditional city. Houses were designed based on household size and income, so there were a variety of housing types, sizes, and resident's income level. Diversity was also one of the most important planning criteria for Doxiadis. As discussed in the previous chapter, he stressed the use of hierarchal urban functions according to the scale and size of the populations of community classes.

All current sustainability approaches discussed in this chapter and most sustainability experts agree that diversity, including mixed land use, is one of the most influential design concepts that should be considered in achieving a sustainable urban form. According to the literature, a mixed land use concept means that many services are located within a short distance and encourages walking and liveable urban areas. Single use planning of neighbourhoods results in less diversity, more traffic and reduced safety (Newman, 1997). A greater mix of uses leads to more social interaction, increases pedestrian movement, more safety and more attractive urban spaces. As mentioned, mixed land use and higher density are associated with less car travel, however, some scholars argue that these findings are not easy to verify (Rutherford, McCormack and Wilkinson, 1996). As a result, all these sustainable criteria are clearly visible and rooted in the early old traditional urban forms, and through Doxiadis' ideas and theory apply to current theories of sustainable urban forms. These can be examined to see how they have been addressed in the modern urban form.

Some sustainable urban design concepts have more influence on environmental and social factors than others; their influence may even be different within different countries. These design concepts should be addressed depending on the environmental and social conditions of the city in question. For example, some hot desert cities use trees to provide cooling and fresh air but this may actually be harmful and alien to the environment because of the lack of water

in these cities. Using specific design elements for a specific local context can contribute to achieving sustainable urban forms worldwide. However, further design elements should be considered regarding communities based on religion, such as those in Saudi Arabia.

## 3.8 Conclusion

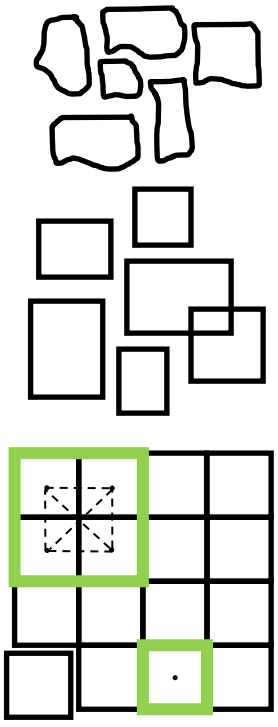
This literature review chapter has explored the theories and design concepts and framework developed for achieving sustainable urban forms. Different studies were interested in adopting various criteria to help solve many social and environmental problems, aiming at creating more sustainable urban forms and neighbourhoods. The neighbourhood theories of Howard and Perry were highlighted, discussing their principles and the concepts of the neighbourhood when first established and defined within the urban planning area, reviewing the social and environmental considerations applied on the ground, and how these have impacted on the development of new modern sustainable urban forms and approaches today. The compact city is one of the most influential modern concepts that has also contributed to achieving sustainable urban forms. The other key urban movement reviewed was the New Urbanism, which focused on neighbourhoods to achieve sustainable urban developments. These concepts were reviewed in this chapter to help understand the design principles adopted that help cope with modern social and environmental problems.

# Chapter 4: Research Methodology

## Contents

### Chapter 4: Research Methodology





## 4.1 Introduction

Following the development of the research conceptual framework in the literature review, the main purpose of this chapter is to describe the research methodology adopted to achieve the main aim of this research project, which is to evaluate the social and environmental performance of the current urban form in Riyadh, and to answer the main research question of how sustainable it is.

This chapter thus outlines the research strategy and methods used. The first section presents the strategy of the study and the general approach followed. The case study and selection is explained and justified in this section. The next section describes the research design, and in the third section the methods used for data collection and analysis are addressed. Finally, the limitations of the fieldwork are pointed out.

## 4.2 Research Strategy, Approach and Methodology

Research in the social sciences is an investigative inquiry with a specific end goal, to reach new inferences through the deliberative examination of available and reliable sources. It implies the conducting of a methodical investigation that clarifies and depicts a situation and achieves particular objectives from as many different angles as possible. There are many different strategies which can be used to accomplish research objectives, including qualitative and quantitative data collection methods (Peil, 1982; Peterson, 2000). In this research, the methods employed were mainly qualitative.

Riyadh was primarily planned as a city of replicated neighbourhood units, and the focus of this study is therefore to investigate a single neighbourhood unit. A selective case study approach has therefore been chosen using mainly qualitative research methodologies. However, a basic quantitative method was used to investigate the urban context and its services. The objectives of this research are to examine the criteria for a sustainable urban form in the selected neighbourhood through an examination of the strategies of the design, development, and use of the neighbourhood as the framework of investigation. The research methods used include interviews, observations, the analysis of archival documents and secondary data, literature reviews; and a basic analysis of the selected neighbourhood. This research strategy is used to understand the urban form under investigation and to answer the aforementioned substantial research questions. The sustainability criteria developed for this research are based on the

literature concerning the principles of sustainable urban forms. The research strategy is divided into three elements discussed in more detail in the following sections.

### *4.2.1 Qualitative Research Methodology*

Qualitative research plays a significant role in providing a complete and detailed description of the research topic and, in particular, it is exploratory in nature. Qualitative research is based on collecting information, analysing it, and interpreting the data by observing the views of people (Anderson, 2006). Concepts, meanings, definitions, metaphors, symbols, characteristics, and descriptions of things are included in qualitative research. On the other hand, quantitative research is based on collecting data through the counting and measurement of things, classifying the data, and then using statistical analytic tools to draw conclusions from it (Anderson, 2006). In-depth description is required in qualitative research, but numerical data and explanatory laws are required in quantitative research (Anderson, 2006).

Qualitative research can be used to develop theories whereas quantitative research can be used to test theories. Quantitative research is considered to involvement as measurement and, on the other hand, qualitative research is considered as predictive (Tellis, 1997). It is required to use communication and observation in qualitative research, but to use other empirical instruments in quantitative research. Sample size plays an important role in quantitative research, but does not affect qualitative research. Dialectical and inductive reasoning are used in qualitative research, whereas logic and deductive reasoning are used in quantitative research. Additionally, qualitative research is based on research questions, but quantitative research is based on hypotheses. The basic unit of analysis in qualitative research is words or ideas, but in quantitative research the basic element of analysis is numbers (Bryman, 2012).

A qualitative approach is used when the work requires systems of interpretation. It values a far-reaching point of view, applies rationales and considers indirect explorations (Rudestam and Newton, 2001). The case study approach is one form of qualitative research that has been adopted in this research.

### *4.2.2 Case Study Approach*

A case study approach is selected for this research to perform an analysis of the current modern urban form and architectural characteristics of Riyadh. The case study is selected based on a

square neighbourhood unit within the rectangular grid pattern blocks of 2 km by 2 km. It can be noted that this is a prevalent kind of neighbourhood-based urban pattern. In Riyadh's development, four types of urban pattern have been laid out: the traditional urban pattern; the cul-de-sac; the grid pattern; and the square 2km x 2km super block with a rectangular pattern (Alamri, 2011). Of these types, the square super-blocks planned by Doxiadis are the most predominant. It is important to highlight that this particular pattern has been repeated throughout the city plan, as outlined by the Riyadh Municipality and Arriyadh Development Authority, whereas the traditional urban pattern is found only in the downtown area. The grid-iron examples are square blocks, utilized as a part of the first modern development outside the old city called the Almalaz neighbourhood in 1953 (Alkhedeiry, 2002). The use of the cul-de-sac is limited and was utilized as a part of a government development of gated communities, for example in the Diplomatic Quarter. In the urban setting of Riyadh, square neighbourhoods are considered as residential areas since 1972, and hence were selected as the target of the case study (see Figure 4-1, 4-2). According the High Commission for the development of Riyadh (2013) new developments spread towards the north and east side of the city and it can be seen that such square neighbourhood units covered most of these urban areas (see Figure 4-2).

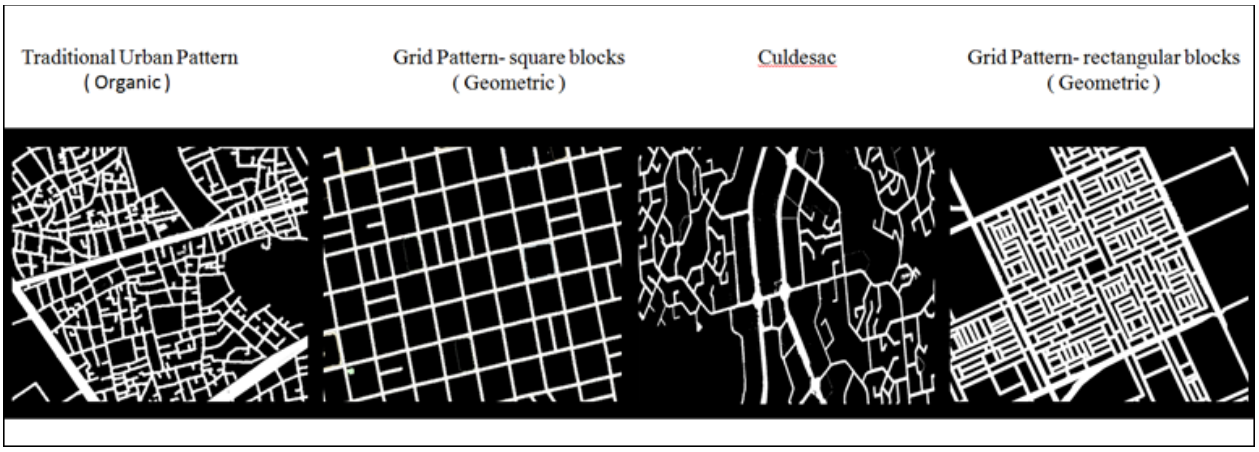



**Figure 4-1: The urban patterns of neighbourhoods in Riyadh city**

(Source: Alamri, 2011)

According to Yin (2003), the case study approach is a valuable tool to understand complex social and environmental phenomena. Most importantly, it enables the investigators to determine the holistic and meaningful characteristics of individual lives and, as in the case in this research, of neighbourhood change, relationships, and organizational and managerial processes. The advantages of this research technique include, the capacity to present an all-encompassing

perspective and to capture the significant qualities of real-life events, and its suitability for in-depth exploration (Yin, 2009). The study is therefore a research strategy used to enhance knowledge of individual, organizational, group, political, social, and other related phenomena. It is therefore a common research strategy in many academic fields such as sociology, psychology, political science, social work, and community planning and other urban studies (Yin, 2003).

The case study as a strategy is used in a top-to-bottom study, which endeavours to accumulate data on an individual subject from as many sources as possible (McQueen and Knussen, 2002). The case study research approach is therefore context oriented and covers complex multivariate conditions (Yin, 2003).

This is why it was deemed appropriate to choose a case study approach for the present study. Additionally, the case study approach allows a close collaboration between participants and the researcher. The participants are free to tell stories or give opinions and, as a result, they can describe their perceptions of reality which can be helpful for the researcher to better comprehend their actions and the subject of the research.

There are various kinds of case studies: explanatory, exploratory, descriptive, multiple, intrinsic, instrumental, and collective case studies. Not all of these kinds of case studies may be applied for a single research study. When it is required to answer questions related to explaining the presumed causal links in real-life situations where it is too difficult to use experimental strategies or surveys, we can use an explanatory case study method (Baxter and Jack, 2008). When it is required to explore situations without any unique or predicted set of outcomes, we can use an exploratory case study approach. Thus, this approach is suitable to explore complex situations with multiple possible outcomes. In order to describe a phenomenon or intervention in the context of a real-life situation, the descriptive case study approach can be used (Baxter and Jack, 2008). By considering all these kinds of case studies, it can be said that the present research is best suited to an exploratory case study approach.

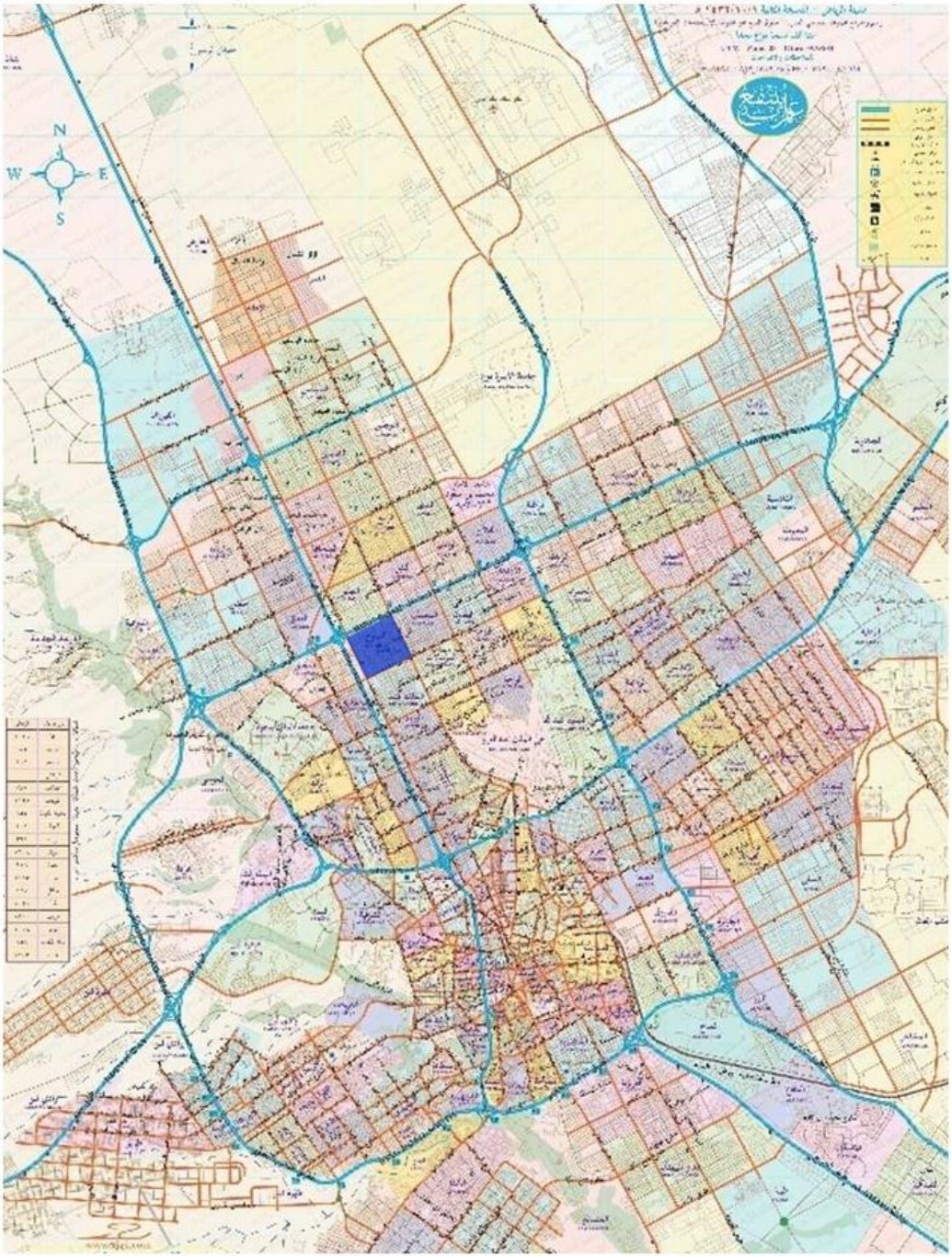



**Figure 4-2: Riyadh Map. The square super grids are clearly indicated. The case study is highlited in blue.**

(Source: Alajaji map, 2012)

In case of an exploratory case study, it is possible to explore a phenomenon in relation to real-life situations and the present research examines whether the current urban form meets the criteria adopted for sustainability. A number of areas need to be considered in order to answer the three

research questions in this study. It is required to explore the sustainability of the current Riyadh form in social as well as environmental terms. The effects of modernization on the current urban form need to be explored and analysed in order to assess its sustainability or the lack of it with respect to both social and environmental criteria. Moreover, Saudi cultural norms are based on the Islamic religion and it is required to explore any conflicts arising because of the modernization of the urban form. Therefore, the exploratory case study approach could be appropriate to investigate all these areas.

An exploratory case study provides opportunities for the researcher to understand the built environment (Yin, 2003). The correlation between a programme's implementation and its effects needs to be evaluated (Tellis, 1997). When strategies for urban development are implemented, it is important to find out how the urban form has been designed, developed, and used.

Case study methodology permits the comprehensive examination of a specific setting or situation and a variety of information gathering and investigation procedures can be utilized.

Although, there is no simple way to choose between single and multiple case techniques, or about the number of cases to be examined these decisions are affected by two standards: the nature of the exploration and the possibility of replication in testing or confirming the study's results (Groat and Wang, 2002). This study focuses on one case study, rather than a set of comparative case studies, because a single case study is generally chosen when the designed study investigates different and complex elements at different scales. It bodes well for an examination to reveal the complexity elements of one setting rather than to look in less depth at more settings. The aim of the research was to carefully investigate and capture most of the social and environmental issues that are involved in the modern urban form rather than looking at what are the best solutions in two selected cases. A comparative study would examine and analyse in detail the contexts and characteristics of two case studies in relation to a specific subject. It is believed that there are variables between each neighbourhood unit in Riyadh, according to, for example, its location, internal functions, and relation to the city. Therefore, the comparative study approach would not be relatively helpful for this research, as the expected results from some of these neighbourhoods might be affected by these variables. A comparative study would still be helpful indeed, however, and selecting one case study would be more useful to efficiently examine and link the urban form to sustainability in the developed three stages methodological framework.

**Table 4-1: Case study's main urban and building architectural features**

| Case study | Architectural type | Building features | Urban features |
|---|---|---|---|
| Almoroj neighbourhood: 2x2km, 400 hectares | - Detached single villas<br>- Two-three story detached apartment buildings | - Detached villas, yards bounded with high walls.<br>- Detached apartment buildings, facing on to streets | -Rectangular blocks<br>- Streets width up to 36m and with T junctions<br>-Various land size and parcels, mostly squares |
| Criterion-based selection for the case study which is common in all other cases | | | |

The chosen case study neighbourhood of Almoroj has been selected after analysing the master plan of Riyadh city, and it was decided to consider existing varieties of urban forms. As mentioned above the new square 2x2km neighbourhood with a rectangular grid pattern of blocks is selected as a case study. This is the prevalent style of neighbourhoods in the city, repeated in most of the city plan. The basis of the choice of the Almoroj neighbourhood is that most of these new neighbourhoods share a common concept in their housing form, streets patterns, and land use policies. Also, the same building and urban planning policies and regulations were applied to them. These neighbourhood units are typical and they have similar urban forms, centres, and structures (see Table 4-1).


**Figure 4-3: Consolidation of super blocks (neighbourhood units, CCV). Almoroj is outlined by a dotted-line.**

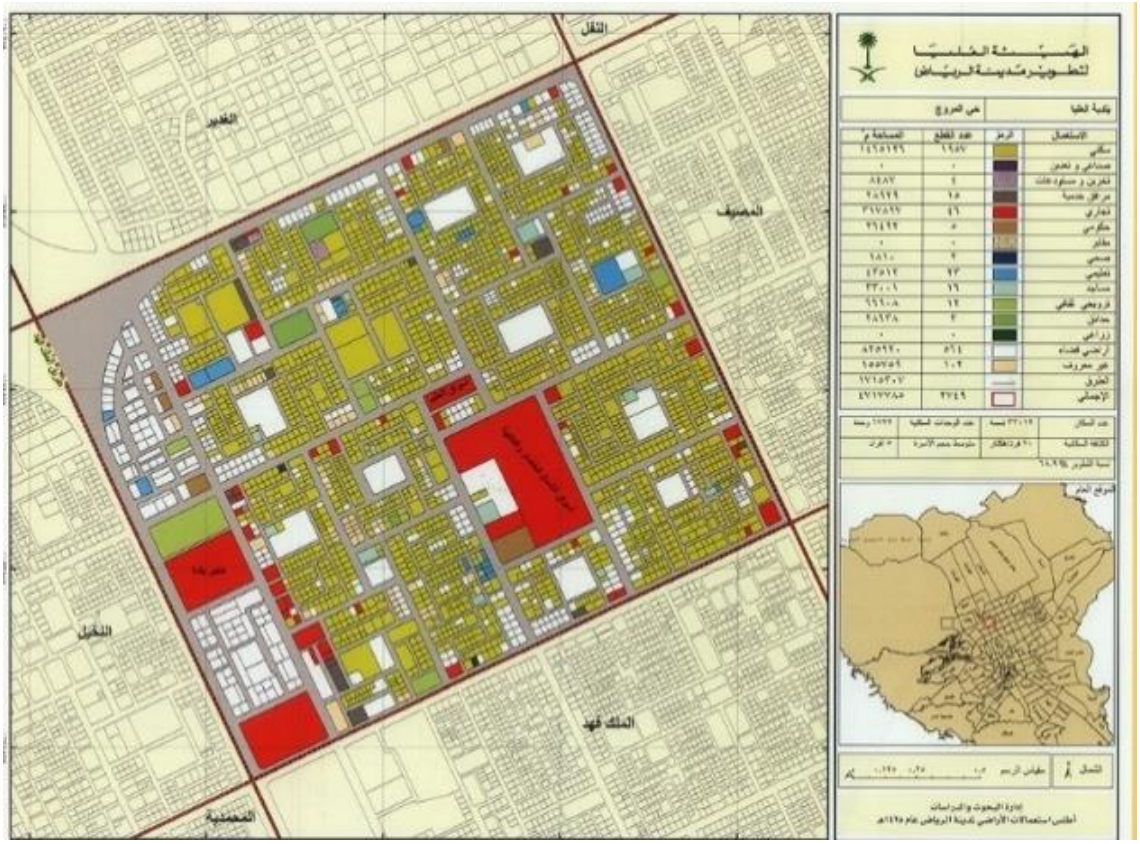



**Figure 4-4: Almoroj neighbourhood**

(ADA, 2006b)

Riyadh is where the present author lives and has come to recognise its urban planning and architecture. Another reason is that the author's experience is an essential factor of the motivation for the study, as a lifelong resident of Almoroj.

### *4.2.3 The Methodological Process*

Within the case study approach, the framework developed for this research is to study the stages of design, development, and use of Almoroj neighbourhood based on the criteria developed. Studying the initial design of the neighbourhood enhances the understanding of the ideas that the case study neighbourhood was based on. Doxiadis designed a comprehensive plan for Riyadh in the 1970s, based on a modular grid and regulations and policies for neighbourhood planning. However, some of these planning ideas were not fully implemented (Alhathloul, 1992, Ebn Saleh, 1998). Thus, the development stage is also important to understand the gap in the urban development changes since the design change period. Nassar (1997) argued that the actions of many entities, both private and public, have contributed to the evolution of city forms. Equally, people are capable of shaping the visual form of their community for better or for worse through

various actions including regulations, individual development decisions, and design reviews. Consequently, these two stages have contributed to the emergence of the current urban form of the Almoroj neighbourhood. Urban form may be defined as the arrangement of a city's large functional units in a manner that reflects the historical development of the city as well as its more recent planning history (Rose, 1967).

To identify the urban form of any city, it is essential to understand the way it was built, modified or adapted in the period of its development. A systematic interpretation of the urban form helps to understand the rules and principles of its development and to relate them to the objectives of sustainability (Kristjánsdóttir, 2005; Alberti, 2008). According to Doherty et al, (2009) human behaviour tends to add a layer of operational complexity that varies culturally between countries and socioeconomically within the urban forms of cities. Studying the social behaviour of the users (in this case residents), and their needs and lifestyles, is therefore an important part of the case study that relates to some of the sustainability criteria such as mixed land use, thermal comfort, and accessibility. Thus the present research was conducted based on the study's framework the stages of design, development and use.

## 4.3 Research Design

The research design of this study is based on linking four selected methods of data collection and analysis to the study's three objectives (see Tables 4-2, 4-3, and 4-4 below). The research methods used are: 1) a review of literature, and analysis of archival documents and secondary data; 2) interviews; 3) direct observation; and 4) urban space analysis.

**Table 4-2: Relationship between research objectives and research methods used**

| **Objectives** / **Methods** | **Objective 1:** To identify sustainability criteria. | **Objective 2:** To investigate the characteristics of Riyadh urban form | **Objective 3:** To examine the results of the urban form based on the criteria the methodological framework developed |
|---|---|---|---|
| **1:** Review of literature, archival documents, and secondary data. | ■ | ■ | ■ |
| **2**: Interviews | | ■ | ■ |
| **3**: Observations | | | ■ |
| **4**: Urban space analysis | | | ■ |

**Table 4-3: Relationship between the research objectives and chapters of the thesis**

| Chapters / Objectives | Chapter 2-3 | Chapter 5 | Chapter 6 | Chapter 7 | Chapter 8 | Chapter 9 |
|---|---|---|---|---|---|---|
| **O1:** To identify the sustainability criteria. | ■ | | | | | |
| **O2:** To investigate the characteristics of Riyadh urban form | | ■ | | | | |
| **O3:** To evaluate the case study's urban form according to the adapted criteria and methods | | | ■ | ■ | ■ | ■ |

**Table 4-4: Criteria for evaluating the sustainability of the urban form of Riyadh**

| Objective 3 | Evaluation Criteria | Study Focus | Chapters |
|---|---|---|---|
| To evaluate the case study neighbourhood, based on the adopted criteria and the three the stages of design, development (since 1970s), and contemporary use. | **Compactness** | a. Design<br>b. Development<br>c. Current Use | **Chapter 6** |
| | **Climate related design** | | **Chapter 7** |
| | **Sustainable transport** | | **Chapter 8** |
| | **Diversity** | | **Chapter 9** |

Table 4-5 below presents the criteria for the sustainability of the urban form (compactness, climate-related design, sustainable transport, and diversity), which are associated with the research framework and methodology. These criteria were generated from well-established theoretical accounts and each of the criteria has important sub-criteria that will assist in achieving the objectives of this research. Then the results of the examination of these criteria are used to provide answers to the research questions.

**Table 0-5: Criteria for evaluating the sustainability of Riyadh's urban form**

| Identified Sustainability Criterion | Sub-criteria | Stage |
|---|---|---|
| Compactness | 3. Density<br>4. Accessibility | d. Design<br>e. Development<br>f. Current Use |
| Climate related design | 3. Greening<br>4. Thermal comfort conditions | |
| Sustainable transport | 3. Variety of travel options<br>4. Streets design and connectivity. | |
| Diversity | 3. Mixed land use<br>4. Variety of housing, demographics, and social activities | |

## 4.4 Research Methods and Data Collection

The research methods used in any study depend upon the types of research questions asked, the criteria controlling the research and the main focus of the contemporary or historical events (Yin, 2009). The case study approach chosen for this research requires the collection of information related to urbanization in Riyadh focusing on the neighbourhood level. There are various sources through which such relevant information can be collected including primary and secondary data. While the secondary data in this study include archival documents and maps, the primary data encompasses interviews with residents, and local planners and architects, direct observation during site visits and photographs, and urban space analysis.

The justification for the multi-strategy methodology is that blending two or more methods in the same study helps to overcome the limitations of a single method, minimising, for example, the negative effects of a deficiency in information. It also helps improve the precision while avoiding generalisation. Moreover, the single strategy methodology can prompt predisposition, as the utilisation of a single method may permit speculation that might have an undesirable impact on the precision of the research outcomes (Bulmer and Warwick, 1993).

### *4.4.1 Review of Literature, Archive Documents, and Secondary Data*

In order to understand the historical, social and environmental conditions, different resources were used to collect data about the case study under investigation in a literature review, analysis of archival documents of the master plan of Riyadh by Doxiadis, and documents from the Riyadh Municipality, Arriyadh Development Authority (ADA), and Ministry of Municipal and Rural Affairs (MOMRA).

A copy of Doxiadis master plan documents could not be found in the Archive of MOMRA and the Riyadh Municipality. Doxiadis Associates' archive is located in Athens, and it was contacted by email to attempt to obtain the documents needed for this study. Several emails were sent to the organiser of Doxiadis' Archives, Mr. Giota Pavlidou, who helped in obtaining the master plan of Riyadh. However, there were documents that are specifically related to the neighbourhood units that could not be accessed, due to the office policy of not providing long distance assistance. Even in personal visits, they do not allow the copying of more than 20 pages per visit. Thus, a limited travel and time budget precluded visits to examine the 28 documents of the master plan.

Statistical data, maps, planning and building regulations, and policies for the neighbourhood design were collected from the Arriyadh Development Authority, the Ministry of Municipal and Rural Affairs (MOMRA), and Riyadh Municipality.

Furthermore, the research has benefited from the findings of the literature review in chapter 2 providing information on traditional values and urban spatial characteristics that reflect the context of an Islamic Arab society and which respond to the local conditions and climate, as well as the Ekistics theory of Doxiadis which includes the Dynapolis model and the Modulus concept. These ideas were the basis of the master plan of Riyadh and specifically the establishment of the 2 x 2km square neighbourhood units. The study of these concepts has provided information about the neighbourhood plan and its implementation. The literature review in chapter 3 on sustainable urban forms has examined the ideas of achieving a sustainable urban form and the design concepts used to develop the aforementioned criteria for examining the sustainability of the current urban form in Riyadh.

### *4.4.2 Interviews*

Interviews are an important component of the research methodology used in this study. The researcher selected interviews because the study relies significantly on findings obtained from

qualitative social research. Research interviews that are qualitative in nature can offer deep insights into the events and phenomena under investigation. Rubin and Rubin (2012: 4) stated that *"In-depth interviewing allows the researchers to explore complex, contradictory or counterintuitive matters".* Interviews can also throw considerable light on topics that are not very well-explored or known about and are an excellent tool to deal with topics that are highly sensitive in nature. The interviews were designed and scheduled to include questions that would reveal the maximum and most valuable information.

Semi-structured interviews are commonly used in social research and are beneficial in this study as questions are open-ended and offer a formal structure and set a particular direction where both the respondents and interviewer have the freedom to elaborate on issues and perform follow-up discussion (Gill, 2008). Although interviews of this kind are informal in nature, respondents find it more comfortable in communicating their views and perspectives (Eric, 1995). Opportunities are also provided to obtain in-depth information on issues, situations and phenomena that were previously unexplored or unknown.

Moreover, semi-structured interviews create the opportunity to understand the "how" and "what" and also explore more the "why" (Anderson, 2009). Semi-structured interviews have been criticised because the data generated are difficult to manage given their in-depth and lengthy nature, often covering small samples of respondents whose views may not be representative of the general population, and as the analysis of data collected is more labour and resource-intensive (University of Portsmouth, 2010). Notwithstanding these criticisms, interviewing assisted this study to achieve its objectives as shown below.

Local decision makers, planners, architects, and experts were interviewed to understand how the current urban form was designed and developed according to the identified criteria. In order to better understand the use of the current built environment, and the social behaviour of people living there along with their experience with, perception of, and concerns about the urban and architectural spaces of the neighbourhood, including public and private spaces, the a sample of Almoroj residents were also interviewed. The opinions and responses of these people were analysed as per the sustainability criteria.

The information gathered during interviews helped in analysing the present modern lifestyles of residents including their day-to-day social and recreational activities. The interview responses

also assisted in describing the facilities available and accessibility to public space and use of dwellings.

Different interview techniques are described in the literature; however, the face-to-face interview was used in this study to facilitate direct physical communication between interviewer and interviewee. Transcripts were recorded and hand-written notes were taken to avoid loss of data due to possible technical failures of the digital audio recorders. The interviewer and interviewee chatted before the start of the interviews and this created a friendly atmosphere, so that the whole exercise was comfortable, without any untoward pressure from either the interviewer or the interviewee (Opdenakker, 2006).

***Sampling techniques***

With regards to the selection of the residents to be interviewed, convenience sampling was adopted to make the sample representative rather than specifically selecting special cases. The researcher selected participants representing categorical groups of people including gender, age, and functions.

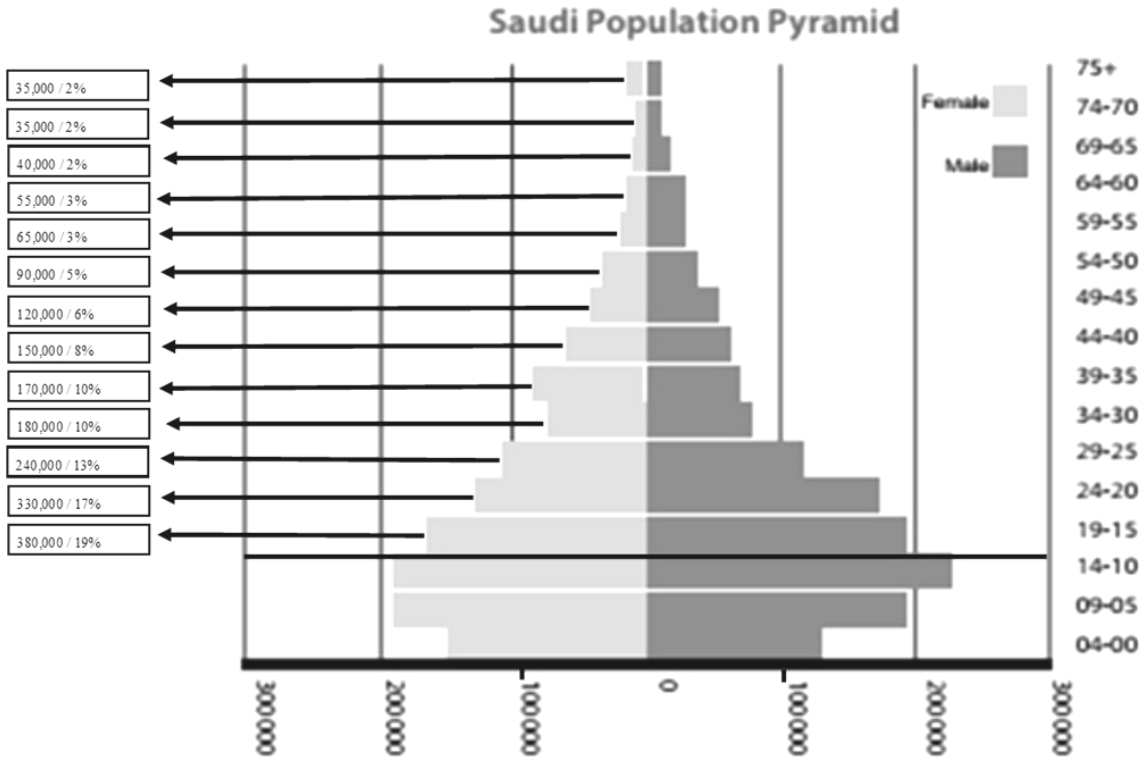
The percentages of types of participants were identified for each age group; each group of interviewees were hence chosen based on the proportion of the age group of the general population.

This Figure 4-5 shows age groups and percentages of the population against numbers of people. It was found that those aged from 15 - 19 (teenager group) represented the highest proportion of the total population (n=6). According to the High Commission for the Development of Arriyadh (2013), the national population census shows that Saudi society is a young society. Interviews with the residents were conducted with people aged between 15-85 years old. In Riyadh city, males represent 52% of the population, whereas females represent 48% (ADA, 2016). In the case study neighbourhood of Almoroj, 55% are male and 45% female, and similar numbers of men and women were interviewed.

With regards to the function category, the sample was divided into five groups: men, women, teenagers, workers and visitors. This division was based on equal gender proportions; However, teenagers were considered a separate group because they are a large segment of society as shown (Figure 4-6). They are also one of the groups most in need of adequate infrastructural facilities like

schools in their neighbourhoods. Workers and visitors were also separated into single groups as they might have different experiences from those of residents. This sample structure was used to cover the fullest possible range of experiences and needs of the society to gain a complete picture of the quality of life for all groups.

Convenience sampling was also used to ensure that females participated in the interviews, so as to avoid any form of unethical practice, particularly in Muslim societies like Saudi Arabia where cultural standards separate men and women (Bulmer, 1993a). Hence, problems may arise if male interviewers interview women unknown to them. Even though women play a significant role in Saudi Arabia, for example in choosing dwellings, they can only be interviewed with *Mahram* (the closest male relative needs to be present with their consent). However, this consent is possible in theory, but in practice is difficult to apply in a conservative country like Saudi Arabia, even by telephone. Consequently, with the assistance of a female field assistant who is a cousin of the author and a lecturer at King Saud University, convenience sampling was adopted for interviews with females in line with the categories and age groups below.




(a)

| | Saudi | | | Non-Saudi | | | Total Population |
|---|---|---|---|---|---|---|---|
| | Gender | | | Gender | | | |
| **Neighbourhood Name** | **Male** | **Female** | **Total** | **Male** | **Female** | **Male** | |
| Almoroj | 12,935 | 10,068 | 23,004 | 5,803 | 4,055 | 9,859 | 32,862 |

(b)

**Figure 4-5: Population census in Riyadh city (a) and Almoroj neighbourhood (b)**

(Source, (a) ADA, 2015; (b) ADA, 2005)

Conversely, probability sampling is whereby the chance of selection of each unit from a population is known (Ritchie and Lewis, 2003). It was used in this research to select simple random samples (SRS) of visitors and workers to interview. This kind of sampling is the easiest among the different techniques. According to Moore and McCabe (2006), *"a simple random sample (SRS) of size n consists of n individuals from the population chosen in such a way that every set of n individuals has an equal chance to be the sample actually selected".* Therefore, in this study the desired number of visitors and workers selected within the neighbourhood area (2x2 km) was chosen randomly from the population which is geographically limited and thus data collection did not require travel over long distances. The case study area of the Almoroj neighbourhood was reached easily by car to randomly select the visitors and workers in the neighbourhood to interview.

***Sample Size and Data Saturation***

According to Bryman (2014:425):

> *"One of the problems that the qualitative researcher faces that it can be difficult to establish at the outset how any people will be interviewed if theoretical consideration guide selection. It is impossible to know for example, how many people should be interviewed before theoretical saturation has been achieved".*

Issues that affect sample sizes in qualitative research can be dealt with using the principle of data saturation. Although debatable, saturation is the point where data collected gives no new information. Even with the emergence of such information, it might be considered invaluable with regard to the research constructed theory (Given, 2008). Studies of statistical significance advise that proportions of sample sizes should be in the range of or multiplied by ten (Mason, 2010). Therefore, saturation is the point in the research where the data which has already been collected is sufficient and there is no need to collect more. The saturation of data can be achieved

when there is sufficient evidence and there are no gaps that remain unexplained, and the research results can then be easily constructed. If, however, the researcher fails to achieve the saturation of data, the resulting outcomes would be incomplete (Given, 2008).

While several factors may be used to determine the sizes of samples in a qualitative study, researchers do not agree on the various factors that may be used to ascertain the accuracy of sample size. Guest et al. (2006: 59) stated that:

> *"Although the idea of saturation is helpful at the conceptual level, it provides little practical guidance for estimating sample sizes, prior to data collection, necessary for conducting quality research".*

Guest et al. (2006) found that some sources have attempted to provide guidelines for determining sample size. Bernard (2000) demonstrated that most ethnographic studies utilize about 30 to 60 interviews. However, Bertaux (1981) demonstrated that fifteen is the smallest sample size acceptable in qualitative research. Conversely, Morse (1994) suggested that ethnographic studies should incorporate samples of about 30 to 50 while phenomenological studies should incorporate at least six participants. Creswell (1998), on the other hand, argued that while 5 to 125 interviews are acceptable for phenomenological studies, grounded theory studies should include 20 to 30 interviews.

Several researchers have provided specific guidelines that could be used in determining sample size in qualitative studies. In particular, Charmaz (2006) believed that about 25 participants is suitable for small qualitative studies or projects. Richie et al. (2003) said that the participants in a qualitative study should number less than 50, while other researchers, such as Thorogood and Green (2009), suggest that qualitative studies that use interviews as their main data collection method must include at least 20 participants. According to Mason (2010), these observations are merely guidelines; therefore, a study does not necessarily have to adhere to the requirements highlighted. The purpose of data saturation is to determine conventional portions of the qualitative sample sizes.

Even though qualitative research has well-established and generally accepted criteria of validity, reliability, reproducibility, and general quality, different schools of thought differ on the standard set of criteria to be applied. In short, what are those standards and what would the quality margins

be? Therefore, the concept of saturation is not applicable to all research approaches based on qualitative methods (Tay, 2014).

The number of interviewees in the present study reached 44 participants: 12 men, 12 women, 6 teenagers, 4 workers, 4 visitors, and 6 experts (including 5 urban planners and architects, and 1 decision maker). The men, women, teenagers and two of the workers are residents in Almoroj. To facilitate the analysis of the interviews, a coding system was developed: **A** men, **B**, women, **C** teenagers, **D** workers, **E** visitors, **UP** urban planners, **DM** decision maker, and **AR** architect (see Appendix A for more details).

### *4.4.3 Direct Observation*

According to Marshall and Rossman (2006: 98), *"observation is a fundamental and highly important method in all qualitative inquiry."* Direct observation is one of the most important methods in qualitative research or inquiry. According to Lynch (1960), visual perceptions which the observer develops when entering distinct spaces and places are a fundamental tool in the investigation of a built environment. Direct observation, however, is mainly applicable when the main goal of the research study is to assess ongoing events, behavioural processes, or situations (Holmes, 2013). This becomes necessary as one of the objectives of this study requires the assessment of the physical outcomes of the design of neighbourhood units. These can be seen easily where other data collection procedures would not be as effective. In tandem to this, urban studies reveal that neighbourhood conditions and characteristics are strongly associated with physical activity levels. The study by Kwarteng (2013) revealed that physical activity is influenced largely by various factors, including social, individual, and environmental factors. Information about the quality of use and functions of spaces in the urban form of the Almoroj neighbourhood was thus obtained through direct observation of the neighbourhood.

Direct observation in this research was conducted through fieldwork visits to the site and experiences recorded that are closely related to the criteria identified, using photographs to gather evidence regarding the characteristics of the physical design of the neighbourhood unit of Almoroj and its use. This assisted this study in comprehensively investigating the area's spaces and capturing important components such as artefacts in the urban environments (Cullen, 1971, cited in Mandeli, 2011). Furthermore, it helped in observing the urban life in the public spaces of the Almoroj neighbourhood as well as the functionality of the adjoining urban settings and the actions of people in these setting in line with the arguments of Whyte (1980).

Observation as a method of data collection can be relatively structured, where the observer records events that belong to one of several discrete categories identified beforehand (Marshall and Rossman, 2006). Holmes (2103) observes that structured direct observations are highly applicable when the observer needs to gather standardized information, and the sustainability criteria identified in this study form the framework that structured the direct observation and collection of visual data according to the eight sub-criteria. Zeisel (2006:159) defined the phrase 'observing physical traces' as *"Systematically looking at physical surroundings to find reflections of previous activity not produced in order to be measured by researchers"*. Typical major and internal commercial and residential streets, houses, pavements, mixed use and commercial buildings, and green areas were carefully selected and observed to support the analysis and evaluation of the sustainability criteria, along with other relevant data gathered through interviews and urban space analysis. As Drury (1992) noted, the observation of urban spaces help to reveal other problems associated with the various uses in the neighbourhood and the functionality of the urban form in relation to parks, municipal open spaces and pavements.
Zeisel (2006) emphasized the relevance of visual data, stating that observers can achieve the demonstration of research concepts when they use visual trace records. Therefore, investigators wishing to use trace observations in tandem with interviews to test their interviewees will find visual data useful. Similarly, Ball and Smith (1992: 9) noted that:

> *"Photographs of people and things stand as evidence in a way that pure narrative cannot. In many senses, visual information of what the people and their world looks like provides harder and more immediate evidence than the written word; photographs can authenticate a researcher's report in a way that words alone cannot".*

Ball and Smith (1992) further suggest that the use of photographs can help to facilitate the assessment of visual phenomena in qualitative and ethnographic studies. Given the qualitative and visual phenomena nature of this study, photographs were deployed as the foundation for the analysis and assessment of visual phenomena in the neighbourhood, including self-decoration, masks, the cross-cultural analysis of visual arts, graphic and plastic, architecture, costumes, and religious iconography. These photographs were taken not only to describe and exemplify the urban architectural elements and features as well as the functionality of some specific urban aspects and buildings within the research context, but to also support the data analysis for each sub-criterion.

### *4.4.4 Urban Space Analysis*

Understanding maps is an important component of understanding how urban planning and design works. Thus, the analysis of maps can provide substantial information in evaluating a neighbourhood. In this case study, mapping diagrams are used to understand the urban spaces and the local context. Also, they were used to gather data regarding the quality of local facilities and services. Additionally, for some situations, illustrations and architectural plans have also been incorporated.

The urban space analysis of the Almoroj neighbourhood is analysed based on the analysis of the Urban Task Force led by Richard Rogers (1999), as presented in chapter 3, which illustrates the concept of a compact and well-connected city. Other diagrams mentioned in chapter 3 are also considered in the urban space analysis, including the early concept of neighbourhood unit proposed by Perry as well as the updated neo-traditional neighbourhood principles of the New Urbanism.

The urban space analysis aimed to study the data gathered about the case study neighbourhood, which included brief summary data about the site; illustrative materials of urban forms (houses and buildings, streets, and facilities); the layout plan of Almoroj from Riyadh Municipality, upgraded according to the direct observations conducted; a drawn 3D model of part of the neighbourhood; and road cross-sections of the 3D model. This is in addition to measurements and distances; for example, block lengths and the sizes of green spaces such as parks and municipal open spaces. The distances to facilities and services were also calculated. Many layers diagrams were created and drawn on maps for each urban function (for example catchment areas) so as to be easily read and analysed.

## 4.5 Data Analysis

> *"Analysis takes you step by step from the raw data in your interviews to clear and convincing answers to your research questions"* (Rubin and Rubin, 2012:190).

The gathering of data was conducted between 1 June and 1 September 2015. The interview questions used during data collection mainly focused on the built environment of Riyadh city, specifically in the Almoroj neighbourhood. The researcher used various interviewing questions depending on the roles of the interviewees. Since the interviewees mainly spoke the Arabic

language, the interview questions used were translated in to Arabic. In addition, in order to facilitate the interview process, the researcher exploited connections with friends and relatives; however, the researcher contacted directly the participants important for the study and ascertained their willingness to take part in the interview process.

As mentioned above, 44 people were interviewed in the categories of residents, workers, and professionals. The interviews with residents took place in houses, worker were interviewed in their offices, and visitors in coffee shops. The questions asked can be seen in Appendix A. The timing was based on the participants' convenience, and mostly conducted during the working day for local planners and architects or in the evening for neighbourhood residents. The recorded interviews were translated into text from Arabic to English.

Thematic analysis was used as a method to assist the researcher to present the findings in a systematically organized manner according to the developed themes. The identified sustainability criteria were used as themes to organize data from the interviews, direct observation and secondary sources. The responses to the interview questions were classified into eight themes which are the previously identified sub-criteria (see Table 4-6). Each two themes which relate to one of the main criteria, were entered into a separate file where the answers were directly linked to each relevant theme.

The findings obtained during the interview process largely supported the data obtained from various literature sources, including books, theses, papers, photographs, historical documents, and observation. The risk of errors was reduced by using different techniques and methods during the investigation reported in each of the analytical chapters.

## 4.6 Limitations of the Methodology

There are a number of methodological limitations of this research investigation, as follows:

Firstly, some shortcomings must be acknowledged in the process of selecting interviewees. For example, women's participation in this research and gaining their agreement was a serious challenge, as their consent was obtained via their male relatives. To involve teenagers aged 15 was another problem, as they also needed permission to take part in this study. However, after long debate and consultation, this was achieved but at the cost of unnecessarily longer times.

Secondly, most of the interviewees did not have experience of being interviewed. The researcher had to explain each interview question in a simple way and in great depth, particularly to the elderly, some housewives, and teenagers, due to their lack of background knowledge about the subject. Each interview took around one hour to go through the list of questions. It is important to mention that in these cases, some answers were limited to a few words only.

Thirdly, the researcher encountered many concerns in the Ministry of Municipal and Rural Affairs and Riyadh Municipality with regards to access to information and data of the original plans of the city and its neighbourhoods, especially urban planning regulations. The work culture in government institutions also led to considerable hindrance and the process of acquiring permission, information and statistics was cumbersome and time consuming.

Fourthly, the non-availability of planners and designers, and staff of various urban departments involved in neighbourhood design and development was also another problem. The neighbourhood in the case study was designed 40 years ago by two foreign architects. It was found that one of them is dead, and it was hard to reach to the second who is retired. Unfortunately, it appeared that some important research material and information could only be accessed through them. Some ministerial and municipality officials were also busy with other commitments, and hence were unable to spare extra time to find the required information. However, regardless of this, some very useful material about Doxiadis original plan was obtained in Arabic from the archives of Doxiadis in Greece. As mentioned, there were around 28 thick archive documents related to the comprehensive Riyadh master plan (see Appendix C, the filled form of request to obtain relevant copies from Doxiadis' archival documents).

Fifthly, translation from Arabic to English and vice versa was another trial, as it consumed lots of time in arranging, managing, translating and then making the material readable as well as presentable.

Sixthly, the process of direct observation and taking photographs in this context was not easy, especially with the presence of women in public. Taking photos of women in the streets might be a dangerous activity and the researcher may be penalised. Taking photos inside houses needed permission and not all the residents agreed to show what was inside their private spaces.

Finally, the results of this study can be to some extent generalised to similar neighbourhoods in the districts of northern Riyadh city, but such inferences cannot be generalised to other

neighbourhoods in Riyadh because of differences in the socioeconomic conditions of North and South neighbourhoods. House prices and the status of residents in the North neighbourhoods are higher than in other districts, as discussed in the findings in chapter 9. Nevertheless, the methodology can be generalised and used in Saudi Arabian cities, towns, and neighbourhoods by changing some of the criteria that might be of interest for future research into neighbourhood units planned for other cities in Saudi Arabia.

## 4.7 Conclusion

The research strategy is composed of three main elements. Firstly, due to the fact that the urban form of Riyadh was primarily planned as a city of replicated neighbourhood units, the focus of this study therefore turned towards investigating one neighbourhood unit. As a result, a selective case study approach has therefore been chosen. Secondly, mainly qualitative research methods have been utilized in this study. However, a basic quantitative method was used to investigate the nature and quality of the urban context and its services. The sustainability criteria developed for this research are based on the literature on the principles of sustainable urban forms. Thirdly, in the case study of the selected neighbourhood, the processes of design, development and use of the neighbourhood form the framework of the investigation.

The research design of this study is based on linking four selected data collection and analysis methods to the study's three objectives. The research methods used to understand historical and social factors include: (1) interviews; (2) direct observation; (3) review of archival documents, secondary data, and the literature; and (4) urban space analysis. The sampling techniques used included both probability and non-probability approaches. Probability sampling included purposive and convenience sampling, while non-probability sampling included simple random samples. The number of participants in the interviews was based on the concept of data saturation, where the data which had been collected were sufficient and there was no need to collect more. Finally, the limitations of the fieldwork were outlined and considered in terms of any shortcomings of the data.

# Chapter 5: Neighbourhoods and Urban Form in Riyadh

**Contents**

## Chapter 5: Neighbourhoods and Urban Form in Riyadh

## 5.1 Introduction

This chapter provides a historical review of the urban forms of neighbourhoods in Riyadh. It presents an overall picture of the old city and its urban form. Although the first neighbourhoods used and preserved traditional urban and building elements, when cars were first introduced subsequent changes started to reshape the urban form of the city. How modern urban elements, such as the use of villas and the grid system, have affected the urban planning in the city to date is also considered.

The first Riyadh city master plan was initially planned by Doxiadis during 1968-1972 and design guidelines for macro and micro-scale local plans were put in place. The city plan was based on a modular grid, of 2x2 km super-blocks (Community Class V). Doxiadis' plan focused on the modulus, which is a self-sufficient unit and to him this was a new dimension for the future city. The focus of this research is therefore on this square neighbourhood unit. The comprehensive master plan is discussed below in order to understand the design stage and the principles of these super-blocks.

According to the High Commission for Development of Riyadh (ADA) and Riyadh Municipality (RM), Community Class V (CCV), which is the urban scale that was originally set by Doxiadis for a city or polis, were used as neighbourhood units in Riyadh. The urban policy, regulations, guidelines and urban functions involved in designing CCV neighbourhoods were partially changed by Riyadh Municipality and The Ministry of Municipal and Rural Affairs (MOMRA). The urban policy and regulations at the neighbourhood level have changed over time, but it is significant to note that the super-block concept is still maintained by the latest firms working on the Master Plan, although they have introduced a new planning approach for the city. The modulus structure used by Doxiadis and RM is discussed further in detail in this chapter.

## 5.2 Riyadh Context

### *Riyadh's location, climate, and population*

The city of Riyadh is located at a latitude 24' 38' N and longitude 46' 43' E on the Najd plateau, in the eastern central part of the Arabian Peninsula, between 570 and 690 metres above sea level (Figure 5-1). Wadi Hanifah is located towards the west and sheer escarpments are present towards the east and south (MEDSTAR, 1999).

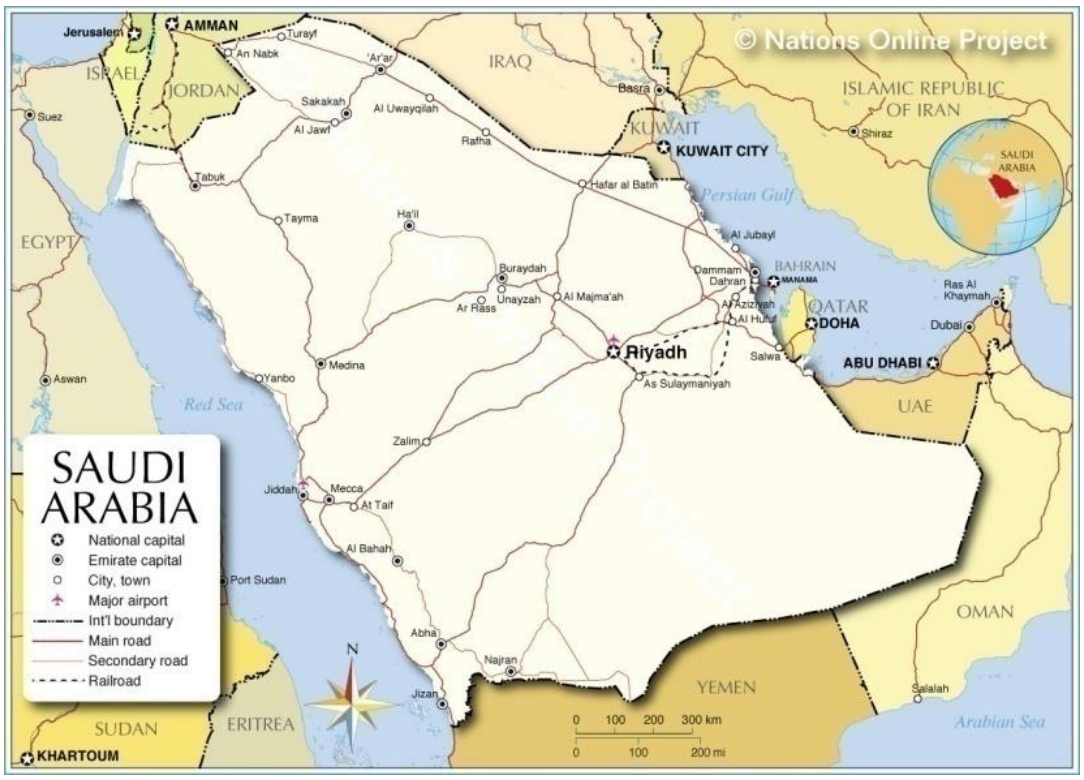



**Figure 5-1: Map of Saudi Arabia, showing Riyadh city**

(Source: Nations online, 2013)

There are a number of Wadis (valleys) surrounding the city. These include Wadi Qaddiya, Wadi Wubayr and Wadi Al Aysan. Wadi Wubayr flows south-west to north-east and Wadi Al Asyan from north-northwest to south-southeast. The climate in this part of the world is hot and arid. Summers there are hot and long due to high temperatures and low precipitation along with cold winters.

Until 1917, the old city was considered to be a built circle made of mud walls that are approximately 1700 metres long and 7.5 metres high. The town had no particular regular shape and was covered with botanical gardens of palm groves. There were nine gates that allowed passage through these walls. The population of Riyadh in 1917 was said to be about 12,000 to 15,000 persons (Philiby, 1920).

Contemporary Riyadh is the largest city in Saudi Arabia and is still rapidly growing and developing compared to other Saudi cities. This growth can be attributed to it being the country's capital city. Riyadh has extended from a small area enclosed by walls to about 2.453 square kilometres constituting a modern city in less than half a century (High Commission for the Development of Arriyadh, 2013). Its shaped urban grid organization is peculiar to the area's natural habitat and topography, which represent a contemporary urban placement of the city (ADA, 2003).

**Riyadh in year 1437 Hijri (2016)**

| | |
|---|---|
| Population | 6,506,700 |
| Population Growth Rate | 4 % ( 1431 - 1437 h ) |
| Saudi Population Ratio | 64.19 % |
| Non-Saudi Population Ratio | 35.81 % |
| Saudi Population ( aged 0 - 14 years ) | 30 % |
| Proportion of Saudi Males | 52.5 % |
| Proportion of Saudi Females | 47.5 % |
| Proportion of Non-Saudi Males | 63 % |
| Proportion of Non-Saudi Females | 37 % |
| Size of Labour Force | 2.2 million workers |
| Number of Households | 1,116,339 households |
| Average Household Size | 5.7 persons |
| Number of Housing Units | 1.2 million units |
| Saudi Families in Owned Houses | 56 % |
| Saudi Families in Rental Houses | 40 % |

**Figure 5-2: Statistics of Riyadh in 2016**

(Source: High Commission for the Development of Riyadh, 2016)

The population of Riyadh makes up about 22.36% of the entire population of Saudi Arabia and, as per the Department of Statistics and Information (2010), the population of Riyadh has increased from 100,000 in the 1950s to approximately 6.5 million in 2016 (ADA, 2016). If this growth rate remains the same then it is anticipated that the population will reach 10 million by 2020 (see Figure 5-2). Riyadh's population includes various cultures and is diverse in languages and activities as well (Garba, 2004).

## 5.3 Historical Background of Riyadh's Urban Development

### *5.3.1 Riyadh's neighbourhoods and its urban forms and patterns*

For the purposes of this study, the discussion of the historical development of the city of Riyadh is limited to the development of neighbourhoods in the city. As a consequence of the phases of urban development in Riyadh, four neighbourhood urban patterns can be found. These include the traditional urban pattern, the cul-de-sac, the grid pattern, and the 2kmX2km square super-block with rectangular pattern of blocks. Nonetheless, the new square super-

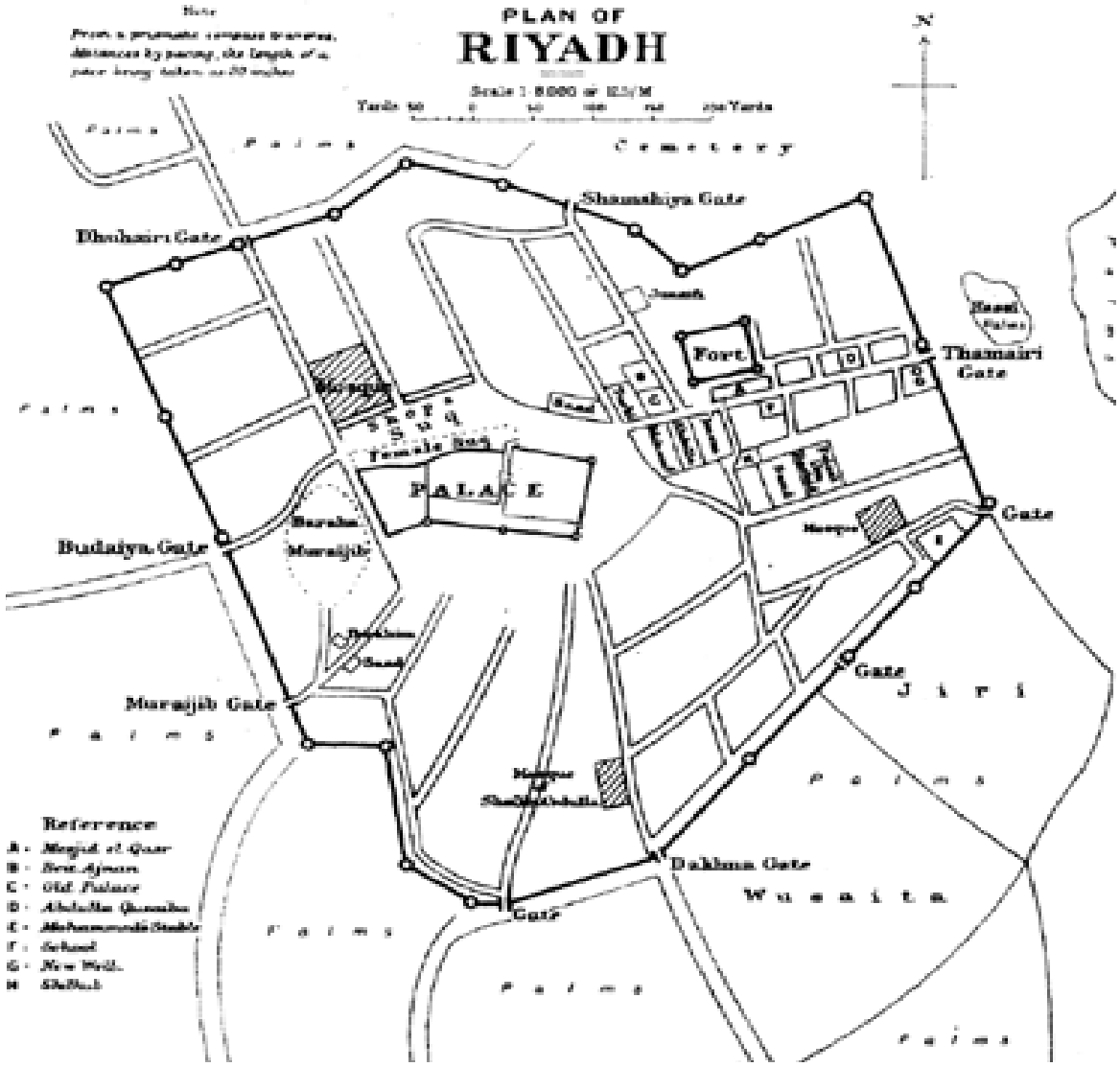
blocks designed by Doxiadis are the most predominant until today. This pattern has been duplicated in the majority of the city's Master Plans, as outlined by Riyadh Municipality and the Arriyadh Development Authority (ADA, 2003).

### *5.3.2 Old Riyadh city and its organic form*

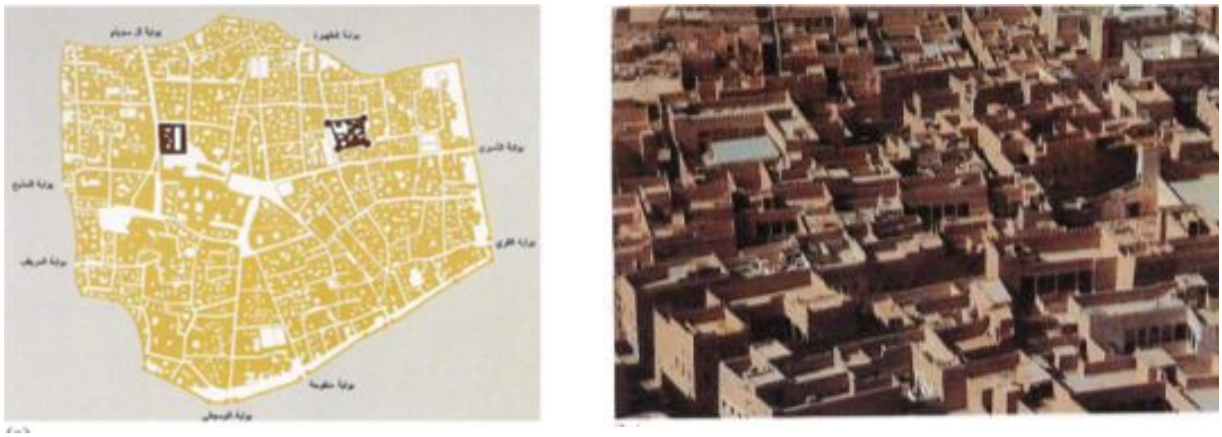
In the early1900s, Riyadh was a very small town with a population of around 14,000 in 1910, and around 27,000 in 1930. The area covered was less than one square kilometre at the beginning, and the habitants followed a tribal government system at the time, when agriculture was the main resource (Alkhedeiri, 2002:74).

The spatial structure of old Riyadh was made up of small neighbourhoods consisting of blocks of homes that actually characterized rectangular buildings with central courtyards (see Figures 5-3 and 5-4). The land plots were between about 10m x 10m and 10m x 12m. The buildings encompassed a courtyard of about 3 to 4 metres wide, with small openings on the facades. This configuration was found on both sides of the main roads, which were 8 to 12 metres wide. Pedestrians enjoyed shaded narrow streets to most of the mosques. The city's walls were made with a mix of bricks and mud, and rose to a height of about 8 metres, and were defended by gates. The Al-Masmak Palace, also referred to as the Al-Masmak Fortress, is one of the primary structures held within the walls of Old Riyadh. This building, which was recently renovated, was the first section of the city to be developed when King Adb al-Aziz took over in 1902.

The Justice Palace is situated at the centre of the old city. It served as King Abd al-Aziz's seat and was close to the Congregational Mosque (Al-Masjid al-Jami') of Old Riyadh. Jami' Turki bin 'Abdallah, 'the Mosque of Turki bin Abdallah', is in close proximity to the Justice Palace and this is similar to the layout of any other of traditional Islamic city. Commercial and community activities occurred in a large urban space located in the centre of old Riyadh, which has been commonly known as Sahat al-'Adl, 'Justice Square' (Al Hathloul, 2003).




**(a)**



**(b)**

**Figure 5-3: Old Riyadh: (a) plan of Riyadh in 1917 and the walls and towers of the city of Riyadh at the beginning of the twentieth century (b) a compact, walkable, accessible, climate sensitive urban form.**

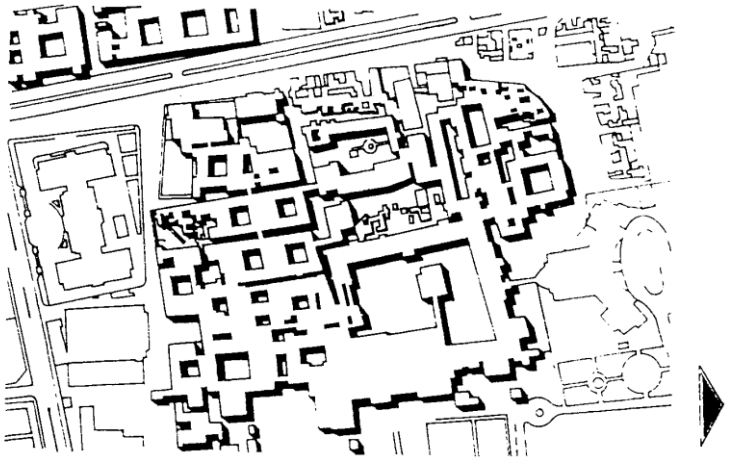
(Source: High Commission for the Development of Arriyadh, 2012 (a), Philby's Map, 1922(b)).

**Figure 5-4: Early-twentieth-century Sahat al-'Adl (the Justic Square) view in Old Riyadh.**

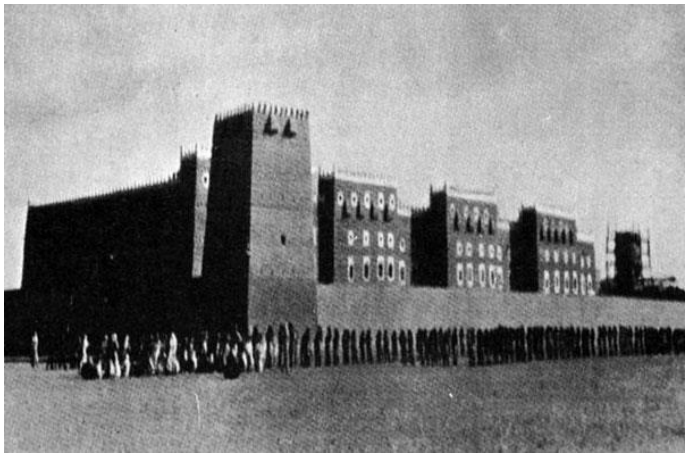
(Source: Centre for the study of the built environment (CSBE), 2009)

### *5.3.3 Traditional urban neighbourhoods (e.g. Deerah)*

According to Al-Hathloul (2003), Riyadh's borders in the mid-1930s expanded beyond the walls of the old city. King Abd al-Aziz established the construction of Qasr al-Murabba' (the Square Palace) about two kilometres away on the northern side of the city in 1937, which signified the expansion beyond the original walls. In addition, its area exceeded 16 hectares (derived from its square shape of 400 by 400 metres (see Figure 5-5). Al-Murabba' was a form of walled palatial complex and housed the king and his family. Additionally, there were some residential buildings where the king's retinue lived and a couple of administration buildings. Al-Hathloul (2003) claims that the construction of al-Murabba fuelled the development of al-Futah, which is an area situated between al-Murabba' and the old city. It is located in the western part of the street connecting al-Murabba' with Old Riyadh. Al-Futah's development came about due to the decision of some of 'Abd al-'Aziz's sons' to build their palaces there in the 1940s.



**(a) Al-Murabba site plan**



**(b)**

**Figure 5-5: Qasr al-Murabba' (the Square Palace) in 1930s, located north of Old Riyadh.**

(Source: Alhathloul, 1981)

Al-Hathloul (2003) stated that 'the construction of al-Murabba' to a great extent influenced the physical development and growth of Riyadh'. Al-Murabba' itself was large, occupying an area of close to a third that of Riyadh. The city then underwent immense expansion. This was in part due to al-Murabba's location north of the old city. The situation of the palace can explain Riyadh's primary direction of growth. Other neighbourhoods also developed as a result of al-Murabba's construction. Further areas were then developed, including, al-Nasriyah and al-Deerah development.

There was a transitional period of the city's development that was between the old traditional and the modern forms. Al-Deera is the oldest transitional neighbourhood and it reflects the relatively unplanned expansion beyond the walls of old Riyadh walls during 1940s (see Figure 5-6 and 5-7). Regarded as one of Riyadh's densest and most compact neighbourhoods,

al-Deera can be characterized by the traditional vernacular building type, which is mainly seen in the traditional urban core at the centre of the city. Ledraa (2015a) conducted a study that comprised of a comparative characterization of recent neighbourhoods versus traditional central core neighbourhoods, with Al-Deerah as an example. Based on all of the measurements, the block types in the inner city tend to perform much better than the other forms of neighbourhood in the city in terms of accessibility, ability to walk, social relations and proximity.

Furthermore, it is evident that the form of the Al-Deerah neighbourhood demonstrated a mix of uses, which is more diversified than those of other neighbourhoods in the city. The traditional ideologies for designing neighbourhoods implemented primarily for inner-city neighbourhoods were consistent with the principles of New Urbanism. This explains the inconsistency shown between the inner core and outer neighbourhoods of the city.

Three new technologies were introduced in Riyadh due to the construction of al-Murabba' and other areas (al-Hathloul, 2003). First, the automobile was introduced as a means of transportation. As a result, the streets within al-Murabba' were expanded to allow vehicles to pass through. However, the introduction of automobiles in the old city of Riyadh led to the demolition of some buildings in the city to allow the streets to be widened. The second new technology to be introduced was electricity, which was produced through the use of generators. Moreover, water closets with complex drainage systems were also introduced.


**Figure 5-6: One of the first transitional neighbourhoods in Riyadh city at the end of the 1940s. Demonstrating the physical elements of the traditional urban form pattern in Riyadh.**

(ADA, 2004)

**(a)**

**(b)**

**Figure 5-7: Transitional period 'suburbanization', showing the traditional Arab houses of 1940-50s communities built to meet the then rising demands for housing.**

(Sources, (a) Ladeera, 2015, (b) Mubarak, 2004)

According to Al-Hathloul (2010), it was necessary for al-Murabba' and Al-Nasriyah to be linked to each other, as well as to the walled city of Riyadh. As such, 1953 saw the construction of the first street linking al-Murabba' with Al-Nasriyah, a street that was paved with stones. In addition, in 1951, a railway linking Riyadh with Dammam, located in eastern Saudi Arabia, was opened. Figure 5-8 shows the locale of the old city of Riyadh marked as no.1. The most important projects that represent the city's growth beyond its walls are also visible in the image. They include al-Murabba' (2); Al-Nasriyah (3); Al-Malaz (4).

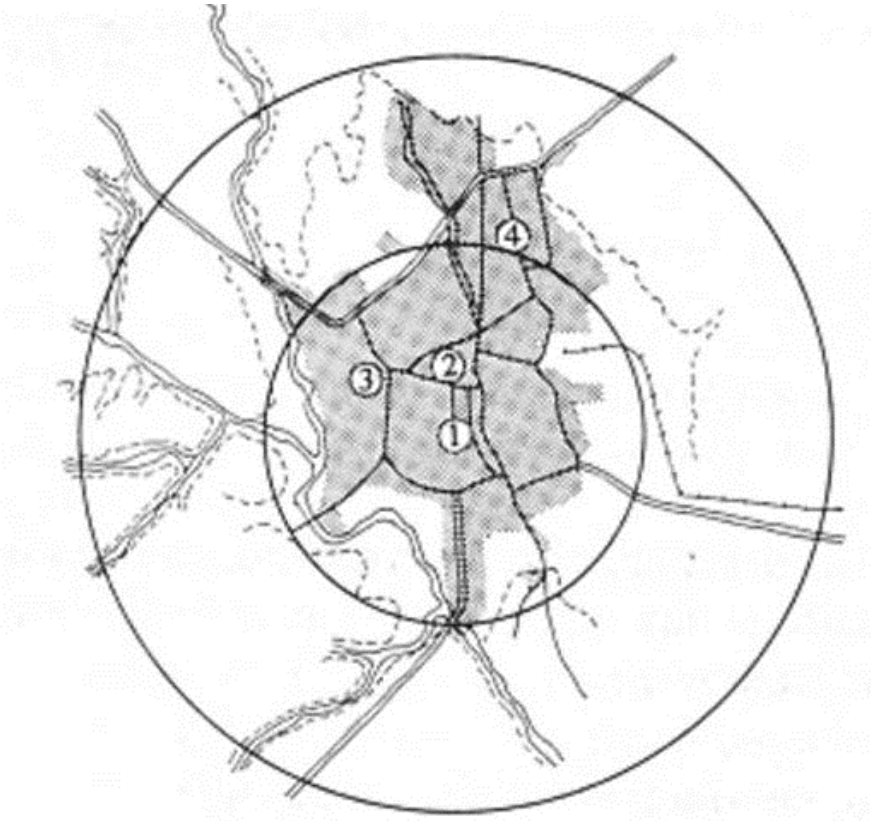



**Figure 5-8: Site location plan of Old Riyadh and the major projects that took place in Riyadh during the first half of the twentieth century.**

(Source: Alhathloul, 2010)

### *5.3.4 The grid-Iron Al-Malaz neighbourhood in 1953*

Since 1930, the population of Riyadh has increased rapidly. The growth rate was estimated to be 5% between 1930 and 1950, and 7-8% between 1950 and 1970. The population reached 46,000, 160,000 and then 350,000 in 1940, 1960 and 1970 respectively with a spatial exposure of approximately 85 square kilometres in the 1960s. With these increases development challenges were also forced in the provision of services and the control of growth in the right direction. In the 1950s, a small airport was constructed in the northern part of Riyadh. New boulevards linked the airport to the city centre and to the Murabba Palace area, and this became the preferred location for the construction of Ministries, Palaces and many modern buildings.

The ministries were relocated from Jeddah to Riyadh in 1953. Subsequently, a group of buildings were constructed along the airport road (King ʻAbd al-ʻAziz Street) in Riyadh to house the different ministries. The Egyptian architect and planner, Sayyed Kurayyim, designed the buildings, and the Egyptian contracting company, Arab Contractors, built them. In order to house the employees of those ministries who had moved from Jeddah, a large-

scale housing project was needed. Thus, the Al-Malaz residential region was built. Al-Malaz was a district developed in 1953 of a residential nature and was said to be the first neighbourhood in the city that was based on modern Western patterns (Alhathloul, 1991). It was intended to be utilized by middle and high income receiving employees of the Ministry of Finance, and Al-Malaz was given the most modern structures (Alsuliman, 1989; Al-Hathloul, 1981). Al-Malaz was a grid-iron neighbourhood and it had 3 districts, with 180 apartments and 754 villa-style dwellings made of mainly mud material. The total area covered by Al-Malaz was 500 hectares. This use of iron grid system was a popular major aspiration for later developments in Riyadh (Alkhedeiry, 2002:115; see Figure 5-9 below). It was built with a hierarchical street system and rectangular blocks. The streets were 30m wide on the borders and then 20m wide for major roads and 15 to 10m for minor streets. The shape of each plot was square with average dimensions of 25x25m.

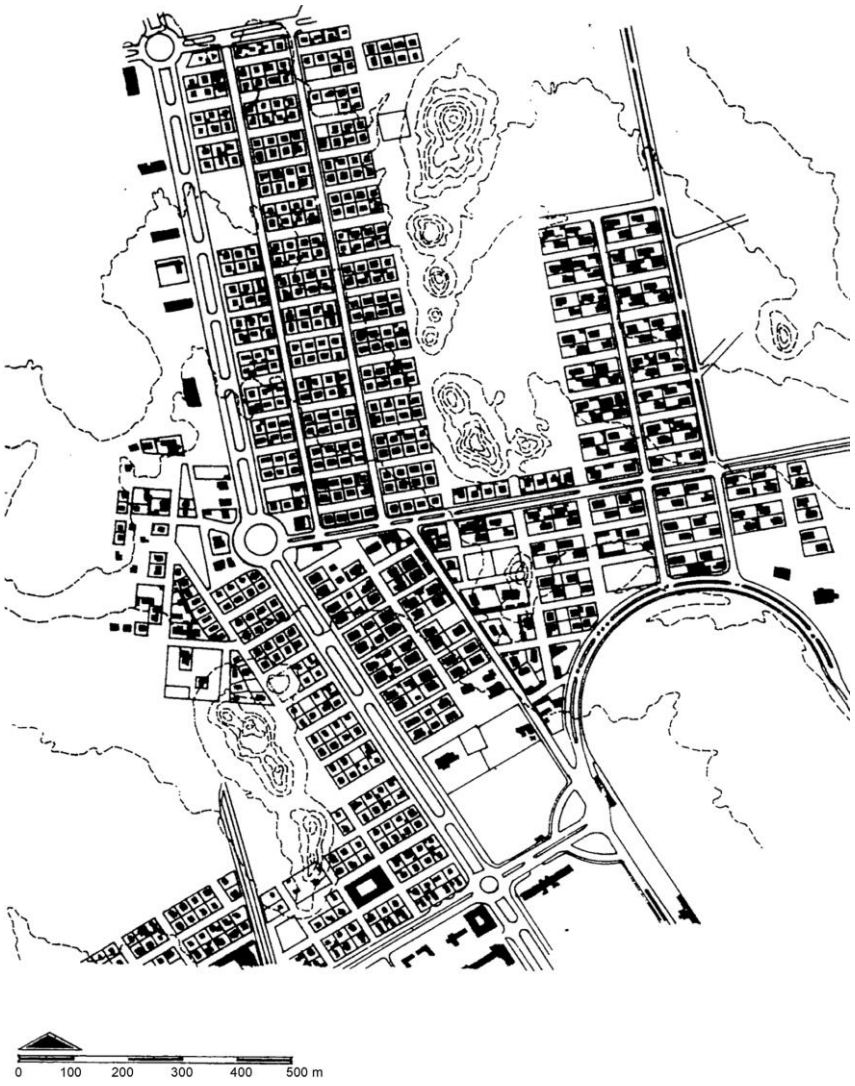



**Figure 5-9: Al Malaz District, Arriyadh 1953.**

(Source: CSBE, 2011)

Al-Hathloul (2010) pointed out that living in apartment buildings was a new concept that was only introduced to Riyadh during the mid-1950s with the al-Malaz project. The al-Malaz case was instituting policies, which stressed a primary or single land use, which was mainly residential. They also stressed the importance of setbacks and facilitating effective car navigation by creating a number of street intersections that respect roads right of way.

The detached villa was a significant form of building that became common as a model for residences after the al-Malaz project. Al-Hathloul states that the general public aspired to the status of government employees in the 1950s and 1960s and regarded them as of a high social class. They even emulated the design of their residences. Al-Malaz's status as a government project also led to the popularized model, since people took it as an authoritative government statement about how homes should look. As a result, soon after employees of the government took up residence in new villa-type residences in al-Malaz, people in Riyadh generally started to build their own houses to match (Ebn Saleh, 2001; Alhathloul, 2003).

Accompanied by the spread of villa-type buildings and grid planning, zoning regulations and building ordinances were applied in Riyadh. The laws and regulations responded to some concerns about the al-Malaz project. These included square lots which villas were built on and the setback distance imposed on each side of the lot. Due to the institutionalization of building ordinances, both grid-planning, and villa-type dwellings continued to be used in Riyadh as in other cities in Saudi Arabia.

### *5.3.5 The development of modern neighbourhood planning*

To understand how the planning of modern neighbourhoods developed, it is important to consider the historical development of the neighbourhoods in Riyadh as provided for by statutes and regulations. The formulation of building regulation and contemporary planning in Saudi Cities such as Riyadh was initiated by the 1937 Makkah Municipality and Municipalities statute, order number 8723. This order stated that it was the responsibility of Makkah and other municipalities to undertake key tasks such as beautification, organization of the town and improving the scenic outlooks in the interest of the public (Al Hathloul, 1981). This provision was enacted before the foundation of Al-Malaz in 1957.

The developing oil industry since the 1940s has caused the rapid growth of urbanization in Dammam city, on the east coast of the country. In 1947, the Saudi Oil Company ARAMCO was asked to plan the city of Dammam and the new city Alkhobar. Alkohbar was fully planned by ARAMCO's engineers based on a grid system with villa-style housing (Figure 5-

10). Since then, Alkhobar has become the paradigm of modern life that has been followed in most Saudi cities (Alhathloul, 2010).

**Figure 5-10: Plan of the city of Alkhobar.**

(Source: Alhathloul, 2010)

The administration of Makkah Municipality designed the Roads and Buildings statute in 1941; however, this statute was deemed too immature. Municipalities and town planning offices were in 1960 issued with a regulations circular by the Deputy Interior Minister for Municipalities. It provided that 33% of the area covered by land developments should be reserved for facilities and services, building permits were readied, and built-up areas should not exceed 60% of villa-style buildings and their heights should not exceed 8.40 metres. These regulations were and are still used in the first and later Master Plans for Riyadh, discussed later in this chapter.

The government determined that the Al-Malaz neighbourhood would be the standard for the ideal modern physical planning of neighbourhoods. After its construction, Al-Malaz neighbourhood was used as the standard representing how other Saudi neighbourhoods would be developed (Alsaid, 2003; Alhathloul, 2010).

A Greek firm, Doxiadis Associates, then undertook an important planning project in Riyadh in 1968 aimed at controlling and directing the city's growth until the year 2000. This plan established the modular grid in the city. Also, Doxiadis' plan generally suggested planning criteria and building regulations which were mostly ignored and confirm what existed with some modifications. Later in 1978, the Doxiadis Master Plan for Riyadh was revised as a 12-

year plan by the French company SCET-International. A later urban planning firm MEDSTAR revised both plans in 1996 and since then has been working on developing the Master Plan of the city. It is important to note that, the primary features of the previous Doxiaidis' Master Plan have been maintained, especially the 2x2 kilometres grid. Currently, the super-grid in the Doxiadis' plan is still maintained for most of the city's new neighbourhood developments. Therefore, the original master plan that formed a modular grid of neighbourhood units plan is discussed in more detail below, focusing on the Modulus or neighbourhood unit plan since the time of Dioxides up to the latest changes made by Riyadh Municipality.

## 5.4 Doxiadis' Master Plan of Riyadh (1968-72) and its Neighbourhood Units

### *5.4.1 The city's urban problems and needs prior to 1970*

According to the Doxiadis' master plan (1971), the city had grown in a random way and did not have a complete recognizable structure. This led to a need for major structural and planning legislation to control the city's growth. The city, however, needed a clear network of streets to facilitate people's movement from work to home and also, the city was to sub-divided into neighbourhoods with clear borders in order to allow for the management of independent neighbourhood units. There were issues due to many functions being concentrated in the city centre and in the central business district. One issue is traffic congestion on the streets because of incoming and outgoing workers. Another is that, services for the residential areas needed to be distributed while preserving access to the places and buildings. The city had grown mainly in the centre and this resulted in administrative and business functions being concentrated there. It had also expanded in a linear way out of the old city. This affected the topography of Riyadh, which is perpendicular along the Wadi Hanifa (see figures 5-8 and 5-19). There was a need to control this rapid spread of the city and thus more changes needed to be made in the residents' activities and their lifestyles. The new framework and urban structure could accommodate these changes (Doxiadis, 1971:1-5).

The commercial streets in the central business district operated as the main streets in the city, which led to chaos. The city had no direct streets that linked the north side to the south. This resulted in drivers passing through the city and from other cities via these commercial streets, which created congestion. Heavy goods vehicles could not find their way out and thus, had to go through the central business district. There was no clear street hierarchy and no distinction between the streets for fast and slow speed traffic. There were no effective designs of street

intersections and thus, poorly designated lanes for drivers to turn. The demand for building construction was also higher than the supply. There were too many people living in one house and dwelling size was not compatible with family needs. Population density reached 400 persons per hectare in the old city. There was a lack of proper infrastructure, and a lack of loan and mortgage facilities from the government and private institutions (Doxiadis, 1971:5-7).

Various new developments had not taken care of the traditional architectural and aesthetics principles of Riyadh. The area also lacked accommodation for its national administrative functions, as some ministries were situated on the Al-Matar road and the Royal Court. The Council of Ministries was in the south Al-Murba area. If all these were located in one place, then it would save people's time. The locations of public buildings like schools, mosques and hospitals were also not appropriate. There was a need to build self-sufficient neighbourhoods with educational, commercial and recreational facilities. The expansion of the city also faced issues of shortages of water and also it was not suitable for drinking. The volume of water supplied to the city was 2.380 $m^3$/hour along 400 pipes and consumption was 45,000 to 75,000 litres per day. There was a lack of sewage filtration and also electricity supplies were not enough to meet needs. There was also a need for more commercial institutions and professionals' offices. Industry also needed to be relocated with a larger capacity and away from the central area of the city (Doxiadis, 1971:5-7).

### *5.4.2 The First Master Plan of Riyadh 1968*

The commission for the first Riyadh strategic Master Plan is considered to have been the most significant development in Doxiadis' career. This commission came into being approximately eight years after the completion of his well-known project for Islamabad. This Riyadh Master Plan was seen as the most important and prioritized by Doxiadis until his death in 1975 (Daghistani, 1995). The Doxiadis designs in Riyadh reflected rational decisions and strategies, which were drawn from the theory of Ekistics and the conceptual model of Dynapolis. This model was organized according to the demands of the project and its urban territory, at the macro and micro levels of the planned local urban scale.

By 1960, the city encompassed 85 square kilometres and was rapidly swallowing up marginal settlements such as Manfuh. Around the city centre, a radial pattern of city expansion was occurring. New housing areas were developing along the axes of principle streets, and large tracts of land were subject to development planning, as indicated in Figure 5-11 below (the Al-Malaz marked in orange). The main functions that attracted heavy traffic were relocated

away from the central business district; for example, the area for Ministries was located along the Matar Road.

(a) (b)

**Figure 5-11: Urban extension of Riyadh in 1968: (a) Doxiaids Master Plan for Riyadh in 1972; (b) the old city shown in yellow, and the Almalaz neighbourhood in the top right shown in orange.**

(Source: Middleton, 2009)

The previously mentioned urban and housing problems and needs led the Town Planning Office of the Ministry of Interior for Municipalities to invite the Doxiadis Associates to design a first comprehensive master plan for Riyadh city in 1968. Consequently, the Saudi Arabian Council of Ministers in 1972 adopted the final comprehensive master plan. The Saudi government's intention was to expand Riyadh up to the year 2000. The contract was drawn up and indicated the development of a Master Plan and Programme, whose aim was to steer the development of Riyadh. The main report stated that the Master Plan will demonstrate the development of the city up to the year 2000, set up policies and study the present and future needs for the development of Riyadh (DOX-SAU-A/19, 1971).

The first Master Plan for Riyadh was put into practice starting in 1968 and was completed in 1972. Its goals and policies were established to guide the growth of Riyadh city in important areas such as housing, transportation, community buildings, public utilities, expansion, open spaces and communication links. It was important for Riyadh to grow within the broader area

surrounding it. In order for this to happen, it should be developed in a form that gave it dynamism. Achieving such dynamism would require an open-ended development pattern with a spine of developments. The spine consisted of developments meant for administrative and commercial functions. This would allow all functional developments, including residential areas, to grow simultaneously.

The plan of Doxiadis (1971) stipulated that the growth pattern of a city should support the growth of human settlements given that they are crucial in meeting the needs of inhabitants. Two principles guided this kind of growth of human settlements: adopting a linear city growth pattern; and organising the elements of city life based on units in a better way than the current organization. In that regard, the latter principle governs how city communities are structured.

In addition, it was stated that all income groups should be catered for in the housing system. As such, there should be a comprehensive housing programme that addressed the needs of all income groups. Also, the transport system ought to be balanced, which means that the city functions were to be distributed in a balanced way to facilitate inclusive growth for Riyadh. Importantly, public utility systems had to be in agreement with the Master Plan to ensure that they would appropriately serve inhabitants.

In addition, Doxiadis noted that Riyadh city's national administrative functions could be achieved because the existing spatial form did not provide an adequate area to accommodate the city's objectives. The plan of Doxiadis stressed the need to define an area for national administration to establish state and national prestige, highlighting and symbolizing the principles of unity and strength (DOX-SAU-A19, 1971).

The main concepts of the Doxiadis Master Plan can be summarised as follows:

- Work from a linear growth theory for the city, running along a middle spine, moving in a north-south direction. This would prevent the infringement of the city on the built-up area, Wadi Hanifah.
- A city-wide grid encompassing a system of highways located on the vaguely rolling terrain of the city. The highways demarcate 2 x 2 kilometres super-blocks. The plan organized the area in the city in an efficient land-use plan, which transformed it to give the city an urban form. Principally, the upper-income residential, administrative and commercial north-east districts are set against the lower-income industrial south-west that is service-oriented.
- City-scale zoning regulations included the type and density of housing developments, and the smallest sizes that could be offered for lots in new residential areas.

- To revive the city centre, the Master Plan contained Action Area Plans, which covered 11.5 square kilometres.

Doxiadis reviewed the previous estimates in different population surveys, putting forward a vision of population growth up to the year 2000. The population growth from 1930 to 1986 was predicted to be around 6.5 %, while from 1950 to 1986 it was 7.5%.

However, Doxiadis does not seem to have accepted these predictions in designing the future city functions and the urban development of other cities such as Jeddah and Dammam. According to his analysis of the causal factors in population growth, the population of Riyadh in 2000 was predicted to reach 1.4 million, with growth rates of 8% in 1975, 5.50% in 1985 and 3% in 2000. This assumes the population was higher and the city had grown, then the population growth rate would decrease. For this scenario, the metropolitan area would extend to 30,400 hectares, according to Doxiadis' plan (DOX-SAU-A19, 1971).

The implemented Master Plan of Doxiadis recommended a single direction of growth, towards the north-south and west-east side of the city, with a compact super-grid organization. This profoundly affected the already established urban spatial form of Riyadh. To him, urban development should be concentrated along this linear spine. The plan also includes directions to connect new settlements along existing ones. The spatial form of the city is redefined with the super-grid of 2x2km. This then defines the urban territory and the integration of micro and macro spatial scales, and forms a hierarchy of cascading transportation structures in the city (see Figure 5-12). According to the plan, this square 2x2km unit is deemed to be the best size of unit for the expansion of the city. The basic constituent of the 2x2km grid *"has been chosen as (the) unit... (since) its dimensions have proved convenient and ... it coincides with the idea of al-Murabba which is a basic traditional element of the city"* (Doxiadis, 1971: 294).

The size of Al-Murabba royal palace compound coincided with the 2km square block adopted by Doxiadis (Doxiadis Associates, 1974). This 4km$^2$ block could have been an attempt to reproduce the Arabian village. Choguill (2008) believed that the original plan with the super-block was based on the ideas of Perry and Radburn. The main roads run along the borders and not within the super-blocks. There were arterial interiors to contain facilities such as religious, shopping and schools and they exclude through traffic (Choguill, 2008).

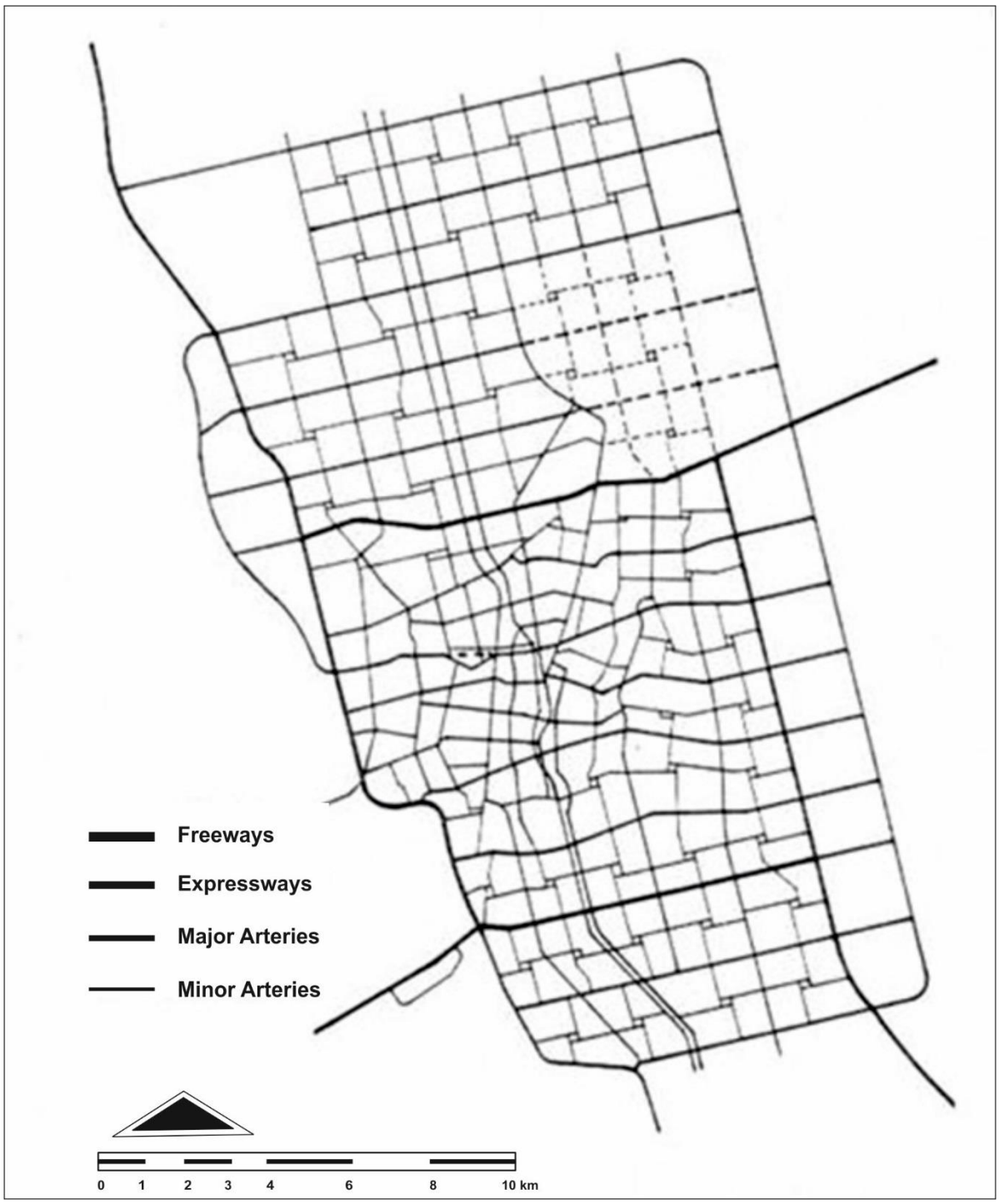



**Figure 5-12: Doxiadis Master Plan of Riyadh, 1971.**

(Source: DOX-SAU-A19, 1971).

The master plan suggested a number of developing schemes to accommodate future expansion. Riyadh city's future expansion was based on the evaluation of particular physical conditions, such as the suitability of the topography in different zones, including the general morphology of the land, man-made barriers, the conditions of subsoil; the attractiveness of natural scenes; its closeness to green areas, natural water courses; and suitability according to micro-climatic conditions. The location of the existing airport at the time was seen as an

obstacle impacting the city's expansion and might have affected the future urban expansion. The final master plan suggested some alternatives (to relocate) for the existing airport location, and the Highest Committee of the Saudi Government proposed to retain the airport's current location for 10-15 years (DOX-SAU-A/19, 1971).

It can be seen from Figure 5-13 that there were a number of alternatives in the design concepts for expansion in the master plan. The present alternative selected (No7) was towards the North-South. Based on that, there were two plans for the airport. The first referred to retaining the existing airport, whereas the second suggested relocating it outside the city limits.

The urban area of Riyadh city is divided into three zones, as per the organization of the Master Plan: the Action Area, the Master Plan Area, and the Controlled Development Area. The Action Area, covered about 11.2 $km^2$. The Master Plan Area, focused on residential development, was through sub-division legislation controlling density, building heights and minimum lot sizes. The Controlled Development Area was regulated through loose regulations concerning land use. These regulations, however, allowed the construction of community facilities and residential or public buildings of not less than 200 square metres on plots of not less than one hectare.

The northern axis was established as the city development's main spine, which would accommodate the progressive expansion of the urban centre in the existing central business district. The aim was to distribute urban development and density in the urban structure. The N-NW to W–SW axis spatially organizes the urban territory through the alignment of the 2x2km grid-iron framework of blocks, called the modulus. Decentralization of functions was demonstrated through the division into five major districts with the grid-iron framework served by a hierarchical transportation network. It can be seen in (Figure 5-14) that the concept of a highly concentrated urban centre was replaced by the spatial zones of activity along the spine shown in blue.

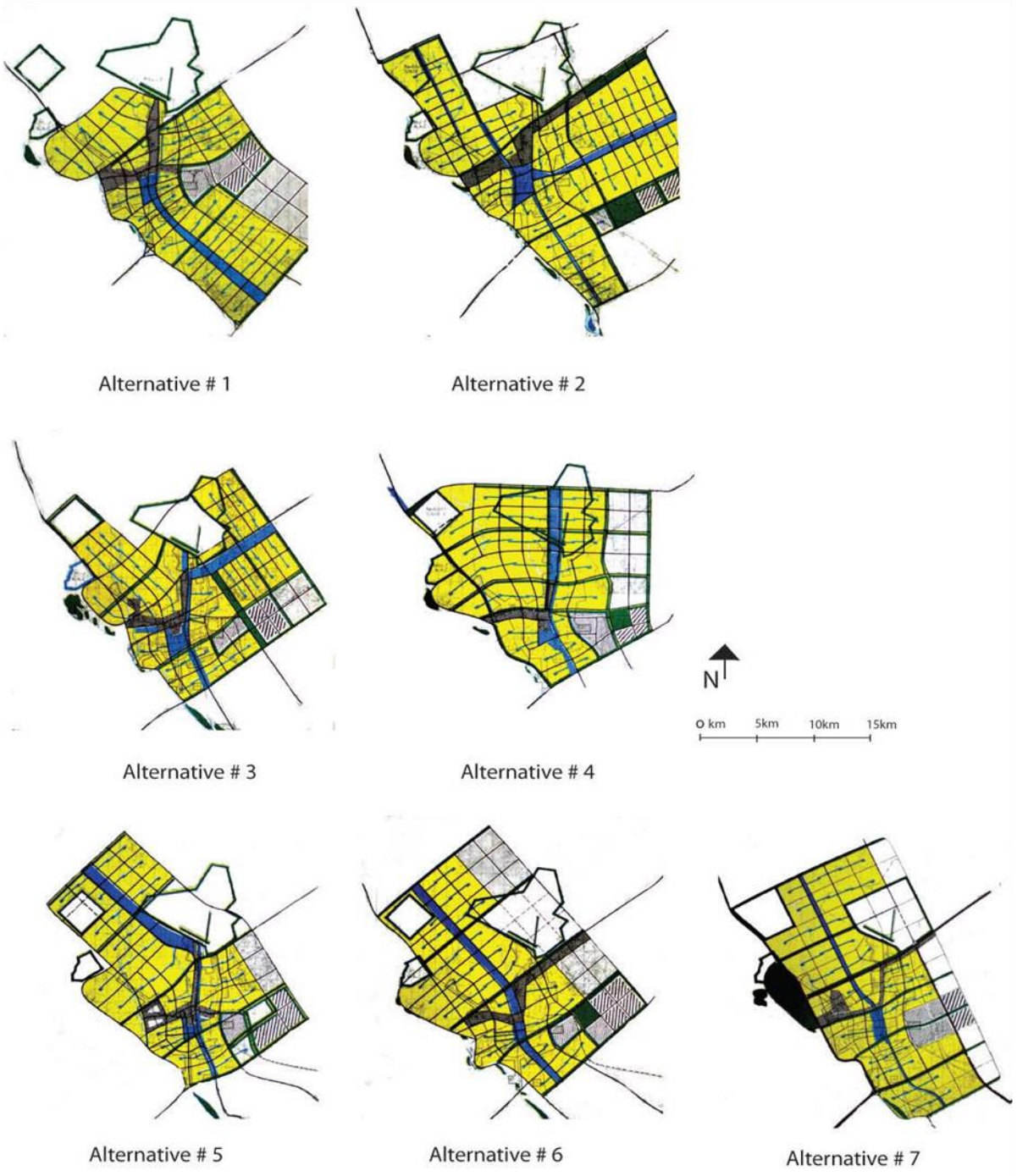



**Figure 5-13: Alternative urban structural strategies**

(Source: Dox-SAU-A19, 1971).

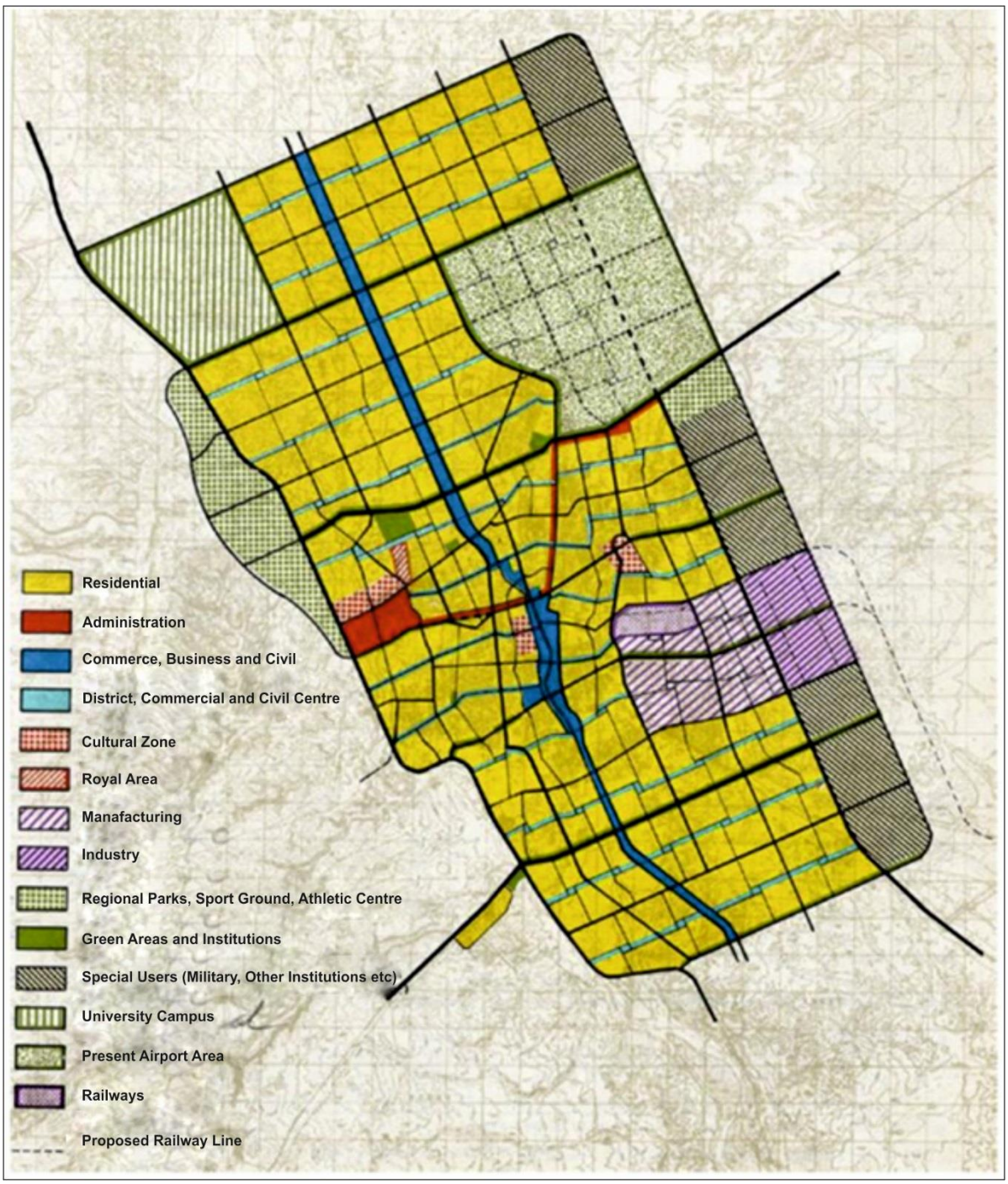



**Figure 5-14: Urban Structure of the First Strategic Master Plan Riyadh.**

(DOX-SAU-A19, 1971).

Figure 5-15 presents the overall organization of Riyadh in the design and the division of urban territory, which follows the spatial hierarchy of Doxiadis' Community Classes, and Ekistics theory concerning human settlements. The urban centres of CCVs were linked to the central spine (seen in blue in the above figure). A new industry zone was created as a buffer zone to limit future expansion to the east, similar to what Wadi Hanifa does from the west.

It can be seen from Figure 5-15 that the city was planned as a CCVII, for the year 2000, which contains six community classes of VIs. These districts are defined with high volume highways and spatially organized to sequentially stack in a northern orientation, centred on the activity spine. In addition, each Community Class VI comprises 8-10 Community Class V moduli. This is further divided into 4-6 Community Class IV units, with a relatively convenient human scale consideration. The Riyadh Master Plan considered the Community Class hierarchy with associated urban functions with specific population measurements based on the Ekistic spatial scale (see Table 5-1). For example, it specifies the internal structure of zones of civic and commercial functions required in each lower order in each Community Class division. It is clear from this table that the unified spatial pattern of the city refers to Community Class V, the modulus of 2x2 km grid-iron framework of blocks. This modulus can accommodate 50,000 residents, aligned perpendicularly to the axial activity spine.

The road and buildings regulations, used in the previous developments before Doxiadis, define the existing town planning and building regulations to be followed (Alsaid, 2003; Alhathloul, 2010). According to Middleton (2009), Doxiadis Associates accessed the copy of the book from Mr. Saud Linjawi's personal bookcase in 1968. In addition, they benefited from the translated version of the recommendations of Mr. Rassim Shanth, who was the city engineer in Riyadh Municipality at the time. The regulations were applied to town planning and buildings and included regulations of building heights, setbacks, and classifications, all of which did not previously exist in Riyadh except in cases of newly developed areas such as the Al-Malaz neighbourhood (Alhathloul, 2010).

Building regulations were suggested by Doxiadis (see Table 5-2); however, they were mostly ignored. The building regulations which existed at the end of the 1960s before the comprehensive plan of Riyadh started are still being used (UP1, 2). The building regulations include specification for the construction of houses and other buildings, the height of fencing walls, setbacks, and outlining for minimum floor areas as well as window sizes. There were no regulations governing land use and zoning, and industrial schemes could be found before the Doxiadis' plan (Doxiadis, 1972).

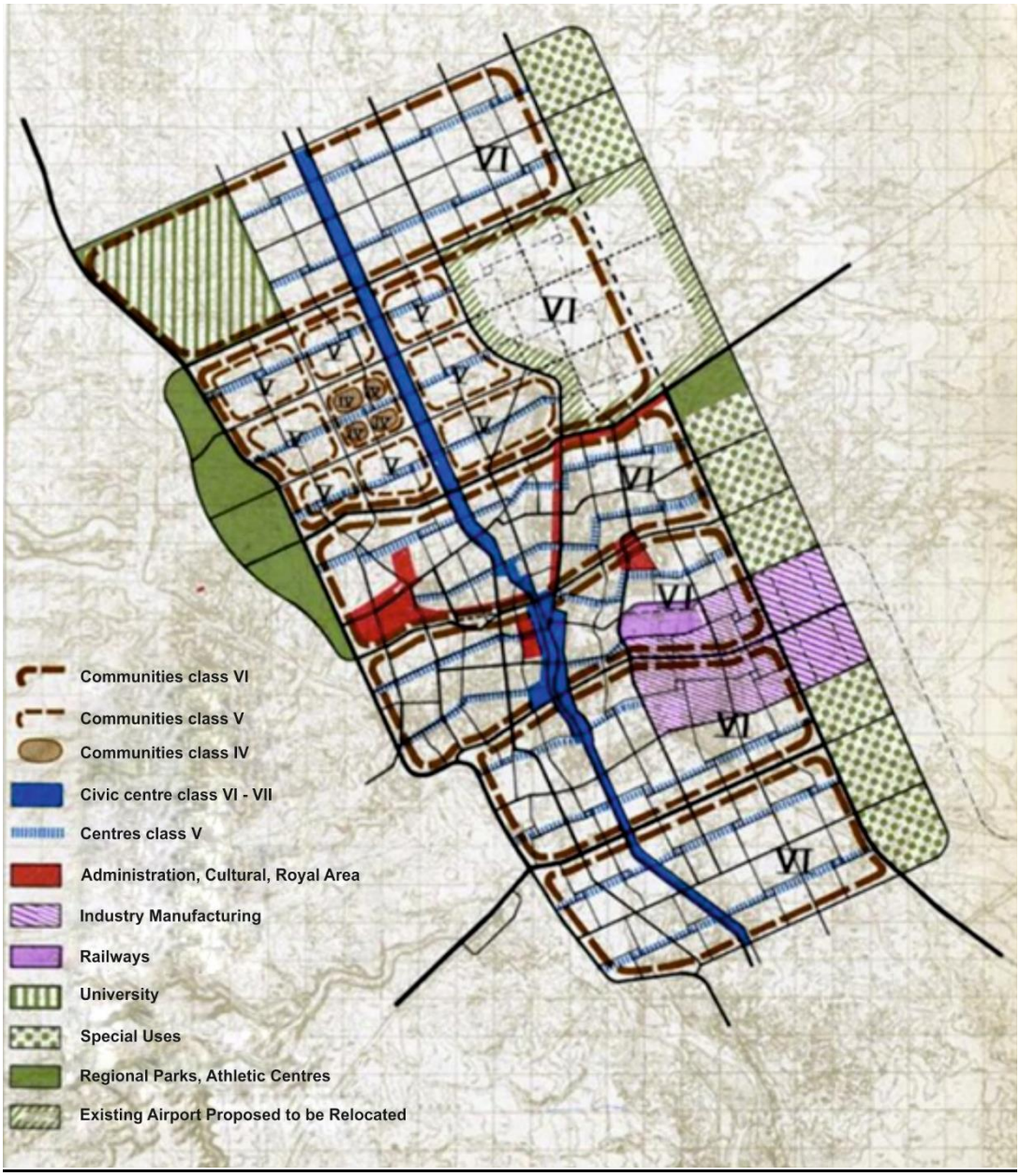



**Figure 5-15: Organization of territory by community classes.**

(DOX-SAU-A19, 1971).

The analysis of the existing structure of Riyadh shows that new streets within the old city were to be added around existing neighbourhood units. To minimize expropriation costs, a deformed grid was established to respect the city's existing major roads. The road network plan was therefore based upon the existing north-south and east-west road arteries, and regulates and integrates the existing road structure in Riyadh. The local road network inside the neighbourhood units was determined on the basis of the distribution of residential areas. A suitable hierarchical classification and connections were designed to conform to the expected travel flows and to achieve a balanced distribution of traffic.

**Table 5-1: Hierarchy of community classes and urban functions for Riyadh, Kingdom of Saudi Arabia, 1972.**

(DOX-SAU- A19:263, Table-47)

| Order of Community | Size of Population | Functions | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Business | Commerce | Education | Services | Health | Transport | Socio Cultural | Recreation | Industrial | Administrative |
| **Class I** | **40** | | | | | | | | Small Square | | |
| **Class II** | **250** | Kindergarten/ Primary school | Corner Kiosk | | | | | | Play Area for Pre-school age | | |
| **Class III** | **1500** | Kindergarten/ Primary /secondary school | Small Local market | | Barber | | Bus-stop Post Office | Small Mosque | Play Area for pre-school age children | | |
| **Class IV** (Neighbourhood or Small city) | **9000** | Secondary school | Small shopping centre | Real Estate Office | Gasoline Station Plumber, electrician-n. Photographer | Dispensary Doctor's Office | Taxi station Small Post-Office Telegraph Office | Mosque, Local Club | Small Public garden square | Handicrafts | Police Station for every 4-5 communities |
| **Class V** (City) | **50000** | Secondary/Trade Commercial school | Central Market | Bank Insurance Offices | Lawyers Doctors Engineers | Health Centre, Private Clinics | Local inter urban Bus Railway Airport Central Post-office | Large Mosque, Meeting Hall, Library | Playing Fields, Small Parks | Light Industries, Intermediate Industries | Local Police, Division Municipality Offices |
| **Class VI** (Large city) | **300000** | Small University | Commercial Centre | Large Bank, Headquarters business firms Large representative offices | Professional Organizations Large local offices | General Hospital | Large Local and inter-urban Bus Station | Central Mosque, Museum, Art galleries, Small Concert Hall | Stadia, Parks, Theatres | Intermediate and Heavy Industry | Government Headquarters |
| **Class VII** (Metropolis) | **2000000** | Large University | Large Commercial Centre Wholesale centre/ warehousing | Central Offices Banks, Insurance, Headquarters large firms | Headquarters of large private offices | Large General Hospital Specialized Hospital | Central Rail, Bus Stations, Large Airport | National Museums, Permanent Art Galleries, Exhibition Halls | Olympic Stadium, Race course Large Parks | Heavy Industry, Special Industries. | Seat of National Government |

The structural plan for Riyadh city's transportation was presented along with the framework of the preliminary development plan of the city to the year 2000. This was added to the final developmental plan for the city of Riyadh. A regularized extension of arterial roads into the super-grid formation established the freeway connectivity between the superblocks, whereas the internal urban traffic is avoided via by-pass roads.

Figure 5-16 shows the adopted national and local road network strategy for the existing highway roads. The main roads (thickened in red) include: the road to Dammam in the east, the north-northwest to south-southeast road, and the west-southwest to east-northeast super highway; all are high speed, long distance network roads by-passing Riyadh and the central business district (DOX-SAU-A6, 1969).

The local scale roads differ from the national ones, as the road structure within the modulus was organized to establish a more human friendly organizational hierarchy. This is considered via the avoidance of vehicle traffic rights through the city CCVs. The incorporated traffic calming strategies into the design included, for example, clearer and safer street hierarchy design that secures minimal access to inside residential areas. For all new, proposed and existing communities, designated green areas, pedestrian paths, parking, and guidelines for typical road widths were established. A twelve feet lane width was recommended as standard.

Doxiadis' attempt to envisage the population growth till year 2000 was unfortunately unsuccessful. This is due to the fact that the original estimate about the increasing population at the time was only 1.4 million until the year 2000, which seemingly undermined the impact of the oil boom industry that brought many new jobs into the capital. The newly settled arrived employees were apparently not fully accommodated in the Doxiadis' original design, neither was the rapid growth of the population (Al-Mubarak, 2004), all of which has ultimately led to an unexpected increase in the population of year 2000 to 2 million instead of the estimated 1.4m.

The increased pressure of the population and the growth of urbanization beyond Doxiadis' plan to fulfil the needs of the people, forced MOMRA, which was established in 1975 to hire two planning firms SCET in 1986 and MEDSTAR in 1996, to develop and revise the master plan of Doxiadis, as briefly discussed below.


**Figure 5-16:: Hierarchy of Road Network**

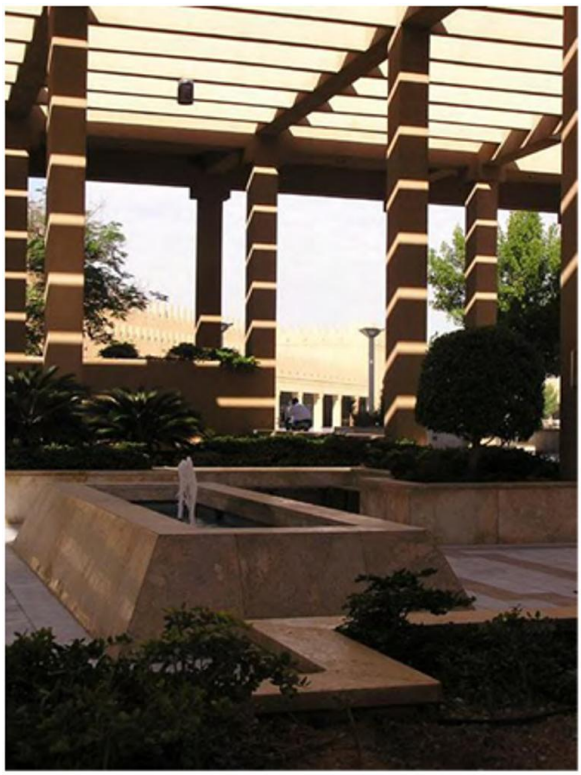
(DOX-SAU-A19, 1971)

### *5.4.3 Neighbourhood development with special urban and building regulations*

There seemed to be some sort of dissatisfaction for the city's authority towards some aspects of Doxiadis' plans, particularly with his vision of the residential aspects of inside CCV. This is evident in their later attempts to develop new neighbourhood units in the city. The neighbourhoods of the Ministry of Foreign Affairs housing (MFA) in 1979 and the Diplomatic Quarter (DQ) in 1982, were established due to the shortcomings of the Doxiadis plan to offer a better place that considers more social and environmental aspects (Alshaikh et al., 1985).

The aim was to establish residential communities that adopt neo-traditional ways of living within the spatial unit of the Doxiadis super-block. These two urban neighbourhoods were developed with specific urban and building regulations and urban planning standards. Both neighbourhood projects were created by Albert Speer and Partner. The MFA was developed within Doxiadis' structure of super blocks, while the irregularly shaped DQ was developed on the periphery east side of the city nearby the valley of Wadi Hanifa (see Figure 5-17 and 5-18). It appears that they had more awareness of the importance of environmental and social issues, and some environmental issues like the provision of shadowed passages and urban spaces, and some social considerations like the provision of more friendly central social gathering open spaces; all these appear in the plans and the pictures below. Nevertheless, it is also apparent that Doxiadis' internal urban residential areas of the super blocks are flexible to accommodate such developmental changes.

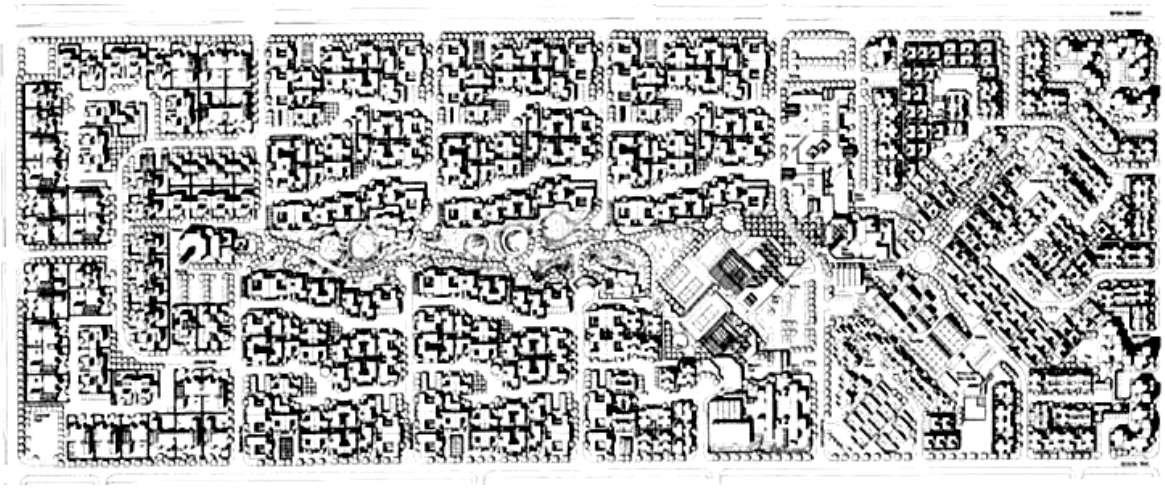
(a)



(b)

**Figure 5-17: DQ master plan (a), and Sahat Alkandi Plaza and a major street (b)**

(International urbanism seminar, 2005)



(a)


(b)

**Figure 5-18: The Plan of MFA (a). MFA Housing (b)**

(International urbanism seminar, 2005)

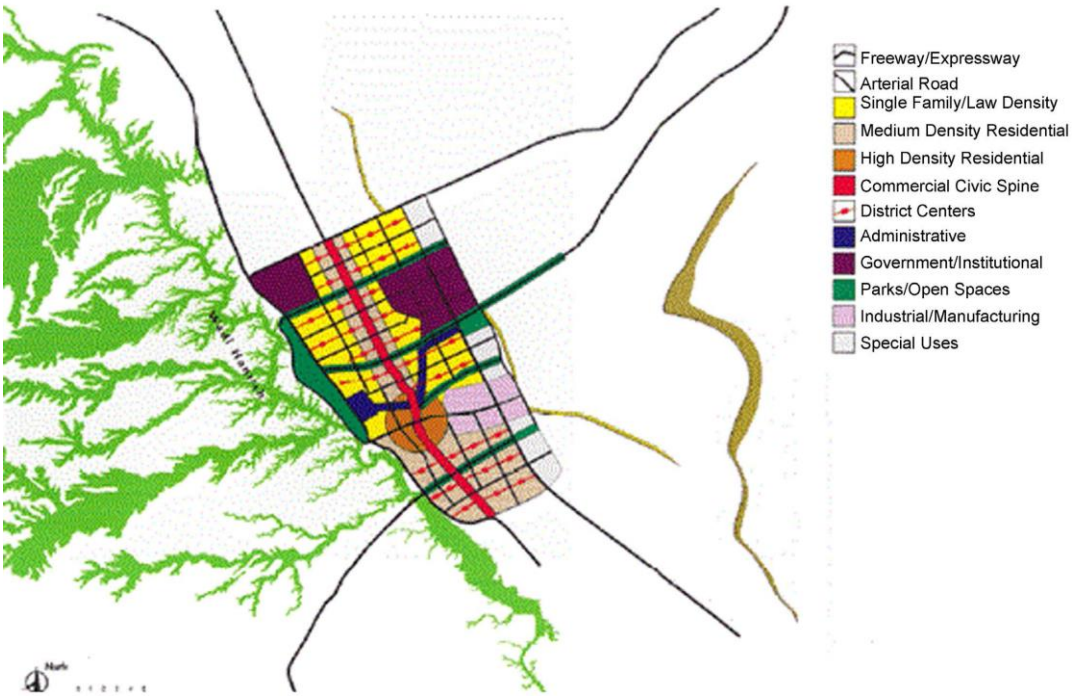
## 5.5 The SCET and MEDSTAR Plan for Riyadh 1978-1996

Figure 5-19 below presents the three official master plans that formed the Riyadh city plan to date. This section discusses the master plan that came after Doxiadis and the MEDSTAR, the latest master plan of Riyadh.

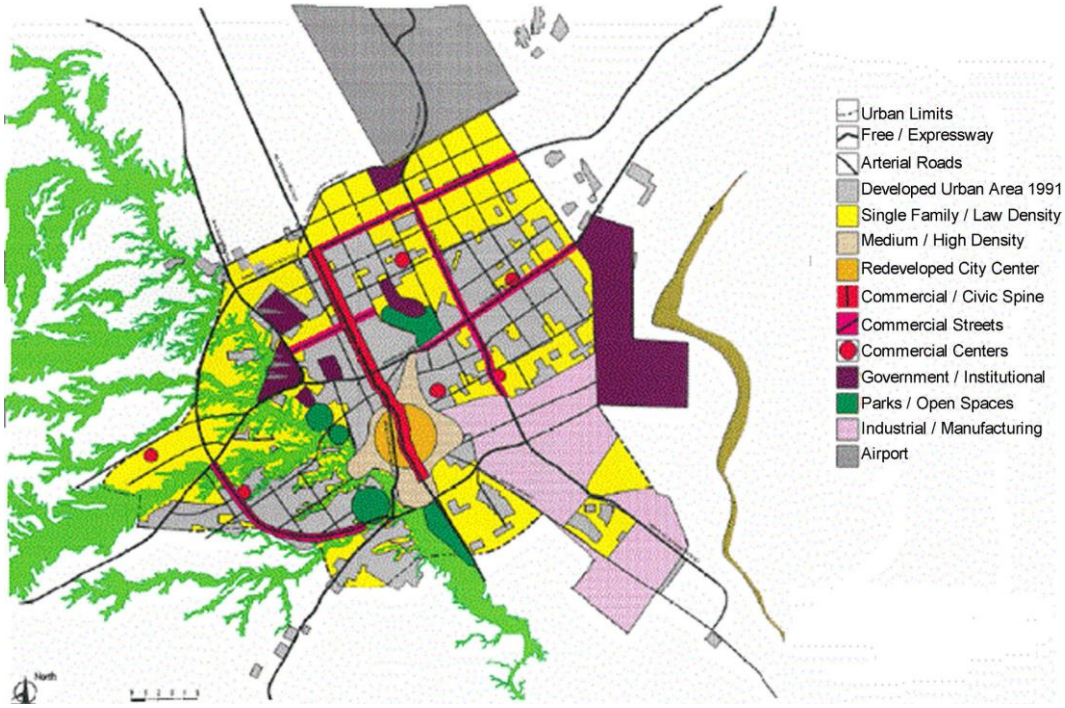
In 1976, a consulting French firm, named SCET International, specialised in urban development, was tasked to review and revise the Doxiadis Mater Plan. The aim of SCET Plan was to coordinate the policies of the urban structure in cooperation with relevant government agencies (Daghistani, 1995). However, the outcome of the twelve-year plan never received Saudi Arabia's government approval for its unacceptable design solutions, but the plan had contributed in understanding the city's problems and needs for expansion.

An example of such a contribution was the south eastern expansion of industrial areas and development of residential districts on the eastern side of the old airport. The Doxiadis plan provided for a 300 $km^2$ boundary, but in 1977, due to extensive subdivision activities, this has increased the area to 700 $km^2$. The 1982 SCET revised master plan had approved vacant subdivisions with an additional 250 $km^2$, which led to a subdivision being approved beyond SCET's boundary (Mubarak, 2004). One of SCET plan's results was to restore the city's structure to a radial growth pattern. Among the plan's key focus was linking the transport infrastructure to commercial development. Crucially, the main urban design strategy of the 2x2 km grid pattern, the outline of communities in the Doxiadis master plan was maintained by the SCET plan (MEDSTAR, 2003).

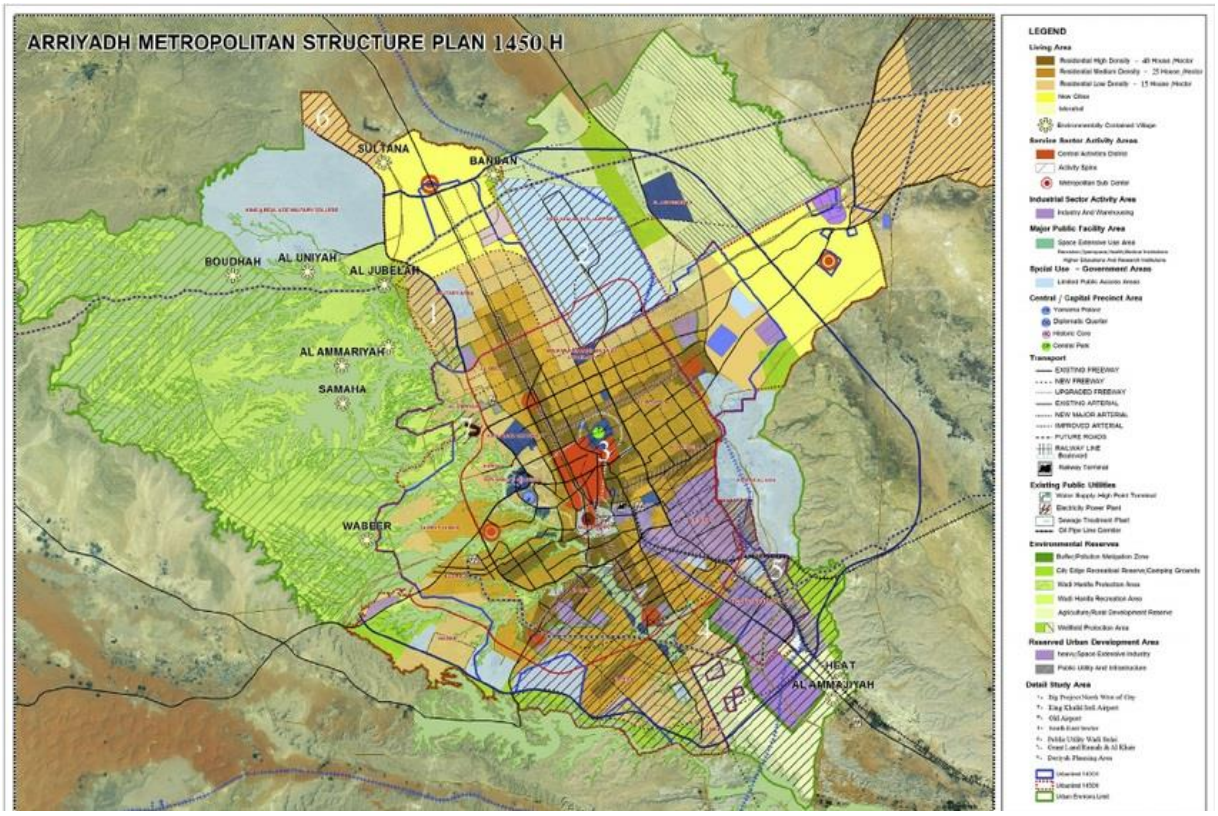
In 1996, The High Commission for development of Arriyadh (ADA) adopted another finalized city plan designed by MEDSTAR. The currently followed plan reflects considerable shifts in the way Riyadh's spatial form was formulated, developed, and governed. It has been acknowledged for its comprehensive value-driven strategy, which integrates economic development, urban governance, urban identity, and draft regional strategic plans. Nonetheless, 2009 revision of MEDSTAR resulted in extending the development program to 2030. In essence, the ADA aim was to formulate a 50-year vision and a 25-year strategic framework, as well as a 10-year comprehensive implementation plan, for the city and its surrounding regions. In addition, the ADA embraced the continuous updating of the city plan at regular intervals.




(a) Doxiadis Master Plan (1986-1972)




(b) SCET Master Plan (1987-1990)



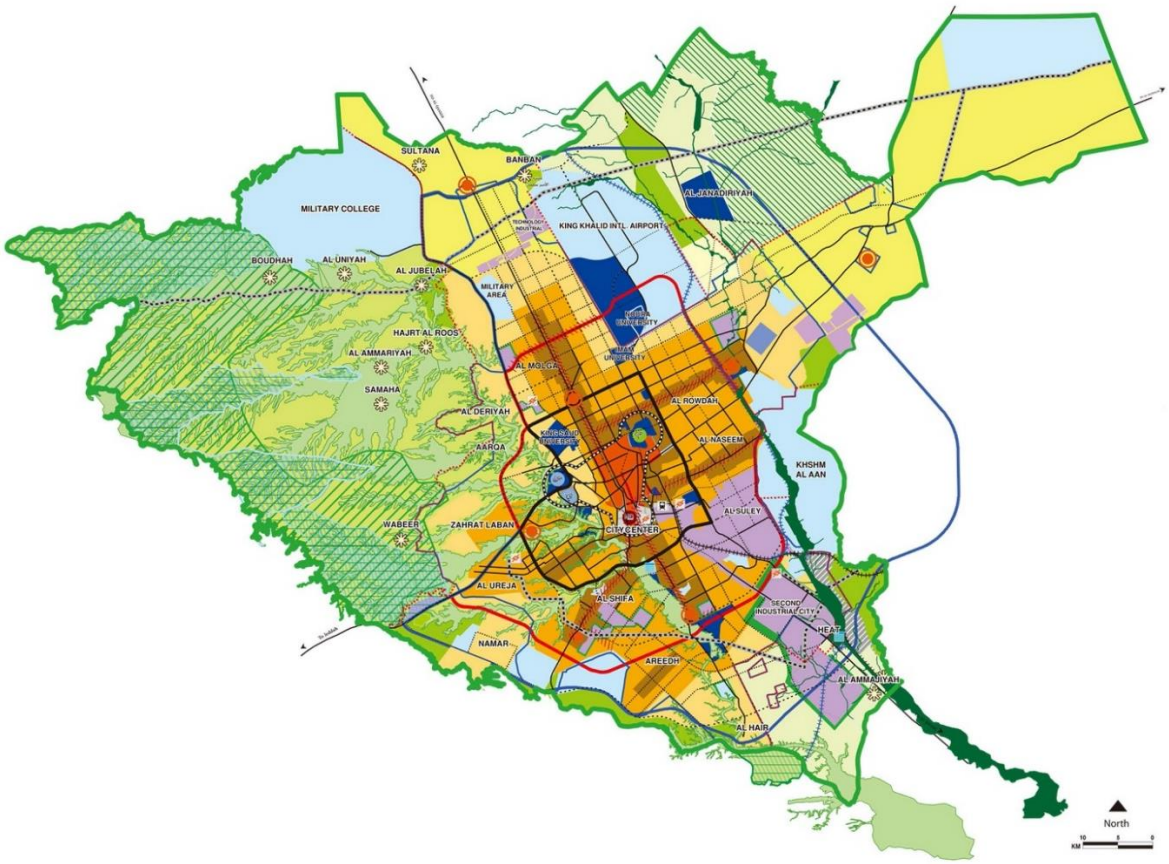

(c) MEDSTAR Master Plan (1996-20230)

**Figure 5-19: The development of Riyadh's master plans (1960s to 2030s)**

(Source: Modified from ADA, 2003 and ADA 2009)

The MEDSTAR plan adopted the idea of metropolitan sub centres that would supplement the major commercial centre providing public and commercial activities close to sub regional areas. There will be high density spines with sub centres and two new cities (shown in yellow north and east of the city in Figure 5-20a), comprising of districts with 50,000 to 100,000 people, and the gross residential densities ranging between 10-20 dwellings/hectare (ADA, 1999). New urban nodes were planned to be high density with developments of mixed use built in a hierarchy of centres to meet community needs (shown as red circles in Figure 5-20a). Finally, future road network including ring roads are being constructed and will be completed in 2022.

The centres were located at highly growing growth sectors at a 10km radius to key intersections of arterial transport network and public routes. Additionally, other important urban projects such as the Wadi-Hanifa ecological remediation are included in the currently implemented plan.




**(a)**


**(b)**

**Figure 5-20: MEDSTAR plan 2021. (a) The red circles on the map are the new dense urban developments that are sub-centres of the city, the two new cities are in yellow north and east. (b)The proposed road network 2002-2022**

(Source: ADA, 2009)

Most importantly, the MEDSTAR maintained a procedure for spatial arrangement that follows Doxiadis' Dynapolis idea of a 2x2 km super squares (see Figure 5-21). Several linear axes aimed to create new urban centres and allow for the separation between the city spines and neighbouring areas.

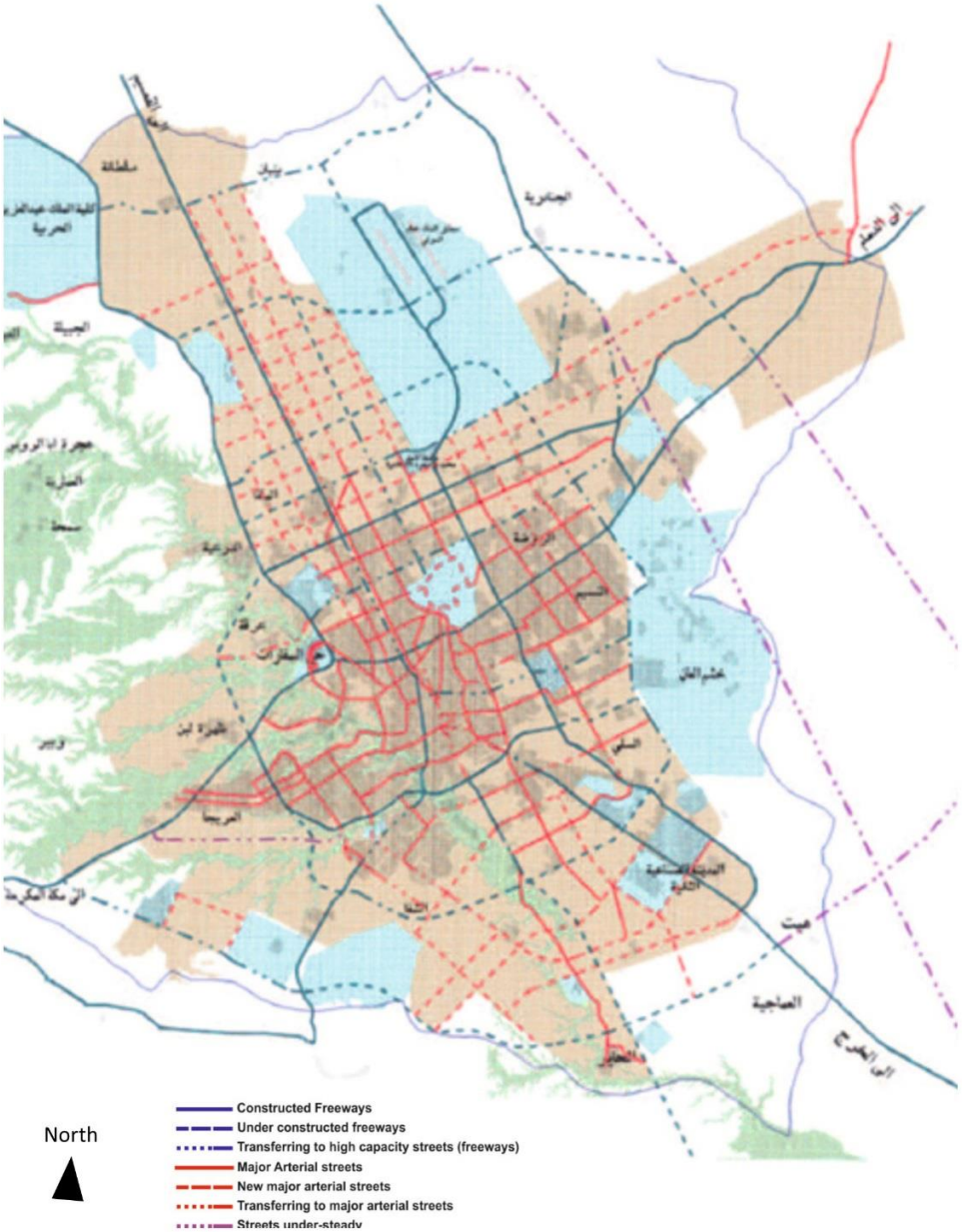



**Figure 5-21: The red doted lines are the new road networks expanding north and east. The transport structure revealed the continuity of the super block 2021 (2x2km).**

(Source: ADA, 2004:67)

Figure 5-22 presents a comparison between the urban design strategy of master plans of Doxiadis and MEDSTAR. It can be seen that Doxiadis' plan was based on a compact modular grid of 2x2km block for the expansion of the city while the MEDSATR focused on a

centralization-decentralization concept with concentrated high density urban centres distributed within the city.

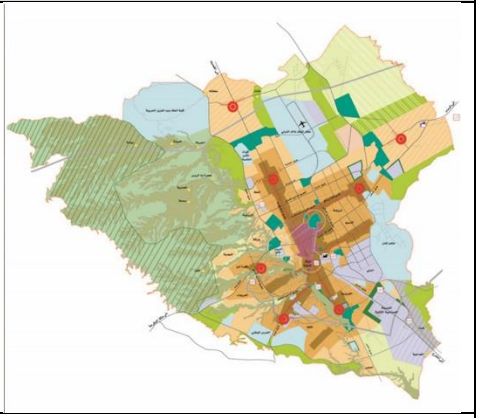
| Urban Design Strategy | Doxiadis Master Plan (1972) | MEDSTAR Master Plan (1996-2030) |
|---|---|---|
| **Design** |  |  |
| **Urban Structure** | Single Axis<br>Compact urban Blocks 2x2km | Centralization-Decentralization<br>Multiple Axis<br>7 Nodes distributed (remarked in red) and 2 new satellite cities |
| **Urban expansion & growth** | Uni-directional aggregation of Moduli | Disperse of integrated dense urban centres |
| **Local community concept (2x2km)** | Spatial Community Class hierarchy strongly bounded<br>Self-sufficient community and urban form<br>Geometric blocks | Four communities with associated centres<br>Cul-de-sac structure<br>Interactive urban communities based on catchment areas |
| **Functions** | Urban functions hierarchy | Hierarchical urban functions |
| **Urban scale of Neighbourhood** | $1km^2$<br>Walkable | |
| **Transportation** | *City:* Highways structure<br>*Neighbourhood:* Pedestrians and cars | *City:* Radial and Ring roads<br>*Neighbourhood:* Pedestrians, cars, and New public Transport |
| **Land Use** | Mixed land use (less vertical) | Mixed land use (vertical and horizontal) |
| **Urban Connections** | Modulus Connected to the main spine | Connections between Nodes<br>Connections inside neighbourhoods |

**Figure 5-22: Comparative Matrix of urban design strategies 1972, 1996.**

(Source: modified from Middleton, 2009)

## 5.6 Doxiadis' modulus (CCV) in Riyadh

Doxiadis' spatial hierarchy of Community Classes is formed in Riyadh with the interior division of the 2x2 km modulus, but the division of community classes IV, III, II and I is more clearly defined in this city (see Figure 5-23 and 5-30). The initial plan of Doxiadis suggested the range of plot size within the minimum range of 150 $m^2$, as in the old city;

nonetheless, this can reach to an average of 1,500 square metres on the city periphery (see Figure 5-24). According to Alhathloul (1992), the plan suggested different standards for different areas instead of one standard of plot sizes, asserting that this would suggest segregation of socio-income classes (Alhathloul, 2010). In the case study, the average plot size in Almoroj was planned to be 400 square metres.

According to the Ekistics theory, old and new residential areas should have established equal economic and social opportunities. Generally, the urban form of CCV appears to be highly effective physically and functionally. This is due to the fact that all CCVs are self-contained settlements. Their centre gives way to the pedestrian movements and separation with car traffic. The related urban functions are spatially organized in tandem with Ekistic scale of community classes (seen earlier in Table 5-1), which present the community class system with a breakdown of functions that are distributed in relation to service area limits.

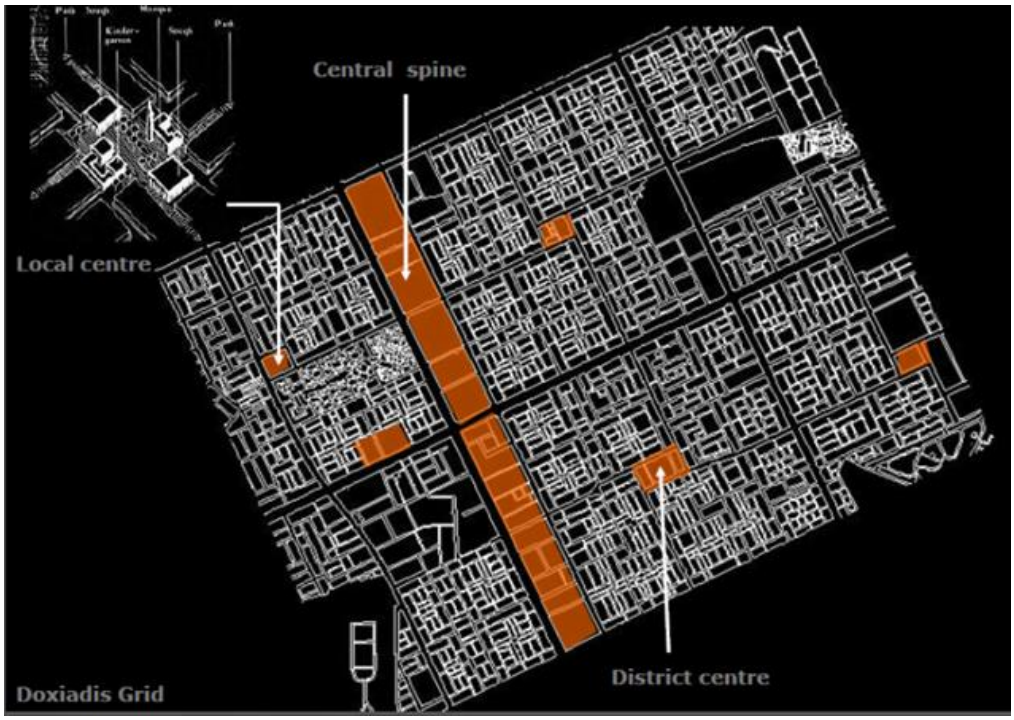



**Figure 5-23: The modulus by Doxiadis.**

(International urbanism seminar, 2005)

For example, secondary schools are suggested by Doxiadis to be at CCV and IV, and primary schools suggested to be at the III. Another example is the large mosque suggested to be at CCV, whereas the local ones were kept at CCIV, and then smaller mosques at CCIII. The services in the centre of the modulus have also been broken down into small services according to the size of the community class in question. The design shows that from the centre of the CCV to the furthest point it is either 800m or about 10 minutes' walk to reach

either side. It also shows that from the centre of CCIV to the furthest point it is either 400m or about 5 minutes' walk to reach either side. The distance obviously gets shorter in line with the size of the community class inside the modulus.

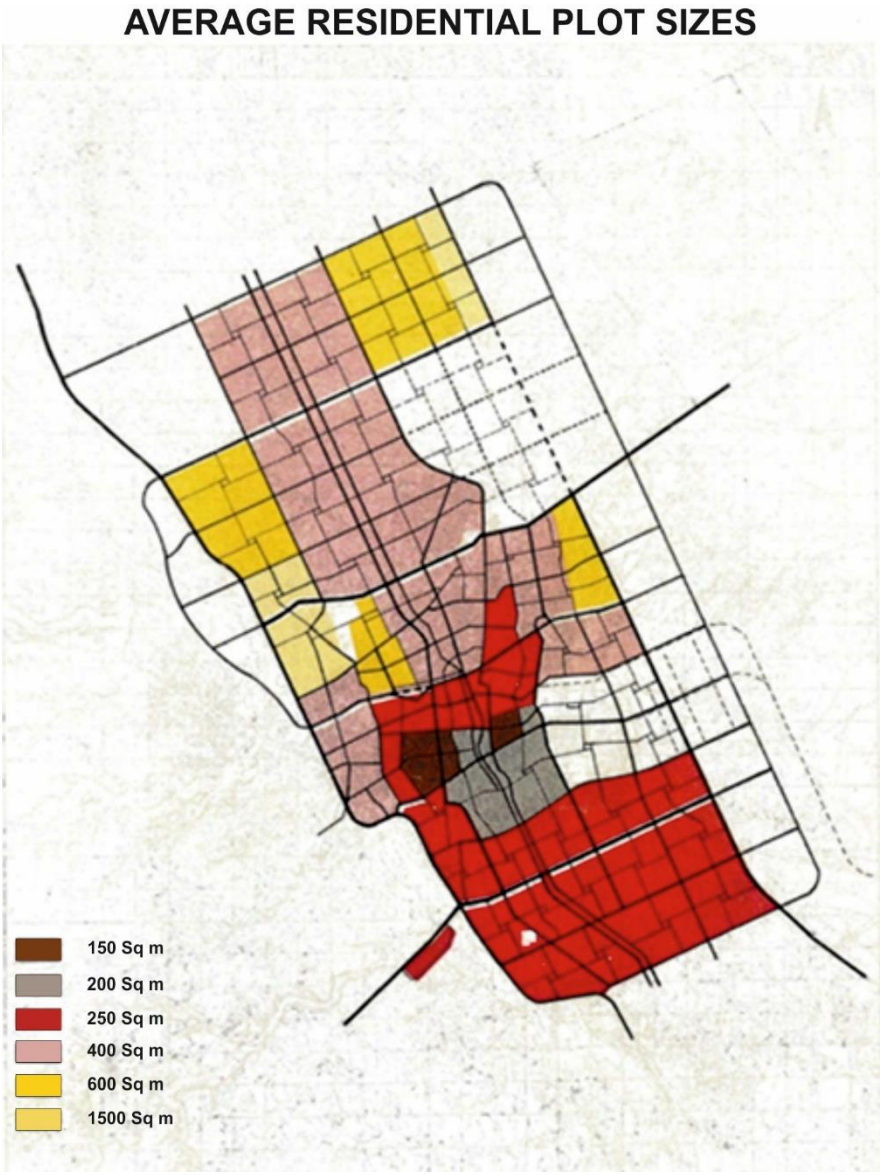



**Figure 5-24: The average residential plot sizes**
(Dox-SAU-A19, 1971)

Doxiadis envisaged CCV, with a population of 50,000 people, to be considered as a city as per the Ekistics units. It has been identified as the main units for the city expansion. A new modulus will be developed when the city and its population grow beyond the existing modulus. This model of Dynoplis proves to be a dynamic city. In short, CCV represents the new dimension for the future city. Hence, it emphasises that this particular community class is the main focus of this research investigation on the city neighbourhoods.

The justification of selecting a CCV to be the neighbourhood unit scale instead of Doxiadis' label as a city, is that it is the official label used and developed by Riyadh Municipality. Neighbourhood units are essential for the formation and transformation of cities because these units play a vital role in the social and organizational life. Also, the concept basically refers to the self-contained block of the city because it encompasses all the basic facilities of the urban life. It also falls in line with Mumford (1954) who supported the idea of *"neighbourhood planning"*. Further, Mumford considered neighbourhood as a social fact, stressing that wherever people share geographical locations, they form some sort of neighbourhood. He argued that conscious planning of neighbourhoods is essential for developing an integrated city.

### *5.6.1 Land use and urban functions*

Community class V provides a range of important facilities and services for the neighbourhood residents, as listed in Table 5-1 and the diagram of Doxiadis zoning regulation for the neighbourhood units in Figure 5-25 and Table 5-2 defines the urban functions used in the neighbourhood area of South Olayia. The symbols R12 and R21 represent the zoning regulations for residential areas of detached houses and apartment buildings respectively. It suggests that the apartment buildings are to be kept alongside the main street borders of the neighbourhood. The single family dwellings of one to two storeys are to be located in the inner classes. Schools (S1) and Parks (P1) are located on the corners of each of the four community class IV and they meet in the middle of community class V. The commercial and administration buildings are placed in the central zone (C3) of the neighbourhood.

Looking at the depiction of Riyadh Conceptual Model of a Community (see Figure5-26) there appears to be typical rough rectangular streets that end or terminate towards a centre that includes open space in front of the local mosque at the CCIII and CCIV levels, and a centre of what appears as CCV that includes a commercial and civic centre. The testing of the modulus constitutes a well nested pattern of the streets as well as the centres. Furthermore, the nature of the commercial functions in the urban centres were not ascertained in the detailed design schemes. In addition, traditional aspirations about an Islamic city's principles was put in place.

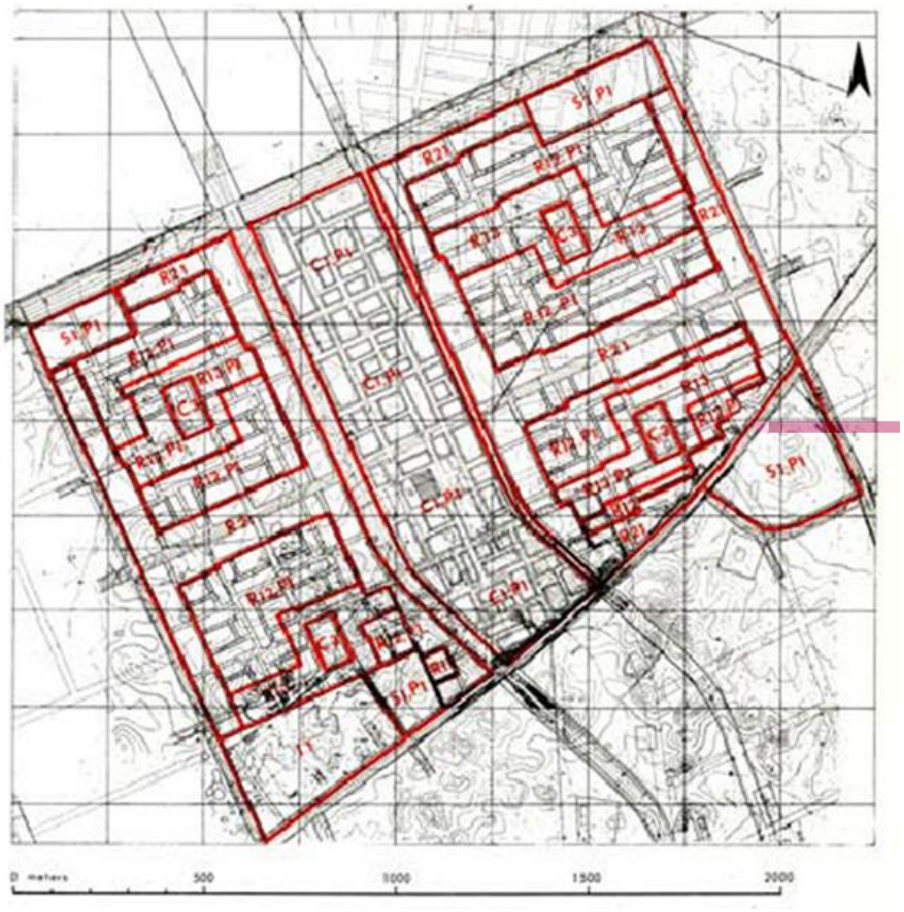



**Figure 5-25: Zoning regulation of one of the neighbourhood units (South Olayia)**

(Source: DOX-SAU-A/19, 1971)

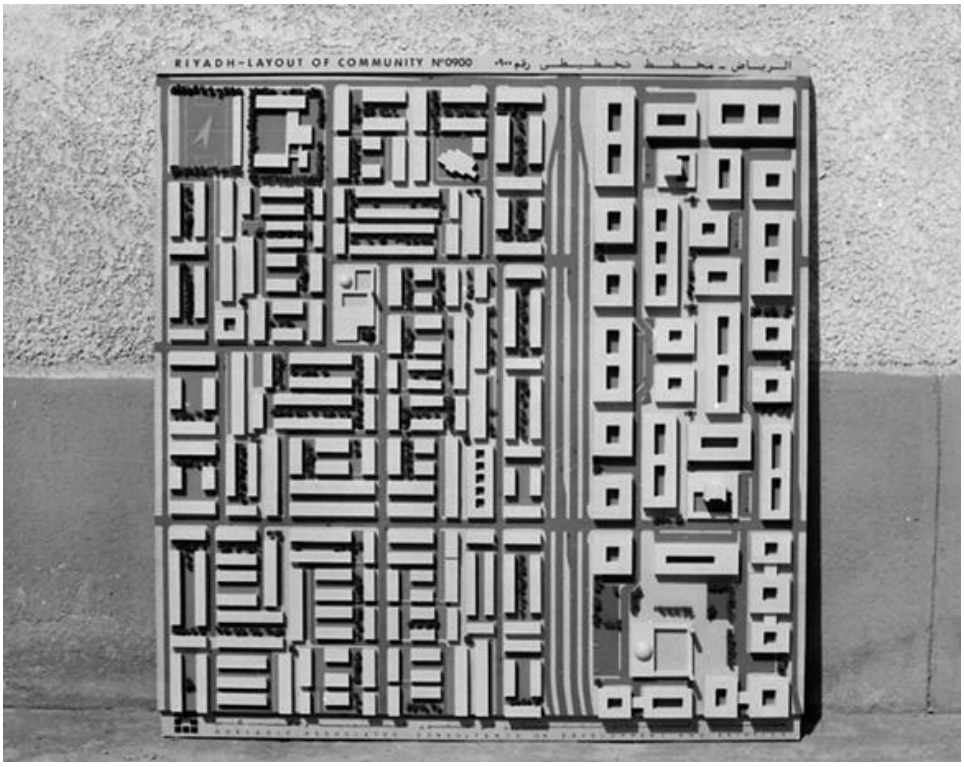



**Figure 5-26: Riyadh Conceptual Model of a Community (A part of Community Class V adjusted to the main axis of Riyadh,**

(Source: Retrieved from Doxiadis office, Reference code: 31804)

**Table 5-2: Riyadh Doxiadis Master Plan, Zoning-bulk and height regulations (DOX-SAU-A/19, 1971)**

| ZONE | PERMITTED USES | N$^{O}$ OF DWELL UNITS/ PLOT | MAX N$^{O}$ OF STOREYS | PATTERN OF DEVELOP MENT | MIN PLOT AREA IN SQ M | MAX PLOY COVERAGE | MIN PLOT WIDTH IN.M | MIN PLOT DEPTH IN.M | SET BACK BUILD LINE IN.M | | | FLOOR AREA RATIO INDEX | MAX TOTAL HEIGHT IN.M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | FRONT | SIDER | REAR | | |
| C1 | COMMERCIAL&BUSINESS CULTURAL,ADMINISTRATION INSTITUTION,RESIDENTIAL | - | 6 | ATTACHED WITH 4,50 M.ARCADES | 480 | 60% | 16 | 24 | - | - | 10 | 3,6 | 23,00 |
| C2 | ADMINISTRATION,CULTURAL INSTITUTION,COMMERCIAL &BUSINESS,RESIDENTIAL | - | 6 | ATTACHED WITH 4,50 M.ARCADES | 480 | 60% | 16 | 24 | - | - | 10 | 3,6 | 23,00 |
| C3 | COMMERCIAL, CULTURAL ADMINISTRATION | - | - | SPECIAL DESIGN AS PLAN | - | - | - | - | - | - | - | - | - |
| R11 | RESIDENTIAL- SINGLE FAMILY,ONE OR TWO STOREYS DWELLINGS | 1 | 2 | DETACHED | 800 | 30% | 20 | 30 | 4 | 4 | 10 | 0,6 | 8,40 |
| R12 | RESIDENTIAL- SINGLE FAMILY,ONE OR TWO STOREYS DWELLINGS | 1 | 2 | DETACHED | 400 | 35% | 16 | 24 | 4 | 2 | 10 | 0,7 | 8,40 |
| R13 | RESIDENTIAL- TWO FAMILIES, TWO STOREYS DWELLINGS | 2 | 2 | DETACHED | 400 | 40% | 16 | 24 | 4 | 2 | 8 | 0,8 | 8,40 |
| R21 | RESIDENTIAL-APARTMENTS OR MAISONETTES BUILDINGS | 4 | 4 | ATTACHED | 400 | 50% | 16 | 24 | - | - | 8 | 2,0 | 14,80 |
| R22 | RESIDENTIAL-APARTMENTS OR MAISONETTES BUILDINGS | 3 | 3 | ATTACHED | 250 | 50% | 12 | 20 | - | - | 8 | 1,5 | 11,60 |
| R31 | RESIDENTIAL-CENTRAL COURT YARD(TRADIT)SINGLE FAMILY ONE OR TWO STOREYS DWELLINGS | 1 | 2 | ATTACHED | 200 | 50% | 8 | 20 | 4 | - | 4 | 1,0 | 8,40 |
| R32 | RESIDENTIAL-CENTRAL COURT YARD(TRADIT)TWO FAMILIES,TWO STOREYS DWELLINGS | 2 | 2 | ATTACHED | 150 | 50% | 8 | 16 | 4 | - | 4 | 1,0 | 8,40 |
| R4 | RESIDENTIAL HOTELS ,CLUBS HOSTEIS AND THE LIKE | - | - | SPECIAL DESIGN AS PLAN | - | - | - | - | - | - | - | - | - |
| P1 | PARKS,SPORTS,RECREATION,PUBLIC CONVINIENCES. | - | 1 | SPECIAL DESIGN | - | - | - | - | - | - | - | - | 4,20 |
| S1 | SCHOOLS ,KINDERGARTENS | - | 3 | SPECIAL DESIGN | 9000 | 20% | 60 | 100 | AS PLAN | AS PLAN | AS PLAN | 0,6 | 11,60 |
| I1 | INSTITUTION | - | 3 | SPECIAL DESIGN | 1000 | 40% | 20 | 30 | AS PLAN | AS PLAN | AS PLAN | 1,2 | 11,60 |

### *5.6.2 Street patterns*

The moduli in the city of Riyadh are firmly bounded by the major road structure. Then the road system leads to what is locally known as Almafroka structure, which demonstrates the idea of controlled minimum access to each CCV. Almafroka refers to a perpendicular network of roads in four directions that meet in the middle of the modulus, shaping the square block centre of the neighbourhood with a circular movement (Figure 5-26 and 5-30). The main neighbourhood centre under Almafroka structure shows the division into four parts designed as residential areas along with four smaller Almafrokas with sub-centres. The centre has to be served with roads from all sides, with no streets cutting through the centre. Also, the centre has to be connected with other facilities within the neighbourhood by a network of rigid streets, surrounding the rectangular residential areas with straight streets. There is a clear separation between the pedestrian and automobile traffic, as well as the defined strong spatial units.

The original plan of Doxiadis offered a variety of hierarchal roads and pathways for all community classes in the city. The street design (see Figure 5-27) suggested decently distanced sidewalks with apparent considerations for green spaces. However, Doxiadis was not concerned by developing detailed landscape designs in his plans. He considered this as a secondary priority after the design of the city transportation and urban infrastructures. It seems that the costs of designing these details is another considered factor for the Saudi authority at the time (ADA, 2004).

In CCV, the street section inside the module shows a clear hierarchical level as follows. The sections in the above figure explains the design of the major pedestrian streets. There are two green belts and the total width is 14m to 16m. The lower level pedestrian street shows a width of 8m to 10m including the green belt. The local road was kept 8-10m. The design of local roads indicate that 1 to 1.5m were allocated for sidewalks on each side of the road. The design does not mention the parking of vehicles. It therefore appears that car parking is adjusted within the same width of 8-10m, respectively. The collector road is the next higher level street and it shows sidewalks were marked in the original design within the ranges of 1.5-2.5m on both sides. Thus, the width of the sidewalks varies. The road was kept within the width ranges of 12, 14 and 16m. The major collector road has a width of 20m, 5.5m for sidewalks that face the commercial zone and greening on one side of the street. However, 2.5m are left for parking and 2.5m for the

sidewalks on the other side of the street that face the residential zone. The Arterial streets shaping the main Almafroka structure are designed with a width of 36 or 40m.

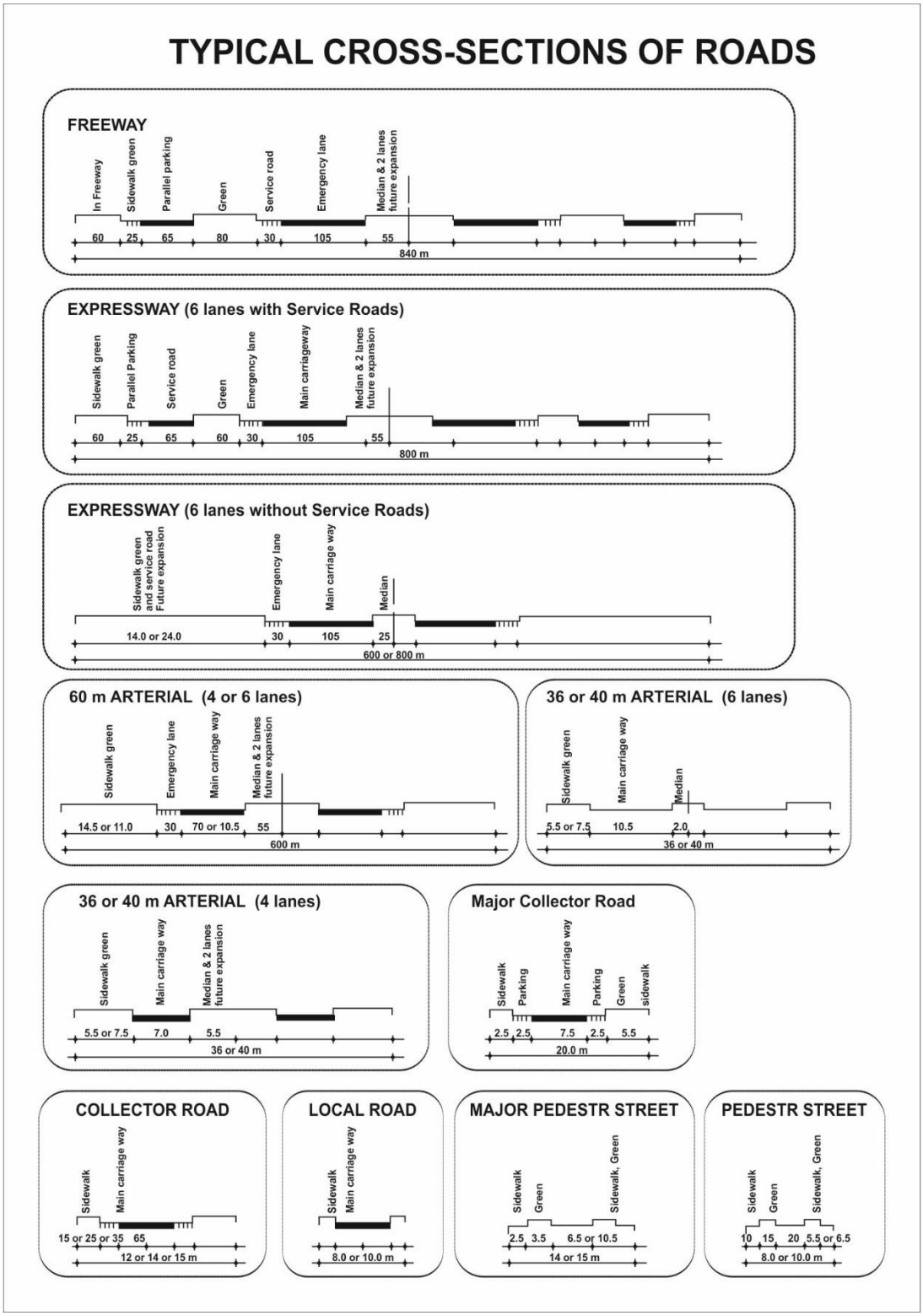



**Figure 5-27: Typical Cross Section of Roads**

(DOX-SAU-A19, 1971)

### *5.6.3 Building regulations*

Doxiadis suggested some building regulations for the master plan (Table 5-2), however the authorities merely instated the existing regulations applied before Doxiadis' plan. This is due to the fact that some of these building regulations were not accepted by the authorities, as they were believed to be unsuitable for the lifestyle of Saudis. The already existing ones seemed to be more practical in terms of efficient use of land. For example, the setback requirements, building heights, floor area ratio, and the square shape of the plots that were used in previous neighbourhoods seemed to have respected the importance of the privacy of residences more than that of Doxiadis' (UP1). This contradicts the goals and policies of the Doxiadis plan.

Table 5-3 shows the differences in dimensions proposed by Doxiadis and SCET, which were ignored, for example the regulators preferred the square plot shape of 20x20 for 400 $m^2$ (Alhatthloul, 2010) instead of the suggested rectangular shape of 16x24, apparently to increase the building width. The dimensions of Doxiadis' plot were not agreed because after excluding the setbacks there would not be enough space for building (Alhatloul, 2010).

**Table 5-3: Size and diminution of plots (Al-Hathloul, 1981).**

| Minimum Area ($m^2$) | Minimum Dimensions (m)[52] [Doxiadis] | Minimum Dimensions (m)[53] [SCET] |
|---|---|---|
| 400 | 16 x 24 | 16 x 20 |
| 600 | --- | 20 x 25 |
| 800 | 20 x 30 | 25 x 30 |

It can be noted from the table above that although some areas were kept as they were, the dimensions of the plot sides differ. Furthermore, Doxiadis suggested that building heights are divided as per the urban characters of the areas. There are two storey buildings in the outskirts of the city, and this is less dense compared to the other areas. In the northern axis of the city, there are three storey buildings, which are adjacent to the civic commercial and administrative zones, while in the city centre, there are four to eight storey buildings that differentiate from the rest of the buildings (see Figure, 5-28).

In the case study neighbourhood Almoroj (see Figure 5-28), which is adjacent to the main spine, Doxiadis suggested three storey buildings for commercial use and two storey for residential use,

including apartment buildings and villas. Doxiadis designed three types of buildings: traditionally attached building zone, with courtyard in the centre; contemporary attached buildings; and mixed attached and detached buildings. According to the building system map (Figure 5-29), Almoroj unit illustrates commercial buildings that are attached, while the residential buildings demonstrate both attached and detached.

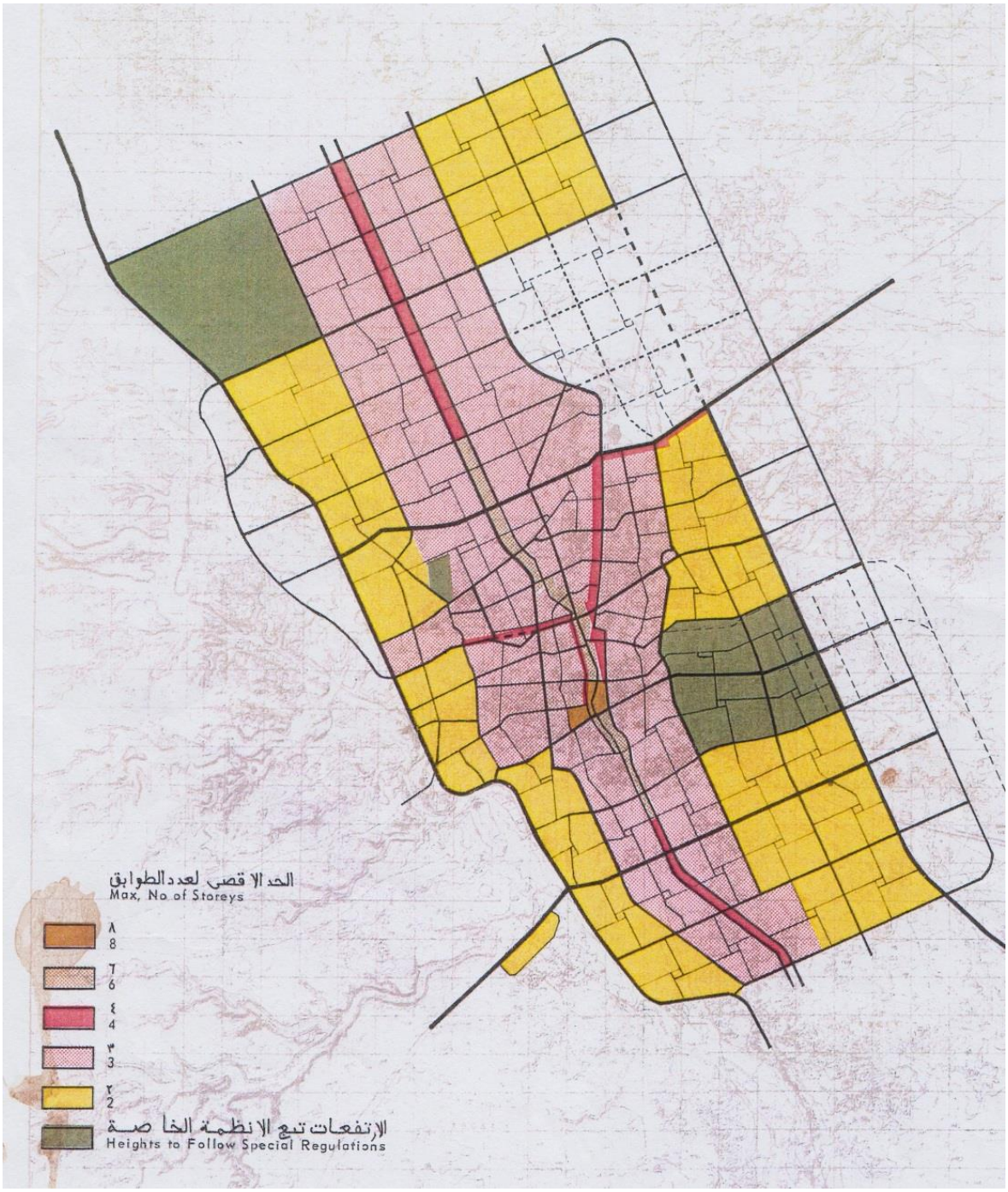



**Figure 5-28: Building heights**

(Source: DOX-SAU-A19, 1971)

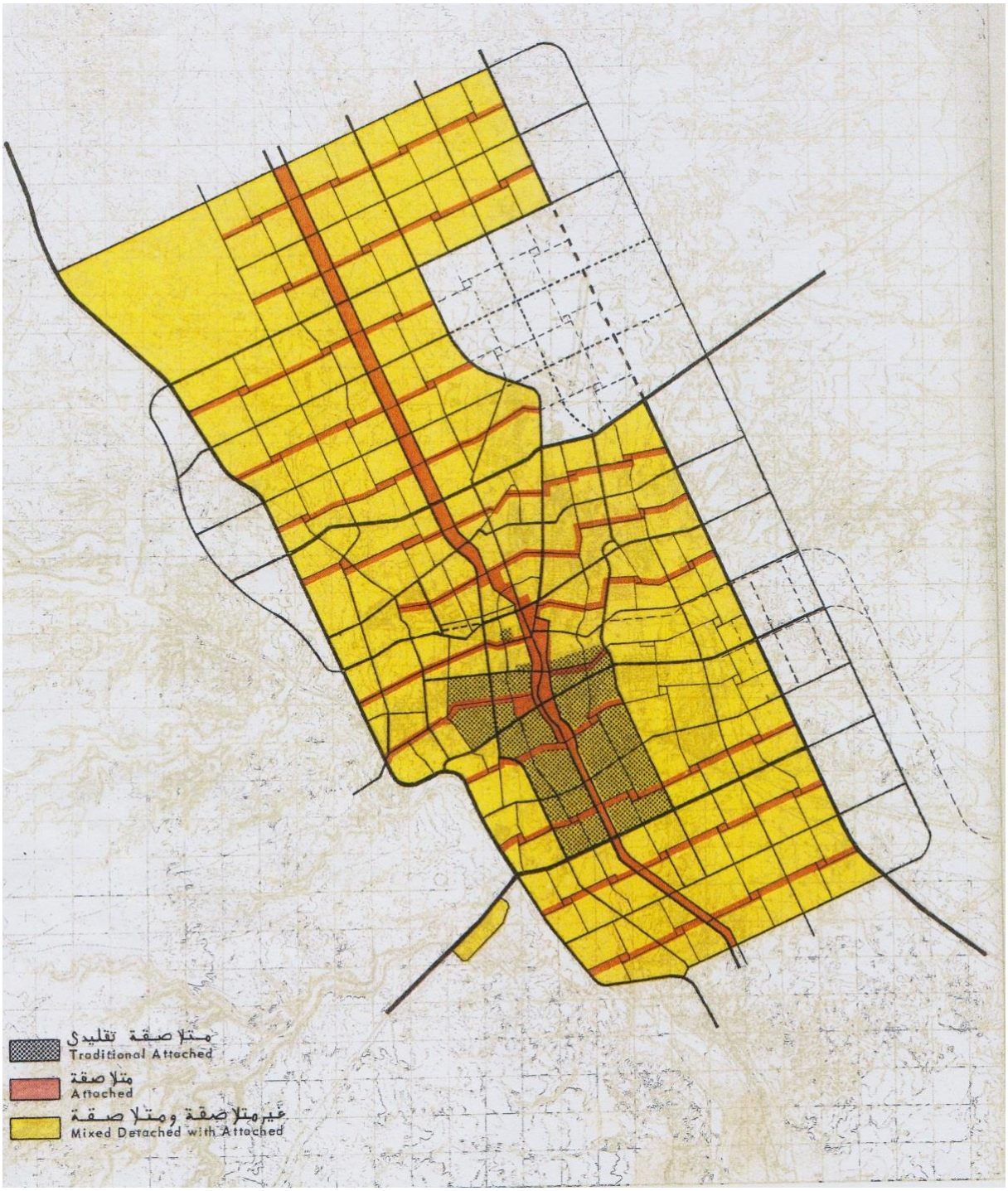



**Figure 5-29: Building system**

(Source: DOX-SAU-A19, 1971)

## 5.7 The developments made by MOMRA and RM to the city neighbourhood

The MOMRA and RM implemented Doxiadis' plan of the CCV neighbourhood, however, there were some implemented changes introduced to his plan. There were social and economic reasons that led the authorities to alter the original master plan, including financial causes, as in the case of designing the detailed landscape of pedestrians and green spaces. There were also socio-cultural causes, to include local lifestyles and privacy, such as narrower setbacks and free standing housing or villas. This was apparently for other commercial benefits (e.g. increasing the number of commercial streets and decreasing public facilities such as parks). Finally, it was altered to improve sufficient usage of the land (e.g. increasing the floor area ratio of land from 35% Doxiadis to 60% RM). According to a UP2 and 3:

> *"The developers have a strong influence in shaping the neighbourhoods units of Doxiadis and the 33% that was kept for facilities and services [it is not from Doxiadis plan] has affected the overall provision of facilities."*

Therefore, the finally developed urban form is not completely compatible with the Doxiadis idea of the Modulus. Thus, there was a clear gap in understanding Doxiadis' Modulus plan in the implementation and development process, specifically the facilities and services.

### *5.7.1 The changed neighbourhood unit planning criteria*

The MOMRA and RM presented a policy for the development of neighbourhood units in Riyadh city. The neighbourhood units in the city were owned and constructed either by the Municipality or private developers. The private developers were also obliged to follow the introduced changes to the set up a list of criteria. The planning measures are based upon the following aspects of urban development such as:

- The dedicated land of the neighbourhood units must be surveyed, and the constructing neighbourhoods need to be developed with a minimum of 10,000 $m^2$.
- The relationship of a neighbourhood unit with its surroundings must be studied,
- Prepare a detailed plan of the neighbourhood unit as per a set of the next identified goals, design principles, and planning processes,
- Design goals are divided into two: appropriate urban forms for safe and comfortable living, and reductions in the cost of urban form including maintenance.

These general principles have to be considered when designing and developing a neighbourhood. The high powered committee of MOMRA and RM decided that there must be compatibility among all the neighbourhood units, and any urban distortion to these policies is not acceptable. The design should enhance the feeling of attachment to the neighbourhoods. While the land use should respect the imposed building regulations, privacy must be maintained particularly in the residential buildings in all the neighbourhood units. Cars should have access to all land parcels, and the design of streets should be attuned to the topography, whilst all the neighbourhood units should have provision of parking spaces and on street parking. Moreover, the services should reach all significant locations. Finally, the plan of the neighbourhood units should have a variety of land sizes (UP1 and UP2).

As aforementioned, the whole land of Almoroj and other big lands out of the old city were owned by private people and the government, prior to Doxiadis' plan. The government was enabling and facilitating the expansion of the city and was/is responsible for its developments. Therefore, the government planned, subdivided the land to be developed, and then both the government and some private developers sold them to prospective developers as large land sizes. In some cases, private people continued to subdivide the big blocks according to the Municipal plan criteria.

Specifically, Almoroj neighbourhood land, which is 2x2kms, was owned by two developers who were the first owners after the subdivision by MOMRA according to Doxiadis' plan. The planning department in the Riyadh Municipality offered a free land subdivision and did the plan of the neighbourhood on behalf of the private owners as agreed by them, and was based on the Municipal criteria with the popular Almafroka street structure as per Doxiadis' plan. During the initial development stage, the authorities were responsible for developed streets in the neighbourhood unit including services that are highly important, such as electricity, water, and telephone supplies. The individual plots were sold to people and then were built by private contractors individually, based on the building regulations (UP3). Public facilities such as open spaces, parks and public schools were developed based on the 33% policy, discussed later (UP1, 2, 3). The urban planners of the City Planning Office followed the policy that RM developed after Doxiadis' plan.

During the development of Doxiadis' plan, no system was developed in support of land subdivision, in addition to how large a percentage of land should be kept for public facilities and

the roads system. Before the 1971s master plan, the urban system used to cut between 25% to 33% for roads and public facilities based on Order 21 in the building and road regulations at the time. However, the widths of the old roads (in road system 23) were not compatible with the new modern urban form. Thus, the urban planning offices and companies struggled as no policies were available in place. This led the government to improve the road and building regulations' book. Additionally, several steps were taken for some existing urban forms and road patterns regarding some old and new neighbourhoods in Riyadh, such as Manfoha and Al-Malaz, so as to count the percentage kept for services and roads (E1).

The average of the percentages that came out from the developed urban patterns was developed as examples or urban plans by the MOMRA with the aim of using most of it for services and the road system. Subsequently, the authorities used the 33% as the basis for a minimum percentage in relation to developing the neighbourhood units in Riyadh and based on this revision of Road and Building orders 21 and 23. City planners and officials had the flexibility to design the neighbourhood communities based on the 33% dedication of land, which according to Alskait (2003), is insufficient for the provision of public facilities within the super blocks.

.

Private developers attempted to use as little land for public facilities in the neighbourhood as possible, and to maximise residential and commercial streets and land for commercial purposes (MOMRA, 2003). The border roads of super block neighbourhoods of Doxiadis attracted commercial use that brings significant traffic and is not as per Doxiadis' plan. Moreover, the developers tried to develop as many commercial streets as they could inside the neighbourhood unit, as the streets policy implied that streets that were 30m or more wide could be used for commercial activities. Consequently, they placed them on Almafroka Street structures within CCV and IV, and in fact the Municipality in many cases used the formation of CCV to CCI in the Almoufraka structure for CCV and CCIV, as was recommended by Doxiadis.

The regulation of the streets designed by Doxiadis were developed in King Fahad neighbourhood, next to Almoroj neighbourhood, and they found that they were narrow and not accepted for modern neighbourhoods, before the development of Almoroj; thus, RM needed to develop new street policy (UP4). In the residential units, where the street is 10m, in some neighbourhood units such as King Fahad district, the Ministry of Municipality asphalted the pedestrian streets defined in Doxiadis' plan. According to the criteria, streets with 30m width and

over could be used for commercial, residential or educational purposes while the streets with 20m or less width must be used for only residential purposes (ADA, 2012; UP2).

It is important to note that, the main streets in this neighbourhood unit refer to 36m width of the big Almafroka and obviously divide the neighbourhood into four quarters. This then leads to streets of 30m, which are a small Almafroka shape, then 15 and 20m, respectively, in the residential areas, and 25m in some special cases. The minimum street width in the neighbourhoods was 15m such as in Almoroj and any newly developed neighbourhoods. Neighbourhoods are surrounded by major streets with a width ranging from 60 to 80m. The guidelines suggest developing the internal streets in the neighbourhoods with T-junctions to avoid unsafe street intersections. Major streets inside neighbourhoods should be connected with outer streets in the next neighbourhood. This might have led some developers, who designed and developed their own area by private consulting engineering offices, to use the Almafroka street structure concept to easily connect with neighbouring neighbourhoods (see Figure 5-30). There must be a clear street hierarchy in the neighbourhoods from the major streets on the edge to the internal residential local streets. RM was flexible with the developers to use any type and design for internal neighbourhood streets, as long as they follow the street policy (RM, 2013; UP3). It appears that during the development stage, the MOMRA did deviate from the Doxiadis' original plan. Doxiadis suggested various urban functions for each community class. According to the RM criteria, the streets with 30m width or above should be used for commercial or mixed use buildings because of their multiple usage nature. Thus, the border of the neighbourhood unit and Almafroka streets become commercial streets, whereas Doxiaids' plan kept a big part of the neighbourhood unit for residential use. Nevertheless, the bounded streets of the neighbourhood units by Doxiadis attracted commercial use because they are very wide and absorb major traffic. Figure 5-31 depicts an example of the affected zoning regulations at the Community Class V used by RM.

Other facilities such as schools, mosques, open spaces, and parks are planned based on the 33% measures, and there was no strict policy for their location, distribution, catchment area, and certain percentage that must be kept for specific services. Mostly, they place them within the residential areas in the middle of community class IV or III, including public schools or parks and open spaces sometimes attached to large mosques (DM1 and UP4). It was reported by UP1 that the provision of some public facilities, mainly public schools whose size and location depend on the size of the population, were not initially constructed in the city neighbourhoods until the size

of the population reached the required size for a public school. In contrast, private schools were developed faster because they simply do not have to follow the same regulations of the RM, usually based on the developer's affordability and commercial businesses.

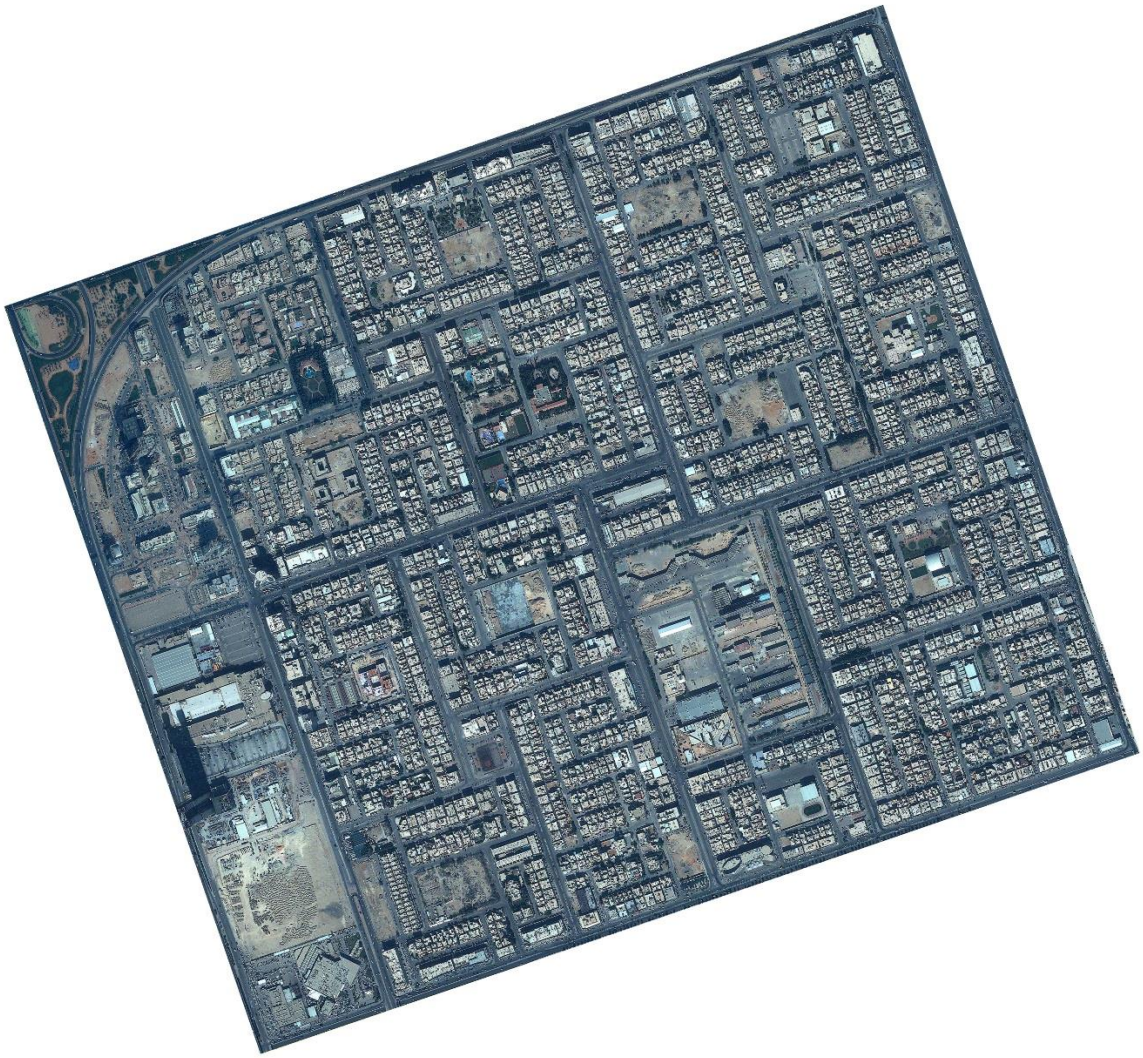


**Figure 5-30: Almoroj plan "Community Class V" with Almafroka structure.**

The community classes V to I are clearly developed and apparent. The streets suggested by Doxiadis plan were not developed and wider streets developed in this case.

(Source: Riyadh Municipality)

Doxiadis' approach also highlighted the creation of multiple nested centres set up within the different hierarchical community class scales. The development phases and the process of change resulted in a number of problems. One problem is that urban centres were incapable of materialising, as a result of the process of uneven residential and public development across the modulus, over a period of time. To exemplify this, it has been observed in Almoroj that only 50% of the total area had been built in 2000 and not as per the original plan, which had to be

completed. However, currently it is 94.6% complete and some centres are developed for different functions such as residential use and not as per the original plan.

The MOMRA applied building regulations corresponding to the previous standards and developed the residential as well as commercial areas comprising of two storeys (Alhathloul, 1998); however, the Ministry did not consider the commercially attached building suggested in the 1971 master plan at the development stage.

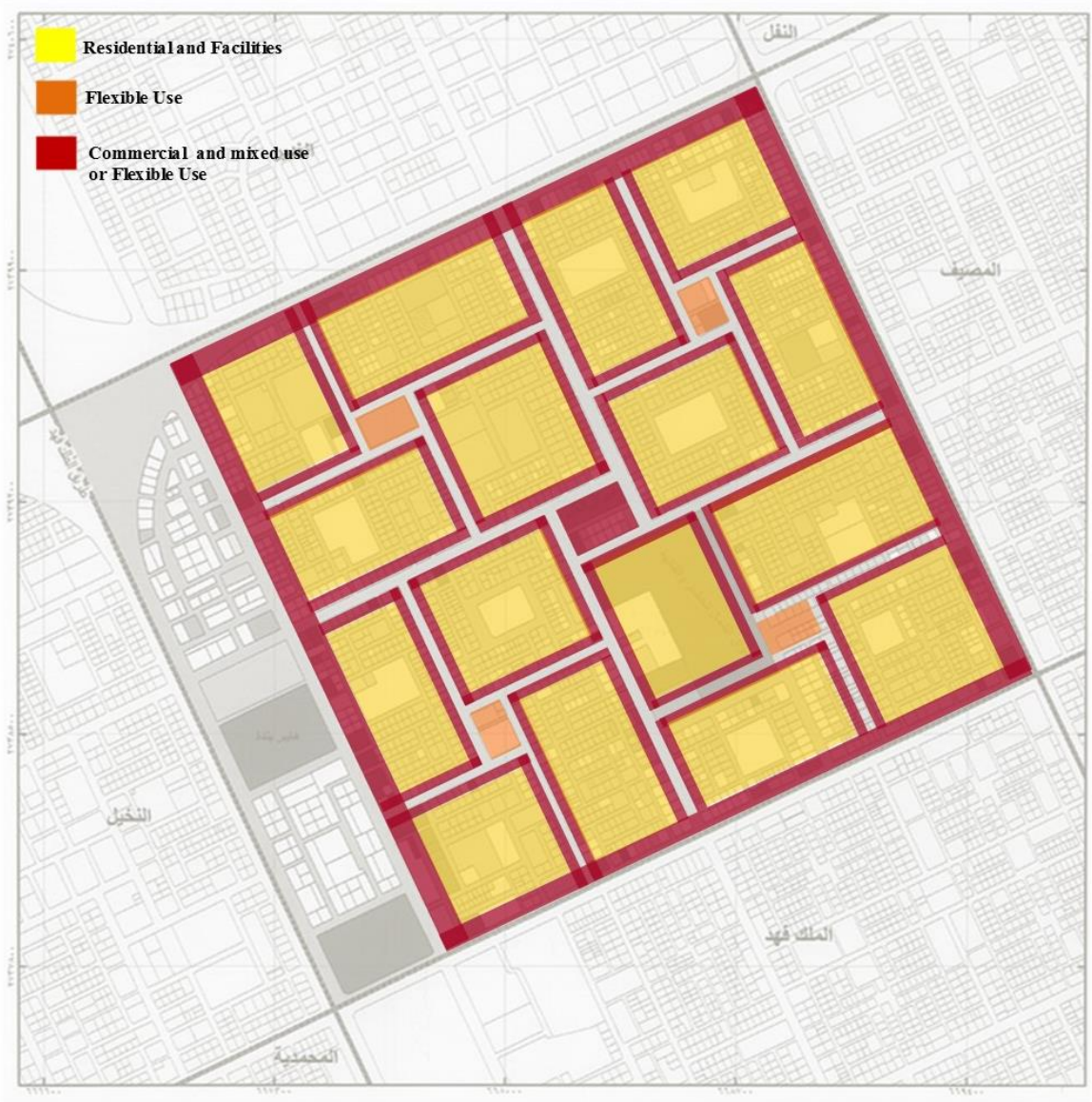



**Figure 5-31: Land use zoning in the neighbourhood unit based on RM regulations**

The latest building regulations show that in the neighbourhood units, 300 square metres is the minimum plot size, which was 400 square metres until the last decade as per Doxiadis'

suggestion. The policy mentions the housing types to include villas and apartments. It also emphasised that prior to building a house, a planning permission must be obtained from RM. Once the plan is approved, no one is allowed to make changes; rather, this is strictly prohibited in making alterations in especially smaller plots. Concerning residential units, residents were permitted to construct either detached villas or attached villas, but with clear specifications. The policy divides the residential units into two. Firstly, for detached and attached houses the resident can cover up to 60% of the total plot size. In addition, the residents should follow the adopted standard for the right height, setback, and built ratio requirements. Secondly, semi-attached villas can be built with the specifications as per the regulations (E1; RM, 1972). The Municipal regulations differentiates between detached and attached villas in the neighbourhood units. In the case of attached villas, each villa should lie on the 12m street. The width of the plots should not be less than 10m, including setbacks. In cases where villas are divided into two units (ground and first floor), the width of the plot for each villa should not be less than 15m, and should provide parking inside the fenced wall. There should be stairs in each villa, but this should not divide the villas into two separate units. Above all, the straight line with the fence wall should be built in between the villas to define the separation.

### *5.7.2 The existing problems in the neighbourhoods*

According to the comprehensive report of MEDSTAR (2003:71):

> *"The neighbourhood is an important component of the city, so there should be a sustainable solution to solve the existing and future housing issues. The existing planning and design of the neighbourhoods are not sufficient in terms of land use and transport and also no longer accepted by the society."*

MEDSTAR (2003) studied the current condition of the neighbourhood units 2x2km aiming to improve the neighbourhood's efficiency. It briefly criticised the use of neighbourhood units on the grounds that that these units are heavily replicated, arguing that they are not sufficient in terms of their land use, transport, and that they are not apparently accepted by the society. Claiming that the urban form of the neighbourhood units 2x2km in the city lead people to drive cars out of their neighbourhoods. In addition, the 16 units/ hectare density of these super blocks are also relatively low, allowing for the wide horizontal expansion of the city.

As a result, the report of MEDSTAR (2003) states that Riyadh is facing many challenges in structuring the neighbourhoods' development. Some of the needs to be reconsidered as important

existing development issues are mentioned in the report, and those affecting the quality, function, and efficiency of neighbourhoods include: 1) there is no clear identity for each neighbourhood; 2) the lack of diversity and mixed land use; 3) long distances between home and work; 4) no effective participation of residents in developing their neighbourhoods; 5) high traffic and speed in the arterial streets; 6) no clear street hierarchy and entrances for the neighbourhoods; 7) dangerous conjunctions and noise; 8) the street design does not support the commercial areas; 9) there is no street furniture and street spaces and paths for pedestrians that protect their safety; 10) a lack of open and green spaces; 11) there is no inclusive open space and networks of green spaces; 12) the developed urban designs are not sensitive to the hot climate; 13) no shadow in urban spaces; 14) the dust and Co2 are not controlled and there is no good ventilation; 15) lack of key facilities such as schools and health care in some areas; lack of infrastructure of civil services such as sewage system and telephones; 16) lack of privacy in private residential units; 17) there are interventions between public, semi-private, and private spaces; 18) there is a need for regulations that support the economic and environmental sustainability at the neighbourhood level and the use of local resources. Eventually, due to the link between development and urban design, there is a significant need to develop better design elements for the future development of the neighbourhoods according to local social and environmental conditions to solve these urban issues.

### *5.7.3 The updated urban policy of neighbourhood planning 2012*

According to MEDSTAR (1999:113):

> *"...preferred approach[es] to neighbourhood planning and design should concentrate principally on a part of the present 'community size'. Instead of the present 2 km x2 km grid providing the basic design unit neighbourhood plans should be limited to a quarter of this area, - in effect forming four communities instead of one as the basis for neighbourhood design and develop Local Structure Plans more responsive to the environment and to social needs. In these circumstances the basic neighbourhood size should, desirable, remain at about 3,000 – 4,000 people with an average of 500-650 residential units."*

Table 5-4 presents the latest updated planning regulations and criteria for improving the existing neighbourhoods and the development of new ones. The new urban policy of neighbourhood planning was finalized in 2012. It has been improved and seems that there are some sustainable considerations revised. The table shows the required percentage of each facility in a

neighbourhood unit, its service area, and the distance that urban planners, land owners, and developers have to follow.

The general regulations that have to be followed for designing a neighbourhood are: to provide ideas and concepts of land use and zones; to consider the land use plan of the strategic plan by Riyadh Development Authority; commitment to the regulations of the urban boundaries; to consider the topography of the site; to provide a report for the soil test; to link the site with the surrounding plans and streets; to design street hierarchies with no conjunctions; to provide pedestrian design and flow, and distribution of services with regard to population density and service area (catchment area); to provide parks with regard to service area; to provide one mosque on each major street with regard to service area; to have a minimum of 30m of land width located on 30m and 36m street width; to keep 40m of land width on 40m streets width; and finally, to follow the regulations of Riyadh Development Authority for specific sites.

**Table 5-4: The new urban policy of services and facilities for developing neighbourhood units (Riyadh Municipality, 2013)**

| **Services** | **Percentage (minimum) %40** | **Planning Percentage** | **Service Area** |
|---|---|---|---|
| | | **Required Percentage** | **The Distance** |
| Streets and pedestrian passage ways | 25 % Maximum limit | | |
| Mosques and its facilities ( + parking) | Local : 3000 m2 Large : 8000 m2 | 2.4 % | 275 m (Horizontal distance) |
| | | | 500 m walking distance |
| Every Primary school (boys, girls) + Nursery + Parking | 10000 m2 | 4% | 550 m |
| Every Secondary school (boys, girls) + Parking | 12000 m2 | | |
| Every High school (boys, girls) + Parking | 16000 m2 | | 1200 m |
| Public Health Center | 2500 m2 | Depend on the Service Scope | 800 m |
| Parks + Parking | 4 % | | |
| Civil Defense Center | 4000 m2 | | 1500 m |
| Police Station | 2500 m2 | | 1200 m |
| Public or Municipal facilities | 2% | 2 % | |

The total percentage kept for public services has been raised from 33 % to 40%, as it is believed that from the local practices, 33% was a very low percentage (Alskait, 2002; UP3). Each facility should be provided with a clear service area (catchment area) and walkable distance based on the level of service. For example, primary schools have 550m as a radius distance, while high schools have 1200m. There is no evidence of having a service area for secondary schools. Mosques are provided with rational service area of 275m for local mosques, and 500m for larger ones. Healthcare has to be provided every 800m in distance while parks should be provided with a minimum percentage of 4% and there is no service area mentioned in the table for their usage. Finally, streets and pedestrian walkways cover 25% of the total area of the neighbourhood or residential area developments.

Meanwhile, the building density has been increased in selected major streets inside all neighbourhoods, as the residential apartments and mixed use buildings can be built three-and-a-half storeys instead of two. Buildings, which are on major commercial streets bounded by the neighbourhood unit, changed from 5 to 10 storey maximum, but dependent on the specific streets' regulations. Each street is different due to the followed hierarchal system, but there are other factors that determine the heights of buildings in the neighbourhood, such as the existing private expensive lands, the demands for office buildings in major streets, and higher condensed populations in some areas than others. In fact, the height differences can sometimes reach up to 10 storeys in some places (DM 2).

The MEDSTAR Plan adopted the gradual hierarchical principle in the distribution of services. First, there was the Public and Main centre, which entails centralized types of services, with banks and government buildings. The second level comprises of centres that are special and secondary such as mosques for daily prayers, schools, parks, open spaces, recreational and other urban services. The third level is for smaller centres primarily for women and children. Pedestrian movement, safety, security and privacy are crucial in designing these centres. They incorporate privacy arrangements and zonal controls (MEDSTAR, 2003). Finally, it is worth noting that these considerations are not new in the planning of Riyadh, as they were planned and suggested in Doxiadis' plan during the review and study of his first comprehensive master plan.

## 5.8 Conclusion

Over time, the concept of Riyadh's neighbourhoods has changed, adopting a more modern style. Nevertheless, the modern urban form of neighbourhoods in the city still has many social, environmental, cultural, and climatic urban issues. The traditional urban form of old Riyadh and the oldest development of the city proved to be more compact than the new sprawling oriented developments. The new residential developments adopted many modern urban and architectural elements, which all came over time from different backgrounds. The free standing villa housing type and the urban grid pattern are amongst the most significant. Doxiadis introduced the first regulated master plan for the city where its urban structure still apparently stands out.

Doxiadis' 2x2 km super blocks have become the neighbourhood unit that has been adopted by Riyadh Municipality. However, at the neighbourhood level Doxiadis' guidelines were not fully followed, and were even ignored and changed. Many significant suggestions by the original plan were disputed, and updated urban policies and regulations were set up along with keeping some existing building regulations before Doxiadis' plan could be used for the new neighbourhoods. These have become as standard for all new developments, regardless of some exceptions found in few areas.

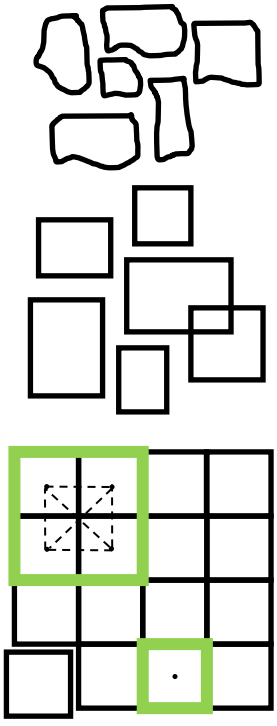
The changes made by MOMRA and RM and the overall design guidelines by Doxiadis, for a typical neighbourhood in Riyadh, will now be analysed in the following chapters. The analysis is based on the developed sustainable urban form criteria for this research to examine how sustainable the selected case study neighbourhood of Almoroj actually is.

# Chapter 6 : Compactness

**Contents**

## Chapter 6 : Compactness





## 6.1 Introduction

This chapter presents the results of an analysis of the data gathered from the secondary sources, archives, interviewees and observations to understand the compactness of the studied neighbourhood unit of Almoroj. There are two sub-criteria to study this criterion: accessibility and density. They are examined at the three stages of design, development, and use. As aforementioned, the original design was by Doxiadis and development was based on both RM regulation and policy and Doxiadis' urban guidelines. The third stage includes the residents' perceptions, direct observations and experiences to understand the use of people and function of the urban spaces in the neighbourhood.

The first section is the analysis of accessibility that includes the provision, distribution, and distances of facilities and services. The catchment areas and populations of each services are discussed. This section helps to understand the equal provision and distribution of facilities as well as how they can be reached.

Section two focuses on the density, to study how dense the population of the neighbourhood is and the intensification of the built environment including the housing, urban blocks, and the size of the neighbourhood unit in relation to the population size. Some examples of national and international neighbourhoods will be presented to relatively understand the density of Almoroj.

## 6.2 Accessibility

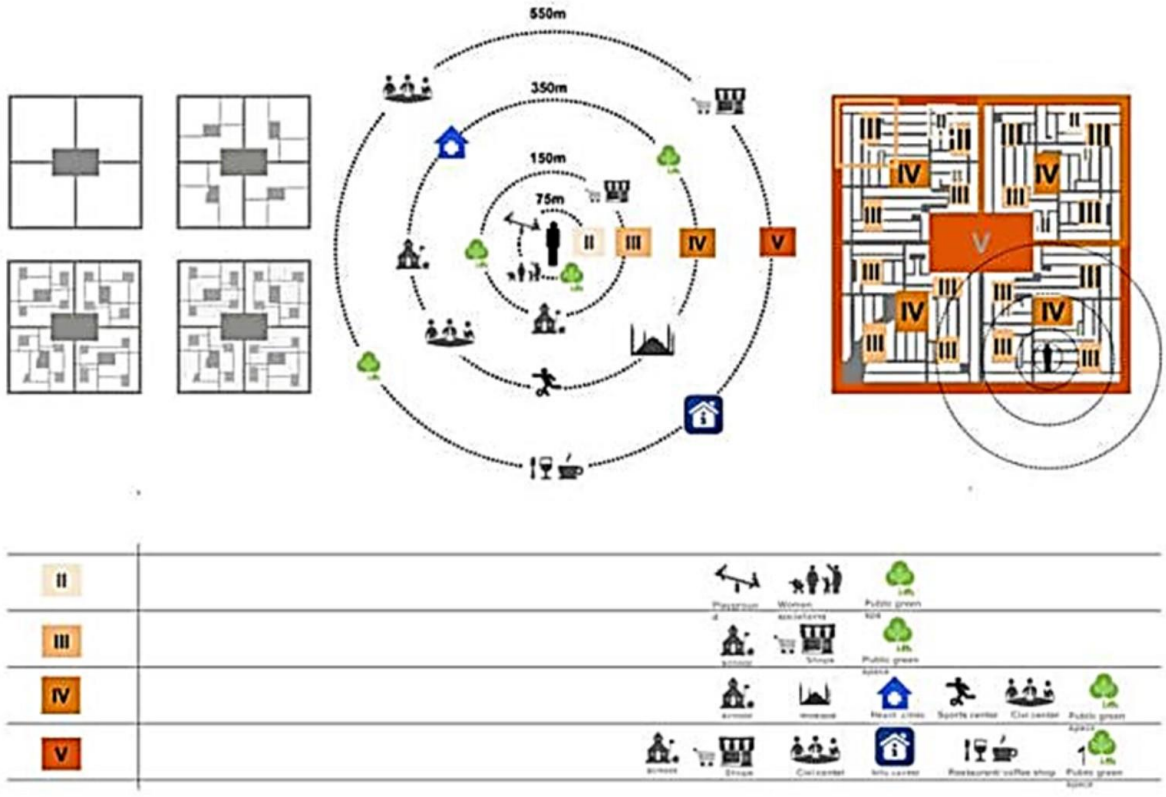
***Definition***

The literature review chapter indicated that accessibility relates to the attainment of most of the required facilities in the neighbourhood, which should be equal and easy to reach by all residents. Accessibility is the way in which the person can easily access different services when they need them. Accessibility depends on various factors and covers the levels of nation, region, and city down to neighbourhood levels (Zhang, 2010). The residents' daily activities are clearly related to accessibility at the urban neighbourhood level (e.g. shopping and school) (Zhang, 2010). The investigation of how accessible Almoroj neighbourhood is in this study will focus on the provision, distance, and distribution of key urban facilities in the neighbourhood, how often, how well and equally distributed the facilities are, and how easy it is for people to reach them.

### *6.2.1 The Design stage, Accessibility in Doxiadis' Plans*

Doxiadis was systematic in his design with regards to spatial and functional accessibility. He recommended that all essential urban facilities and services are to be provided in all community classes from V and below. Each community class is provided with many facilities and services, however, depending on the population served, the size could be smaller. According to the functions and size of the community classes mentioned in chapter 5, Table 5-1, and the diagram in Figure 6-1, there should be an easy access and provision to all important functions at the neighbourhood level.

Functionally, the design was comprehensive, as it provided small squares within the block level, while each facility and service, such as schools and mosques, and even shops should be provided on a human scale. Furthermore, it functions and is organised in a way that is liveable because of the considered convenient distances and nearby locations between housing and moreover, for local amenities. It is also appropriate for the basic provisions and even the distribution of the basic services of educational, health, religious, commercial, parks, leisure areas and open space facilities. The design provided equal access for all, which promotes social interaction and enhances engagement in public life and hence, should enrich local cohesion.



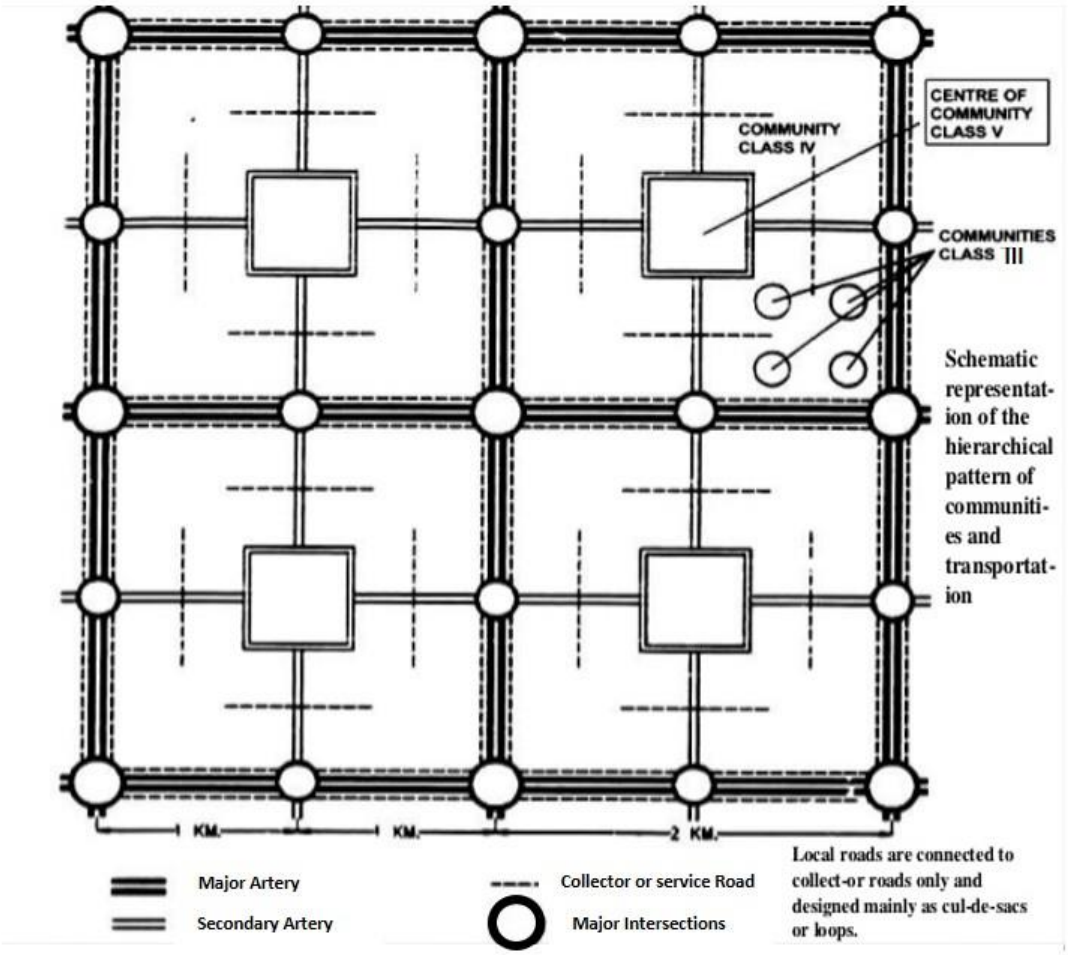



**Figure 6-1: Diagram presenting a collection of CCVs and Doxiadis' perception of urban centres and community classes hierarchy as well as transportation system and accessibility in the neighbourhood units. Local and collector roads, pedestrian paths, bicycle lanes within the lower communities classes ''human scale communities'' provide access to the major public transportation system.**

(Source: www.rmjm.com (a), Frantzeskakis, 2009(b))

However, the original design by Doxiadis was a general guideline that was supposed to be developed at later stages. It did not go into detail in describing the sizes and walkable distances between the neighbourhood urban blocks to enhance accessibility in the neighbourhood, for example, how the provision of pedestrian walkways would work to promote accessibility within the neighbourhood. The design also indicated that the access to the neighbourhood unit should be as limited as possible. Nevertheless, Doxiadis' plan related to all enclosed community classes offering high-quality accessibility for the aforementioned key urban functions. It is clear that the plan undoubtedly aimed at enhancing equal provision of these services within easily reachable distances.

With regards to schools, there are two types within each neighbourhood unit of community class V, primary and secondary schools. According to the size of each community class (CCV=2X2km; CCIV=1X1km; CCIII=500x500m; CCII=250x250m) and the related urban functions for each community class, the distance for the primary children is about 200 metres and to be included in community class III, size 500m X 500m, which is highly acceptable (Roger,1999). However, for the secondary school, the distance is about 500 metres, which is also safe and brings together the communities in a neighbourhood. In reality, Doxiadis' design for compactness in the master plan for schools justifies the compactness with optimistic distances. In each community class, there are mosques, and this is closely related to the population density, and as the population increases, the size of the mosque increases.

Doxiadis very carefully planned the mosques in the neighbourhood. This also includes the parking areas near schools, mosques, and others such as parks and play grounds, which further shows the compactness in accessibility and distances. In respect to the provision of shopping centres, Doxiadis clearly pointed out in the design that each community class would have a market related to the size of the area served. For example, there would be a central market for community class V and small shopping centres in community class IV. This obviously strengthens the argument in favour of adapting accessibility to meet the size of the community classes, distance optimisation, the locations of facilities and local shops, and the overall compactness of the urban unit in question.

The facilities motivate and encourage the people to walk and be compacted within a reachable distance. This therefore indicates that design presented by Doxiadis as a framework satisfies the criteria of urban compactness. However, the original plan did not architecturally materialize.

### *6.2.2 Development Stage*

In general, the urban development of Riyadh's neighbourhood units succeeded in following the general urban layout of Doxiadis' plan, but there were changes in many aspects that affected the accessibility at least in the studied Almoroj neighbourhood. The below map analysis (Figure 6-2) shows how the urban structure of the neighbourhood community is linked in Almoroj today.

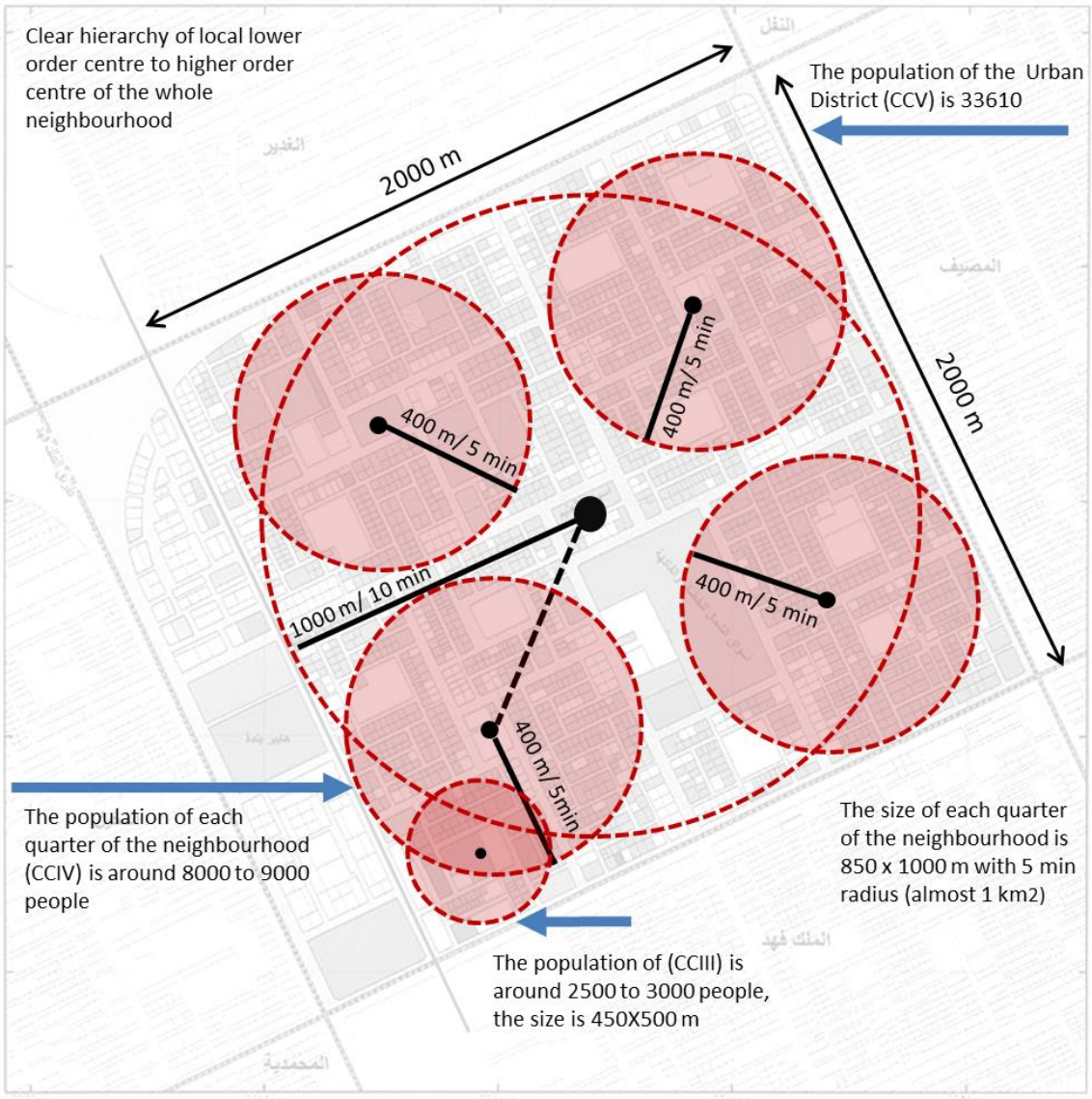



**Figure 6-2:Map analysis of how the urban structure of the neighbourhood community is linked in Almoroj, Riyadh today**
(Source: Author)

Regarding distance optimization, the developed urban form is surrounded or rather, encircled by a network of major streets with the size of 2x2 km. This indicates that the distances within the neighbourhood community class V are not beyond the reach of the residents; however, it depends on the adequate distribution of facilities within the neighbourhood. Some functions are missed in some of the community class IV as per Doxiadis' plan, which make fragmentation within the neighbourhood unit community class V. Each community class from IV to I that comes under community class V should have been developed with all the functions, which were included in Doxiadis' plan.

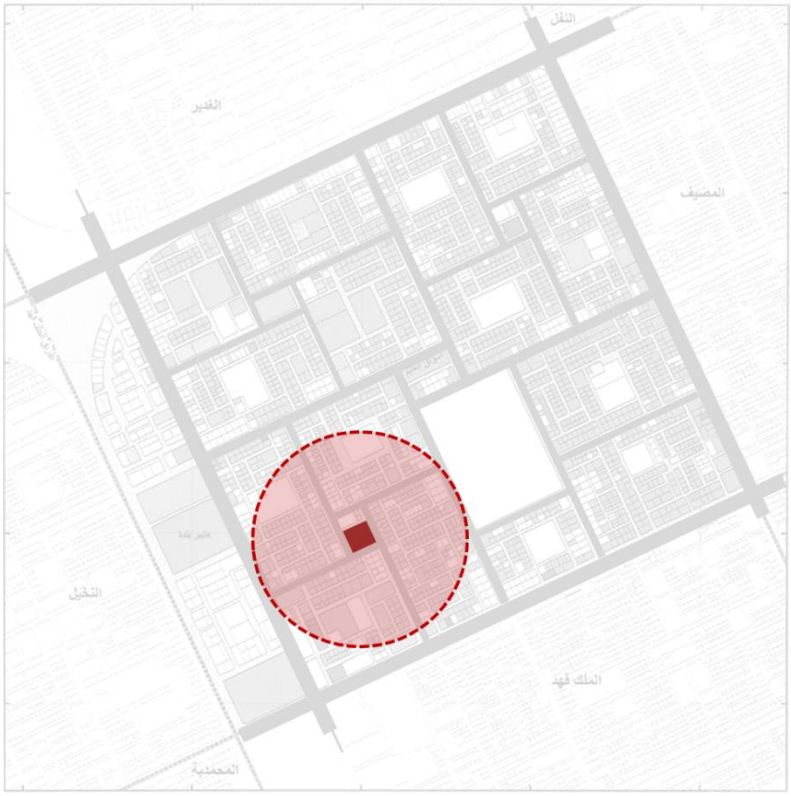
The absence of a park in one of the units in community class IV weakens accessibility and distance optimisation, and consequently compactness. However, systematic urban form

focuses on the design that was developed in a way where streets, roads and other adjoining facilities make the urban form responsive. One of the community class IV was developed completely with all the facilities needed by the residents. This community seems to have better accessibility and distances because all the functions fall in 1x1km, which is the furthest point from the centre, and would not exceed 500m or 5 minutes' walk. The weakness in the development stage that the functions are not distributed in a sustainable manner means there is no easy access and long distances.

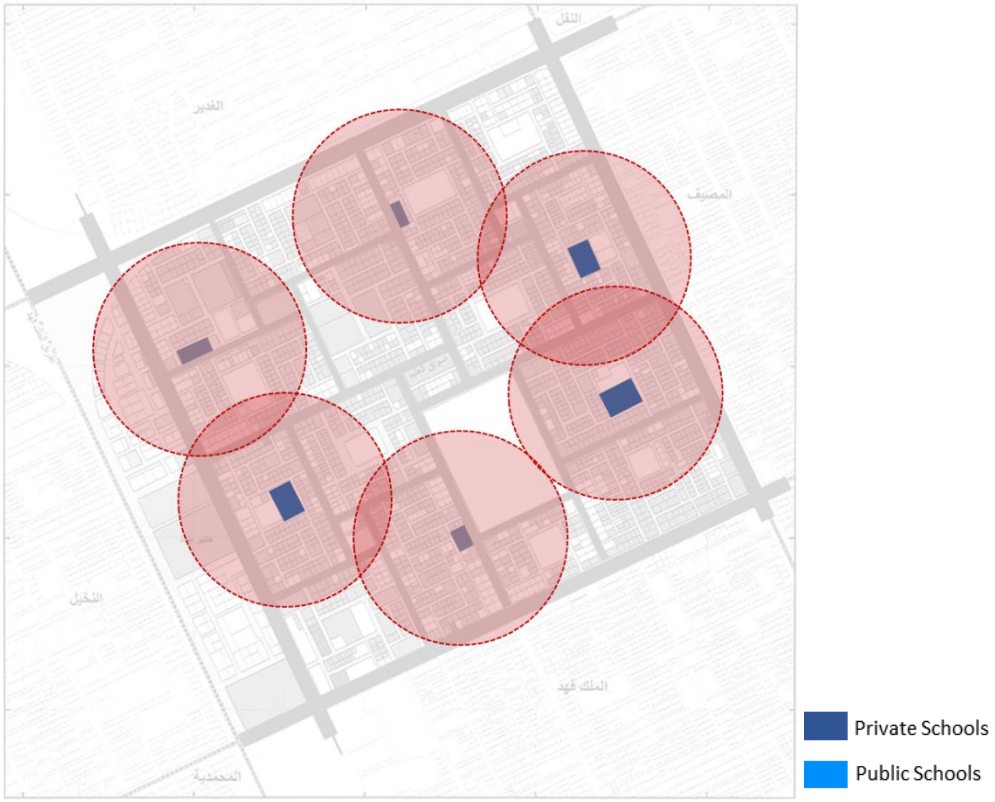
The below maps analysis, (Figure 6-3, a, b, c, d, e, f, g, h, and i) of the development of the Almoroj shows the locations of the currently provided essential urban functions with their catchment areas and service distances for the residents living around.

The development of the neighbourhood meant the facilities were distributed but not according to Doxiadis' systematic and hierarchical plan of functions. There are missing facilities and the development stage by Riyadh Municipality criteria limited the provision of such services.


**(a) Parks**



**(b)Open spaces**




**(c) Primary School for Boys**

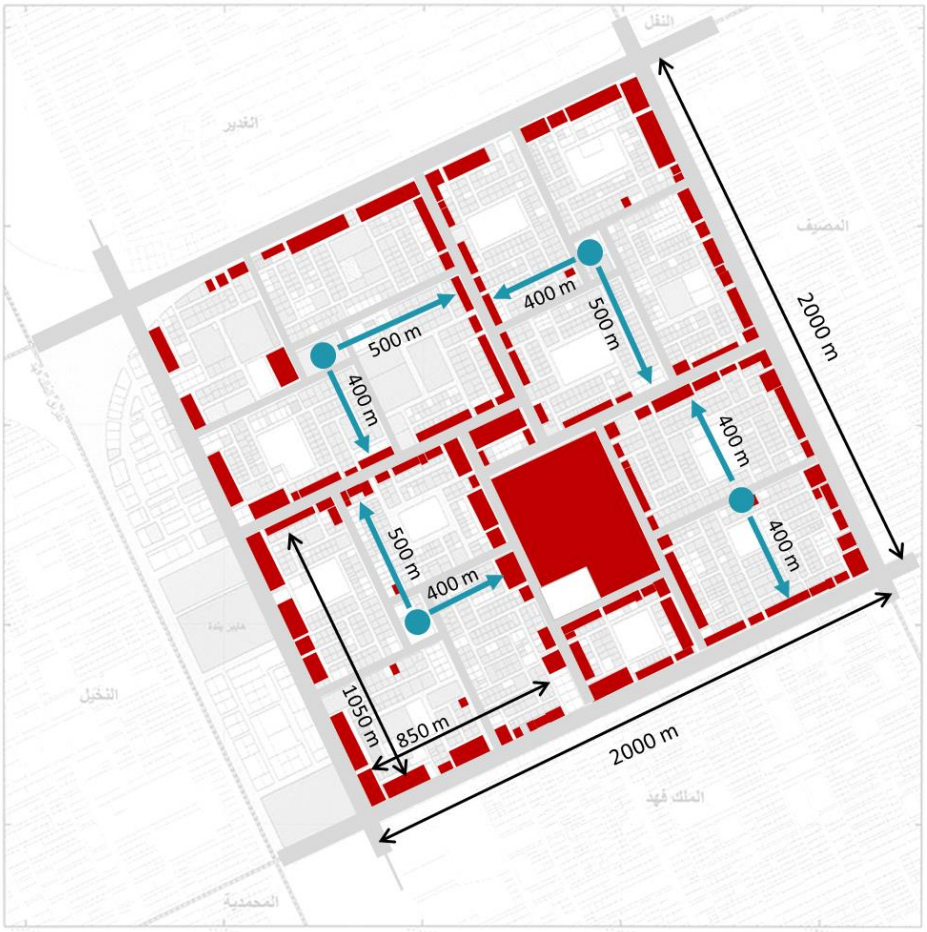

**(d). Primary school for Girls**


**(e). Secondary and high School for Boys**


**(f). Secondary and high school for Girls**

**(g). Health Centres**

**(h). Mosques (n=11)**




**(i). Shops and commercial areas**

**Figure 6-3: The catchment areas for facilities and services**

From the above map analysis, there is one open space, which only covers a quarter of the neighbourhood unit in the entire community class IV, and the rest of the neighbourhood areas are disadvantaged from having easy walkable access to the open space. Two parks are provided in two community class IVs and one is ignored in the fourth; however, the circle of 10 minutes' walk covers most of the neighbourhood areas but not the circle of 5 min walk. The difference between the open space and park is that the open space has field courts for public activities, such as tennis, basketball and football, with small green area, while parks have playgrounds for kids and larger green areas.

The total number of schools for boys is six while for girls there are five schools, and some include only primary or secondary and high level and some include all levels. There are many primary schools for boys (6 schools) and they cover most the areas except for some small parts. The primary schools for girls are lower in number (5 schools) than the boys' ones, and relatively difficult to reach. The secondary and high schools for boys (4 schools, one of them in green is only a secondary level) are not well distributed and if those four schools are placed in the middle of each community IV they will be more easily reached. The secondary and high schools for girls are also not well distributed and still there is a lack of them, as only three schools exist. In addition, the lack of girls' schools appears to lead to some girls having to study outside of the neighbourhood.

The 11 available mosques are distributed very well and they are the easiest facility to reach by most if not all the residents, as the illustrated overlapping catchment areas show.

The local shops are placed in major streets and they are placed on the edges of each community class IV. They are all located near residential areas, thus easily accessible by many. However, some functions of the local shops may not be near to some residents. To be precise, the location of a grocery store in the corner of community class IV can be a bit far for some residents who are living in the opposite corner that is around 800m away. It means that this grocery store can exceed the five minutes reachable distance for those disadvantaged residents.

Although the above located facilities have been developed to meet the needs of the people in the neighbourhood unit, their catchment area is not equally distributed (see Table 6-1 below). Most residents can access mosques, schools and local shops more easily than the health centres, open spaces, and parks. As was seen earlier, there is a clear shortage of some of these facilities in community class IV, while the rest of the community classes in the neighbourhood are disadvantaged from the one open space available, for example.

There was no strict policy for good accessibility; however, schools and mosques proved to have better accessibility levels. In case of emergencies, the services are easily reachable for the residents. In particular reference to mosques, there should be more public spaces alongside to promote social interactions, but this was not emphasised during the development stage. Local shops are located only on major streets and this contradicts Doxiadis' recommendations, which provided shops in the centre of each urban community. Unfortunately, these sorts of small shops are not seen in the currently developed neighbourhood, even though they could enhance the social life of the residents.

**Table 6-1: Result analysis of the percentage of the catchment area and population within walking distance of five key amenities in Almoroj (Most daily used)**

| **Facilities and services** | **Catchment area** | **Catchment populations** |
|---|---|---|
| Educational schools (Boys) | 69% | 22,190 |
| Educational schools (Girls) | 52% | 16,477 |
| Commercial Services | 90% | 30,249 |
| Mosques | 93% | 29,160 |
| Primary Health care | 41% | 13780 |
| Neighbourhood Parks | 38% | 11000 |
| Municipal open space (play fields) | 23% | 7730 |
| **Total** | **100%(400 hectares)** | **33610** |
| **Note:** Any overlaps on the Fresh market (4.5% and 22 hectares) was excluded in the catchment area and population. | | |

Doxiadis provided a clear picture of the breakdown of urban functions for the city neighbourhoods. His concept of South Olaya community (Figure 5-23) presents a clear distribution of the key urban functions that should be provided for each community, based on the area and population size.

As per the Doxiadis plan, around 9000 people should live in each community class IV and similar results can be seen in Almoroj today, except for one of the south eastern CCIV, because of the dominance of the big commercial land that the current fresh market occupies.

There is a clear hierarchy of identifiable centres in Doxiadis' community class IIIs, CCIVs (1x1km), and CCV (2x2). The main centre in CCVs should be working as a hub full of the essential services for the urban community of the neighbourhood unit, which alongside the main spine work as the dominant focal points of the main urban activities of the city.

The centres in CCIVs should provide the daily commercial, cultural, and administrative activities, while CCV centres should include district commercial and civic centres. Also,

schools, parks, recreational and public conveniences are placed in the corner of each CCIV. There are more parks, recreational and worship facilities of lower order within each CCIV and that creates good accessibility, with enough provision and walkable distances to public facilities at both scales (1x1 km) and (2x2km).

The current situation, however, shows clear physical centres for CCIVs and CCV as suggested by the original design, nevertheless, three of the centres are not functioning as community hubs. The land uses were changed and in some cases limited to single use (e.g. residential use), which contradicts Doxiadis' plan.

More significantly, contrary to Doxiadis' designed open spaces in all neighbourhood community classes, the only open space found in Almoroj was only available for one quarter of the neighbourhood. This should at least have been developed in the centre of the neighbourhood, perhaps in a big scale for community class V, alongside some small ones in each of the community class VI units so that all the residents could have more equal and easy access, in order to develop more family recreational activities, as planned by Doxiadis. It does not look like that the MOMRA and RM considered developing such urban facilities to make the city neighbourhoods more vibrant.

One of the centres in CCIV is used for residential buildings. This in return seems to weaken the liveability in the centre. Another centre of CCIV is used only for the benefit of a large mosque. The third centre has been eliminated, as the shape and structure of this south-eastern CCIV has been misshaped, becoming the main fresh market for the northern side of the city. One of the centres, the south-western, seems to be more active, and is used for multiple functions including the Municipal open space of the neighbourhood, known for its recreational activities and large Jumma' Friday mosque. However, commercial activities could be added to the centre of this community instead of concentration on Al-mafroka streets to make a more active and liveable centre. The main centre of Almoroj is used for some functions suggested by Doxiadis, including the main commercial and residential ones, but not the recommended civic centres. However, commercial activities all along Al-mafroka streets, which are connected to the main centre, have weakened the strength and focus of Almoroj centre.

The consequences of changing the urban function of these centres affected the accessibility of some facilities and services in terms of distances (no more than 500 m), provision, and distribution. By having commercial, educational and recreational uses in the centre of each CCIV, these functions would be more accessible, bringing the residents all together in one

place. However, the distribution and provision of some facilities in the current plan weaken the overall accessibility and lead to long distances that would potentially discourage people from using such services, such as parks and open spaces.

For example, it has been found in the neighbourhood that when the mosque is located in the middle of community class IV, it encourages more residents to come, therefore more people know each other and the social interaction in the community is enhanced. This phenomenon is not seen in the other areas where mosques are not placed in the centre. The distances are acceptable, however, the urban design significantly affects the residents' movements within the neighbourhood. The design of the blocks and streets block the residents from some major facilities such as parks and open spaces. This is because the design for pedestrians' accessibility was absent. The distribution of facilities was relatively good and yet, it would be even stronger if there were a strict policy for the location of facilities such as schools and parks. The slow development of public schools led to many private schools being built. These schools are placed in rented buildings or built by the owners in the major streets that weaken the covered areas. Effective distribution of these facilities is highly recommended for better accessibility.

In conclusion, the analysis in this section shows that Almoroj achieves a moderate amount of accessibility while being partially compacted. This means that the developed urban form in this neighbourhood unit partially satisfies the criteria of compactness, owing to the fact that the developed urban form demonstrates accessibility to many services, mainly to local shops and mosques, but not equally to all, such as open spaces, parks, and schools.

### *6.2.3 The Use stage*

This section presents the findings from the experiences of different residents, and relevant research observations, in order to understand the subject of accessibility in Almoroj. The results of the interviews will be presented according to the perspectives of the identified categories of interviewees: men, women, teenagers, workers and visitors, for the reasons mentioned in the methodology chapter.

The interviewees were particularly asked about their opinions and experiences regarding the provision, distribution, and use of the available urban facilities in Almoroj. In addition, they were asked about the distances they travel from home to reach some of the important amenities including the mosque, school, park, open space and market, and whether they think that all their needs are met in the neighbourhood or not.

Most of the men were satisfied with the provided services in Almoroj, including shops, schools, mosque, parks and open spaces. They simply agreed that the provision of these services have been made in the neighbourhood to serve most residents. However, whilst many participants appreciated the access factor to most of these services, they did comment that not all were accessible, especially the open spaces and parks. The participants were asked about the demand for visiting the parks and open spaces and why. It can be postulated from their responses that the neighbourhood offers very little open space for people to meet and relax, and the very few parks and open spaces in Almoroj do not offer the required facilities to meet the rehabilitation and leisure demands of the residents. All the male participants recognised that most services are provided, especially at the community class IV scale, however, most of them declined the use of open spaces and parks in particular, due to different reasons, such as because they are "far" away from home and because of the "hot weather" in the daytime.

A7, a university student said that:

> *"In my opinion, the open space and parks do not have the facilities people need, for example, enough outdoor facilities that can compete with the favoured indoor ones, such as videogames. I very rarely go, only occasionally"*

Another interviewee, A9, also a university student, mentioned that:

> *"The parks and open spaces available do not have advance sporting and gaming facilities. As a result, I think they prefer to stay at home using their free time on computer assisted games and television rather than going to these places."*

Most significantly, there were still some interviewees who live close to the neighbourhood parks and open space in the same community class IV, but they admitted that they do not use them. Although some interviewees had used the open spaces, it seems clear that the unequal distances, lack of facilities and hot weather during the daytime limit the use of open spaces and parks.

One of the participants, A10, a government employee, reported that:

> *"I work for the government during the weekdays and I wanted to visit the parks, but unfortunately my area does not offer such facilities."*

A3, who works for a private company, responded that:

> *"I start work early and finish late, I feel tired and unable to visit the parks and open space available during the weekdays, rarely when I go on weekends."*

It is clear that A10 did have the time and wanted to use the public place in question, but due to the far distance he could only visit the next neighbourhood quarter to enjoy the use of these key urban functions. Concerning A3, it is obvious that some people's lifestyle and/or possibly their laziness restrict them from using public places.

Moreover, one of the interviewees, A6, who is a government employee, distinctively reported that:

> *"My home is not near the open space, this is about 800 metres, so I cannot easily visit it. However, I go to the park, which is 120 metres away, but my preference is in using the open space."*

While another interviewee, A2, a government employee too, answered that:

> *"I live near the park and this is less than 200 metres from my home. I visit the park at the weekend only but not during the week days."*

A6 lives in the corner of this neighbourhood, where there is no facility of open space. In addition, though A2 lives near the park, he does not visit the park every day. It seems he has no time during weekdays because of his other responsibilities.

Two other interviewees clearly asserted that the distance to the services was not a problem for them, because the services were "close" to their residences, at less than 250m. While the rest of the participants stated that the distances from their residences to the services varied, still most of the participants felt close and were using cars for all services even if the travelling distance was 200m. The subject of the extensive reliance on cars in Riyadh will be discussed further in chapter 8. Meanwhile, the distance from home to the services for most residents was more than 500 metres, many of the interviewees reported.

Regarding the distribution of services, there were dividing apprehensions amongst male interviewees. Some of the men participants were undecided about the location and distribution of the services and further acceded that they were unable to approach some services simultaneously. The distribution of the mosques and schools were appreciated by almost all the interviewees. It can be recalled that most of the residents' access was not disputable for mosques, but access to the schools was not similar to mosques.

Concerning the local shops, all participants approved that the neighbourhood unit offer all their daily needs, but they also pointed out that some sub-units of the neighbourhood lack similar facilities. For example, some of the interviewees, including A2, did not agree with the current female schools' distribution in the neighbourhood.

A2, said that:

> *"Though our daughters can study in the neighbourhood girls' schools, the rest of our children study in the next neighbourhood. The distance from our home to the girls' schools is larger than the schools in the next neighbourhood."*

From the above perception of A2, girls' schools were not easily accessible in the neighbourhood, and other interviewees also disagreed with the distribution of schools in Almoroj (this is evident in the urban space analysis diagram seen in Figure 6-2, f and d). In addition, realistically each community class in the neighbourhood should have been connected to the nearest schools for boys and girls. This also shows that this accessibility aspect of distribution and distances to schools is not developed to meet the plans of the design stage. In some cases, the residents have to drive more than 1 km to take their children to school or buy some goods.

Almost all the women interviewees asserted that they were not using the neighbourhood open space and parks, except for three participants. Thais was because of the concern of their privacy as it is highly demanded. Women perceive public spaces in the neighbourhood, such as parks, as places for occasional visits, private spaces for them are more comfortable. Those who do, stated that the reason for using them was for routine walks and to enjoy fresh air in the evening times. When the women were asked questions about the distances, seven of them assented and agreed that the distances to most facilities were reachable. Five interviewees criticised mostly the provision of parks in the neighbourhood, but they also raised some concerns about the distribution of schools as well as some shops. Two of the interviewees, B2 (a housewife) and B7 (a university student) gave contradicting perceptions of the use of parks and open spaces in Almoroj, as follows:

*B2:*

> *"Facilities, and especially the open space, is closer to my residence, hence I visit it regularly both during weekdays and weekends with my children''.*

While B7 said that:

> *"I am a university student and have very little time to visit the park. The closest park is far from my home thus, I am unable to visit it in a short time."*

It is clear that the distance the resident has to travel to the facility affects the ease and desire to visit it. It is found that the residents who are at a distance of between 300-400 metres from home to the provided facilities can easily access and use them more often. However, where

there is distance limitation, those residents in the neighbourhood might not be able to use the facilities very frequently.

Generally, many of the women interviewees consented that the location of the neighbourhood schools, mosques and key shops is satisfactory, but objected to the location of the parks and open space. Incidentally, they were not living near or in the same south-western community class IV, which offers open space and parks in the neighbourhood. The women interviewees objected to the standard of education in the public schools. Private schools are now more in number than public schools. Where they reside, there are three boy public schools and two for girls. However, there are five private schools for boys and girls, and accordingly many residents see that the private schools are accessible in terms of location and provision. Additionally, most of the women interviewees found all their daily needs met from the local shops. The women in Saudi and in Riyadh specifically prefer to go to large shopping malls for clothes, which are mostly located outside of the neighbourhood. Concerning the location and distribution of schools, mosques, shops, parks and open space, one of the interviewees, B9 (a housewife), said that:

> *"I think schools, mosques and shops are properly located and distributed within my area. I have strong opinions about the location of parks and open spaces in the neighbourhood. I do not have a park in my area, and the open space is far from my house."*

Two of the women, B3 (a high school student) and B4 (a school teacher), said that:

*B3:*

> *"I study in a private school now and know the difference between public and private schools. There is a clear difference in how the curriculum is being taught, and the better provided facilities and quality of teaching in the private schools is what makes us choose them; that is why private schools are higher in numbers than the public ones."*

The teacher, B4, said that:

> *"I teach in a private school. The facilities I use in teaching here are not comparable to what can be found in public schools at all. I think students prefer to study in private schools when they can."*

Facilities provision and distribution is disputed by few of the interviewees above. It suggests that all the community class IV do not have similar facilities. It means some of the facilities are missing at the scale of community class IV. As discussed later in chapter 9, most residents in Almoroj are considered among the middle to upper middle income groups, thus many of

them are expected to favour sending their children to the relatively high numbered private schools in Almoroj, due to the higher standard of quality of their facilities and teaching. There are more private schools that are well distributed in the neighbourhood, better than the public schools (as will be discussed later in the thesis). This probably forced some of the women interviewees to criticise the education standards and distribution of facilities.

The provision of services has been affecting all the facilities needed in the neighbourhood unit. Hence the teenage respondents were all interested in talking about their provision and use. Those who had visited Almoroj's only open space or parks, pointed out that they were escorted there by their parents, and one of the interviewees came up with a surprising response. He stated that his father did not permit him to use it because of the possible presence of "bad people" in open spaces. Similarly, two of the teenagers argued that they were only allowed to go there for a maximum of two hours. Concerning needs fulfilment in their areas, most of them did not dispute any shortages, and hence conceded that the neighbourhood offers all they want. The teenagers only valued the accessible location of mosques and schools. When asked the reason for this, they responded that they had made friends in the mosques and schools, and since some of the teenage interviewees, who were mainly under 17, were not regular users of the parks and open spaces, they were not able to provide any critical opinions about them. Respectively, most of the teenagers accepted playing indoors in their homes only. They also showed resistance towards the need to go out very often, but they sometimes did sit in the residential streets for a little chat, but not in summer time. Three teenagers who lived close could go to the open space and parks independently. However, only a few took the advantage of visiting these public spaces on a regular basis.

C1, a high school student, said that:

> *"Though I live next to the Municipal open space, due to security reasons, I am not allowed to visit the open space. I utilize my free time playing at home."*

Security concerns were the most likely reason that C1's father, like many others, forbid their teenagers from visiting public open spaces, this is due to general concerns about anti-social behaviour. In addition, this teenager is possibly only 15 years of age and his parents think that he needs to be escorted to the open space or parks. This directly affects the presence of teenagers in these public spaces, and ultimately their social interaction within the neighbourhood.

Most of the teenagers believe that the neighbourhood's public spaces such as parks and open spaces are fairly safe, secure, and clean, expressing that it is very rare to hear of something described as 'bad' happening to any residents. However, their parents believe that the presence of 'bad' people are possible, as these public spaces are open to everyone including strangers and not restricted to the neighbourhood residents. What they refer to as 'bad people' are those who conduct any sort of anti-social behaviour in public. Of course, anti-social behaviour differs from one culture to another. It is defined by the interviewees as behaviours that mostly involve smoking in groups, especially when some groups are relatively older in age than other teenagers. So, most parents worry that their sons might be influenced by such threatening behaviours. Another example of anti-social behaviour in public is fighting, for no reason, and imposing control over other younger groups in the public space or children who might be visiting alone. In addition, parents fear that their kids might be subject to robbery and unable to defend themselves in public. It was also observed that sometimes strangers and some residents who mostly live in flats near the parks come regularly to use these spaces and make a great deal of noise. This also contributes to the worry of some parents who consider these places as not fully safe and secure to let their children stay alone in, particularly in the evening time. If they do leave them, it is only be for a very limited time, perhaps two hours. These behaviours affect parents' decisions and push for more families restricting children from leaving their homes, especially for social and recreational activities. Even though the results showed fewer issues with the teenagers in public, as it is believed it would be less likely that such social issues discussed occur in middle or high class neighbourhoods like Almoroj, it was clear that their parents were over-cautious and fearful.

Concerning the responses of teenagers, only one of them boldly accepted that he prefers to walk while most of them felt the distances are far to most facilities by foot. In addition, almost all the teenagers did not dispute the distance from home to services regardless of the transport system. The teenagers' responses are similar to those of the women interviewees, as they cannot move and walk freely across many of the neighbourhood streets without a driver. However, teenagers of 18 years and above, who can drive, have a sense that the neighbourhood is large and self-sufficient so they do not need to go to the next neighbourhood for most of their needs. The teenagers' views were not similar, as two of them indicated that the distance to schools is "far". This also applied to the available parks. The teenagers also accepted that the existence and locations of the neighbourhood schools and mosques are the most convenient, but did not agree about the location of parks and the open space. Clearly, those who live near the open space were more satisfied than others. The

teenagers also very clearly noted that the locations of small corner shops in the neighbourhood unit, because of their frequent usage, could have been made easier to reach.

C6 is a school student and said that:

> *"I live at the extreme end of the neighbourhood, there is no high school near my home. I do not walk to my school because it is far [850m], while my friend does walk to his [350m]. I have to walk more than 600 metres to go to visit the park, or wait for my elder brother to drop and pick me up."*

The workers' responses were not that much encouraging because many of the visiting ones do not often engage with the neighbourhood facilities other than the resident workers. Only two workers were living in Almoroj and they were satisfied with the level of access to the facilities in the neighbourhood. The two foreign workers live in apartment buildings, very close (not more than 200m) from the open space, mosque, school and shops. The other two were Saudis and live in villas in a different neighbourhood. The Saudi workers do not use the facilities in this neighbourhood, they even pray at their work place in a prayer room, whereas the two foreigners were using the open space, because of the fact they were living nearby. They did not have enough space in their flats for their children to play, so they had to go to the open space on weekends. However, they did have easy access and could reach most of the facilities, especially parks and open spaces, more easily than the residents who lived in villas. The workers had mixed perceptions about the distances. Two of them appreciated the short distance, especially to mosques and schools, but objected to the far distance to other places like open space and major commercial streets. All workers did not dispute the distance for mosques and schools. Those who were not the residents stated that the distance was acceptable to all services, however, they spent most of their time at their work place in the neighbourhood.

D2 is a Saudi national and works in a bank, and said that:

> *"I come to work in this neighbourhood and do not use many of the facilities except to buy a few things from the nearest shop. My work place is situated in the commercial street in the borders of the neighbourhood."*

The responses of the working interviewees were nearly similar to the 12 interviewed men about the vast size of the neighbourhood unit. Remarkably, the two Saudi workers can identify the borders of the neighbourhood very well, as they come from different parts of the city by car only. The two Saudi workers maintained that they enter the neighbourhood only to the nearest place where they work. This shows that Saudi workers who are not residents in Almoroj do not use the public spaces inside the neighbourhood. This means that they have

less chances for social interaction with the residents. This also shows the many points of access to the neighbourhood, which makes no distinguished entries for the residents.

On the other hand, the foreign workers were more familiar with the inner areas of the neighbourhood and with the location of its schools, mosques, open spaces, and parks. They upheld that because the public places were easily accessible that encouraged them to use them more often. However, two of the Saudis did not use either of these facilities, because they were living outside this neighbourhood, hence their locations were their least concern. From this observation, it is evident that there is a weak accessible connection between these working places on the periphery of the neighbourhood and its internally located public spaces. The concentration of large commercial activities, where all workers work, on the borders seems to prevent several workers, mainly Saudi workers who are not residents of Almoroj, from penetrating the neighbourhood. This appears to hinder these types of citizens from interacting with Almoroj residents.

D4, a foreigner, who works in a restaurant on a commercial street and also lives nearby, on the same street, said that:

> *"I work during the day and I am only allowed to rest from 2pm to 4pm every day. I go to the mosque to pray near the commercial street. I can effortlessly go to the provided facilities because most are near and well located. The distance from my apartment building to the park is only 150m, which is easily accessible."*

Most foreign workers live in apartment buildings and many work in shops underneath. Thus, most of the facilities are nearby compared to villas. It is therefore expected that the workers appreciated the way the shops were placed in the commercial area and they think that most of the needs of the residents can be met.

The interviewed visitors did not show interest to use most of public facilities such as the parks and open space in this neighbourhood because they come only for short visits to their friends and families. They believed that the access to the neighbourhood was good. Nonetheless, although they were not residents, they were confident that they witnessed that the access to schools, mosques and shops in particular was easy. However, concerning access to the parks and open space, they declared that they used those near where they live in the similar neighbourhood.

Generally, the interviews and observations showed that the access to the neighbourhood was easy by car for outside visitors. The visitors can use a number of entries and exits to the

neighbourhood. From a broader perspective, the visitors appreciated the distance to their needs within this neighbourhood.

E1 is a visitor who described the provision of facilities and access in Almoroj as follows:

> *"I visit this neighbourhood very often, in case I need to buy anything, I can easily find the shop and buy things. I also attend prayers in the nearest mosque when I visit my friend's house. In my view, the location of shops and mosque are good. I can say that I can enter from many entry routes to the neighbourhood."*

The visitors acknowledged the size of the neighbourhood and mentioned that the neighbourhood is big enough and can meet the needs of the residents. The visitors' views and concerns about the distribution of services were exactly similar to other interviewees in this research. They further pointed out that shops are very close and they found all their needs around if needed. The visitors declined the use of open space and parks. They see that the local shops in this neighbourhood are similar to the other neighbourhoods so they find them easy. The shops are located on major streets so they do not have to struggle through driving inside the residential areas to find one.

Finally, it has been realised now that there are not enough public spaces, parks and open spaces equally provided in the neighbourhood of Almoroj. Consequentially, this has caused many deficiencies, one of which is that some participants, particularly women and children, preferred to stay at home. Some urban facilities are provided close enough for some residents to equally reach. The results showed how some participants felt they were far away from some key urban functions, having to walk for a long time, or even use cars, and pass through many turns and blocks to find them. Other reasons that were also believed to affect the use of many of the relatively few available public spaces, include the hot climate conditions, insufficient advanced facilities, and security. It can also be postulated that open spaces need more facilities such as football fields and tennis courts other than just parks, and hence were used more because of the provision of more facilities and functions in the only open space in the neighbourhood unit.

However, in conclusion, although the provision, distribution, and distances to the key neighbourhoods' urban functions were will optimised at the design stage, this is not completely implemented in the later urban development stages to present. More parks and open spaces should therefore be developed according to the original plans to meet people's needs and the context. By placing them in the centre of each CCIV, this would make them more visible and most welcoming to the residents. In addition, the residents seem to be more

aware of the facilities that are within community class IV where they live but less aware of the other far away ones. Also, the urban structure of the neighbourhood streets and urban blocks need to be justified with more accessibility for residents' and pedestrians' needs in mind.

## 6.3 Density

The term density here refers to how compact and dense the studied area is, as it gives a clear idea of the number of people living in a place when compared with the size of the place. The study of density therefore helps us to understand the concentration of the neighbourhood unit and the intensification of the built form.

### *6.3.1 The Design Stage, Density in Doxiadis' Plans*

The systematic concept of density suggested by Doxiadis and according to his Ekistic theory is that the neighbourhood units (CCVs) in Riyadh, as in Almoroj later, should be occupied by 50,000 people. According to the created first master plan, the city was proposed to settle a compact urban form of 304 $km^2$ (150 $km^2$ were reserved for residential construction with the aim to accommodate up to 760.000 people by 1985 –, and nearly 1.4 million in the year 2000). The final gross residential density of the territory would be 46 p/hectare (including the national university, parks, industrial zone, special zones, etc.). At the same time, the gross residential density of the city excluding non-residential zones would be 70 p/hectare. Doxiadis recommended a net residential density of 200 p/hectare and the most inhabited part would be in the central part of the city while the least inhabited area would be in the city's peripheral area. Doxiadis' plan for the city offers different standards regarding land size. It demonstrates a minimum of 150 $m^2$ for residential plots in the city centre of Riyadh with higher density, and increases to an average land size of 1500$m^2$ on the outskirts of the plan, where the case study neighbourhood is located. Thus, in Almoroj the average size of land was recommended to be 400 $m^2$ (see Figure 5-22 in chapter 5).

According to Doxiaids' plan, a population density of 50,000 people in a neighbourhood of 4 square kilometres would have an urban density of 125 p/h, with a net residential density of 200 persons per hectare. The exception is the urban core and on the areas adjacent to the main spine.

Additionally, the limitations used to control the population density of neighbourhood units would consequently lead to rapid expansions to neighbourhood units across the city, currently expanding beyond Almoroj neighbourhood. The height of all residential buildings was limited to only three storeys, which might be considered a moderately compact urban form.

### *6.3.2 The Development Stage*

The city now covers an urban area of 2,453 km$^2$, which includes the total built up area of 1,298 km$^2$ (ADA, 2013) with a population of 6.5 million (ADA, 2016). The overall gross population density in the city is 50 p/h, including the earlier mentioned 'special use zones'. Excluding non-residential zones, the gross population density is 89 p/h, and these numbers are more than what was suggested by Doxiadis. The residential use covers 244 km$^2$, and the net residential density is 238 p/h, which is over the original plan (ADA, 2013). Figure 6-5 shows a map of how the density of different neighbourhood units is distributed in Riyadh (ADA, 2010).

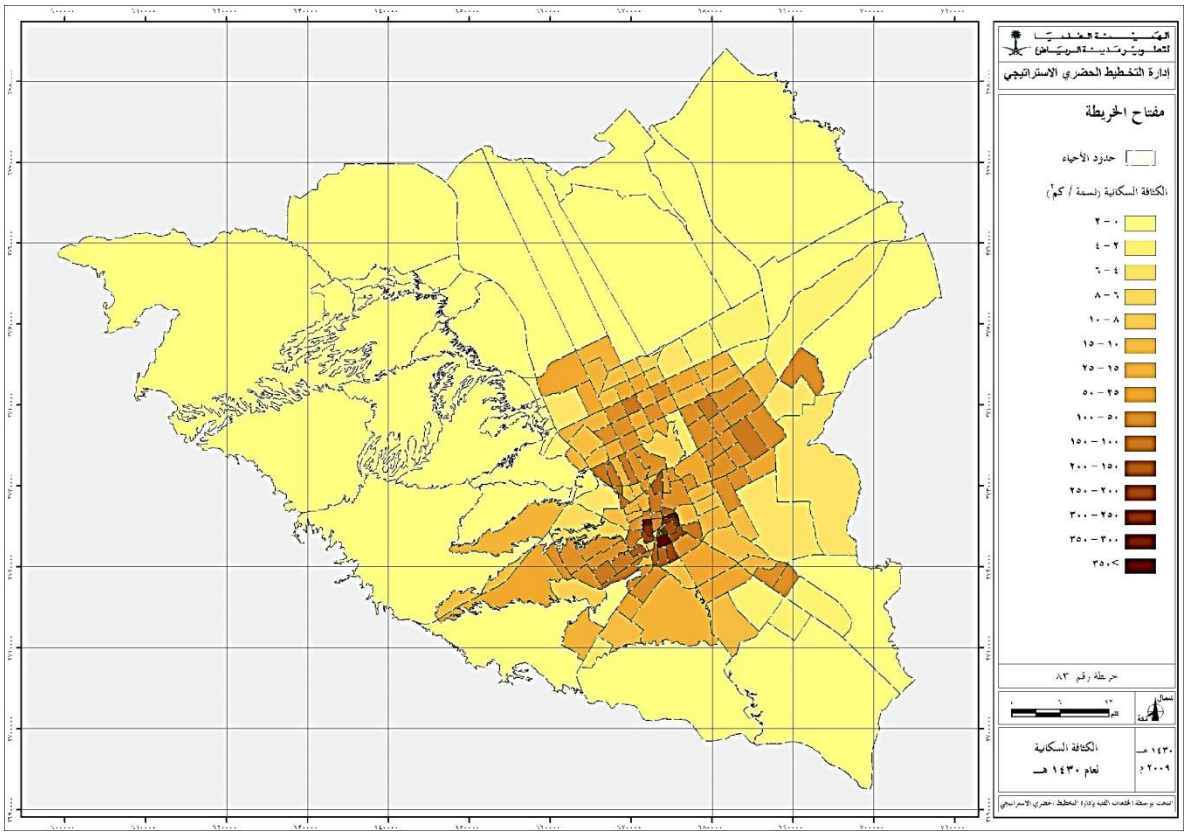



**Figure 6-4: Urban density per neighbourhood units in Riyadh**

(ADA, 2010a)

The data provided in 2004 reports that there were 31,936 people living in Almoroj neighbourhood unit. The percentage of urban development in Almoroj completion was about 69% in 2004, and the gross population density of Almoroj was 85 people per hectare while the net residential density was 125 p/h. Most residents represent themselves as nuclear families. Generally, each nuclear family consists of parents with three to four children as the average of the family size in this neighbourhood is five people (ADA, 2006b). The total number of residential units in Almoroj is 6,722, and it is 16 dwellings per hectare. In 2010, the population of Almoroj reached 33,610 (ADA, 2010a).

However, now after more than a decade this percentage has increased to 94.6% of the lands developed in the neighbourhood, and most of the undeveloped lands are for future commercial and public facilities. It is therefore expected that now the neighbourhood is occupied by more than 35,000 people, according to ADA (2010b) and the interviewed planner (UP5), as regrettably the Riyadh Municipality does not have more updated data about Almoroj beyond this date. Riyadh Development Authority (2006b) expected the population in 2021 to be 43,225 in the Almoroj neighbourhood alone, with the new law of increasing the density up to 75% in the selected major streets' buildings inside the neighbourhood (along Al-mafroka streets). These buildings used to have a two storey height limit so now with the increase of 75% they will be able to have three and a half storeys. After the new law of land subdivision to a minimum of 250 for attached houses and 300$m^2$ for the detached, some large plots have been developed with plots as small as 300 $m^2$ (Figure 6-5). Figure 6-6 is an example of one quarter of Almoroj illustrating the different sizes of developed urban forms with the lately introduced 300$m^2$ plots (highlighted in yellow).

**Figure 6-5: Example of newly developed smaller detached houses in Almoroj (plot size 300 $m^2$).**

This urban development policy has been applied all over the city, not just the studied neighbourhood unit. As a result, there is an increase in the number of houses, as the use of land is intensified, with plots even smaller than suggested by Doxiadis' plans.

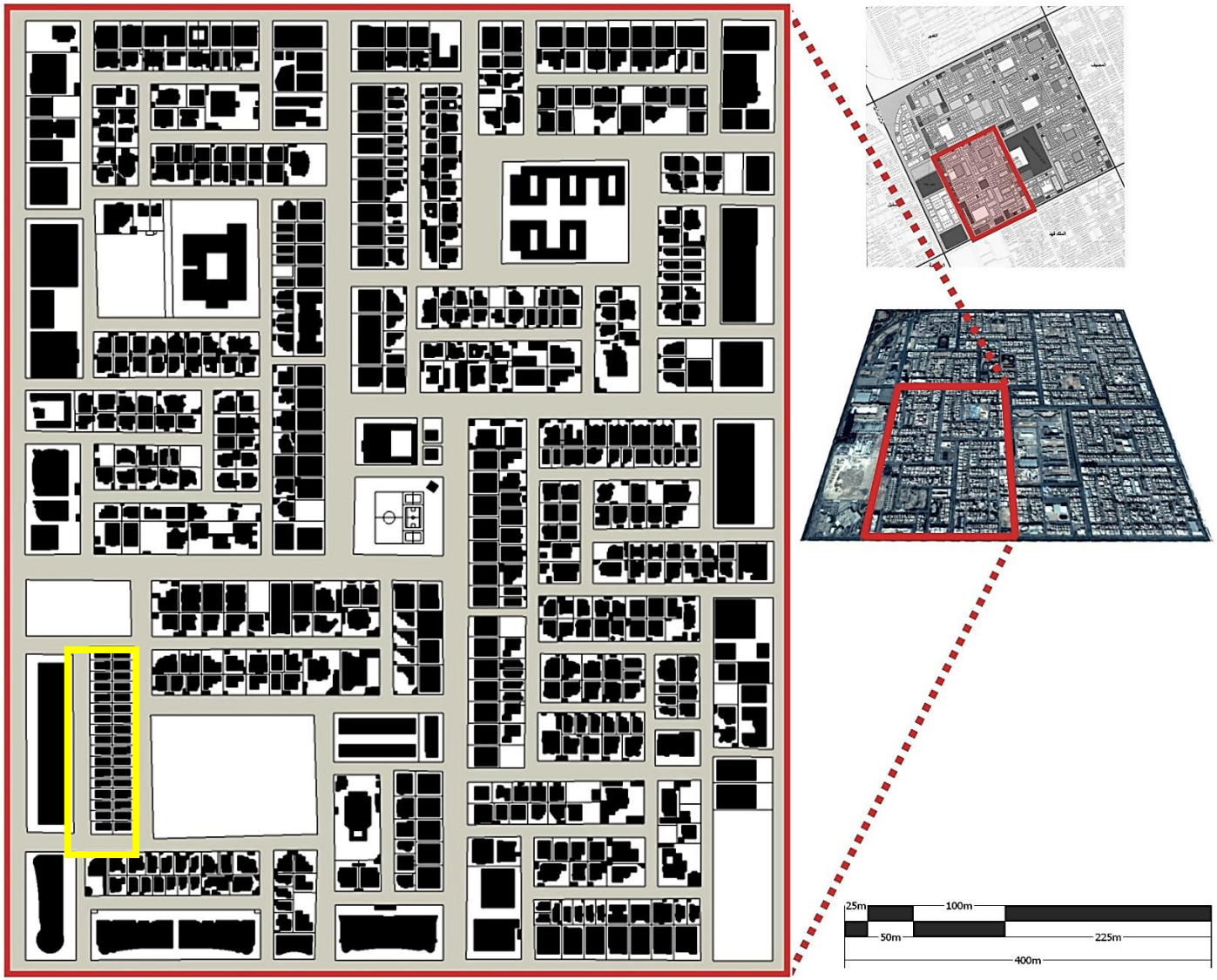



**Figure 6-6: An example of the density of building blocks in one quarter of Almoroj. The lately developed land with smaller size of 300m$^2$ villas is highlighted in yellow (Source: Author).**

Therefore, the gross population density of the neighbourhood unit in Almoroj is expected to grow up to about 108 people per hectare, while the net residential density can reach up to 160 p/h. These numbers are not far from the planned gross and net residential density for the city recommended by Doxiadis. However, still the overall recommended density by Doxiadis is more compact, as it seems that his plan prefers the use of more apartment buildings (flats) than the now extended single residential units of villas. More apartments and attached buildings would help to reach the density of the original plan, however, the current needs, preferences, cultural change, lifestyle, and privacy were given priority, as discussed in later chapters.

### *6.3.3 The Use stage*

In order to understand the subject of how dense the neighbourhood of Almoroj is from the observation and perception of different residents, the results of the interviews will be presented according to the different categories of interviewee aforementioned. To simplify the measurement of the density neighbourhood the participants were asked about how busy and congested they think Almoroj is (in both the residential and commercial areas).

The 12 men interviewees, aged between 20 and 85 years, thought that the commercial streets are much more busy and noisy than the quieter residential streets, especially during the rush hours and night time.

Most residential streets are not very busy except during the rush hours, from 7am to 8:30am and then 1pm until 3pm. Two of the interviewees, A1 (retired) and A5 (a leader of the prayer), said that:

> *"I walk regularly through the residential streets when going to mosque, 2 to 3 times a day, I have always noted that they are very quiet" (A1).*

According to *A5:*

> *"I did not find the residential streets busy compared to the commercial streets."*

This is due to the fact prayer times do not contradict with office and school times, and so obviously, the streets remain quiet. In addition, the residents do not visit shops or any other facilities during these hours especially during the hotter noon times when most people remain inside. Most distinctively, few men found the neighbourhood unit to be busy on weekends, as one interviewee, A4, a university student, said that:

> *"I shop on weekends and found many people commuting to the commercial streets. The neighbourhood unit is also busy during early hours and late afternoon during the weekdays."*

Also, A11, an army employee, said that:

> *"When I go to work I face lots of traffic on the commercial streets in the neighbourhood and it is busier on the major streets on the edge of the neighbourhood."*

It appears that the majority of residents do shopping on weekends and use the commercial streets for coming and going, hence these streets are the busiest. What adds to these already busy streets is the goods delivery to the different markets in the commercial area, particularly in the early hours of the day. This increases the traffic density on the commercial streets. The interviewees also identified Almoroj as a highly dense neighbourhood in major streets on the borders, because the residents, workers, and visitors use these streets for many different purposes. These include commercial 'shops', the governmental offices, and others administrative services like the 'Saudi Airline' offices, which are all open only on the major streets within the city (on the borders of the neighbourhood). Moreover, most participants think that these business activities in the major commercial streets inside Almoroj increase the flow of people and cars, including large vehicles, even from other areas in the city, but not deep into the residential streets (see Figure 6-7, 6-8, and 6-9). The residential streets were quiet essentially at night time.

The 12 women interviewees were housewives, school/university students, and university staff. The responses of the women interviewees about density suggest that they also agree that commercial streets had high levels of traffic, were noisy, and very busy during day time. They added that, the rest of the neighbourhood was quiet compared to major streets.

B1, who is a housewife said that:

> *"The commercial area is very busy to the extent that when I go to the supermarket with my son by car sometimes do not find a place to park our car. My son had to drop me off and went to another car park."*

B10, a student in university in the neighbourhood, said that:

> *"My father drops my sister and I up from university and school. We find many vehicles on the major streets in the early hours and after school. Many of my friends and my sister's friends who study outside the neighbourhood are late sometimes because of the traffic in the city, compared to the inside of the neighbourhood."*

B6, who works in Princess Noura University, argued that:

> *"I have to be in the university at exactly 8.30am, so my husband drops me off and then picks me up at 3.30 pm every day. One problem I noted is that many vehicles in the commercial streets are supplying food and many workers were in vehicles going to work. I also noted that the commercial streets have more cars and people than the residential streets".*

B12 is a young woman, who stays at home with her mother, and she reported that:

> *"My house is near the commercial area and I hear great noises of vehicles in the early hours, these vehicles are mostly for shopping. I also noted that the situation continues till 9.00am. I also go to the commercial area for shopping on weekends with my brother. I found many people driving in the commercial streets more than in the residential streets."*

Looking at the statements above, it is clear from the repeated observations in the quotes above that the commercial streets are heavily used compared to the residential streets. What is more is that the presence of big vehicles by the residents simply suggest that there is a clear concern about the capacity of the major roads for the amount of cars and people using them. If the density of the residents of Almoroj were relatively moderate according to the aforementioned numbers then such congestions of vehicles, cars and activities would have been expected to be lower than nowadays. It was observed that the commercial activities drove many women inside the neighbourhood to the major streets, and far less in residential areas. This means there are fewer women activities inside the public spaces in the neighbourhood residential areas.

The interviewed teenagers, aged between 15 to 19 years, were all students of secondary schools or high schools and living with their parents. There were six teenagers who took part in this research. Likewise, the teenagers upheld the view that the neighbourhood generally remained quiet except for the major streets at weekends. From their point of view, only on weekends the neighbourhood was busy including major and commercial streets. The major streets on the borders of the Almoroj are mostly busy. Most distinctively, C3, who is a high school student, said that:

*C3:*

> *"The major commercial streets become busy on weekends, even more than weekdays. It seems that people living in the next neighbourhood pass through within the city as this neighbourhood is highly connected to the other neighbourhoods. Another possibility is that many of the residents go out on weekends and stay more at home during weekdays, that is why commercial streets*

> *are still busy but less inside the neighbourhood. I also assist my parents in shopping on weekends and I have seen that the main shops, supermarkets, and roads are full of people of all ages."*

C4, also a secondary school student who studies in the neighbourhood, said that:

> *"I noted more vehicles around school areas. The commercial streets I have seen with many cars but not so much. The residential streets remain quiet and not many people walk on these streets. The parks are very quiet on weekdays, but busy on weekends."*

It is important to highlight the above responses of C3 and C4. Both teenagers attend school, and they are taken to schools either by a driver or elders. Both also noted the presence of vehicles at the borders of the neighbourhood and commercial streets and that there is a moderate type of traffic in the commercial streets, while the residential streets were quiet. However, C3 is less dependent than C4, as the former is involved in helping his parents, especially on weekends. The responses of the teenagers further show that the neighbourhood's traffic density is proportionately higher if compared with other similar urban areas regarding compactness, as will be discussed in the last discussion of this chapter. It was noted that not many teenagers appeared in the streets for social or other types of activities, as discussed earlier in the accessibility sub-theme.

The workers were also interviewed because they work in and visit this neighbourhood. There were four workers, two of them were residents (foreigners), whereas the other two Saudis all live outside the neighbourhood. D1, a foreign worker in the shop who lives in the major residential street where the apartment buildings in the neighbourhood are located, said that:

> *"I do not find many cars and vehicles inside the residential area, except on Friday near the mosque. I find the major residential streets are quiet as well the other streets such as streets with villas. Commercial streets are busier during the night, when most people do their shopping than other type of activities."*

D4, who was working in a bank at the time of interview and lives in the east of Riyadh, but who usually works in this neighbourhood, said that:

> *"I come every day from a different area to work in this neighbourhood. I can say surely that the city's major roads are busier than the neighbourhood. Since my bank is in the major commercial area, I found the presence of many vehicles in the early hours in the afternoon more inconvenient. I say with confidence that major streets are more active because of the different amenities and activities."*

The above responses about how busy Almoroj major streets are suggest that during the daytime, the city's main streets were busier and noisier compared to the neighbourhood unit.

Two of the workers asserted that the inner neighbourhood is quieter compared to the commercial streets inside Almoroj, but one of them noted that a lot of shops on the major streets connected to the city bring people inside Almoroj as well as to the next neighbourhoods.

The visitors were approached in the streets and open space as well as in mosques including friends who come to visit at home. The purpose of the visitors' visits was mainly social, visiting their relatives in this neighbourhood and for quick shopping. E2, who is a university teacher, replied saying that:

> *"I come to this neighbourhood more often because my close relatives live here. Since I come most of the time during the night time, I find the residential streets very quiet. Sometimes, I go to the restaurant with my family friends in the commercial streets, and find so many cars and people around. Sometimes I also visit this neighbourhood park with my children on weekends and I also find many people inside the park."*

E3, an unknown visitor, met on the street, described the neighbourhood as follows:

> *"I come to this neighbourhood for taking food from MacDonalds and shopping at Alothaim superstore. I find the commercial streets very busy with many people. I cannot comment about the parks in the neighbourhood as I have never been to one. I can say that I have visited Almoroj mosques to pray while I am here."*

Further to the above response, it is worth noting the comment of why E3 visits this neighbourhood. Some of the surrounding neighbourhoods do not have all the provided facilities, such as MacDonalds and particularly the renowned Alothaim superstore. It can be argued that people visit this area due to the presence of these kinds of unique facilities, as discussed further in chapter 9. The apparent increased density found in its major streets of pedestrians and commuters is not necessarily a true reflection of the actual density of the neighbourhood population of residents. Another significant reason for temporary densities of the neighbourhood is the fresh Market in Almoroj, for example, which is managed by Riyadh Municipality, and is regularly visited on weekends more than any other day of the week, attracting many residents and visitors from out of the neighbourhood to a market place that serves all the North side of the city. However, it becomes busier every Saturday when many private visiting suppliers come to trade relatively cheap fresh products.

The borders of Almoroj are clear because it is bounded by wide and high levels of traffic and dense streets than the major streets inside the neighbourhood (see Figure 6-8, between a. major street, and b and c, both are residential), which show a working street hierarchy,

however, the easy access to the neighbourhood through the internal residential streets and easy connections with the city drives some traffic into the neighbourhood that make it busier than normal with car traffic. Figure 6-9 below show a map highlighting the clear wider borders of the neighbourhood. From the observation, it has been noticed that the neighbourhood has many access points from all sides of the city, not only from the major streets in Almoroj.

**(a). Major commercial street**

**(b). Residential Street (Villas type)**

**(c). Residential street (in apartment buildings type)**

**Figure 6-7: Pictures of different types of streets**

**Figure 6-8: The border streets of Almoroj neighbourhood**

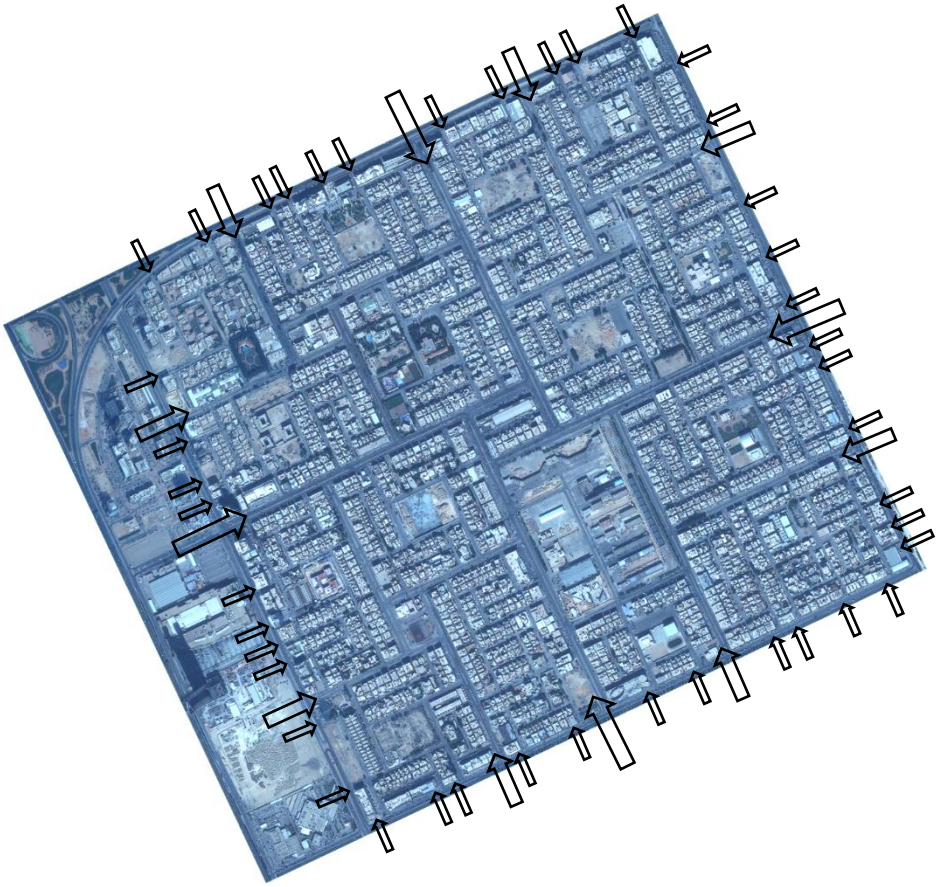


**Figure 6-9: Different entrances to Almoroj, breaking the hierarchy of streets and spaces.**

Some people drive through the neighbourhood to reach other neighbourhoods or areas in the city, instead of taking the busier major streets. Residents are often mixed with people who drive through and stop by the shops or other important facilities that are not found elsewhere, such as some government buildings. Figure 6-9 shows the frequency and diversity of entrances to the studied neighbourhood. However, as will be presented in chapter 8, the major residential streets that shaped Al-mafrokas within all community class IV seem to be less dense and with less traffic than the mixed use major streets that shape the big Al-amfroka. It appears that major streets are used more because they are designed to be high speed roads, allowing users to reach their desired destinations on the other side of Almoroj faster. Another reason is that the residential streets do not provide enough outdoor activities for residents and crossing pedestrians alike, as they are designed mainly for the use of cars, as will be discussed later in chapter 8. As the residents are not encouraged to use public spaces more often, the actual density of local people in the neighbourhood might not be apparent to recognise in the local streets and within the smaller community class parks and shops.

Finally, it is important to mention here that there is a social factor that seems to have played a significant role in the distribution of the population density between Riyadh's

neighbourhoods. In most families in Saudi Arabia, when a boy or a girl is married, the new couple usually move to a small villa or apartment, and often when all children are older and/or married only parents live in the same old house. By the time the parents are elderly and unable to manage day to day activities without a carer they then also move to either their son or daughter's houses.

It is therefore common to find that sons prefer to live near to their parents' residence in the same neighbourhood, or at least in the next nearby one, to be able to regularly visit and look after their older parents. Muslim and cultural teachings promote such socialising virtues to their children. In brief, parents remain the centre for their sons' and daughters' social lives. In return, it is believed such social factors enhance the compactness concept that lead to some sort of social cohesion, at least with neighbouring relatives.

The results from the participants also show that most interviewed residents either live in the same neighbourhood or have a family member who lives in the next neighbourhood, to remain close to their parents' houses. Some interviewees live either with their parents or on their own. At least three to four generations meet their elders and live not far away, within three to four neighbourhoods, which establishes further compactness networking measures within a cluster of neighbourhood units.

However, most distinctively, only a few of the interviewees live very close to their relatives. The reason why they do not live next door, or even in the same neighbourhoods, seem to be because of the development process of the neighbourhood, whilst in the meantime the grown children of the early residents of Almoroj are becoming older and ready to move out from their parents' houses. At the same time, they try to be close to their work because of the traffic in the city. The residents try to move into any neighbourhood in the lately developed North side of the city where their parents live. Some of the residents prefer to be close to their work since they go to work every day and visit their parents once or twice a week.

In conclusion, the population density represents more cars and not so many people, and the residents' perception is that the residential streets are quiet from cars and people, while commercial streets are busy and have car traffic. The perceptions of interviewees (men, women, teenagers, workers and visitors) and the amount of density suggest that major commercial streets show the actual density in the neighbourhood because businesses are concentrated on the major streets but it is not shown in the residential areas. However, when the population density compared to its size can be judged, according to Rogers's principles

(1990), this population can support comparable neighbourhood densities of people and facilities. The next section aims at explaining the argument behind this judgment.

## 6.4 Discussion: To what extent is Almoroj compact?

In order to discuss and understand to what extent Almoroj is actually dense and compact, Table 6-2 presents a comparison of the population density of Almoroj neighbourhood unit with that of: its neighbouring neighbourhood unit of Almaseef; the city's traditional urban core (Deerah); Riyadh city in general; the second largest Saudi city of Jeddah; the Arabic city of Crito; and two Western cities, London and Barcelona. The forthcoming figures (Figures 6-10, 6-11, 6-12, and 6-13) show examples of the compared urban neighbourhoods. These examples were carefully selected and used to support the comparative analysis. They will help in the understanding of different urban densities from different neighbourhoods with different urban forms, building types and layout patterns, along with their cultural backgrounds and lifestyles.

**Table 6-2: Comparison of population density of different cities and neighbourhoods**

| Comparable local Neighbourhoods and Cities | Population Size | Area Size | Current Density | | Future Population (2030) | Future Density | |
|---|---|---|---|---|---|---|---|
| | | | Gross (p/h) | Net (p/h) | | Gross (p/h) | Net (p/h) |
| **At the neighbourhood level** | | | | | | | |
| Dioxides Plan (1970-2000): For each unit (CCV) | 50,000 | 400h | 125 | 200 | - | - | - |
| Almoroj Neighbourhood | 33,610 | 400h | 85 | 125 | 43,225 | 108 | 160 |
| Almaseef Neighbourhood | 54,910 | 400h | 137 | 203 | 57,209 | 143 | 211 |
| **At the city level** | | | | | | | |
| Dioxides Plan (1970-2000): for the Metropolis CC VII | 1.4 M | 30,400h | 46 *inclusive<br>70 *exclusive | 200 | - | - | - |
| Riyadh city centre of Deerah traditional core | - | - | 232.28 | | | | |
| Riyadh City (Overall) | 6.5M | 129,800h ** | 50<br>89 | 238 | 8.3M | - | - |
| Jeddah City | 3.7M | 84,300h | 45 | - | - | - | - |
| Cairo City Demographics | 15.9M | 176,200h | 90 | - | - | - | - |
| Barcelona City | 1,621,537 | 10,100h | 160 | - | - | - | - |
| London City (Spencer,.*et al*, 2015) | 8.122,564M | 126,075h | 64 | - | - | - | - |
| *_Including or excluding other services such as airport and industrial areas<br>**_ Excluding undeveloped land | | | | | | | |

First of all, the numbers show that the density of Almoroj neighbourhood is, as mentioned previously, still less compact and dense than Doxiadis intended in the 1970's plans. Conversely, however, the neighbouring Almaseef neighbourhood has exceeded the original goal of population density of neighbourhood units in Riyadh. The reasons why Almaseef is higher in density than Almoroj are numerous. One possible reason is that the developed residential land subdivisions are smaller in Almaseef than Almoroj (see Figure 6-10). Though they were expected to be sized similarly at an average of 400$m^2$ during the design stage, we find now that there are larger lands in Almoroj than the minimum size limits of 400m2 found in Almaseef today. It is worth mentioning that the average family size in Almaseef is 6 members in a household compared to 5 in Almoroj, so even the same residential unit fits more people in Almaseef than Almoroj.

It is also worth remembering that the building regulations set by Riyadh Municipality assert that the heights of residential buildings (houses and mixed use apartment buildings) should all be similar around all neighbourhoods. Both neighbourhoods therefore share the same range of building heights along the local and major streets inside the neighbourhood. However, recently, as mentioned earlier in chapter 5, the municipality created a new law, which aimed at raising the building heights of some selected major streets inside neighbourhoods, from two to three and a half floors, to increase the overall densities of the city neighbourhoods. As a result, both Almaseef and Almoroj are expected to continue to be higher in density in the next decade (more than 57,000 residents in 2030, ADA, 2010b).


**Figure 6-10: Almaseef Neighbourhood**

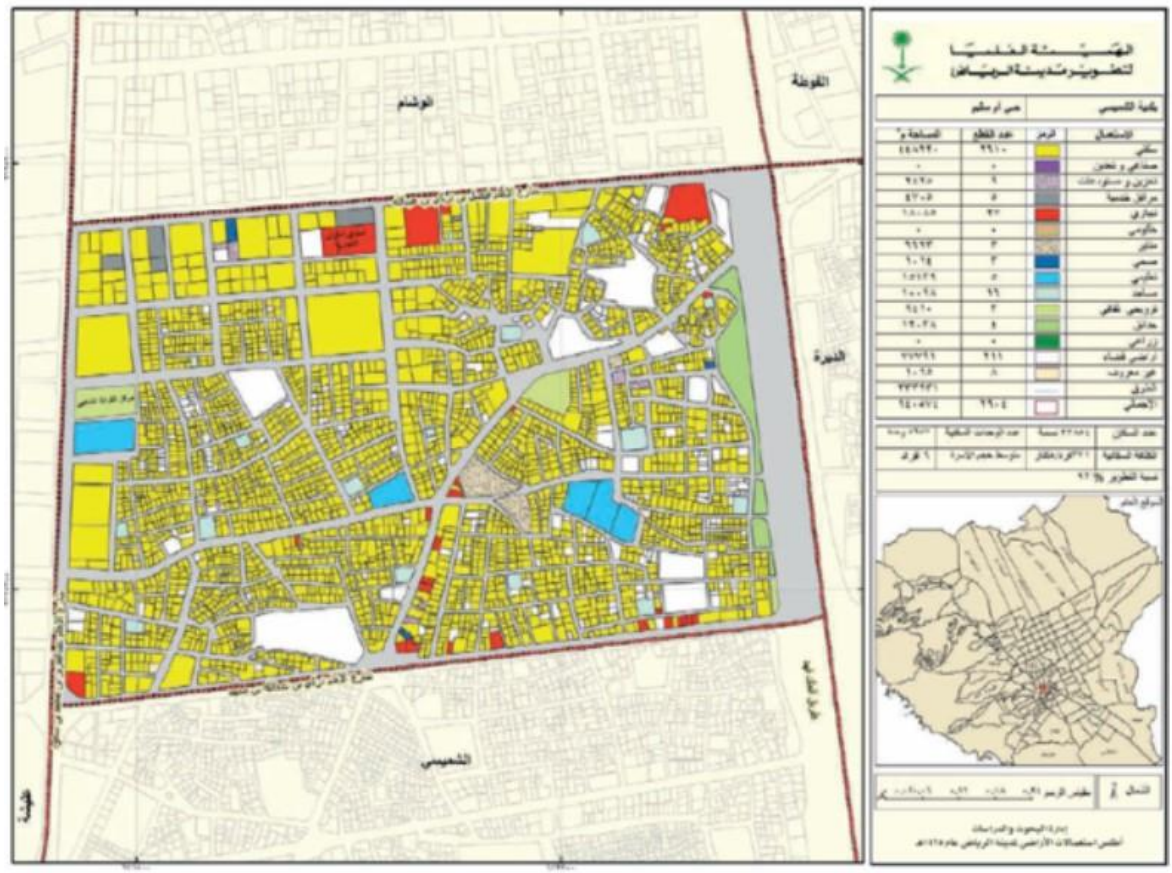
Pictures showing similar architecture and urban features to what is found in Almoroj, but the land sub-division is smaller. Residential lands with average of 450 $m^2$ compared to 640 $m^2$ in Almoroj.

It is also noticed that Almoroj is less compact than the city centre core of Riyadh. As can be seen in Figure 6-11 (a), the composition of traditional high rise buildings, many semi-attached housings, smaller average size of residential units as well as the compacted urban pattern, are the main reasons for why the urban core of Deerah area that includes many traditional neighbourhoods is far more condensed than the rest of the city (Ledraa, 2015b).

However, still the neighbourhood of Almoroj has a higher gross density of 85 p/h than the overall gross density of the city (50 p/h). The obvious reason for that is relatively large areas of undeveloped lands around the city, and also due to the fact that the major streets of the city are fully dominated by more commercial oriented facilities than residential, especially in the sprawling urban areas (the area of super blocks) off the city core (MOMRA, 2009). Am-sleem neighbourhood (see Figure 6-11 (b)) is one of the city centre neighbourhoods and it is a quarter size of Almoroj (940,574 $m^2$) with an almost similar population (33,854) and residential units (5,957).

It seems to have higher overall density than Almoroj, because of the high rise apartment buildings in the residential streets of the neighbourhood and small plot sizes, scoring a density of 371 p/h. This is not seen in Almoroj, where its internal residential streets accommodate mostly single villas on larger plots.

**(a). Riyadh city centre (The traditional core)**
(Source: Ledraa, 2015b)



**(b). Am-Sleem neighbourhood, Riyadh City.**
It is one of the neighbourhoods in the traditional core, with higher buildings and more dense than Almoroj. The pictures show the typical internal streets and urban patterns in Am-Sleem neighbourhood. (Source: ADA, 2006b).

**Figure 6-11: The urban form of Riyadh city centre.**

When it comes to the density of one of the Middle-Eastern Arabian cities, Cairo is known for its very high density and population. The overall density in Cairo is 90 p/h; however, some neighbourhoods have a higher density that reaches 350 p/h such as Mohandessin (see Figure, 6-12). One of the city's wealthier neighbourhoods, Mohandessin, is occupied mostly by upper-middle to high class income people (Hassan, n.d). Figure (6-10d) shows there are larger numbers of apparently well-designed and planned high rise residential buildings of apartments on local roads that can even reach up to more than 10 floors. Villas with no more than 3 or 4 stories dominated the area, but due to the population increase in the 1970s and 80s, villas were replaced by new denser high-rise buildings to accommodate the high population (Kheler et al., 2010).


**Figure 6-12: Mohandessin neighbourhood, Cairo City, Egypt**

A typical residential street in the Mohandessin neighbourhood in Cairo, one of the upper middle class neighbourhoods in the city, high in density with high rise residential buildings.

(Source: (Kheler et al., 2010)

When comparing the density of Almoroj with a different example form a western city, Barcelona, which is known as one of the most populous cities in Europe, we find that the gross density in Barcelona (with its overall density of 160 p/h) is almost double the score of Almoroj (see Figure 6-13). A central urban area in Barcelona, such as Eixample, covers an area of 748 hectares and reaches up to 359 p/h. Clearly, the city is composed of a compact, intensified urban form and blocks. Eixample, meaning "*expansion,"* shows an interesting urban evolution of a compact city design (see Figure 6-14).

Barcelona urban planners proposed to construct special square blocks with the size of 113.3m (372ft), the $45^{o}$ corners, and standard block layouts. The size of the block is 12300 $m^2$, which means 1.2 hectares, and the population density is 359p/h. In addition, free open space was designed for the citizens with appropriate ventilation and light systems for the plot, as the blocks cover nearly 50% of their area. The block apartments were designed for the families with mixed income level. They were built to a height that complies with the typical look and width of the street (see Figure 6-14).

However, there were a number of changes to the construction plan during implementation. First of all, courtyards were used, instead of open public spaces. Secondly, the density of the plan increased, as it was decided they would build higher and deeper buildings. Nowadays, most of the Eixample blocks have different building forms, heights, and depths, which clearly show the ordinance evolution in the past.

**Figure 6-13: The urban form of Barcelona City**

The urban form characteristic is different than what is seen in Almoroj, with more compact urban form and building density.

(Sources: Google maps (e: top), www.densityatlas.org (e: bottom)

It is interesting to mention that the average urban block size in Almoroj is 9,600 $m^2$, which is very similar to the size of the urban blocks in Eixample. However, there is evidence of more distinguished intensity in urban blocks in Almoroj. Both apartment buildings and smaller residential units of villas sometimes accommodate a higher density than the block of single larger detached villas. When looking closely at the typical residential urban block that contains only villas with an average plot size of 600$m^2$ we find that the population density is 80 p/h, considering that there is an average of 16 villas in one block, all with an average family size of 5 members per house. Yet, in the typical block that contains apartment buildings, with two and half storey buildings, 10 flats in each building, and sharing the same block with 6 villas, the population would be far higher with 280 p/h. According to Jenks and Dempsey (2005), there is a correlation between net density and the resultant form of residential development. It is clear that if higher density is needed then there is an increased likelihood of development taking certain forms. For instance, in Barcelona higher densities have evidently forced the construction of high rise structures for housing flats. This might not be culturally and socially acceptable as Saudis are not used to this type of dense high rise building, and this would be felt as too high density for them.

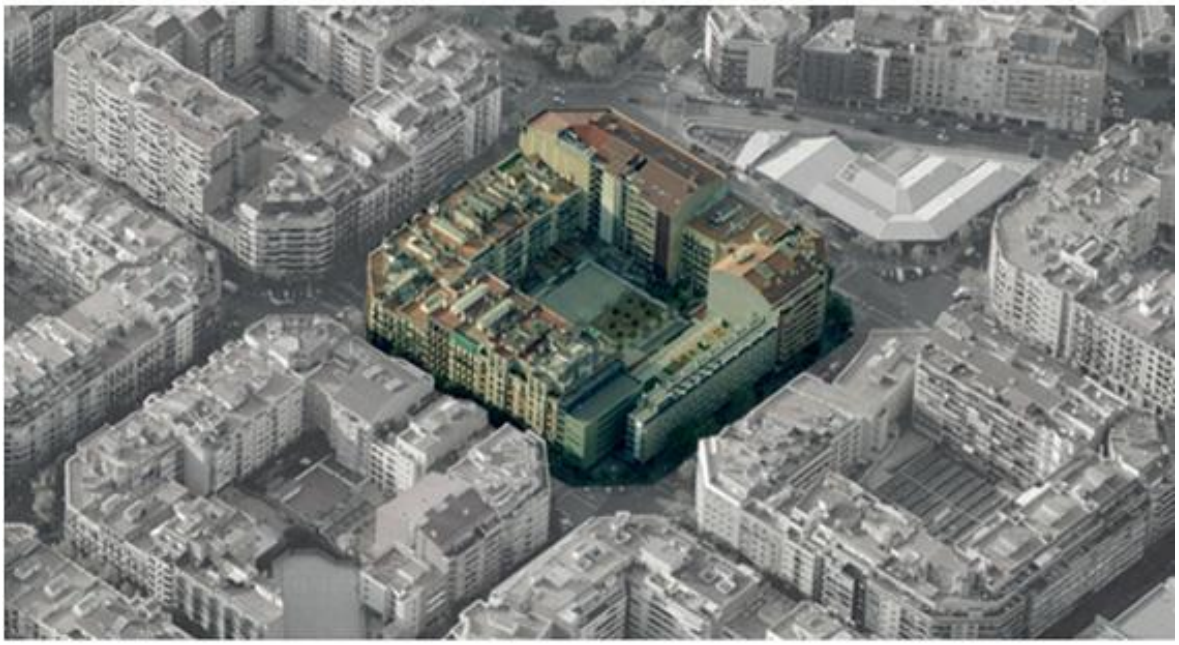



**Figure 6-14: Typical block in Eixample (Ensanche).**

(Source: Busquets, 2005,cited in www.densityatlas.org).

It was generally observed that density in Riyadh neighbourhoods had been given little significance in the past decades. The change of urban policy, such as the height and size of plots limits aforementioned seem to be the first step made by the MOMRA and RM for increasing density. This standard level of density in Almoroj and other similar neighbourhoods is not considered high and it is still socially acceptable. There does not seem

to be any claim or specific density standard that is related to environmental and social sustainable issues for these super blocks of Doxiadis. A judgement that can be made is what densities might be acceptable for future residents. Apart from the Saudi urban context, these standards (e.g. of 16 dwellings/hectare or 50 people/hectare in Riyadh) may characterize a threshold. That is, for most countries' cultures or general expectations, they may be considered to be either too low or unacceptably high (see Figure 6-15).

The concept of land intensification and densification to achieve high density is therefore recommended for more compacted urban forms in the study's neighbourhood example. Jenks and Dempsey (2005) nevertheless note that density is challenging and not a solution when singularly considered. No clear correlation exists between the standards set and style and exact form a development takes, the level of standards deemed to be high, and what is considered acceptable in diverse cultures and locations. While density represents one of the resourceful criteria employed in realizing efficiency and sustainability in land utilization, it is not without challenges. Urban researchers, including Jabareen (2006:39), recommended for more *"intensification, a major strategy for achieving compactness uses urban land more efficiently by increasing the density of development and activity,"* which in return can potentially help to achieve more sustainable urban forms. This would open up the question as to what extent the change of planning policy and building regulations in Riyadh's neighbourhoods would help to shape more intensified urban forms that are more compact in the future. In broader perspectives, since there is no unique definition for better densities in the literature, and also for now, there is little consensus on how dense the residential development should be, at least in Almoroj. Achieving more moderate to high density does not mean that the intensification of the urban area in question would practically achieve higher sustainable levels, as people might still prefer to live in low or moderate density areas because of cultural habit and lifestyle.

If the posited advantages of higher densities are to be realized, Jenks and Dempsey (2005) argue that the key is not more density standards but more appearance and style that the density might depict – the extent of acceptability of such densities and styles within cultures. This is actually true as a lifestyle choice in Saudi Arabia and particularly in Riyadh is to live in quite moderate density urban neighbourhoods with single villas and to avoid the high density neighbourhoods. According to them, it is unlikely that establishing higher-density standards will influence people's thought and behaviour or transform their views of what constitutes a beneficial, sustainable form of development to live in. Only when what is

developed shows that a good quality of life is achievable may high density be considered to work (Jenks and Dempsey, 2005).

(a)

(b)

**Figure 6-15: The density of these three storey houses were felt to be too high by many in Northern Ireland (a), A culturally acceptable density in Hong Kong (b)**

(Source: Jenks et.al, 2005)

The results presented in this chapter reveal how busy and noisy the main major streets in Almoroj are, compared with the much quieter local residential streets inside the neighbourhood because of the condensed flow of traffic of different sizes of vehicles. This is in general expected in the major commercial and administrative nature of the urban functions distributed along these main streets in the city, as they house most of the required facilities. The majority of the research participants of Almoroj residents endorsed the compactness levels in terms of many people's presence on the major streets of the neighbourhood unit. The reasons for the people to be in the commercial area of the neighbourhood differ but still the presence of various facilities in the major streets do lead them to argue that people in the neighbourhood unit cannot be disentangled or separated from the facilities, and this directly suggests support for the compactness in the community class V in this study.

However, we also show how the developed layout of the urban form directly affects many of the neighbourhood accessibility aspects of life, and then indirectly propagates more noise. These results can be compared to Oliveira and Silva (2011), who recognised that urban form openly affects ecosystems and natural habitats and creates a noisy atmosphere in the commercial areas because of the concentration of businesses.

With regards to the aspect of accessibility, in general, the early maps analysis on the accessibility measures of Almoroj showed that the provision, distances, and distribution of several services and facilities were weak and seem to affect how compact the neighbourhood is. The size of CCIVs (1x1km) may be walkable but only if the facilities are well distributed and connected.

The old urban policy of services and facilities for the development of neighbourhood units in Riyadh, issued by Riyadh Municipality in 2010, was just a simple framework that is fragile in terms of defining the exact locations and distances for the developers to use. As a result, there were no clear and decisive detailed requirements by the city authorities that could control and maintain fair distribution and more equally accessible facilities in all different community classes around the city. Also, neither the percentages nor the provision of the necessary urban facilities were strictly followed by the developers, even contradicting what was required.

Therefore, the latest developed planning policy that affected the present urban development of Almoroj (Table 6-3) was set to try to provide more practical details for the distribution of the key urban services and facilities and their catchment/servicing areas. However, there are some

more discussed comments, reported to each service at the table, which explain the current challenging situation of Almoroj in terms of locations, provisions and distances.

**Table 6-3: Comments on the latest urban policy of services and facilities for the development of neighbourhood units in Riyadh (ADA, 2013)**

| Services | Percentage (minimum size) %40 | Planning Percentage | Service area | Comments |
|---|---|---|---|---|
| | | Required Percentage | The Distance | |
| Streets and pedestrian passage ways | 25 % Maximum limit | | | No physical study of pedestrian and vehicular traffic considerations for this service during subdivision approval. |
| Mosques and its facilities ( + parking) | Local: 3000 m2 Large: 8000 m2 | 2.4 % | 275 m (Horizontal distance) | No detailed requirements for location of any mosque type. No urban design elements. |
| | | | 500 m walking distance | No detailed requirements for location of any mosque type |
| Each Primary school (boys, girls) + Nursery + Parking | 10000 m2 | 4% | 550 m | No requirements specify school locations for either gender. |
| Each Secondary school (boys, girls) + Parking | 12000 m2 | | No service area standards for this facility; siting location of this service depends on the regulator's view. | No requirements for distance |
| Each High school (boys, girls) + Parking | 16000 m2 | | 1200 m | No requirements specify school locations for either gender. |
| Public Health Centre | 2500 m2 | Depend on the Service area | 800 m | No detailed requirements for location of health centres |
| Parks + Parking | 4 % | | No service area standards for this facility; siting location of this service depends on the regulator's view. | No standard walking distances. Location is not considered within the regulation guidelines. |
| Civil Defense Centre | 4000 m2 | | 1500 m | Not required to be at the neighbourhood level |
| Police Station | 2500 m2 | | 1200 m | Not required to be at the neighbourhood level |
| Public or Municipal facilities | 2% | 2 % | | No requirements for location |

Distance optimization and locations of schools, and other functions like mosques and parks indicated that the developers seem to be less aware of the importance of walkability. In relation to the mosques, and shops, they are all within walking distance for most of the residents and some for parks and recreational open space.

Their perceptions indicate compactness in the neighbourhood because it offers functions for the residents on a good scale. However, the size of the neighbourhood is too big to cover all the residents' needs within walking distance and it contradicts the concept of Perry's (1929), and Stein's (1942), neighbourhood unit theory who initially defined the target threshold of 400 metres distance for easy walking within neighbourhoods, provided by a school in the unit's centre. The ideal distance between home and services or facilities should be no more than 5 minutes, which is 400 metres, especially for primary schools (Ewing, 1999; Rogers, 1999). Other sustainable urban form theories *"planners and scholars ask for an urban form that is easily walkable, small enough to eliminate even the desire for a private automobile, yet large enough to provide the variety of opportunities and services that constitute a rich urban life"* (Jabareen, 2006: 40). Nonetheless, the distances inside the neighbourhood matters, and it is not accessible for those who use the nearby CCIV facilities, such as parks or open spaces or when they send their children to some of the relatively far schools. In this case, some of the residents have to travel more than 500 metres, which challenges the neighbourhood's sustainability and compactness. Though our results showed that the residents have to walk or travel far for open spaces or parks for recreational activities. The parents of girls drive them to schools, which are in a different community class IV but still within the neighbourhood. It is argued that the residents who were living in the same community class IV that offers the facilities such as parks, open spaces and girls' and boys' schools have more opportunities to walk to the facilities. We found that some missing urban functions in one quarter of the neighbourhood, such as an open space and/or part, did however affect the connection to and the use of the same function provided in the other more fortunate quarter.

One strength of the design is that the mosques, schools and shops keep the residents inside the neighbourhood for almost all of their daily needs, and that this to some extent strengthens compactness. The results also showed that the majority of interviewees did not walk but used cars even though some of these facilities were within walking distances. This reality reflects very well the conclusion of Azmia (2013), who connected the desire of walking to the behaviour of the residents. The behaviour of the residents, such as preference for indoor activities, affects the social interaction between them, even though some facilities are provided in a compact and accessible way. Ultimately, data from the interviewed residents confirms the inefficient use of public spaces, and especially the streets, regardless of the provision, accessibility, and proximity of facilities and services.

## 6.5 Conclusion

The concept of neighbourhood units by Doxiadis appear to have achieved a great level of compactness. The planning of many aspects in the design stage has led to a compact urban form. The provision of facilities and services, good accessibility, and the proximity of urban functions were well-planned and connected in the original plan of Almoroj. Different types of housing forms were proposed, such as attached and detached residences, although the detached villa type predominates. Moreover, the average family size in Riyadh, which is 5 to 6 people, enhances compactness within the neighbourhood, as the density is moderate and the population density suggested by Doxiadis of 125 p/h and the density now of 85 p/h, is lower than other popular densely compact cities, such as Barcelona. However, the density standard of the discussed international cities might not be socially and culturally acceptable The accessibility of, and distance to facilities and services is clear and strong, based on the Ekistic theory of the hierarchy of community classes and sizes with a breakdown of urban functions. The hierarchy of community classes identifies the size of each community and its functions, and the distribution of urban functions within the community shows the strength of the compactness in the concept of Ekistics theory within the neighbourhood design.

However, compactness has been only partially achieved during the development stage. The original design plan was not followed and the new criteria generally affected the shape of the compactness concept on the neighbourhood scale. The lack of and distribution of urban functions within the community classes weakens accessibility and proximity. The housing design proposed detached apartment buildings and villas, and while the villa type still predominates this is a major threat to achieving a compact urban form in this context. The population density of 85 p/h is lower than that proposed by Doxaidis, which is considered sustainable in some cities in developed countries. The accessibility of parks and open spaces is poor, as they are missing in some large parts of the neighbourhood. This has led to long distances and difficult access. Some facilities such as mosques, schools and shops have good accessibility and appropriate distances. However, public schools were developed at a later stage and in some areas they are not easily accessible for all education levels without travelling some distance. Some private schools provide good accessibility and proximity even though the distribution of private schools were not planned with a strict policy for locations. Local shops are placed on the major streets, but the structure of Al-mafroka streets proposed by Doxiadis and developed by Riyadh Municipality promotes compactness, as they are within the catchment areas, and cover most of the population inside Almoroj. The weakness in the development stage is that there was no policy for the specific functions of local shops and

schools. For example, certain basic functions of shops such as grocery stores or barber shops should be provided for each community class and it is left open for businesses to decide. This might lead to a concentration of some functions for one community, which may be missing or out of reach for another. As mentioned in chapter 5, a percentage of 33% in the neighbourhood is kept for public facilities with no strict policy for some specific urban functions limiting the provision of public schools and facilities, such as parks and open spaces. Those square neighbourhoods are called commercial units (MMORA. 2013). However, this proportion of 33%, if used efficiently, could allow for a more compact neighbourhood, but according to Al-skait (2011) this percentage was inefficient.

How people use the neighbourhood and its functions are important elements in evaluating the level of compactness within the neighbourhood unit. Urban form would also be judged in terms of the use of its urban spaces. The urban form of the neighbourhood is compact to a large extent, but some missing functions slightly weaken its compactness. The analysis of interviews showed that people's use of the public spaces is very weak, with little social interaction. Most of the residents prefer to conduct indoor activities inside their houses and participate less in outdoor activities, leading to quiet residential streets. The private facilities and more room for different activities inside villas keep the residents inside their houses, which to some extent helps achieve compactness but with less social interaction in the neighbourhood. One community class IV provides for parks and open spaces; however, the residents' use of these public spaces in the neighbourhood remains limited. However, the commercial streets have high densities of cars and people, which implies that residents regularly use and interact within the commercial areas. It also shows the presence of people from other parts of the city on these main streets. Social sustainability considers aspects of community living such as intermingling with neighbours and addressing each other’s problems prerequisite for its application, which is not seen in Almoroj.

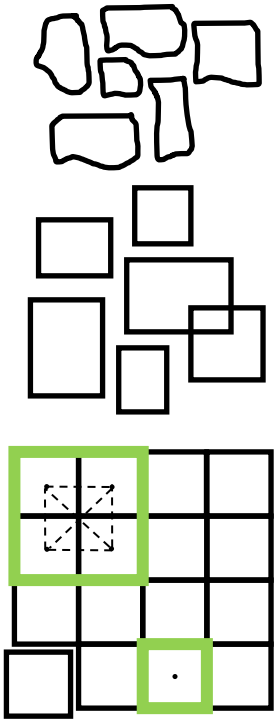
Finally, the neighbourhood demonstrates compactness to a large extent in terms of the optimal provision, accessibility, and proximity of facilities and services; expect, that is, for the missing urban functions for community class IV. This weakens the compactness, the balance of functions, and social equity. The quarter level of the neighbourhood, which is 1X1 km (community class IV), with complete urban facilities and services, proves more compact in terms of distances and size than the whole neighbourhood unit, which is community class V regarding social and environmental performance.

# Chapter 7 : Climate Related Design

## Contents

### Chapter 7 : Climate Related Design





## 7.1 Introduction

This chapter provides an analysis of the design, development, and the use stages of Almoroj neighbourhood in terms of climate related design. It is divided into two sub-themes, green spaces and thermal comfort. The first section of green spaces studies the availability and quality of the current parks and open spaces as well as the use of green spaces covered at three levels: the residential buildings, streets and neighbourhood levels in Almoroj compared with the original and developed plans. Secondly, the thermal comfort section looks at the related design considerations in the subject, also covered at the three urban levels mentioned. This will analyse climate sensitivity designs such as the orientation of the city's main streets and building regulations put in place by the designers and city authorities, which were thought to have had a direct impact on the quality of life in the case study example. The analysis also considers comfort through the efficiency of the energy consumed. Finally, the last section presents a discussion on some of the significant findings in the climate related design criterion to see to what extent Almoroj neighbourhood can be considered sustainable.

## 7.2 Green Spaces

### *7.2.1 Almoroj Green space: From design to development*

The review of the plans of Doxiadis did not demonstrate the way he considered the detailed landscape and green space design for the city, especially at the city neighbourhood level (Community classes V, IV, III, II and I). He wanted each resident to have at least $4m^2$ of green area in the city. The guidelines are presented in Table 7-1 are about green spaces, whereas the original plan negates it. As seen in this table, Doxiadis also provided clear hierarchy of green and open spaces based on the scale of the community. One apparent significant design element in the original plan is the separation of pedestrian paths from automobile, using green belts as a buffer, which permit wellbeing and alluring environmental spaces that prompt social interaction and safety for pedestrians (see streets sections Figure 5-25, in chapter 5).

The existing city structure underpins the presence of a wide range of community layouts. It appears that, community classes IV and III express very strong enunciation in all moduli. In addition, the master plan suggested separation between automobiles and rights of the pedestrians, including sidewalks as well as green spaces in the residential areas. The original plan indicated open and green spaces and further culminates leisure areas within community class V. In reality, the absence of detailed landscape design and only guidelines and planning criteria existed, entertaining spaces led the MOMRA officials to repeatedly discuss and

further ask for a comprehensive design of landscape. In fact, meticulous landscape design was not developed by Doxiadis, for instead the Doxiadis Associates primarily focused on the infrastructure of the road network of the city. The development of green spaces was not regarded as a priority to be considered at the expense of other more important features. Despite the ministerial requests, little was achieved in this debate (Doxiadis, 1971).

**Table 7-1: Doxiadis' plan for green spaces at the neighbourhood level**

| Community Classes | Green spaces (includes parks and open spaces) |
|---|---|
| Community class V | - Playing Fields and<br>- Small Parks |
| Community class IV | Small Public garden square |
| Community class III | Play Area for pre-school age teenagers |
| Community class II | Play Area for Pre-school age |
| Community class I | Small square |

The development stage somewhat undermined the environmental considerations in Doxiadis plan. Green spaces were thus not an essential design consideration amid the development stage. It was disregarded, as there was not any basic urban green methodology received. Arguably, green spaces such as parks or open spaces in the neighbourhood were left until the end of the design process, according to 33% of public services and facilities (UP2).

> *"The Riyadh Municipality was keen to provide green spaces through the planning regulations. Riyadh Municipality asked for one park and one open space for the neighbourhood, which are developed but the developers would not develop more than the two parks. This was the challenge faced by the municipality limit"* (interviewee: UP2).

Of course, Cities Planning Office (1975) did not permit the authorities concerned to by-pass the allocation of land for the services and facilities, including landscaping of green areas, which is 33%. Accordingly, the Municipal planners of Almoroj neighbourhood were restricted and hence could not accede the limits. It is worth noting that the developer's calculation of the dedicated percentage of urban services in most neighbourhoods was very flexible (UP1 and 3). Surprisingly, the authorities were tolerant for such flexibilities, and for government owned lands they were even more flexible, and in some cases the 33% target was not strictly followed. In contrast, privately owned lands are under strict law surveillance. Since private owners and developers of a neighbourhood unit, as is the case of Almoroj, notice that the government plans for the neighbourhood have a percentage of services that exceeds the limit of 33%, they would demand the authorities refund for the affected lands of

residential use, which were much more profitable in terms of the property market value during that time. This has apparently led to raising the sensitivity between the municipality and the developers in managing the design of appropriate landscaping for the neighbourhood.

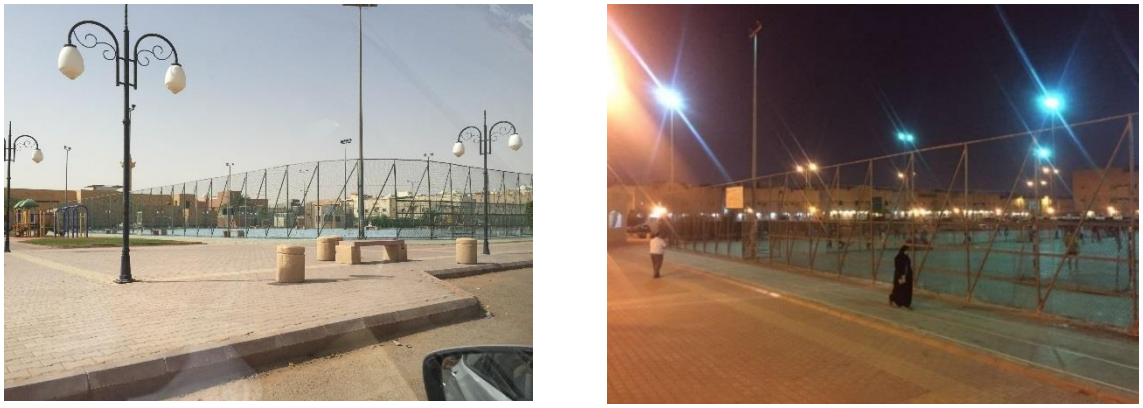
Moreover, in many cases, the municipal planners in Almoroj neighbourhood complemented more urban utilities and services on the cost of green spaces. This consequently resulted in less space for parks and green space than that which was originally suggested by Doxiadis, as will be presented later. It was noticed that the urban planners and private developers at the time began the design process with the streets, the residential and commercial land subdivision as the main priority, and then they looked into other important facilities such as mosques and schools, hence a small percentage was kept for parks and open spaces. It appears that there was some sort of unwarranted tolerance by the authorities when it comes to complying to planning regulations, and this encouraged some developers to fully exploit more residential lands, compensating for green and open spaces for the sake of quicker commercial profits. There are only two small parks as well as one open space currently in Almoroj neighbourhood unit, which is notably not an equal distribution. An interesting point was made stating that one of these parks (Bin Seidan) is provided privately by one of the key developers of the city. However, this park's location is close to the edge of the neighbourhood that makes it somewhat invisible, or not welcoming, to the residents (seen in Figure 7-1).

According to the ADA, (2004, which its land use are of Almoroj has been verified and updated by the author), the total area of open green spaces in Almoroj is 38,158 $m^2$ (1.1$m^2$ per capita). There was no precise standard for creating green spaces at the development stage of the neighbourhood level. The standard of green spaces at the neighbourhood level is 4% now in relation to the size of the neighbourhood. This percentage should be developed for new neighbourhood development (usually land of 10000 $m^2$ or more). In this scenario, for the 4 % developed that means 160,000 $m^2$ should be kept for green spaces in Almoroj and this would allow at least one park for each community class IV, respectively. Therefore, each park will be able to reach this community in a walkable distance. To reach one of the international standards, however, the standard of Health for green space, for example, states that 9$m^2$ per capita, that is about 385,000 $m^2$, should be kept for green spaces in the neighbourhood. However, it is clear that the above percentage of green spaces in Almoroj is very low compared to that of the recommended international standards for green spaces, this will be further discussed in the discussion section. Figure 7-2 and 7-3 presents the current distribution of green services in Riyadh city and Almoroj neighbourhood. Another issue refers to the absence of policy or regulation that specifies the details for sidewalks. Along with the

residential areas, green spaces and other street furniture, such as lights and greening, are a matter of private personal interest. To have sidewalks and greening in the residential areas are left to the land owner, who decides whether or not to grow plants in front of the houses, whereas the greening in commercial streets are the responsibility of the Riyadh Municipality.

Bin Seidan park

Almoroj Park



Almoroj Municipal open space

**Figure 7-1: The tow neighbourhood parks and Municipal open space**

(Source: Author)

**Figure 7-2: The overall distribution of green area in Almoroj neighbourhood**

(Source: ADA, 2012)

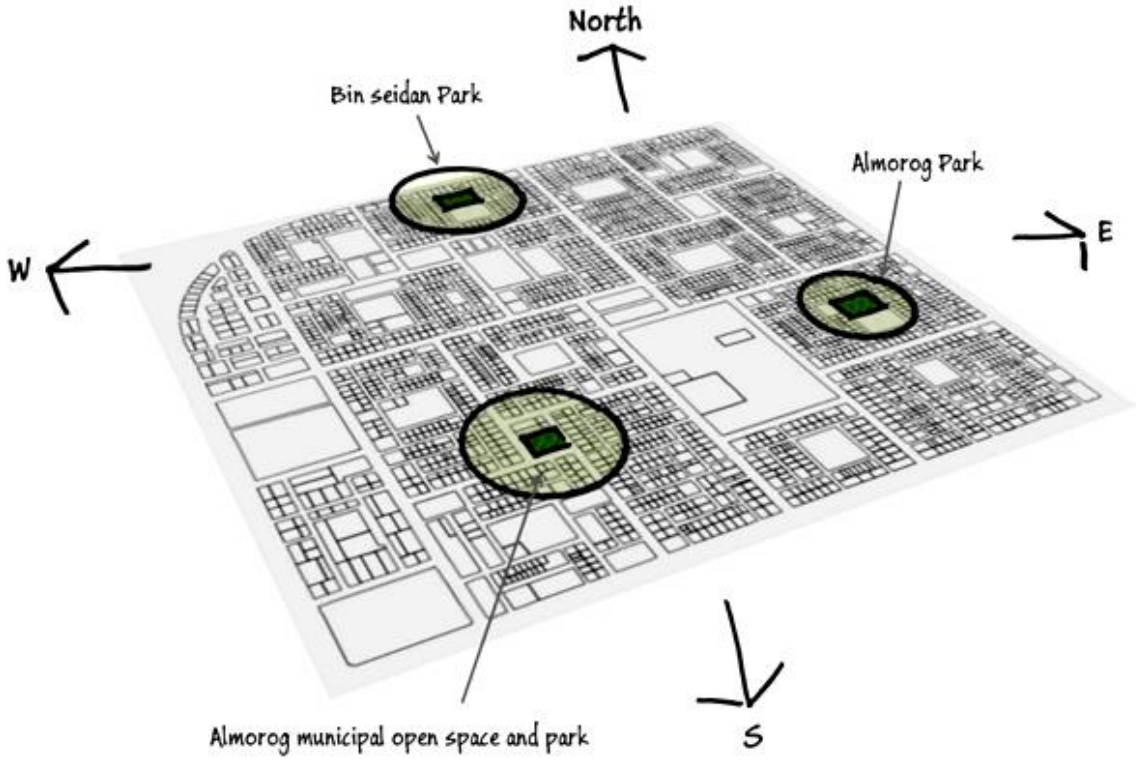



**Figure 7-3: The distribution of green area in Almoroj neighbourhood**

(Source: Author)

### *7.2.2 Almoroj green spaces nowadays (The Use stage)*

The interviewed participants were asked about the existing green areas in neighbourhood streets, parks, open spaces, and private greeneries, inside houses. The information accordingly was gathered during the fieldwork survey. It was witnessed that the most major and minor streets provided some trees, but not enough to provide adequate shading to protect the pedestrians from the threats of direct sun heat, especially in the residential area. This seems to have significant effects on the movement and lifestyle of the surveyed residents in the field.

All the men interviewees directly or indirectly described the absence of vegetation, trees and greenery in especially open spaces, residential streets, as well as commercial streets where they live (see Figure 7-4, 7-5, and 7-7). It can be established from their responses that because of lack of greenery in the residential streets, most interviewees said that they are responsible for planting trees in front of the houses and it is not Riyadh Municipality's responsibility, as there was no strict greening concept developed under the planning policy of the neighbourhood.

**Figure 7-4: Examples of sidewalks in different residential areas in Almoroj neighbourhood**

(Source: Author)

Ultimately, this was the residents' choice and affordability. Some of them found it hard to water grass/plants on the pavement in front of houses because of high temperatures, and grass and plants cannot survive because they need so much water (see Figure 7-5). Some distinctive responses A6 and A4 were:

*A6:*

> *"I planted trees in front of my houses when we moved in, and I tried to keep it up for the first three years then I got tired. The sun is really hot and I need to water them a lot".*

*A4:*

> *"I feel the neighbourhood really lacks green spaces so much that I feel we do not have any at all. To my knowledge there are two parks in our neighbourhood, but me and my family are not regular users because it is too far – [around 1 km away]".*

**Figure 7-5: The poor conditions of the few green areas available in Almoroj neighbourhood**

(Source: MOMRA,2004)

It was also evident from their answers that this lack of trees, greenery in the streets and open spaces, drove many residents inside their houses. This would obviously limit the activities in the neighbourhood unit, undermining the interaction between the local social groups. Additionally, the social border between public and private spaces is not defined, as many residents use the front space or pavement outside the houses as a private territory that should be public to make people comfortable and safe to walk through and be encouraged to interact socially in public.

In pertaining to greening in the neighbourhood unit, the majority of women participants rejected the current pattern of green spaces and trees. Of the total, just a few were happy with the current condition of green spaces, especially where a park is near and accessible to them. The other interviewees rejected this idea because they lived far from them, and only a few parks and open spaces were available. They all realize that the major streets have no trees and they do not offer pleasant conditions. They indicated that they grew trees every two years but shortage of water and hot weather does not support the trees. All the women declined to walk in the streets, while the open spaces also do not attract the women to walk there because of low levels of greenery, and it is less cool in the open spaces.

Therefore, it suggests that there were few green belts and not many trees that could cool the environment and attract the women to walk and visit. They also mentioned that some facilities in the parks or open spaces they visit out of the neighbourhood attract them more, such as catering cars for food and ice cream. The distance for privacy is a really important factor that women need in the parks among their sitting places. Many women said that trees and green landscapes make them feel more secure and private. Another reason has been observed why

the women do not go frequently to the parks or in public spaces and this refers also to the convenience of private gardens at home (see Figure 7-6). B7 and B2 said that:

*B7:*

> *"We have a park near to my home and I think it is good, however, I can tell the neighbourhood really lacks green spaces and the ones there are not easily approached, as people think there is no park".*

*B2:*

> *"We prefer to sit with a distance that we can feel more comfortable to talk and chat, and we like to have many trees in the parks or open spaces to feel the privacy".*

**Figure 7-6: Private gardens inside the houses**

(Source: Author)

It can be noted that, women who live in community class IV where the green spaces are provided seem more privileged than those who live in another community class IV where there is no provision of green spaces. Debatably, the green spaces provided at this community class IV level add more social and environmental opportunities to its residents.

It is discussed in chapter 9 that the residents of Almoroj fall into the middle class category. Consequently, it was found that many of the interviewees prefer to go and utilise the large size parks outside of the neighbourhood. When they sit on the grass and chat or have coffee, they mostly keep a distance between other users as an act of respect and for more privacy. They do not feel comfortable being in close proximity to other people, as they believe that their privacy would be challenged and their activities would be limited. Women, in particular, are highly concerned about the size of parks, as this is an important factor to enable them to carry out their different activities freely. All of them asserted that a decent distance from strangers allow them to take off their veils to eat, drink, and even to easily talk a little bit loudly. It was observed that the parks in the neighbourhood are relatively small as compared to some neighbourhood units, but only few have large parks. Large parks are mostly provided at the city level and not inside neighbourhood units. It is noticed that very few neighbourhoods have one large park in the middle such as Alwahha in the north side of the city near to Almoroj. Therefore, residents are drawn out of the neighbourhood for the few parks in the city. The quality of parks is another significant element that affects the use of parks. Some facilities in the parks appeared to influence women and teenagers' use. Women like to use parks that have enough trees to sit around for shade and privacy and often look for those with well-designed sitting places and jogging paths. They also stressed that children's games and swings encourage them to use the parks. Teenagers like to use parks that have more grass to play on and field courts to play in, for football, tennis, and basketball, as in the open space provided. It seems that the quality of parks and open space are fairly good for women and teenagers. In Almoroj, one park, Bin Seedan Park, is less used because of two reasons; its size is relatively small and its location is near the edge of the neighbourhood, which makes it less welcoming. These reasons indirectly affect the quality of parks and consequently their use.

Two of the teenagers said if there were trees in the open space, they would visit often in summer, as they sit under the trees when they visit the park. Most distinguishably, only one teenager came up with a highly convincing answer. He said that Riyadh Municipality should grow trees and create grassy fields in the neighbourhood. The teenagers asked for heat resistant trees in the neighbourhood unit. Furthermore, the teenagers knew about the

importance of green spaces and trees and the way the trees could help the climate in the neighbourhood unit, especially in the open space whether inside or outside the house.

The teenagers explained the cooling processes first and they were asked about the way to make the streets cool by lowering the heat or temperatures. All the teenagers disputed the present design of green spaces and trees in the streets because of the lack of shadows, green trees and grass so many preferred to stay under air conditioning. The participants were asked, if they were not walking in the streets, or visiting the open spaces often and only remaining inside the houses, how could they connect with the others socially. All of them indicated that they connected through social media or in house visits from friends who were in the neighbourhood. They also mentioned that they prefer the open space than the park because it has football and tennis fields (seen in Figure 7-1). The most distinguished responses were as follows:

*C1:*

> *"My friends and I only have one choice when we want to play football, which is in the open space".*

*C4:*

> *"I see many people in the parks and I feel they do not live in our area or close to my home. I only recognised that there are two parks in the neighbourhood".*

*C6:*

> *"I live in apartment buildings and the open space is close to my building. The green spaces in the neighbourhood are very little and I do not see trees or green in the streets apart from nice plants or trees in front of some houses".*

It was observed that teenagers prefer the municipal open space while children have a preference for the public parks because of the provided playgrounds. It was also noted that, the green spaces encourage the teenagers to play and a lack of spaces may therefore discourage them from playing. In addition, it was noticed that the community class IV where the open space is placed in the middle of it is more vital and liveable than the other three CCIVs.

The worker interviewees' responses suggest that growing trees in front of the houses or even inside is not that simple, as every day each newly grown tree must be irrigated or watered, which is not possible for some of them. However, the residents do like to plant plants to make

the spaces attractive and pleasant. One worker reported that the company where he works plants trees around the building to attract and please their customers. He works in a bank and it seems that they plant them just because they care for the customers. The other one said that the company does not care to plant trees or beautiful greening in front of the building. The non-Saudis asserted that the green spaces are not enough, especially the trees in the residential apartment building streets where they live and the parks. D3, a non-Saudi works in local shop stated that:

> *"The residential streets where I live have no trees and so little vegetation. It seems that the owners of these apartment buildings do not want to have the responsibility for planting trees and maintenance and therefore, the streets do not look attractive".*

D4, a Saudi worker in a private company:

> *"I do not know much about the green spaces in the neighbourhood, however, the major streets lack trees. The company where I work do not care about greening or planting trees. I do not really visit the available parks and open spaces in Almoroj".*

It seems that the workers become conscious that many companies and retail shops as well as apartment building owners do not care about green spaces. It has been found that, the major and residential streets do not look pleasant for pedestrians, and the lack of parks and open spaces prevent some residents and workers from really taking advantage of using them.

The visitors argued in depth and explained that residents in the neighbourhood do not take the opportunity to socialize while they are on the shopping streets. It is further contended that since the neighbourhood unit does not offer enough green spaces to keep them longer in the public spaces, people do not tend to get involved in any of the activities. They remained certain that the present way of living is enough for the residents. The visitors were further asked about the improvements in a sense that could provide chances to interact. They realized that the major streets lack trees and greening, as has been observed (see Figure 7-7).

**Figure 7-7: Lack of trees and greenery on the middle parts of the major street.**

(Source: Author)

The visitors were aware about growing grass and tree plantations outside their houses, but they also pointed out some issues such as many insects, so much watering for newly grown plants, the soil is not the clay type for planting trees in some houses' lands, and thus, they need much time and effort. The Riyadh Municipality offers to spray to eradicate the insects twice a month or as per the needs of the season. However, this does not seem to be enough, as many users do not grow plants that at least protect from the sun heat. Interestingly, two visitors said:

*E1:*

> *"I visit this neighbourhood just for the open space to play football with my friends and it is the only place we know around and the nearest one. My neighbourhood does not have one".*

*E4:*

> *"This neighbourhood does not attract me in terms of green spaces. It looks so dry and looks like a desert with buildings. I could not recognise the parks in the neighbourhood. It seems that they are hard to find".*

It appears that the visitors have difficulty noticed the parks because there are just two parks and they are not well positioned. In addition, the weak landscape design in the neighbourhood actually disengages the residents and the visitors.

## 7.3 Thermal Comfort

The term thermal comfort in this research refers to the residents' experience with their built environment in coping with the challenging climate conditions in the neighbourhood. It includes all the design considerations that would enhance the quality of living for the neighbourhood residents, such as: providing better ventilation while avoiding bad dusty winds, reducing undesirable sun radiation and heat during natural daylight, and maximizing shaded areas for people to walk and relax in an ecologically friendly environment.

This section looks into the undertaken design considerations for making the case study thermally commutable at three levels: 1) the building, its form and site plan; 2) the streets, with patterns, orientation, and landscapes; and 3) the neighbourhood unit in general.

### *7.3.1 Design and development of thermal comfort: The building, streets, and neighbourhood levels*

#### *1) Background of Doxiadis' Design*

It appears from the original design of Doxiadis, that the architect's perception was a general thought of thermal comfort, and accordingly, he offered the solutions in his initial plans for Riyadh city. In addition, it is acknowledged that the orientation of Doxiadis' main spine, angled slightly North-South, put in to help ventilate the city.

Doxiadis' design seems to perceive the urban structure of Riyadh to avoid direct east and west solar radiation, for example, and minimizes sand storm exposure with the aim to capture the north and occasional south– southeast breeze (Doxiadis, 1971). It is also felt that while doing so Doxiadis' orientation of the city's main axis can achieve other specific climatic, spiritual, and natural objectives for the local context (see Figure 7-8 for the analysis of the city's main axis).

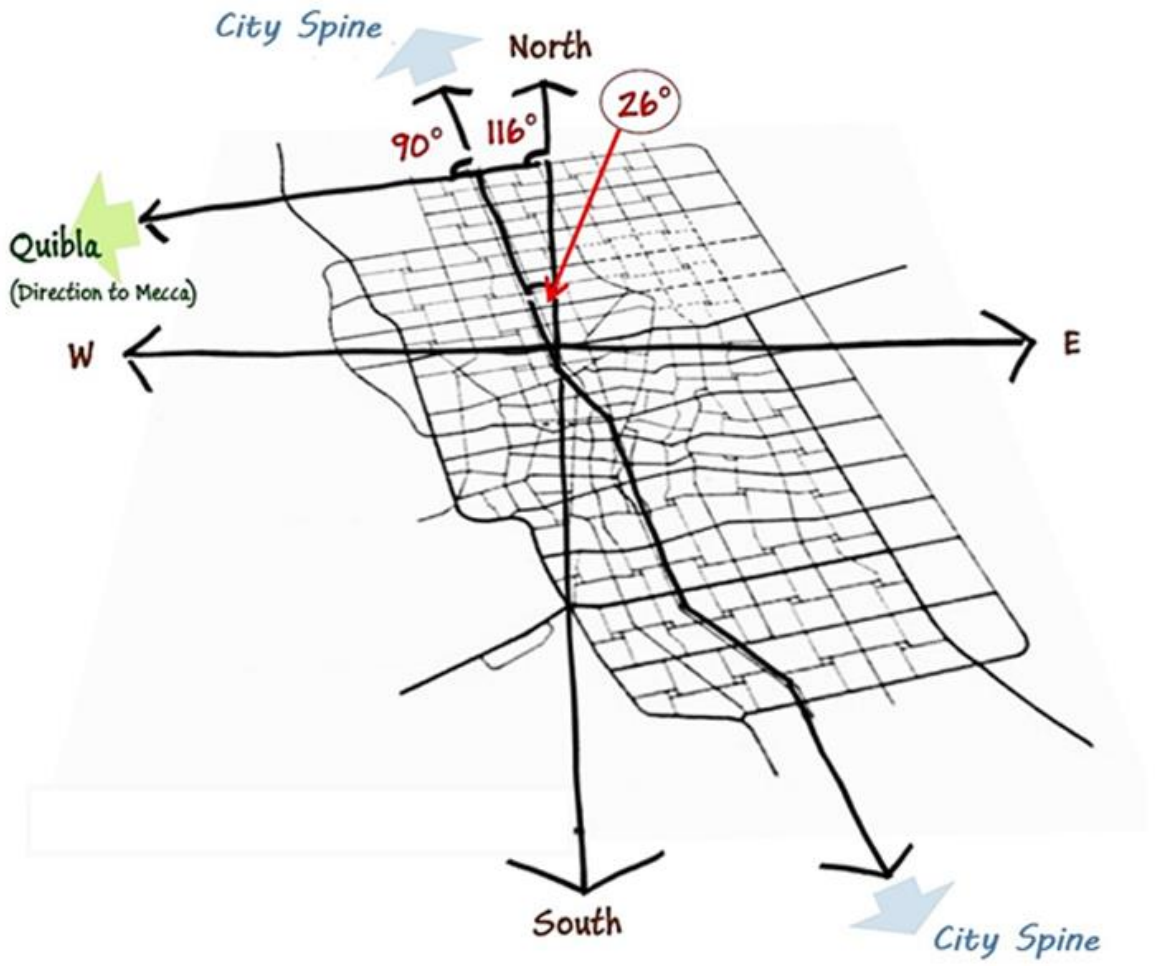
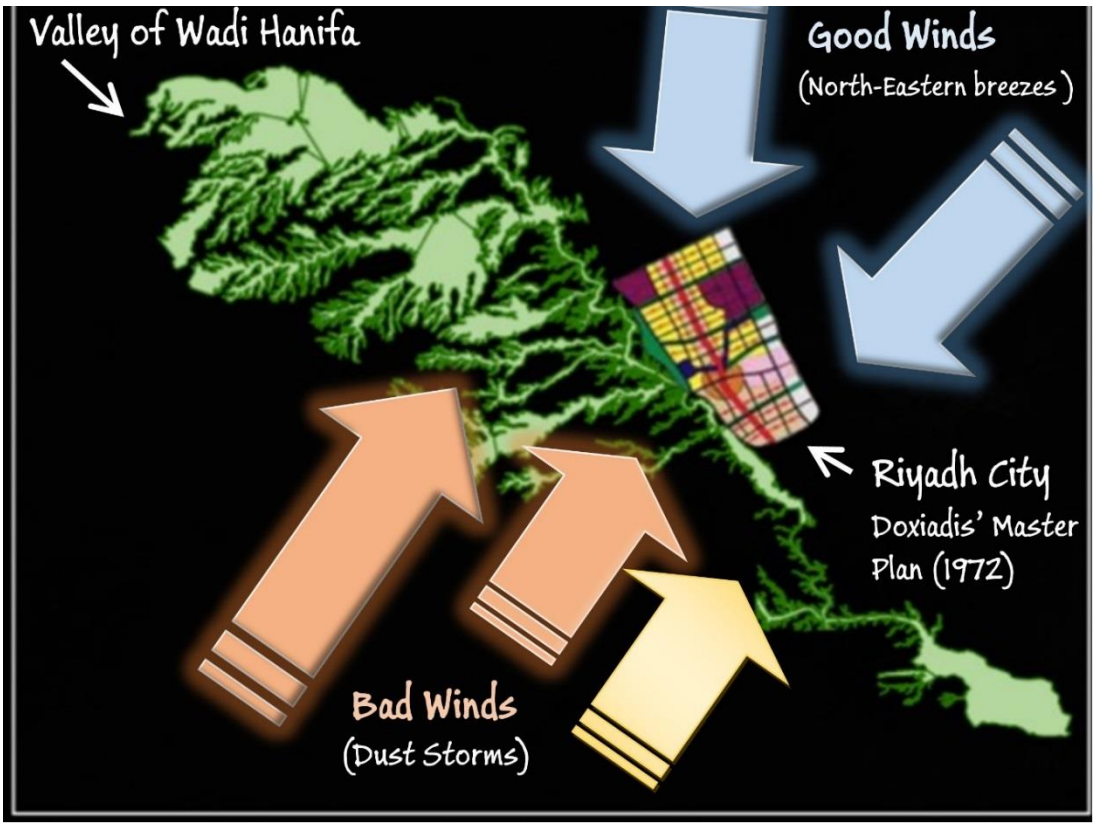



**Figure 7-8: Analysis of the city orientation in Doxiadis' original plan**

(Source: Author)

It can be seen from Figure 7-8 above that, the main spine rotates at 26$^{o}$ degrees to the West so that the West-East axis, perpendicular (90$^{o}$) to the city's spine, asserts itself and is directed towards in the spiritual direction of Mecca, the Quibla. All the mosques in the streets can easily be constructed and aligned with the city streets so no valuable lands are wasted if the direction was not in line with this axis. Also, this slight rotation of the North-South direction seems to work very well naturally and geographically with the location of the existing valley of Wadi Hanifa, which acts as a natural barrier to lessen the effect of the dusty storms coming from the south-western direction, as seen below (Figure 7-9).




(a)

(b)

**Figure 7-9 : Wadi Hanifa valley. The valley seems to act as a barrier to protect the city from bad winds (a). Picture (b) shows the configuration of palm trees to help achieve this aim** (Source: Author (a); ADA, 2013(b))

Unfortunately, there was no detailed designs in the master plan that specifies how Doxiadis considered thermal comfort in the design of the city at the neighbourhood units, streets, and building levels. However, Doxiadis set up streets, lands, and building regulation standards, which were followed partially against the spirit of the original design. The Egyptian building standards were followed by Riyadh Municipality, which were further designated as building setbacks (as discussed in chapter 5). In due course, he ultimately suggested conducting research on these aspects to make a viable built environment. This simply implies that new standards should have been introduced in the master plan by Doxiadis or Riyadh Municipality. The new standards might have reduced the pressure of sun heat and could potentially have provided outdoor thermal comfort in houses and streets.

However, for introducing new standards, Doxiadis or Riyadh Municipality might need research based information to provide standards, which simply suggests that at that time there was no such data of social and cultural values. This had limited them to introduce new measures while some ministries or local urban planners should have had the responsibility of developing a new standard for the existing building regulations that respond to the hot climate. At that time, local architects and planners were not trained enough to translate their valuable knowledge regarding urban and architectural design. In addition, there was no research conducted about building and urban materials including building methods to make the construction environmentally friendly. An urban planner UP6 who worked for more than 30 years in the Ministry of Municipal and Rural Affairs stated that:

> *"I designed three of the neighbourhoods in Riyadh city more than 30 years ago. Climate condition was not the first priority at the neighbourhood design level, and simply followed an uncomplicated urban policy developed by Riyadh Municipality while many of Doxiadis' urban guidelines at the neighbourhood level went un-noticed. Around 45 years ago, an office was set up called Cities Planning Office where we designed the neighbourhoods of Riyadh city and other cities in the Kingdom. At the building level, people design their houses individually to show diverse characteristics to show architect's responsibility. However, they have to follow the building regulations".*

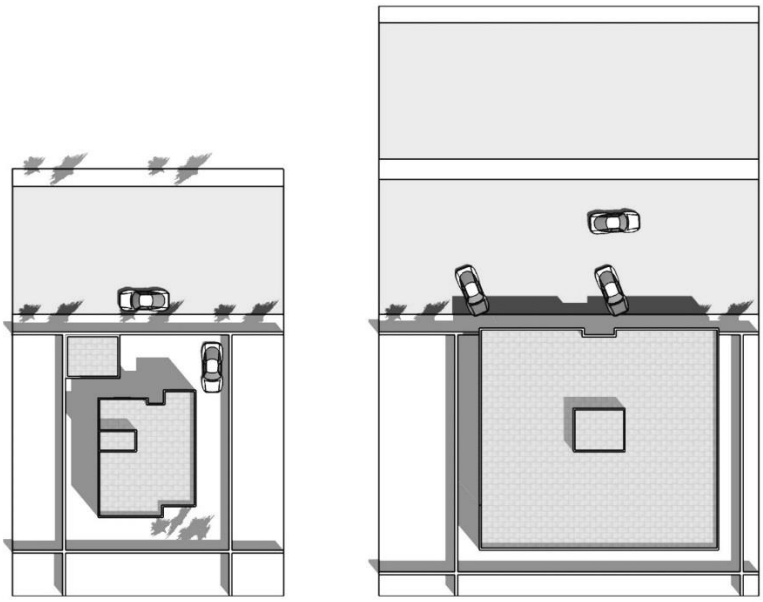
It seems that Saudi society has adopted the style of suburban life. This means that people prefer to have cars and villas with private garden lifestyles. Indoor social facilities at building level (housing) become a significant factor in designing neighbourhoods. This, therefore, has led the authorities to ignore many social and environmental considerations such as open spaces, friendly sidewalks and orientation of streets and blocks. Some of them believe that

designing wide sidewalks with trees along would be useless, as people would not use them efficiently. Also, the cost of the implementation was a matter. According to the urban planners and architects, the developers who are the owners believed that having many open spaces and parks would not bring enough profit (UP5). Therefore, they have affected the development of the neighbourhoods and they do not utilize parks and open spaces as an urban feature for their developments. This contradicts CABE (2005), which states that quality parks and public open spaces raise the value of lands. It is believed that successful green spaces have a highly positive impact on urban communities. Also, the functions of their ecology include the application of sustainable drainage, they provide a better microclimate, shade, air filtration and enhance biodiversity (CABE, 2005), all of which have not been undertaken in the latest developments of the green spaces in Almoroj.

***2) Thermal Comfort at the Buildings level***

Doxiadis' wide-ranging design allowed for clear physical guidelines for the building forms and regulations, as discussed in chapter 5. However, it was up to the municipal regulatory bodies to set the precise framework that shaped the current designs of buildings in the city's neighbourhoods.

The residents' buildings found in Almoroj neighbourhood have been constructed mainly as two different types (Figure 7-10), detached two storey houses (villas) and two to three storey apartments (flats). The typical average size of villas is 500 to 600$m^2$, whereas most of the flats range from150 to 200 m2 in average size, with 10 to 14 flats in one apartment block of an average size of 600-800$m^2$ (see Figure 7-11 and 7-12).



Detached house unit (villa) Block of apartments (flats)

**Figure 7-10: Site plans of the two different types of residential buildings in Almoroj neighbourhood**

(Source: Author)

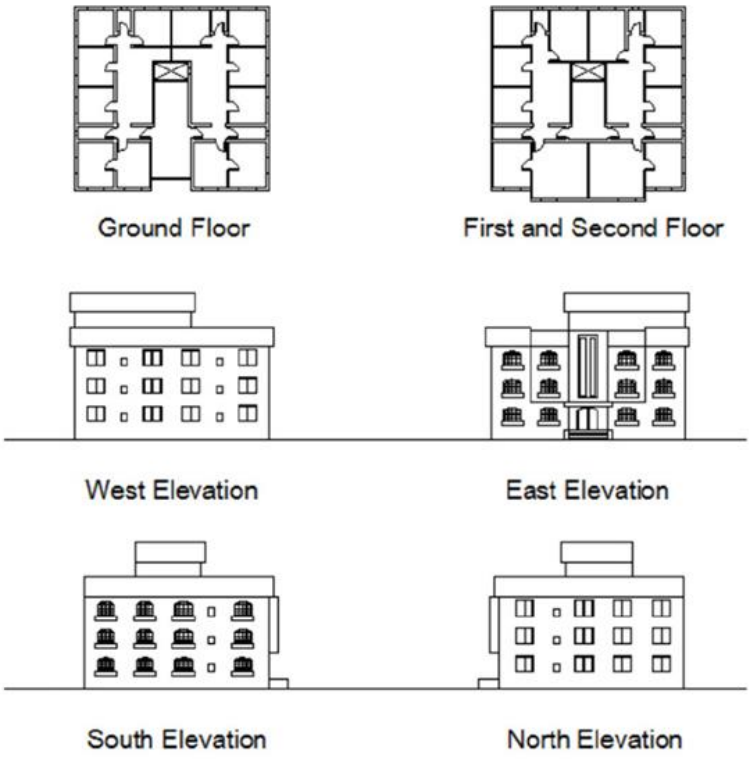



**Figure 7-11: Design layout of typical apartment building in Saudi Arabia, and Almoroj.**

(Source: Taleb and Sharples, 2011)

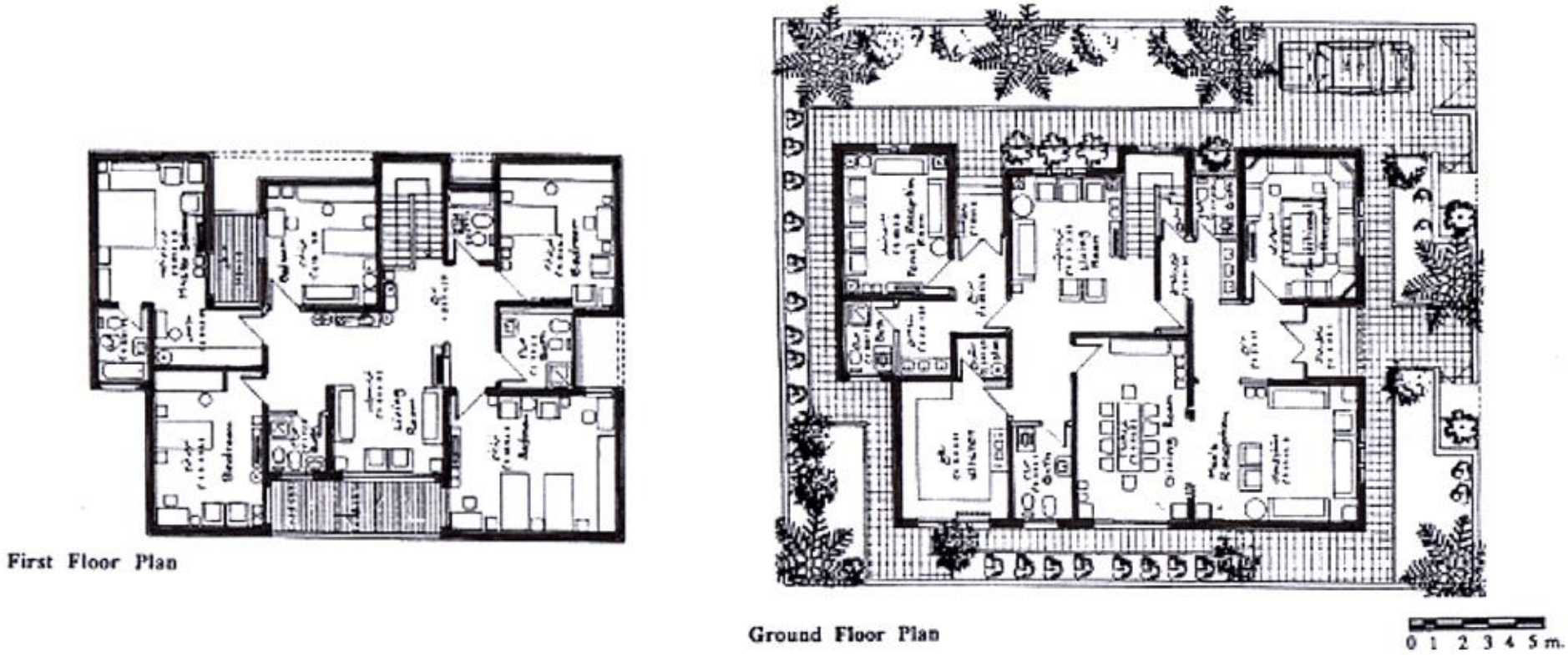



**Figure 7-12: Design layout of typical average detached house building (villas).**

(Source: ADA 1986, cited in Bahamam, 1998)

The building regulations provide prospects to build three stories maximum, including 2m for setbacks with 1/fifth of the street width being kept for setback in front of houses in apartment buildings. They can be built on the whole land after taking off the setbacks or 60% of land size. Most of the residents and buildings' owners in the neighbourhood tend to utilize the maximum limits of the land for the benefit of the building, especially in the apartment buildings because of costs and values of the commercial area. The typical form of housing and apartment building is a free standing form with a minimum space of 4m between the houses or apartment buildings excluding 2m setback. Figure 7-13 present the distribution of two types of residential units, villas and apartment buildings in Almoroj.

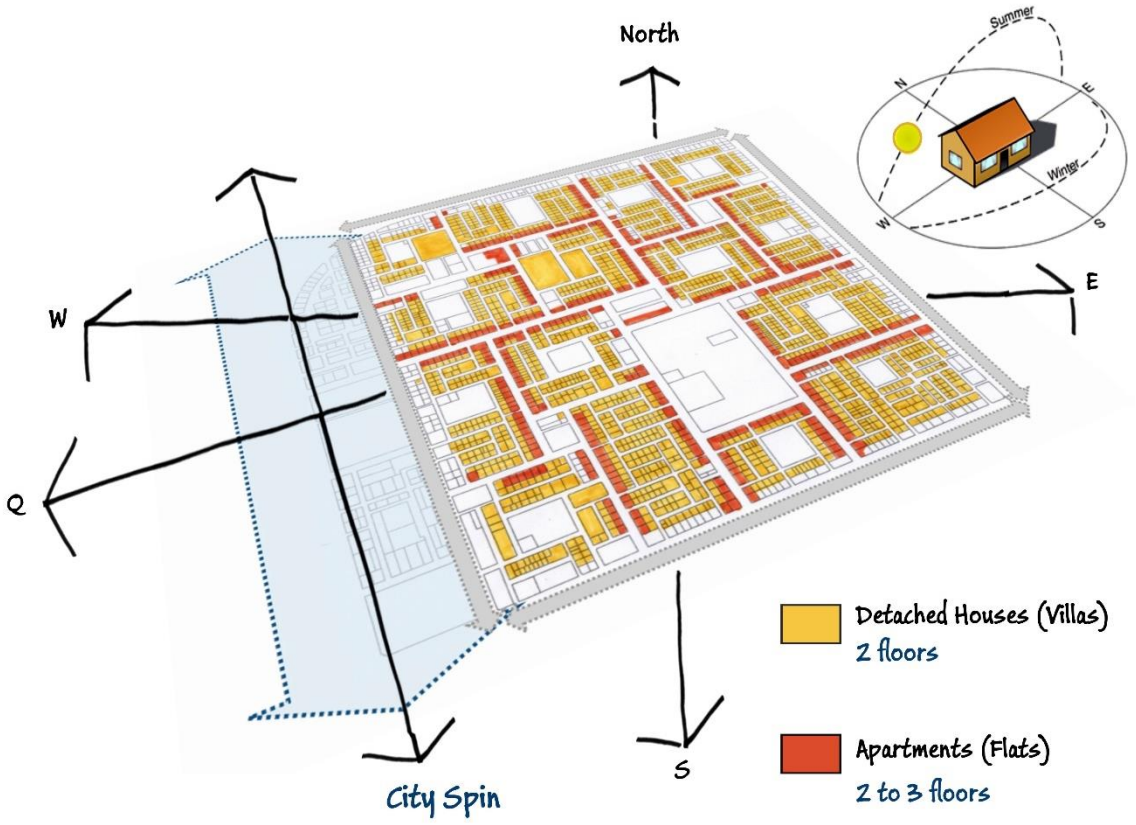



**Figure 7-13: The distribution of the two different types of resident buildings in Almoroj.**

(Source: Author)

Architecturally speaking, it seems that the streets' and blocks' orientation determine the houses and buildings' direction. Most of the houses and buildings have no architectural elements to protect them from the sun and winds as well as for shading. This may be because not all the residents are aware that you can use green spaces and trees to have good thermal comfort in the private open spaces inside the house, for instance, green roofs. Many of the free standing houses and buildings are square or rectangular shaped and are exposed to the

sun from all sides; however, they allow air flow and light to all sides of the building mass. It seems that architects who designed these houses and buildings did not consider the climate conditions. Some architects said that the climate consideration is not a priority at the design stage and the focus remains on functions.

Many residents are not aware of designing their units that suit the climate and not even at later stages. It is understood that because people rely on air conditioning this makes them ignore the natural sources for cooling and architectural devices that help, for example, protecting from the sun heat. Air conditioning is becoming a big issue that leads architects to design houses and buildings without consideration of the climate conditions. Yet, architects should have the opportunity to play with buildings' elevations, orientation, and the design of the building form to respond to the hot climate conditions. This would considerably reduce the energy consumption. Energy efficiency at buildings scale is the most important issue and still needs to be researched in this context thoroughly, as will be discussed later in the chapter's discussion section. It is believed that air condition improves the thermal comfort inside the houses or buildings, but actually makes the outside even hotter. Most distinguishably, architect Arch 1 said:

> *"As we know that most of the clients rely on air conditioning, we do not consider the climate condition and obviously the design of the house is not sensitive to climate. Simple houses' main facade is always the one that faces the streets. Many clients are not asking for sensitive climate design as they care more for a beautiful form, facade, and perfectly functioning."*

It should be noted that villas are the most chosen housing type in Saudi Arabia for the local people. Hakky (2012) found 78.8% of people in the Saudi context wished to live in villas. In fact, Hakky claimed that it is "the only option available" for many people within their domains. This can be seen from the following table that shows Hakky's results and justifications (Table 7.2).

In the same context, the individuals were asked about housing types in the Saudi context:

> *"Why did you choose the 'villa' as a type for your house?" He/she will be astonished and will deny the question, and his eyes might widen from the astonishment. He says, 'What do you want me to choose? Is there another choice?' He might say your question is 'silly'."* (Al-Yamamah, Weekly Magazine, 1993, cited in Bahammam, 1998:559).

At the moment, this is the only type in his mind, as it is familiar and it has become the custom in the country. Therefore, it can be said that this is the new lifestyle of the Saudi family, and moreover, that this type of dwelling has to be accepted. Apartment buildings, where newly married or small families live, is another housing type. These two are the most dominant housing types in Almoroj neighbourhood.

**Table 7-2: Hakky's results on studying residential buildings in Riyadh.**

Right table is preference of housing types, left table is most attractive elements of the villa (Hakky, 2012)

| Preferred Type of Housing | Total | Percentage |
|---|---|---|
| Villa | 197 | 78.8 |
| Apartment | 2 | 0.8 |
| Courtyard house | 32 | 12.8 |
| House with a private yard | 11 | 4.4 |
| Other types of housing | 8 | 3.2 |
| Total | 250 | 100 |

| Attractive Points | Total | % |
|---|---|---|
| It includes a garden | 231 | 97.05 |
| Its size is always larger than an apartment | 229 | 96.21 |
| It can be designed according to individual needs | 227 | 95.37 |
| It provides enough privacy | 227 | 95.37 |
| It includes a play area for children | 227 | 95.37 |
| Bedrooms are located in a separate floor | 220 | 92.44 |
| It provides separation between guests and residents | 220 | 92.44 |
| It is socially impressive | 219 | 92.02 |
| It includes a car park | 218 | 91.59 |
| It provides a visual connection between inside and outside | 217 | 91.18 |
| It provides complete independence (ex: utilities) | 216 | 90.75 |
| Servants can be isolated from the rest of the house | 215 | 90.34 |
| It is possible to modify its design | 212 | 89.07 |
| It allows expansion | 202 | 84.87 |

In Almoroj, as in many other neighbourhoods units, most of the lands were built individually by private landlords. The design of these types of buildings is often left for landlords of the property or an investing developer. These designs have to be approved by the municipality to ensure that all building regulations (see Table 7-3 below) are met.

**Table 7-3: Building regulations in Riyadh neighbourhoods**

| Building type / Standards | Apartment buildings | Villas |
|---|---|---|
| **Number of floors** | 3 | 2 |
| **High** | 12 m | 8.4 m |
| **Front setbacks** | 1/5 of the street | 1/5 of the street |
| **Sides setbacks** | 2 m | 2 m |
| **Footprint** | Total area excluding the area of the setbacks | Max 60 % |

It was significant to realize that there are no explicit regulations that address thermal related issues for the residents in the city. Although the regulation sets the required framework for things like the dimensions for the building height, setbacks, and foot path, it fails to give guidelines for maximizing the comfortability of its users, for example, how to deal with the specific climatic conditions such as the exact direction of the unwanted winds and sun radiation in the area.

Moreover, there are several issues that are left for the architectural designer of these buildings to find a solution to, but it seems that everybody is not willing and/or successful in adopting such design solutions. As mentioned in the literature, a westernized style of villas have been adapted apparently with little consideration of the local climate. It was clear that, many residents are not aware of the importance of designing a sensitive design that can deal with the specific conditions of Riyadh.

Another possibility is that the clients are not aware of or at least even interested in adopting natural or traditional design solutions to have a climate related design that would save energy and maximize comfortability. This was proven to be the case when conducting this study survey about the subject during the fieldwork trip. Many people, as discussed later in the chapter, prefer the easy – and very wildly available – option of electrical and mechanical cooling solutions (Air Conditioning, AC). There are many reasons that come into view such as extensive use of AC, but the most vital it seems is the very cheap costs associated with its insulation and running in a wealthy oil-based country like KSA. However, Fawkes (2014) mentioned that in 2012, the current use of domestic oil was 35% of the production and asserted that by 2035 the estimation of the consumption could equal the production.

The modernization in Saudi refers to oil production that brought significant economic, social and cultural changes that affected people's lifestyle. The oil revenues improved the weak economy, and national income per capita was increased. This also provided cheap electrical energy and air-conditioning equipment. This indirectly encouraged residents to stay in an enclosed mechanically controlled environment (Saeed, 1989).

The following evidence of energy consumption measurements support this argument (Figure 7-14, Figure 7-15, Figure 7-16). These figures show rapid increase in demands of electricity from years 2000, 2005 including trends during 2009 respectively (Figure, 7-14). This simply further suggests that the building design is developed in a way that each household utilizes a lot of energy to cool the house in summer (Al-Shaalan, 2014). In addition, of the total, buildings in general consumed 80 percent of the total electricity

produced and A/C consumed more than 70 percent of building electricity and not surprisingly is being used for cooling, see Figure 7-15 and 7-16 (Alabbadi, 2013).

Concerning solutions in buildings in the Saudi context, the Saudi Energy Efficiency Centre (SEEC) found that air conditioners have very low efficiency standards. In addition, 70 percent of the buildings do not have insulation in between the walls and there is no efficiency standard of lights. The Saudi building code energy efficiency section is complex, long, outdated, and not enforced (Alabbadi, 2013).

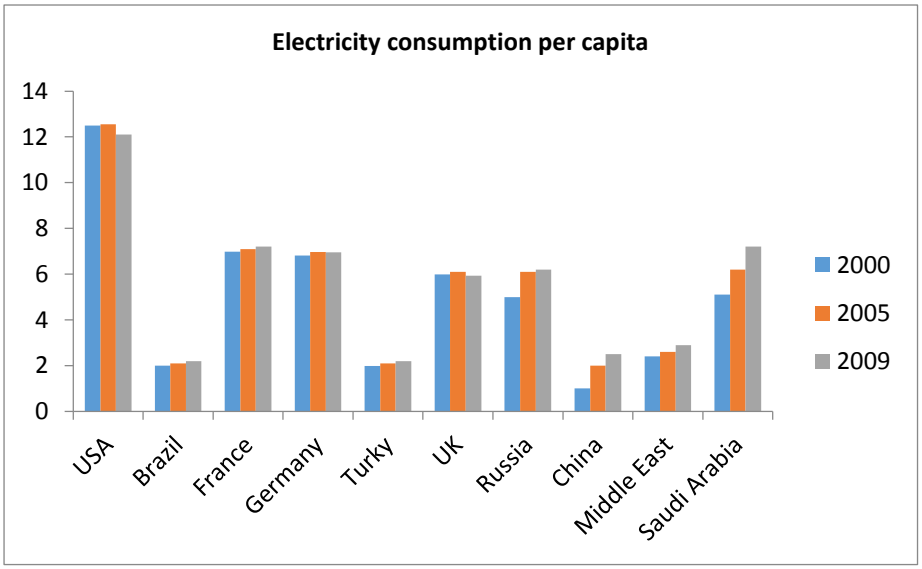



**Figure 7-14: Electricity consumption levels comparing Saudi Arabia with a number of other countries.**

(Alabbadi, 2013)

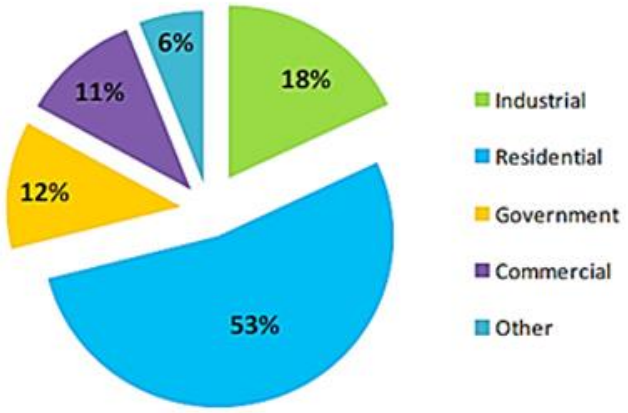



**Figure 7-15: Flow of electricity in Saudi Arabia in 2008.**

(Al-Yousef and Abu-ebida, 2012)

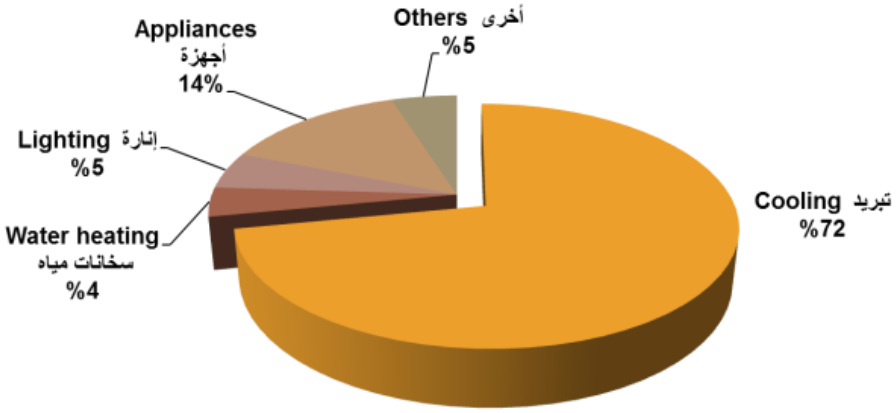



**Figure 7-16: Brakdown of electricity consumption in Saudi Arabia**

(Alabbadi, 2012)

Consequently, the energy efficiency effort focused on A/C, insulation, white goods, lighting and the Saudi Building Code. Yet, urban and building design, orientation and architectural devices for shading should play a major role in reducing the electricity consumption. Regrettably, such fetchers and devices are not convincingly visible during the fieldwork observation of many houses in Almoroj neighbourhood.

There are many common client requirements in the design of villas in Riyadh. Very often these are related to the presentation of the form and function of the building instead to make it more energy efficient. One example of such a requirement refers to temperature where the majority of residents wanted to live in north-facing houses. It appears that these houses have a good reputation because they are not facing the sun. Property that faces north is in demand, and estate agents and buyers have raised the prices of these properties accordingly. This is the only knowledge interviewee participants possessed on designing buildings for climate.

It can be said that, at the building level houses that are constructed in Almoroj neighbourhood are not thermally comfortable. The Riyadh Municipality did not set or suggest planning regulations that support the thermal comfort at the neighbourhood level including the streets, so building regulations had just obligated the basic policy for setbacks and heights. In addition, thermal comfort can only be judged between the designer and the landlord or developer (see Figure 7-17).

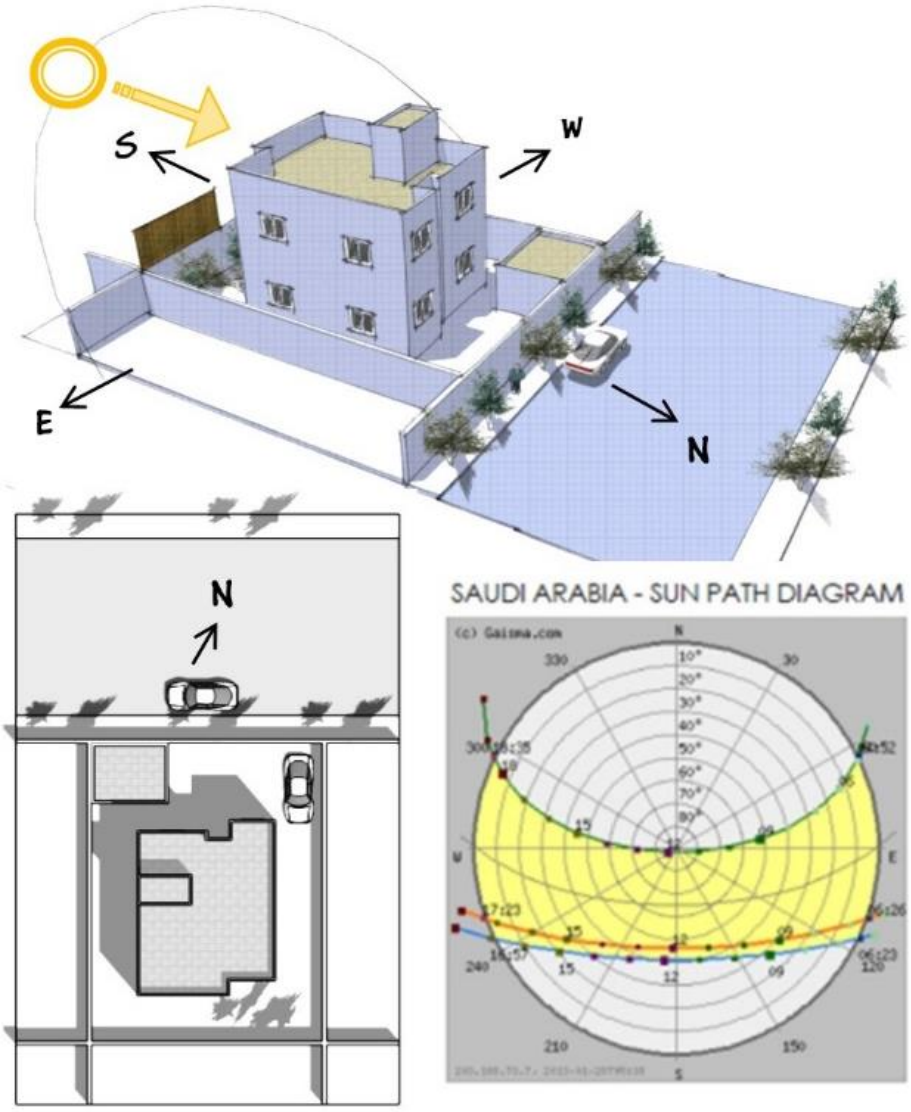



**Figure 7-17: Model of a typical villa. Showing the direction of sunlight on the building.**

Some design elements are used to provide shading and privacy at the back (e.g. tents and shadow screens). Note, sun barkers do not seem to be well-utilized (Source: Author).

***3) Thermal comfort at the street and neighbourhood level***

The pattern of streets inside the neighbourhood was kept either aligned to or perpendicular to the direction of the city main spine. This can be seen from Figure 7-18, which shows the absence of curved or diagonal lines, particularly in Almoroj neighbourhood. The street size varies in the neighbourhood, as the residential streets were kept at 15 and 20 metres, while the major streets offer 30 and 36m width. However, in apartment buildings, the streets' width were kept at 30m. The details of street width in the neighbourhood can be seen from Figure 7-19 along with dimensions of the streets as well as pavements.

The pavements in the neighbourhood streets are not kept similar, as it is distinguished between 1.5m and 2m in the residential and major streets respectively. Though pavements are meant for planting trees, there is no standard and dimensions to plant the trees. The presence of few trees in the streets simply suggests that without a plan few trees are grown, and this has the direct impact of creating poor shading in almost all the streets. This immediately links to the policy for the pavements as well as tree plantation.

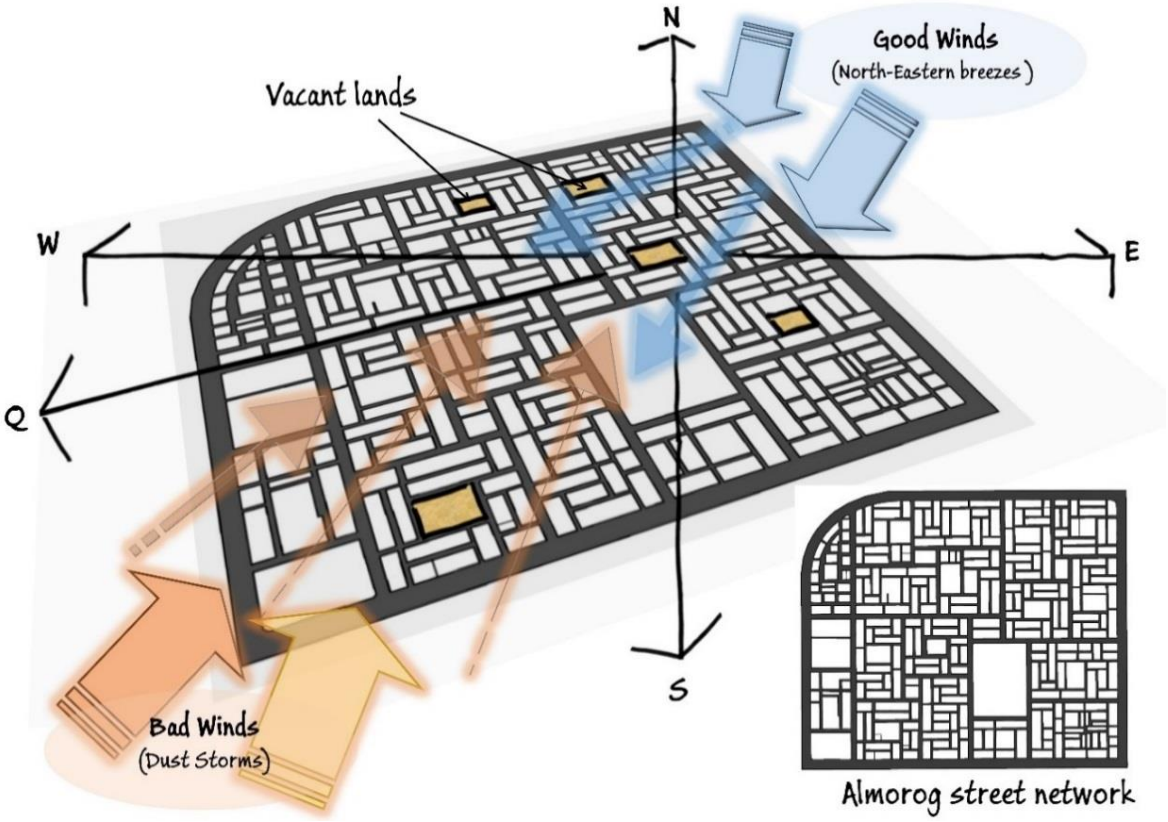



**Figure 7-18: Almoroj streets network. Illustrating the direction of good and bad winds at street level.**

It is noted that the rigid design of the street grid has no curves or diagonal shortcuts. With short heights of buildings, the undesirable dusty winds coming from the south-western side can penetrate deep inside the neighbourhood. Also, there are many vacant large lands, which make the circulation of this wind uncontrollable (Source: Author).

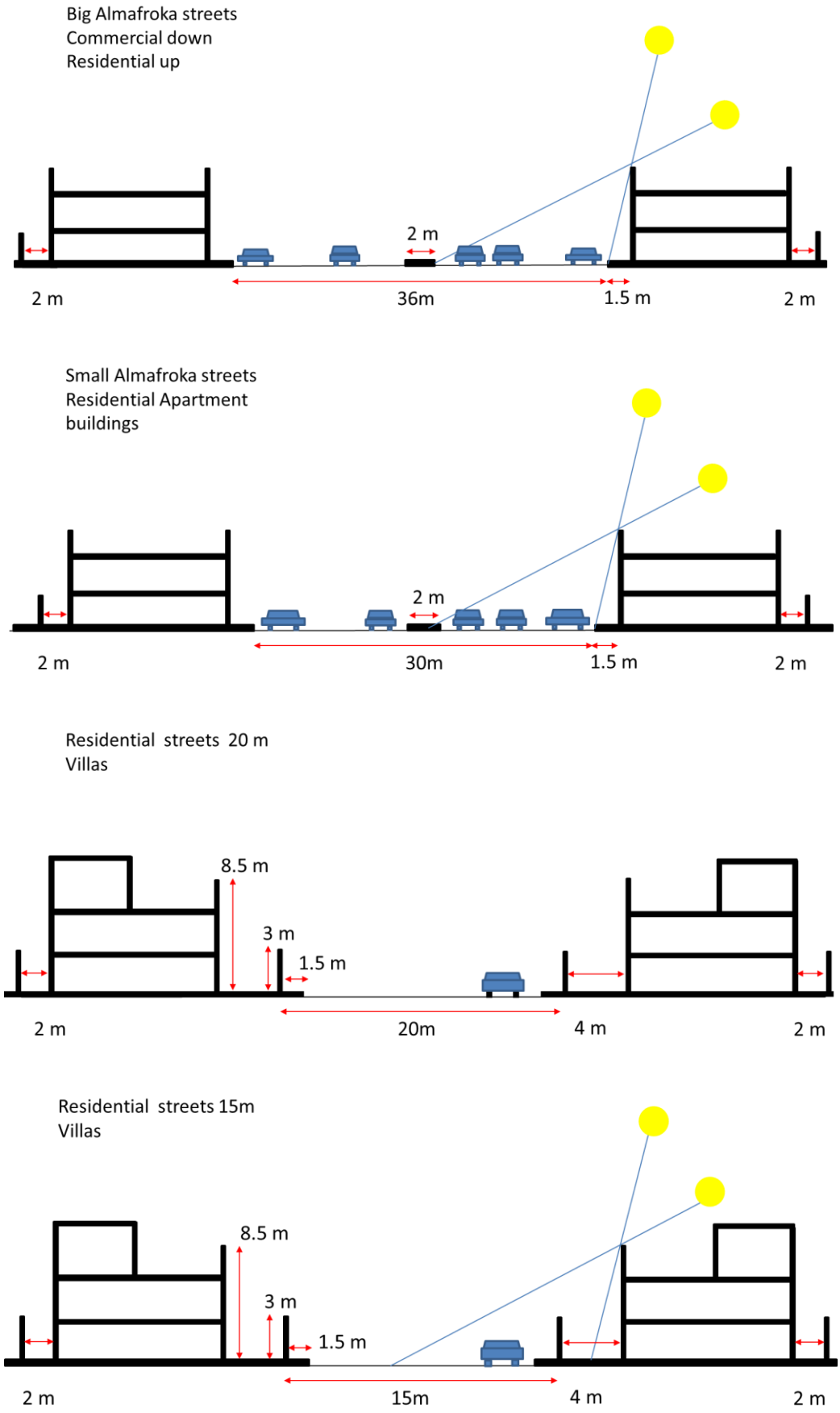



**Figure 7-19: Types and dimentions of streets and pavements**

(Source: Author)

In the neighbourhood buildings, the streets are moderately wider in conjunction with low rise buildings. This gives rise for dusty winds from the south and south-east that infiltrate in the streets and cause lack of comfort for the residents. The policy in place is not that strict, and due to the absence of strategy about developments in the neighbourhood, the dusty winds are worse, as some plots are not yet built upon, and the duty winds directly affect the residents (see Figure 7-20).

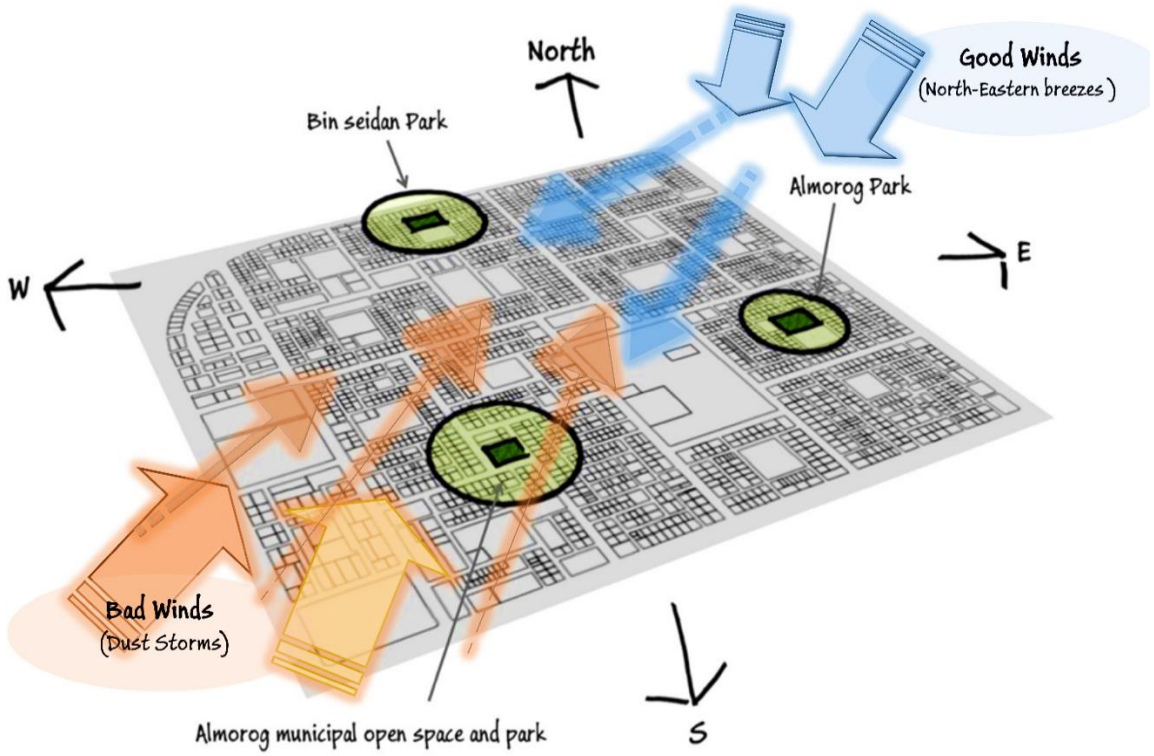



**Figure 7-20: The green areas and the direction of winds in Almoroj neighbourhood**

(Source: Author)

It was discussed earlier in this chapter that there was a clear shortage of green spaces in Almoroj neighbourhood to increase the comfort and joy of residents. It can also be argued that this will ultimately reduce the potential for achieving a better natural and ecological balance such as cooling down high temperatures, absorbing dusty storms, and reducing $CO^2$ omissions.

This research found that, many observed and surveyed people and authorities tended to avoid using green spaces, seemingly because of the early mentioned cultural and climate conditions. Thus, it might be argued that if these green spaces were equally distributed and well managed by the authorities, including the provision of better shaded areas and pathways at the street level so they become climatically comfortable, perhaps more residents would be encouraged

to utilize them more. Even if no more users are convinced, these natural spaces could still benefit the whole neighbourhood's residents. Ben-Hamouche (2013) in his research stated that wasteland is a very important urban problem that can be caused by different issues: topography of the territory, harsh climate, poor quality of the soil, and ineffective usage of the public open spaces. Adding that, to maintain large green areas, it is necessary to use a lot of water and energy that lead to unsustainable consequences, while without appropriate maintenance green areas turn to desert.

Since the super block of the neighbourhood is angled along the main spine, which is $26^{o}$ to the north-west and the internal streets are determined and straight to all directions, the houses and buildings in the neighbourhood face north-west or west-south, south-east or east-north. The houses and buildings facing north-west and south-east with streets axis east-north and south-west are not directly exposed to the sun. However, the other two directions face the sun and also the dust winds, making the residents uncomfortable. The overall height of residential buildings is between 2 to 3 storeys (8.5m to 12m), and as mentioned in Table 7-3 before, the only exception found is in the commercial units on the major streets on the border of the neighbourhood, which can exceed higher than 30m and 10 floors. As seen in the Figure 7-21 below, compact buildings have fewer faces exposed to the sun than dispersed building forms.

| **Cubes** | **Number of Faces in a Dispersed Form** | **Number of Faces in a Compact Assemblage** |
|---|---|---|
| **Number of Cubes** | **Number of Sides in a Dispersed Setting** | **Number of Sides in a Compact Setting** |
| 1 | 5 | 5 |
| 2 | 10 | 8 |
| 4 | 20 | 12 |
| 6 | 30 | 16 |
| 8 | 40 | 20 |
| 9 | 45 | 21 |
| 12 | 60 | 26 |
| 16 | 80 | 32 |
| 20 | 100 | 38 |
| 80 | 400 | 100 |

**Figure 7-21: Dispersed and compact form of building Blocks**

(Source: Ben-Hamouche, 2008:203.204)

As seen in Figure 7-22 and 7-23, the height of the buildings, the dispersed forms, and the width of the streets are not compacted enough to help avoid the direct sun heat and dust and bad winds. The transportation system in Riyadh as well as Almoroj in general perspectives is not sustainable and energy efficient. The principles of human scale solutions were entirely absent during urban spatial development, especially wide and rigid streets. The streets are not designed in such a way that all users could benefit, such as pedestrians, cyclists, and those who are in transition. This simply suggests that the street network designed in the neighbourhood supports the cars much more than the human beings. This further indicates the need to debate the urban design in Almoroj and suggests it is weak and out of line with the climate conditions.


**Figure 7-22: Residential units in the neighbourhood**

(Source: Author)

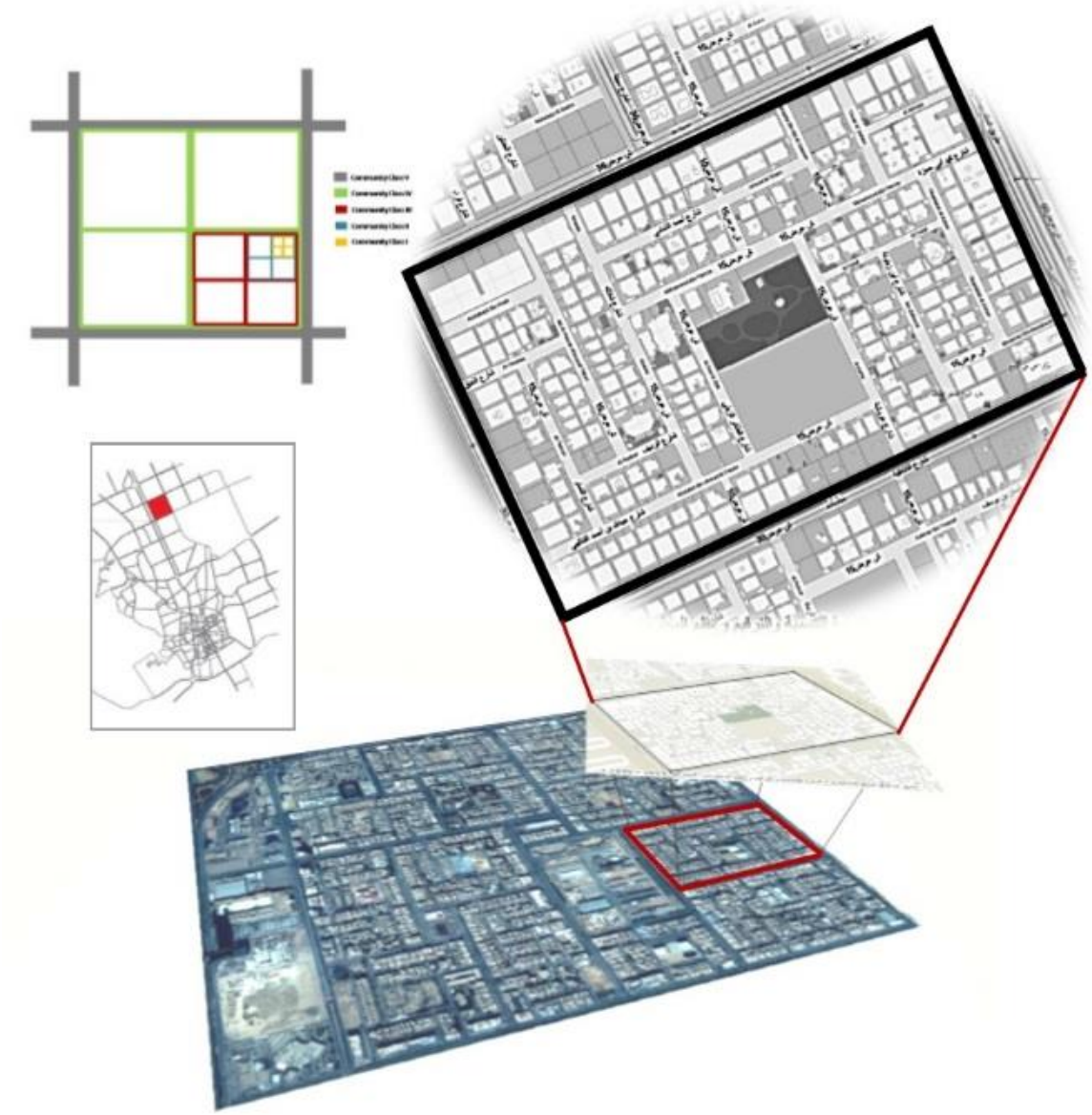


**Figure 7-23: Example of the pattern of building form blocks at Almoroj neighbourhood.**

(Source: Modified by Author from, Riyadh Municipality)

### *7.3.2 The Use Stage*

The participants responded about their experiences of thermal comfort as residents of Almoroj. As explained earlier in the thesis, this section is also organized by the identified groups of participants in order to ascertain the differences in lifestyle and social life of each group in the neighbourhood, and to gain an understanding of their perspective towards the criteria under investigation.

The men interviewees recognised the wider streets and building heights in the neighbourhood. The interviewees further acknowledged the summer heat and lack of shade in the streets as well as public spaces. If there were street shade and trees in the public spaces, this could increase thermal comfort in the streets and residents could feel better while walking in the streets, the open space and parks. Therefore, in the neighbourhood unit, the sun heat is an issue that could threaten and force the residents to consider alternate options. The reasons mentioned by the men were dust and hot sunlight including excretion of carbon dioxide ($CO^2$) from cars (see Figure 7-24). As stated by Alangari et al. (2015) in his study on Riyadh, Middle Eastern countries are frequently affected by significant sand storms. This affects the thermal comfort and people's interactions in public and even inside their houses, as it is exposed to the sun, even with air flow.

Dust winds on streets

**Figure 7-24: The effect of dusty storms**

(Source: www.arabnews.com)

The men interviewees stated that there were high temperatures because of sun radiation, especially during daytime in summer. There are four months in a calendar year when the sunlight is very strong, and this directly affects the residents' ongoing activities such as visiting the parks and open spaces, as well as walking in the streets. Still the summer is long and the rest of the summer months are hot. This was postulated by one of the interviewees, who is an army employee and described by A11 as said:

*A 11:*

> *"I walk in the streets during daytimes only when there is no high temperature. It feels really hot outside, however, night time is better comparatively. Heat is a definite reason why I am not walking on the streets".*

The above quotation in conjunction with the fieldwork observation emphasizes the importance of the comfort that some residents find in using the parks and streets at nights (seen in Figure 7-1, of the Almoroj Municipal Park and open space).

The interviewees acknowledged that the houses that are located to the North West face less threat from the sunlight compared to others. As asserted by A1:

> *"I was interested to buy a house that faces the North side because it is less exposed to sunlight. My neighbours and my relatives are also looking for houses to buy facing north or at least south".*

It is of great importance to indicate that real estates' agents also consider the direction of the houses. They had the firm opinion that houses facing North or South attract more residents to buy even though the prices are higher. Regarding housing forms and requirements, current villas satisfy the residents' desires in terms of the modern style, but they are not aware that some designs could offer them better quality open spaces inside the house. None of the interviewees conceded for different forms of housing; rather, they did not accept the old style of courtyard. A2 explained well and uniquely about his housing form as:

A2:

> *"This is the only choice left with us to use and like it. I have no clue about the sun effect on my housing form. I gave my land to an Architect to design and we never talked about the sun in the design. I do not know if it is my mistake or the Architect. What I know is that I tried to design a house facing the main facade to the street and keep the setbacks off. Actually I got myself involved in designing my house. However, I like the current housing form because this is as per my needs of room functions"*

It is known from experience that clients are involved a lot in the design of their houses. They seem to not really care about the local climate, and architects try to deliver their requirements, not forcing them to consider the environmental design. People mostly want to have a good looking house that is functional. Architects cannot only be blamed for this but also the urban policy should be involved and be strictly implemented. Nevertheless, the raised question here is: is the current form of houses (the typical villa) the solution for better environmental performance? In short, how can the Saudi villas be more environmentally friendly?

The men were very careful about privacy. Even some of the interviewees consented that they had their own arrangements for privacy in the form of hanging curtains outside on the walls that protects the privacy for the individual houses (Figure 7-25). Residents, however, do not seem to enjoy sitting in streets or the outside area of the houses (front yard). It seems that the

outside area of the house does not offer good thermal comfort and keeps people inside the separated built rooms and using air conditioning, unless parasols are used for shading. Some interviewees, such as A7, confirmed that:

> *"I feel hot in the open space outside of the house so we prefer to sit in the built room outside of the house and we use air conditioning. The privacy is important that is why every house uses plastic sheets on the walls".*

Plastic/steel shutters used for privacy (Front side)

Plastic shutters used for privacy (Sides)

Use of high walls for privacy of houses (surrounding walls)

**Figure 7-25: Maximizing privacy solutions in detached houses**

(Source: Author)

It is not only the sun that can affect the temperature of the outside spaces of the houses but air conditioning makes it uncomfortable especially when they are on outside walls that face the private open spaces of the houses. Due to hot weather and high temperature, the women participants in the majority did not feel comfortable in public spaces, especially streets during the daytime and, they do not feel safe walking in the streets at night for safety reasons. However, we still can find a few women residents utilizing some public open spaces and

parks, as seen in Figure 7-1, and they feel more secure with other people and/or in the company of other family members. In the day, it has been observed that the women sit under trees that make them feel cool and private. Regarding the relationship of the women with their streets, the responses were simple; all of them accepted that they never use the streets for any activities, due to privacy issues and the heat during the daytime. All of their needs were met from the present housing forms, and only one interviewee reported that she wanted to move around in the residential streets from the apartment building and the reason was that there was no private space outside apartment buildings and hence, it was more difficult to get some fresh air.

The current housing form does not protect privacy, nor does it protect from sun or dust winds, as all the interviewees emphasized that they had their own arrangements for protecting from sun and bad winds as well as their privacy. This was described by B7 and B11 as:

B7:

> *"Our house gets direct sun and it gets very hot in the front yard. When the weather is dusty the open space inside the house gets so sandy. My father uses plastic sheets on the walls to protect our privacy and somehow protect from the sun".*

B11:

> *"We have so many trees in the front yard and these trees protect us from the magnitude of sun heat. We feel better as trees provide shelter to some extent. We have parasols so if we want to sit outside we can be protected from the sun".*

Since women were unable to drive cars, their relationship with the streets was entirely different than the men. When asked about their relationship with the streets, two of the young women said they are always in their cars when they leave their houses so they are not street users. However, the rest of the women interviewees asked for sidewalks so that they could better develop a relationship with the street, and they complained about the lack of shadows in the streets that prevented them from walking. One of the interviewees, B5, responded by saying:

> *“Our streets are not comfortable in terms of the temperature and obvious attraction. I can confirm that the day is hot and night becomes cool, but they are discouraged because of the design. I prefer to walk in the daytime but I have to go to nice sidewalks with trees because they calm the high temperature. I would walk to the park or the shops if the sidewalks were beautiful.*

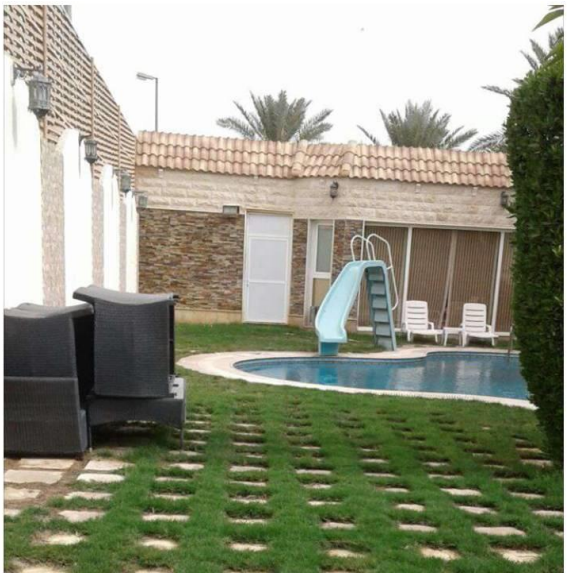
About the privacy wall, the interviewees offered their arguments in another way. In the Saudi culture, privacy of women is highly demanded, so each house has its privacy arrangements, and there are concrete walls with 3m height around every house that protects the privacy (See Figure 7-26). Some houses use plastic fencing on the top of the concrete boundary walls for more privacy from neighbours next door or for protection from sunlight. The form of the houses does not meet the privacy and thermal comfort needs. Concerning suggestions about improving the streets and housing form, the women interviewees postulated that since the streets are wider, therefore commercial and residential streets must offer not just sidewalks but more shaded public space and pathways for pedestrians. Such an atmosphere, they claimed, would encourage women to walk more on the streets. Also, as Jacobs (1961) said, this atmosphere provides more eyes on streets, thus more safety. This, in their opinion, would help reduce car use and drivers would drive in car lanes more carefully, making the roads feel more private and safe.

All women participants were serious about changing the typical form of housing and they wanted to have new forms, but they still desire the villa style. Women and children mostly do their activities at home, usually in an indoor private open space in their front yards, than using the public spaces provided in Almoroj. However, some of the residents do not use these private spaces sufficiently. Most of them use this space but it is exposed to the sun's heat and they do not feel comfortable so some of them use parasols inside to protect from the sun (See Figure 7-26).

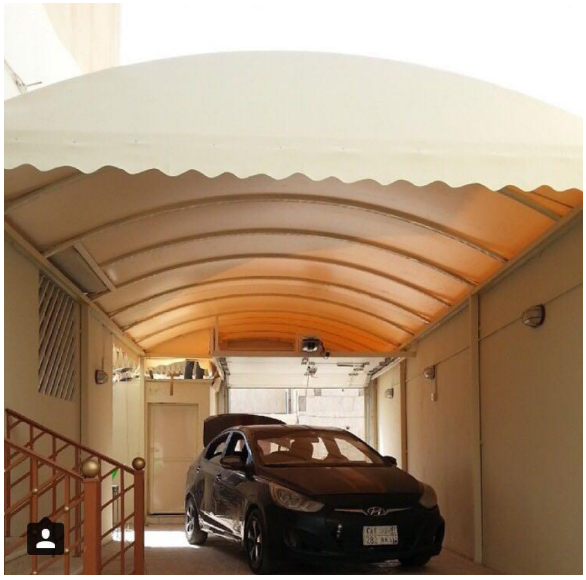
B12 argued about the idea of setbacks:

> *"I feel all our houses look similar and I realized that most of the houses have narrow setbacks. We do not use these setbacks for a particular purpose. I like my uncle's house because he has a wide setback in the back of the house and they use them for social gatherings with family. The environment of his house attracts the visitors and family members".*

The quality of spaces is indeed important. The idea of the setback in Almoroj seems to be weak because of the quality of using the spaces in the setbacks. Many residents built their houses to the maximum limit and left 2m as setback based on the Riyadh Municipality regulations. One of the issues that has been observed is that people use the setback in the back or sides of the house for different functions, but sometimes these spaces were left unoccupied. They use them as a storage, outside covered kitchen, room for sitting, and room for the maid. So, some of them seem to be useless, thus considered as a weak space both socially and environmentally (see Figure 7-26).

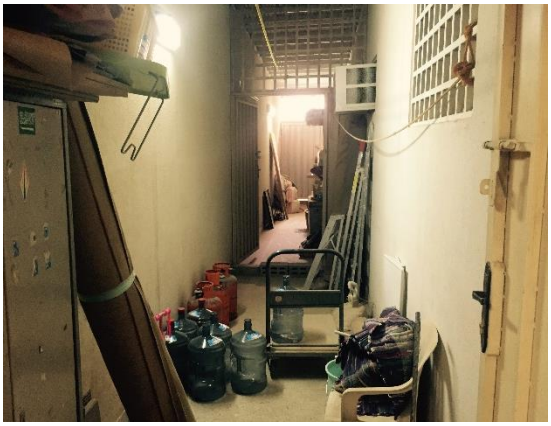


**Open backyard used for social activities**



**Parasols covering a setback used as a garage**

**Unused corridor (side setback)**



**Corridor used for storage (back setback)**

**Non-functional small garden inside a house**

**Side setback used as a small private garden**

**Figure 7-26: use of setback spaces inside some detached houses**

(Source: Author)

The teenagers' reactions to various questions were not surprising, as their responses were in light of their experiences, as being the residents of the neighbourhood unit. All the teenagers understood well the question about sunlight, and they found that during hot summers their houses were exposed to sun that forced them to do fewer activities in the front or back yard or in nice weather or at night. In addition, teenagers complained that they were unable to go to the open space or parks in hot weather. All the teenagers further maintained that their front gardens were very hot during summer.

Two of the teenagers just accepted their houses satisfied their needs, as, they explained, they used some architectural devices for shadows. However, one stated that, as he was living in the apartment buildings, his needs were not met and the reason was that his family did not let him go out at nighttime and in the day time it was too hot. Regarding improvements in the streets, some of the teenagers asked to have some sitting places outside their houses in the neighbourhood. Two of the teenagers, C1 and C5, explained the thermal comfort in the neighbourhood and house as:

*C1:*

> *"My friends and I do not use the streets in the daytime because it is hot, and there is no space for us in the streets that is comfortable and shaded to play or sit and chat. We feel more comfortable at home and cool the room through the use of air conditioning".*

*C5:*

> *"I live in an apartment and my father does not let me go out in the daytime. The point is I do not have an open space to play near my accommodation".*

It can be realized that the design of the neighbourhood did not encourage the teenagers to play in public spaces. Also, the design of the houses keeps them inside under air conditioning and not in the yards. Furthermore, as aforementioned, they spend most of their time in the room separated from the house where they get together to play and spend time for enjoyment such as eating and chatting (seen in the model in Figure 7-17). Apartment buildings are not designed to meet the teenagers' requirements, as they need private open spaces to play or have breathing space. They also pointed out poorer thermal conditions and linked this to the hot weather. However, they agreed that at nighttime, the temperature drops, and helps them to feel better than the daytime in summer. It was observed that teenagers are more present in public spaces at evening times.

In response to the question about privacy, all teenagers defended their right to privacy at the house and neighbourhood level. At the housing level, they indicated that there were separate places for men and women in their houses. However, one of them uniquely differed with other teenagers because he was living in the apartment building, but privacy was still maintained.

At the neighbourhood and street level, as they were young, they wanted to sit outside in the streets, but there were no seats, and in these places they could not make noise because of the other residents and because it might not be safe. Concerning the significance of visual access to the open spaces, where the residents houses face the parks or the municipal open space, the teenagers' responses were divided, as nearly half of them asked for visual access and further pointed out that they would go to the open spaces nearby if there were any. The rest of them just contended that their house privacy would be at risk if it is been directly exposed to busy open public spaces, thus they did not support the visual access to the parks or open spaces.

The workers very rightly found the neighbourhood unit was hot with no shade, even though there are wider streets. The Saudi workers who were living in different neighbourhoods responded to the question about thermal comfort and exposure to sunlight very well. They said their workplace are exposed to sun, which increases temperatures in the outside area in the building. Regarding hot weather conditions, of course, these were the threat to the design responses to the climate, which keep them inside where they work. The days in summer remain very hot, while at night, there was a decline in the temperatures but as the workers said, they do not work at nights and the work finishes at 2.pm for government workers and 5.pm for private companies. Two of the workers D2 and D3 said that:

*D2:*

> *"I stay at work and I am not encouraged to go out in my break time because the weather outside is hot and the street outside has no trees or vegetation".*

*D3:*

> *"I work in the restaurant and I see many people at night time but not in the daytime. I believe it is heat during the day that affects peoples' activities such as walking. People do not stay on the sidewalk in the streets when they come to buy from the restaurant and wait inside till they get their orders".*

This shows that the sun affects the ongoing activities of the residents and the workers. It is obvious because of the excessive use of cars that threatens the environment and thermal comfort and concentrates the big businesses and shopping malls on the major streets on the

borders of the neighbourhoods (see Figure 7-27). As per their needs, all the worker interviewees demanded more trees, greenery in the streets as well as in the open spaces. They even went on to argue that streets and open spaces were the places that can keep the neighbourhood unit functional, and the only way to provide comfort to the residents and workers in the neighbourhood.

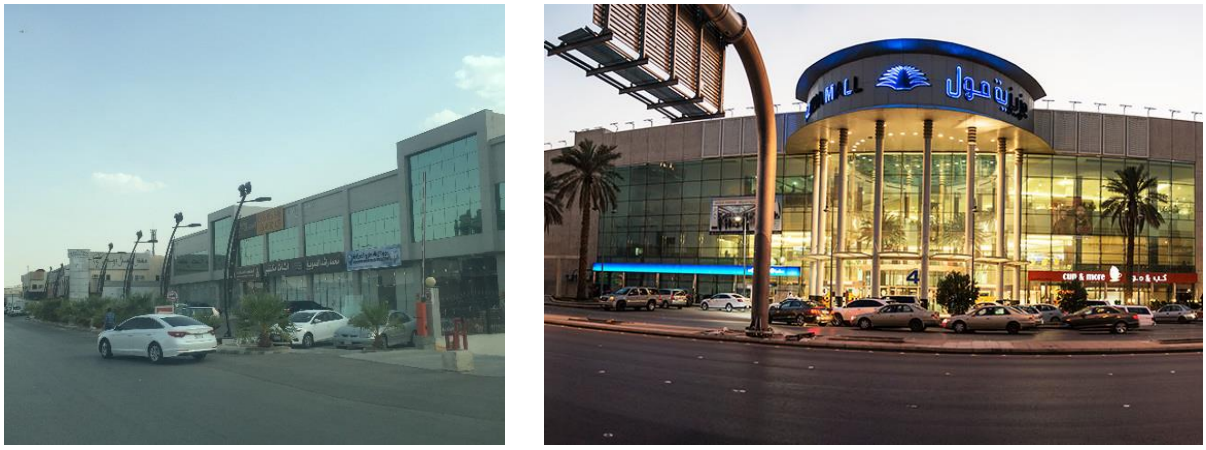


**Figure 7-27: Example of commercial buildings and shopping malls in Almoroj**

(Source: Author)

The visitors had similar contentions about thermal comfort in the neighbourhood unit. The visitors also hold views similar to others such as no shade in the streets, only small trees that could not provide enough comfort to the residents while walking in the streets or visiting the open space as well as parks. They were asked what they thought was the impact of non-shaded streets upon the visitors, and their responses suggest that visitors could not meet and interact in the streets and this further undermines the social cohesion in the neighbourhood. In the broader sense, the visitors are using streets, visiting parks and open spaces, and hence can face the threats of sunlight. Thus, in the absence of good design for thermal comfort and shadows, the visitors do face and conquer the challenges from the design. They further pointed out that a water sprinkler system was a good idea to cool the environment because they have seen similar systems in some open spaces and parks in the city. They prefer to visit parks or open spaces with garden parasols for shaded sitting spaces as well as fans ultimately for good thermal comfort.

Some of the streets, as the residents observed, use large trees to make extensive shadows for cars (see Figure 7-28). Although this is good for thermal comfort, these large trees do cover the facade of the house and there is inconsistency and no balance of proportion in providing such trees for everybody including visitors.

**Figure 7-28: Inconsistency in shadows in residential street**

(Source: Author)

The residents park their cars either inside or in front of the house. All interviewees have access to car garages from inside the house. Some prefer to keep their cars even in the daytime inside the house because of the strong sun, unless they have their own big trees or hang parasols to make shadows for their cars (see Figure 7-29). It can be concluded that most interviewees prefer to be vigilant about creating shade for their cars rather than when walking a long way.

**Figure 7-29: Parasols used to shad cars, which undermined the pedestrian rights and comfortability.**

(Source: Author)

## 7.4 Discussion of Climate Related Design

Essentially, some of the imminent issues are challenging the urban form's sustainability in reference to climate and these are discussed in this section. The early presented results express that the total number and area of vegetation including green spaces in this neighbourhood unit is comparable to that which the original designers' have suggested. However, Almoroj neighbourhood failed to target the standards put forward by some worldwide organisations (Figure 7-30). This repeats the findings of Almayouf (2013) about the green services of Riyadh city, as in his study deficiency of green services of Riyadh was recognised to be incomparable with other cities in the region and internationally, see below Figure 7-31.

| Existing standards |
| --- |
| World Health Organization standards: 9 $m^2$/capita |
| Public health bureau and the ministry of housing of the USA: 18 $m^2$/capita |
| European Union standards:26 $m^2$/capita |
| United Nations standards:30 $m^2$/capita |

**Figure 7-30: Standards of green spaces per capita in world organizations**

(Source: Khalil, 2014)

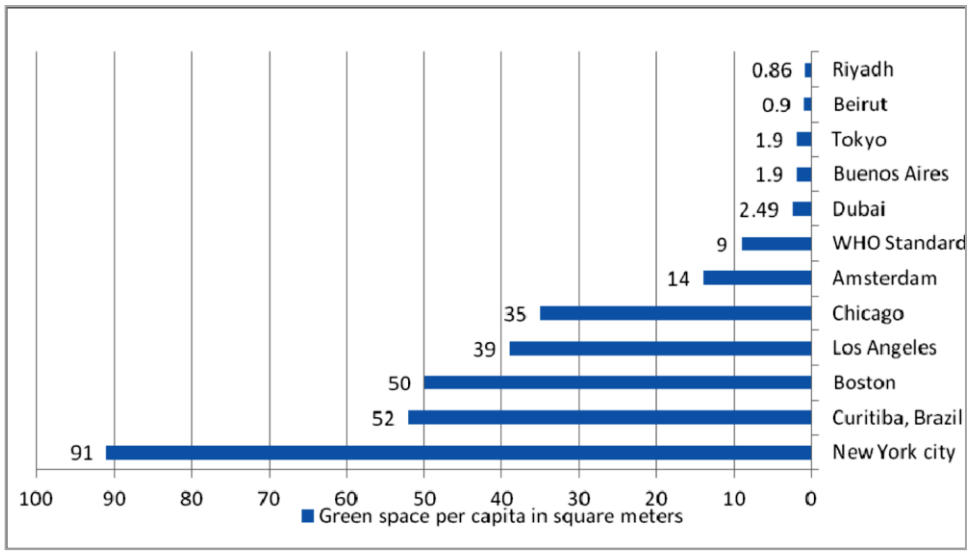


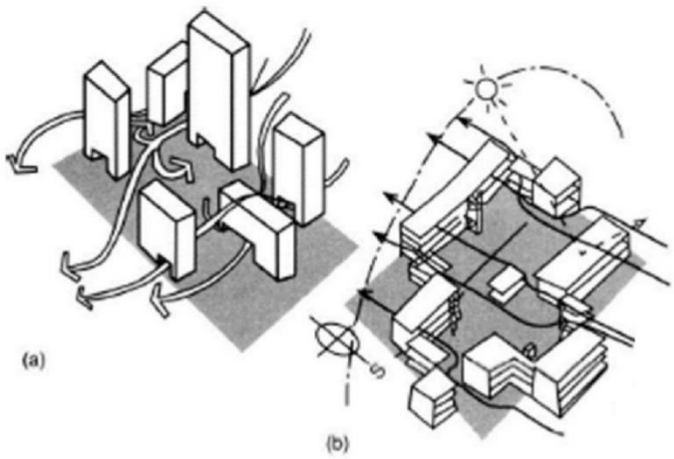

**Figure 7-31: Green space per capita in selected cities.**

(Source: Almayouf, 2013)

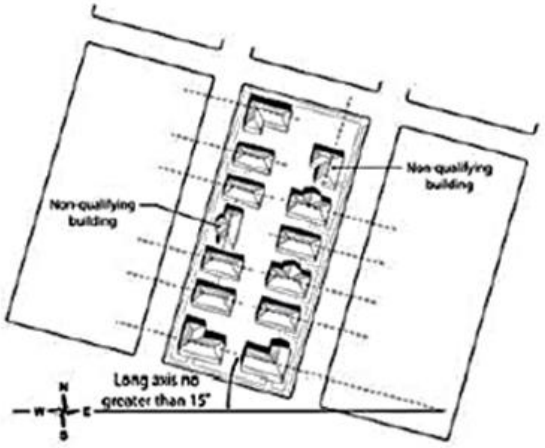
This raises questions about the environmental and social effects that the deficiency of green spaces in the neighbourhood can have on its residents. The results from the interviews indicate how such impacts are evident on the lifestyles of the residents. There is a lack of quality and social interaction in public, because of the absence of better design related solutions in public parks and open spaces, and the deficiency in tackling air pollution and difficult climate conditions are also examples of the findings in this research. Despite the presented standards of green spaces, the question here is what standard is suitable for the Saudi context?

Various urban design encounters represent a genuine concern and cognizance in planning with the environment, either by taking points of interest from the capability of normal vitality or by shielding the living spaces from hard climatic conditions. The residents of a city or neighbourhood can be attracted through thermal comfort, especially in hot weather (Yu and Hien, 2006). Urban spaces must be designed as per the weather conditions to keep the neighbourhood residents intact (Smith and Levermore, 2008).

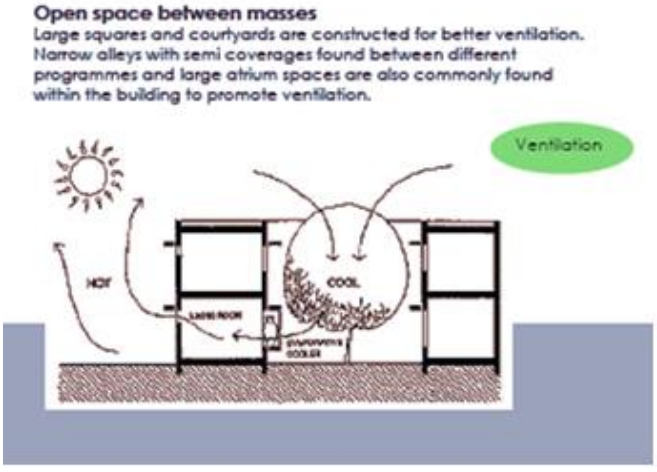
There are several traditional architectural and urban design techniques found in the literature in chapter 2 that would deliver good thermal comfort both inside and outside houses. A few cases can be checked through the history in the customary fabricated environment and contemporary urban activities (see Figures 7-32 and 7-33). Regrettably, such techniques are not appropriately utilised in the design of most of the studied residential buildings in Almoroj. Some building regulations, for example, found in this case study, such as the setbacks, could limit the flexibility of design and applying of certain architectural concepts relating to the climate. The design of the house could be different with new concepts of traditional courtyards, for instance. This type of design at least minimizes the sunlight and might create a friendly environment within the household. The streets in the design stage were not productively intended to respond to the hot climate, as there was no confirmation of contemporary street design innovations.




(a) High rise, (b) medium rise buildings.




(c)



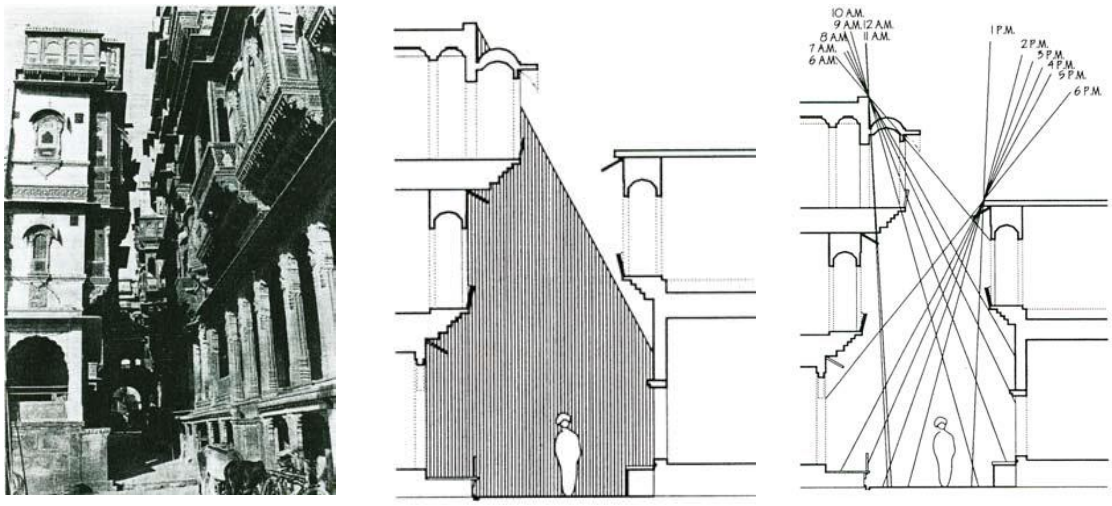

(d)

(e) **A traditional house in Riaydh**

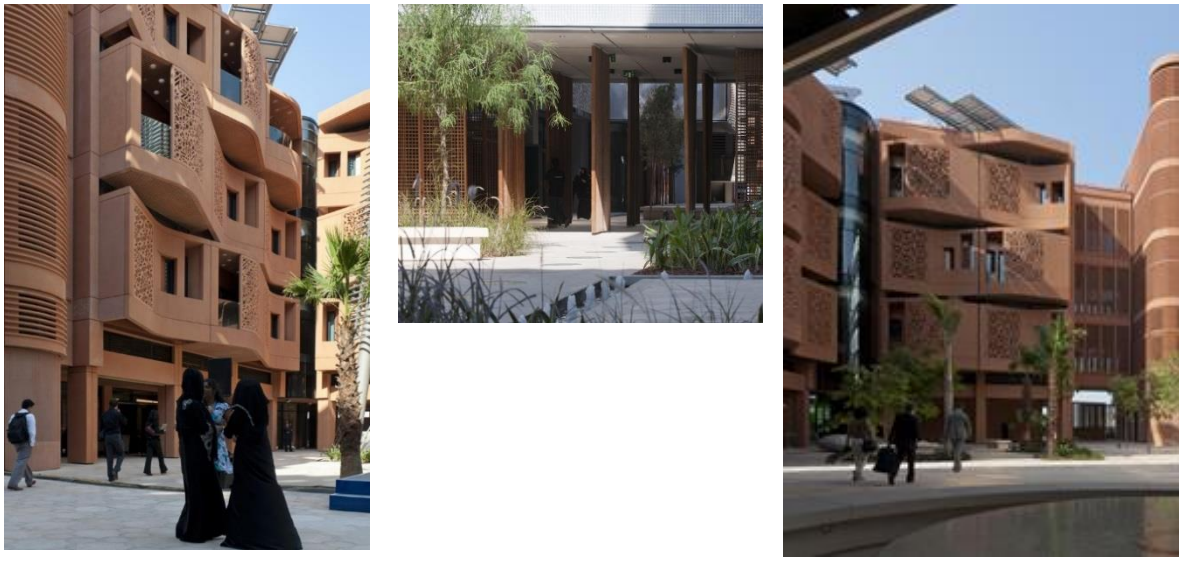
(f) **modern use of the courtyard**

**Figure 7-32: Ideas of sensitive urban climate related design solutions that are not utilized in Almoroj neighbourhood.**

(Source: Schilter & Evans,1998 (a, b); Wathaifi, 2015 (c,f);Yan et al, 2012 (d); Saeed, 1989 (e))




(a)



(b)

**Figure 7-33 (a): Solar control through self-shading façade in a hot-dry climate.**

Where (a) represents the traditional and (b) the modern architecture and urban form.
(Source: Krishan, 1996 (a) ; Foster and Partners (2007-2010), United Arab Emiretates (b))

Most of the interviewees were unsatisfied with the available thermal comfort situation outside in the neighbourhood and inside the open spaces of houses. The residents were unable to walk in the streets and use public spaces due to many reasons but most significantly, hot weather and lack of shaded places on sidewalks for pedestrians. These results are partially comparable to Shishegar (2013), who studied 'Street Design and Urban Microclimate' and analysed the effects of Street Geometry and Orientation on Airflow and Solar Access in Urban Canyons

and urban morphology, urban surfaces and vegetation cover as factors that affect the climate. Our results also indicate that due to lack of ventilation elements, the residents were not able to walk and feel comfortable in the streets and this might have negative impacts on the residents' health, interaction, and activities. The streets do not offer shade, and it seems that residents, owing to the fear of direct sunlight as well as the absence of street furniture, were not able to walk or sit in the streets. This research equally regards the Muslim culture where women need privacy to provide safety and security. This therefore suggests that men, teenagers, workers and visitors' reasons for not walking or sitting in the neighbourhood streets are not similar to women's. Thus, it is argued that where interviewees were unable to walk or to sit in the streets this will have an impact upon the social cohesion and interaction, and further negates certification of sustainability regarding climate related design at the neighbourhood and building level.

There is a positive effect of vegetation to minimize heat (Susca, 2011). However, in this case due to the lack of vegetation cover and greening, the residents were not encouraged to walk in the neighbourhood streets. This suggests that the streets' width did not permit creating sidewalks with public standard green belt or otherwise. However, original design of the neighbourhood shows 15-20 metres width in the residential streets, and 30-36 metres width in the major commercial streets. This means that Doxiadis' original plan as well as changes made by the MOMRA kept provision in the residential and commercial streets to create sidewalks but not landscape schemes. Nonetheless, provision is there but at the implementation stage, the sidewalks' creation in the streets was ignored and the landscape scheme was ignored in both design and development stages. Arguably, in the residential streets, sidewalks could have been created of 2m at least on both sides, and 3m sidewalks in the commercial streets with pleasant trees. It appears this might not affect the drivers but it could make them more responsible to drive carefully in the neighbourhood streets. The provision to some extent convinces acceptance of the design as compact but non-existence of proper public sidewalks and greening plan adds doubt to the design efficacy. Therefore, particularly based upon the interviewees' responses, direct observation, and urban space analysis, the street and housing design do not fulfil the requirements of the climate related design concept. The results are indirectly compared with Chen and Ng (2012) wherein they studied outdoor thermal comfort and outdoor activities. In our study, the residents were unable to undertake outdoor activities because of the lack of thermal comfort outside in parks, streets and open spaces. In their case, outdoor open spaces are important for the sustainability of a city. The researcher noted that the planning stage of constructing a city or neighbourhood

plays a pivotal rule. Therefore, it can be postulated that there was less likely an awareness in designing the streets, houses, and open spaces that simply disproves the climate related design in this neighbourhood. As a result, it all affects the environmental and social aspects such as less social activities and air pollution.

Our results are not in agreement fully with Gupta (1985), who highlighted the importance of natural cooling systems and each method was measured through the temperatures. The methods were of dense clustering of buildings, sun control through orientation and structural projections, cooling of sunlight surfaces by use of fans, massive construction for roofs and walls and courtyards and other air ducts for ventilation. Our results to some extent can be compared to Gupta who indicated that thermal comfort can be managed through the advent of air movement in the built space. The buildings and housing in this case are clustered in a way that they are open to the sunlight and heat, and this is letting the air pass through into the houses or buildings making them feel hot. In addition, thick walls help in protecting from the solar radiation. In this case, high temperature roofs further increases temperatures because of less knowledge about installation systems and urban design. The sunshade projections (e.g. on facade) might reduce the harsh temperatures in the neighbourhood residential buildings. So, there are innovative building and urban concepts that could be applied to this context that would indirectly or directly enhance the social and environmental performance in the neighbourhood.

This also suggests arguing that either Doxiadis' plan or the changes to the plan by MOMRA and RM were implemented inappropriately and that this contributed to the harshness of the environment in the neighbourhood unit. The lack of green spaces and the provision of private gardens do not encourage the residents to visit the open public space and parks.

The residents cannot be blamed for not growing trees or grass due to the following. It is significant to argue that vegetation or trees need so much water because of the hot weather and due to water-scarcity, especially in Riyadh; this might be one of the reasons that the municipality did not have a complete landscape plan for the neighbourhood. It does not mean that urban planners and designers ignore this concept at all or find alternative ways. In broader perspectives, original design is not criticised due to the fact that Doxiadis' plan and changes kept in view the needs for green areas, trees or any kind of vegetation. Since water in the houses is supplied from the sea, which is very far away and perhaps limits the domain of extending another service. This all indicates that the present hot climate and design does not

provide license to the residents to socialize. This therefore means climate related design in the neighbourhood is not functioning up to the desires and needs of the residents, the environmental and social issues discussed hence suggests concluding that, the neighbourhood unit is not sustainable concerning climate related design.

This research noted the effects of lack of knowledge of growing local greenery and trees from the interviewees and direct observation. The residents failed to socialize, which means that design at the street and building level failed in responding to climate and in strengthening social cohesion among the neighbourhood unit residents as well as in saving energy use and reducing air pollution.

The men, women, teenagers, including workers and visitors found the streets and open spaces uncomfortable. This therefore suggests that the residents were unable to walk or to run activities in the streets and to visit the open spaces. The results envisage that since residents could not visit open spaces and walk in the streets this makes the neighbourhood less sociable and questions the sustainability of current climate related design implemented in greening, and thermal comfort. The results do not agree with Zukin (1995) who studied the culture of cities and found varied developments in the streets and public spaces. Our greening results also do not fit with DOE (1996, cited in Jabareen, 2006) who argued that greening contributes towards sustainable development and improves the urban areas including quality of life. The results also oppose Makhelouf (2009), who concluded that open spaces and parks are the lungs of a city.

The women's issues are entirely different from the men's because of the fact that issues are judged entirely from a different perspective, as in the Saudi context, women cannot drive, they wear the Abaya, and the conservative society along with the new lifestyle mean women are not used to doing many outdoor activities. The women's lifestyle and culture somehow affects their social performance in the neighbourhood unit. However, it does not mean that this lifestyle would isolate women from the community, as, compared to the Ministry of Foreign Affairs Housing project (mentioned in chapter 5), the researcher observed that women interact, walk, and feel safe as the project focused on pedestrian scales with comfortable street textures and landscape schemes. Therefore, quality sidewalks in the streets and landscape design can increase social interaction among the women because it provides more security and privacy, and encourages them to be more outside in public spaces. The results, however, suggest that women were discouraged to comfortably socialize in the

neighbourhood, thus more appropriate urban design features need to be considered to meet their specific needs. The lack of landscape design demonstrates its failure to explicitly acknowledge this.

The teenagers' issues regarding climate in the neighbourhood unit also indicated that they, instead of playing in the parks, were forced to sit in the houses and play video games, which shuts them out of the social activities. Even though many teenagers' behaviours of preferring indoor activities may affect the social interaction, the provision of climate related design would give more chance for them to do more outdoor or public activities. While the hot conditions do not convince those people to walk or stay and play, it is anticipated that better thermal conditions in public spaces would help attract more young visitors. This is in agreement with Thani (2013), who inferred from a study that hot-humid cities were more exposed to solar radiation and hence residents would be unable to walk with pleasure in the streets. The increasing heating and reduced evaporation results to overheating the urban areas. This then discomforts outdoor activities.

The neighbourhood unit is deficient of green concepts such as green roofs, and yet all of the residents were sure that their present houses met their needs. This establishes sustainability partially but not fully as results from the direct observation for the use of spaces shows. The interviewees did not feel comfort inside the private open spaces of their houses because of the lack in design and knowledge. In regards to privacy, especially for the women, the original design could not provide enough privacy to the women at the urban scale, and hence they were forced to make their own arrangements concerning security and privacy. Our results do not agree with Al-Bishawi (2015), whose study about 'The case of Nablus, Palestine' for women's behaviour in public spaces concluded that women could be seated in the open spaces differently, so they could feel protected and secured. Therefore, open spaces in the neighbourhood should take into account the specific needs of women residents in the Riyadh context.

Potentially, some of the views of the participants even if regarded as exaggerated, still show the neighbourhood unit does not offer climate related design fully. Obviously, the high temperature can be combated with, for example, the introduction of large trees in the residential as well as the major streets. Therefore, it is apparent that the small or unarranged trees or, as seen in the residential streets, those planted by the residents cannot deliver the benefits as compared to large size trees or planned trees. Lack of greenery on the top of the

roofs or within the walls of the residential houses or using natural green concepts also complemented highest temperatures. However, the houses that were situated in the neighbourhood unit faces North with less sunlight and simultaneously their residents had fewer complaints about the weather conditions. It can be seen that due to the threats of high temperatures, the people in the neighbourhood unit remained isolated; especially the workers and visitors had weaker connections with those who are living in big houses. The design process looks challenging along with constraints, or the design was overlooked during the implementation stage regarding certain aspects from the original design that were dropped such as provision of green spaces and sustainable building or housing design. The results of climate related design in this research are comparable to Brandrup (2001) who analysed the factors associated and warned of safeguarding the trees in a neighbourhood to maintain a friendly environment.

Our results also do not fit with Shaw (2007), who pointed out that climate change presents designers, architects and planners with significant opportunities to create or remodel outdoor spaces and buildings that are resilient in the face of future climates. Adaptation will enhance the liveability and quality of life in communities in future. The weaknesses in this criteria show environmentally thoughtlessness and therefore do not encourage the neighbourhood unit residents to socialize, consequently creating less social cohesion among the residents.

As per the building regulations, $1/5^{th}$ of the street width is kept un-constructed in front of the housing form. This therefore means a villa that is 400m square metres on a street of 20m width must leave 4m in front and 2m at the side, or must leave 160 metres of land without construction based on the policy of 60% maximum cover area of the land size. In the neighbourhood, this space is utilized for many purposes such as private activities or other purposes. Arguably, in this space the residents do not feel comfortable with thermal conditions regarding the weak architectural design, lack of awareness of architects and owners of climatic design, and it is the only housing form with the policy of the setbacks.

In the hot arid climates, courtyards are traditionally used in the middle of buildings to minimise the intensity of heat. Ratti (2003) suggested the combination of the following aspects for best land use and also could provide better thermal conditions. In terms of combination, larger surface area can provide high thermal mass, and daylight through courtyards was not so harsh. In addition, narrow spaces for shade can provide thermal comfort, in spite of heat islands. In our case, open areas in the villas are used for some family

purposes such as sitting for fresh air and chatting, barbecue parties, and sometimes cars are parked there. However, the results of thermal conditions in this research do not fit with Ratti (2003). As per the direct observations, due to high temperatures, there are impacts inside the house, as to cool the house means lots of energy is consumed, and the residents remain inside the house that is socially threatened as well. This would have a negative impact upon the local environment.

Nachet (2014) discussed energy consumption in the Saudi context, and further pointed out that there was 3 times higher electricity consumption than the rest of the world. The energy production in the Saudi context is based upon oil, which is 59%, and 41% from natural gas. The same energy sources are used to purify the water, and the main source is still oil. Equally, the transport sector is also the beneficiary of oil and this is how the system operates and functions. However, the results of high utility energy indicate that the consumers utilize more units during summer for air conditioning, especially when there is hot weather. The results explain the high demand for air conditioning during the summer months, and low electricity tariffs. Regardless of the above, the electricity consumption increased 7-8% annually. However, during the summer the demands increase. According to ECRA (2014), between 2004 and 2013, the demand increased from 28 to 54GW, while annually there is the need to increase by 6% energy. Nachet & Aoun, (2015) also noted that in the future by 2032, there will be a need to have 120GW. Of the total production, the residential sector still is the biggest consumer. However, broadly, the distribution of energy source is: 50% electricity consumed in residential sectors (e.g. residential buildings), while, industry, commercial and governmental sectors are utilizing 21%, 15% and 12% respectively.

It is also important to discuss the issue of energy consumption to the current urban form. Especially compact urban forms are less exposed to the sun than rectangular urban grid single detached buildings, which is the case here, but due to absence of shade in such types of housing forms, the force of the heat is not minimized. This means that energy utilization is increasing and does not lessen the load upon oil consumption. Alternatively, renewable sources such as wind and sun are a better future than oil and gas, but still this technology is not prevalent in the Saudi context. Meanwhile, the general use of the current style of single detached building adds burden to energy consumption, and the preference of the social aspects provided in these villas will ultimately threaten the present limited resources. Figure, 7-34 illustrates how better compacted urban forms can be achieved by sacking this type of single detached building.

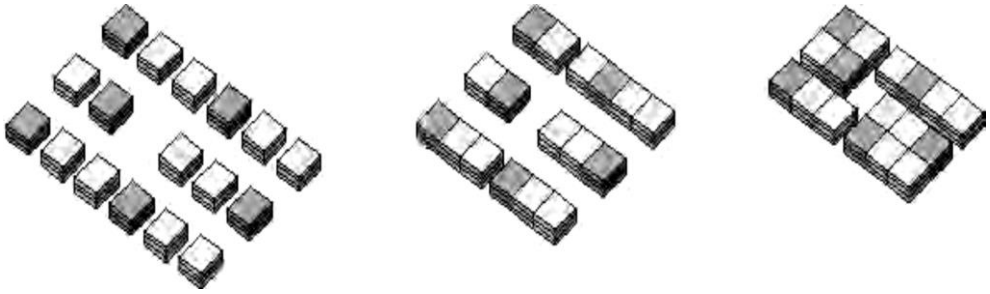


**Figure 7-34: Low rise buildings and densification**

(Source: Webber et al., 2013)

There are social impacts of the privacy wall outside the house, and fenced walls in front of the houses in the neighbourhood are used for privacy and security, excluding the residents from the outside world as well as neighbours, and not encouraging pedestrians, and especially women who may then have no sense of community. It seems that streets and houses include a thin pavement and are not separated to the extent that a person could notice the differentiation between the street and the house. Many of the residents in the neighbourhood do use the open spaces inside the houses for social activities. It is likely that the residents do have social activities in such types of housing forms. In reality, the current design, the efficient use of land, the policy of setback, and the privacy wall do not encourage the residents to publicly socialize and hence the design concerning climate is not sustainable. Therefore, upon this basis, it can be debated that the climate related design in the neighbourhood at the housing and street level is disputed if not fully, then definitely partially.

## 7.5 Conclusion

Although greening and landscape designs are known for making an attractive and pleasant public space that help reduce hot temperatures, protect from dusty winds and make shadows, they do not satisfactorily exist in the case study neighbourhood. The streets whether commercial or residential are poor in terms of greenery and trees. If adequately provided with local climate drought resistant trees, they would encourage residents to interact outside their houses, even in their front yards. Open public spaces such as parks are fewer in number or poorly kept in most cases due to which women and teenagers prefer to socialize or play within their own houses. Riyadh has very few green spaces in local neighbourhoods such as Almoroj, which can contribute to environmental sustainability if adequately managed. Moreover, there are some parks that are altogether missed out because of poor planning and limited accessibility to women and teenagers. These parks should be designed with due

consideration to hot climate, needs of women and teenagers with possible attraction of food and craft shops so that women and teenagers visit them to enjoy and spend time outdoors.

In the context of housing design, the Villa, which is a very popular choice among people, is also emerging as an issue. A conventional Arabian House was centred around an inner courtyard in order to meet the local climate, Islamic needs of privacy and modesty. As there was a dearth of architects in Saudi Arabia at that time, there were not many options in the design of villas. A typical villa design comprised of a singular housing unit located on the centre of a square plot with an outward look, as there was no inner courtyard in it; the design did not account for the hot climate and was closed inside high walls more as a means to secure the boundary than to provide privacy to the occupants. The private open space between the house and its outer walls is highly exposed to sun which results in some people making different arrangements to address this. However, if the modern day aspects of architectural design and urban trends, for instance solar orientation, layout, shading devices and other architectural elements are incorporated then it would result in more highly sustainable performance of buildings. High energy consumption, from natural sources, is another issue that affects the thermal comfort of people outside. People are thus not encouraged to frequently use outdoor spaces, and rather they rely extensively on air conditioning during hot seasons and the design of houses is highly based on controlled mechanical rooms.

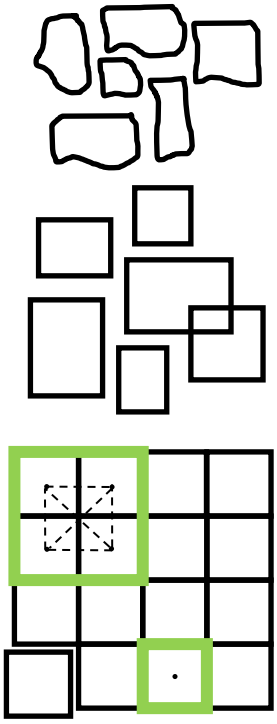
Ultimately, it is believed that better climate related design solutions, such as taking into account the orientation and shadings of buildings and streets to avoid overheating impacts, would reduce energy consumption and make more comfortable living places in the neighbourhood. Nonetheless, cities can never be truly sustainable if their constituent communities and neighbourhoods do not fulfil the prerequisites of sustainability. As it is viable to include sustainable elements in design considerations of neighbourhoods so buildings at the local level become vital to the attainment of sustainability of human settlements because without it our survival in the future is impossible.

# Chapter 8 : Sustainable Transport

**Contents**

## Chapter 8 : Sustainable Transport





## 8.1 Introduction

This chapter is the third part of the developed criteria for testing the social and environmental sustainability of the urban form of Riyadh. It presents the findings and analysis from evaluating the transport system in the case study neighbourhood of Almoroj under two sub-themes: firstly, the variety of travel options, and secondly, street design with connectivity. The first sub-theme looks into the original plans that considered the options of transportation and how they are implemented in the current plans of the neighbourhood, as well as how the residents use transport for their needs inside the neighbourhood. The second sub-theme evaluated the streets' design and walkability features. It discusses how the streets and urban blocks are connected to the residences and main facilities in Almoroj. Before the conclusion, the third section discusses the chapter's results with reference to the reviewed relevant literature.

## 8.2 Variety of Travel Modes

### *8.2.1 Design Stage: Travel options in Doxiadis' plans*

The original design of Riyadh put emphasis on vehicles as the main transport system in the city. In community class V, the design reports considered clearly the importance of streets, pedestrians' paths, and sidewalks. However, they did not show much care for urban human scale designs for the movement of pedestrians, which would be highly appreciable. This perhaps is due to the fact that Doxiadis seemed to believe these details would be accurately calculated in the development of future masterplans, with the exact future needs in mind. As a result, the plan estimates that the roads are only designed, as explained in the following sub-theme, for the two general kinds of transport, vehicles and pedestrians, while other travelling options were left to be considered later.

The original design of Doxiadis does not, for example, speak in detail about the use of buses within the city of Riyadh; it only gives a brief recommendation to include a system of public transportation in the long run plan for the city master plan of year 2000 (DOX-SAU-A/19, 1971: 104).

There is no evidence suggesting, other than walking, a sustainable transport option at the time of the general guidelines of the initial designs. Certainly, Doxiadis' plans did not anticipate the future needs for today's sustainable transport in the neighbourhoods. This can, arguably, still be considered a weakness in the initial design. Doxiadis did not consider the metro

system to be a travel option in the city, and in particular there is no mention of how any similar system could potentially link the neighbourhood units together. Thus, future transport needs and requirements were not fully kept as a priority when presenting the final design of the city in the early 1970's master plan.

One reason why Doxiadis' plans do not include other options of transportation in Riyadh is possibly the fact that oil was very cheap in the Kingdom of Saudi Arabia, even at the time of Doxiadis' plans, and this will most certainly lead the majority of Saudis to drive their own cars than be willing to use public transportation systems. Another reason perhaps is that at that stage, the Saudi officials dismissed the public transportation systems at least for the early masterplan of the city when meeting with Doxiadis. It is also possible that initially funds were not allocated for facilitating buses, hence making them a secondary priority.

With regard to how Doxiadis considered the option of walking as a transport mode, his design reflected the size of the neighbourhood to be comfortable for pedestrians. Urban functions in community class V are provided in a radius size of 10 min walk when these functions are placed in the centre. Urban functions in the centre of community class IV have a distance of 5 min, which is walkable. For example, primary schools are placed within community class IV that means pupils do not walk more than 500m. Also, there is evidence in Doxiadis' plans, presented in chapter 5, of separation between pedestrians and vehicles that make safe and easy access to facilities. Another example of the consideration of pedestrians in the original plans is the minimization of the capacity of the inner local streets to reduce traffic through the neighbourhood's residential areas, as discussed in the design of streets later. Finally, it is clear that the design did not indicate in-detail plans about the inclusion of viable and more sustainable transport systems for Riyadh, especially at the neighbourhood level, which is the focus in this research.

### *8.2.2 Development stage: The developed transportation system in Almoroj*

The transport structure in the original plan of Doxiadis and associates was a general guide to develop the neighbourhood transport system. This included cars and pedestrian passages in all neighbourhood units. However, when the development stage started, the transport plan presented by Doxiadis was partially amended. The Ministry of Municipal and Rural Affairs and Riyadh Municipality exclusively altered the original plan. For example, the recommended separation between automobiles and pedestrians was not considered in the developed urban structure to date. The design of Almoroj is now considered to be a car-based city.

Looking at the existing condition, the neighbourhood unit of Almoroj does not support the use of buses, bicycles, nor any other option of transport system. There are only cars that run across the neighbourhood (Figure 8-1).

villas

Apartment buildings

**Figure 8-1: A car-based design of streets. The position of cars when parked in residential streets**

There are a number of questions that need to be addressed for not developing a proper pedestrian system in the neighbourhood unit for this research investigation. A number of reasons have already been mentioned in the design stage, nevertheless, an additional reason is that the city expanded rapidly, and the need to develop new neighbourhood units to house people has meant that the authorities have restructured the city street system to absorb more cars – according to ADA (2016), there is almost 1.992 Million cars in Riyadh today, an

average of 1.8 to 2.2 vehicles per household. Most importantly, according to the interviewed official urban planner (UP3), even the pedestrian routes planned by Doxiadis were paved with asphalt for cars to use, so as to save time and money. The design's implementation clearly aimed to facilitate the circulation of cars in Almoroj.

Furthermore, Riyadh Municipality did not set up proper urban planning criteria that would enable a more sustainable transport system. There was no evidence of encouraging walkable catchment areas for facilities. For example, primary schools should be within 5 min walk or 400m, and high schools should be within 10 min walk or 800m. The shops in the neighbourhood are distributed on the major streets on the edge of community class IV and that means they are walkable because the furthest distance would mean the residents walk 500 m, which is almost 5 minutes walk. However, as seen in the map analysis in the previous chapter, some of these mostly needed daily urban facilities were randomly distributed within longer walking distances, reaching to about 1km, as in the example of some of the neighbourhood parks. Other facilities such as health centres and open spaces are not even walkable and out of reach.

One of the major issues in the sustainable transport refers to reducing distances. Hoverer, due to the lack of an alternative transport system, the residents have no choice but to use cars as the available mode of transportation. This in return has also increased distances for the residents, changing their lifestyle when the use of cars creates a traveling culture. Consequently, the extensive use of cars has apparently distanced the communities from coming closer to each other, compared to what more walking opportunities might provide. Moreover, this has led to more negative impacts on the environment.

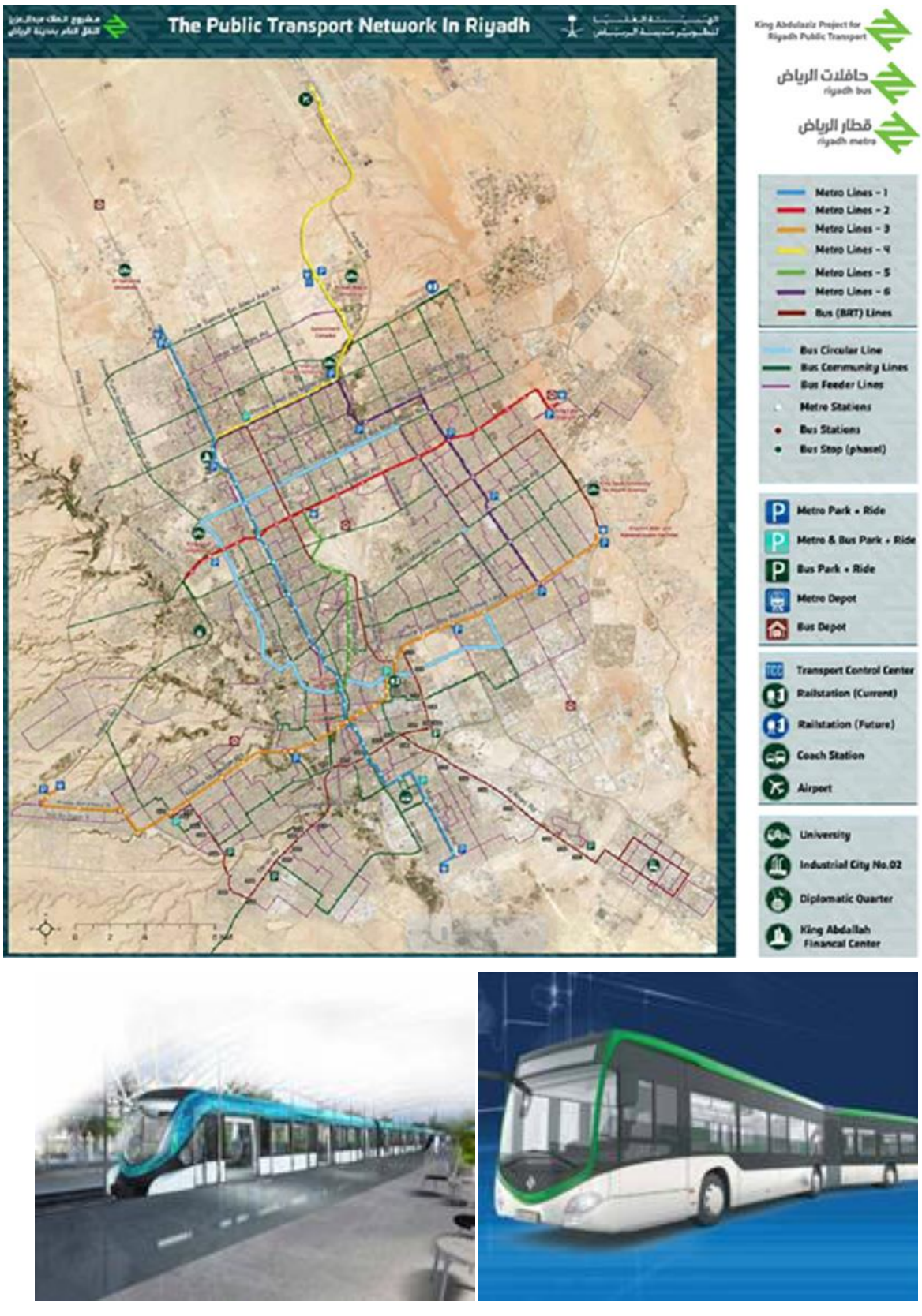
There were many opportunities for Riyadh Municipality to look for more transportation alternatives in the early stages of urban development. It seems that during the early urban development stage, the authorities did not invest in offering alternative public transport systems, especially within the neighbourhood unit. The only exception is a single routed bus line that runs only on the main spine of the city linking the far Northern side of the city with the city centre, and the vast majority of its users are non-Saudis (Figure 8-2). For the Saudi residents, at present, the transport network system is mainly the use of private cars.

**Figure 8-2: The only available bus line in Riyadh, used only on the city main spine and mainly by non-Saudis**

(Source: www.arabnews.com)

The suggested plans of Doxiadis for developing future transportation system (bus system) were only considered very recently (mentioned in chapter 5). The city authority reflected on improving the buses and metro systems for future developments and the main reason is the high traffic and congestion in the city. In fact, the work on these new systems has just begun, but only on the major streets and is expected to be finished in 2019 (see the proposed plans in Figure 8-3 below). The Riyadh Public Transport Network (RPTN) includes the Metro system, Bus Rapid Transit (BRT), community or neighbourhood bus lines, feeder buses and park, and ride facilities.

From the proposed plans, it is clear that the future bus lines will only enter a few of the main streets in Almoroj neighbourhood. Currently, the only one travel approach of cars will continue to be used, and perhaps the proposed bus system might not accommodate the expected population of Almoroj, 43000 people in 2020, on the main streets alone. The principles of New Urbanism such as Transit-Oriented Development (TOD) need to be studied and considered for the use of, for example, bus systems inside neighbourhoods.








**(a) metro and bus lines and stops**


**(b) Bus rapid transit (BRT) and metro stations' catchment area**

**Figure 8-3: Plan of the new proposed metro and bus systems in Riyadh**

(Source: ADA, 2015)

Moreover, the development plans do not fully support the idea of sustainable transportation in the neighbourhoods. It seems that Riyadh Municipality were not certain and confident in developing more eco-friendly options that could reduce the reliance and impact of cars on the streets. There is no clear-cut municipal policy or serious endeavours that encourage the use of more sustainable transport solutions, such as the removal of the current obstacles facing the pedestrians, explained later, to encourage walkability within the neighbourhood.

### *8.2.3 The Use Stage*

The results gathered from the 12 men interviewees show that all interviewees drive cars, inside Almoroj, between the neighbourhood's key urban functions, for shopping, prayers, delivering children to schools, as well as for using the available parks. They acknowledged that many residents are using different options of travelling, such as walking and some cycling other than driving cars. They were subsequently asked why they prefer the use of cars inside the neighbourhood instead of walking or cycling. Most pointed out the hot weather as one of the main factors that restrict their ability for walking or cycling, as they rely more on their car's air conditioning for cooling during traveling. They further elaborated that distance to some shops and mosques is still walkable, but they still depend on the easy option of cars. Other significant reasons for depending on cars were safety, time, and the economic fact that petrol is very cheap. However, not all the men interviewees preferred to use cars to go to mosque for prayers, as some went on foot when the distance was close. A1, who is retired, said that:

> *"I go to the mosque to pray the five daily prayers, twice using a car because of the weather, and three times walking from home to mosque. I use the car only because of high temperatures and in the cold weather".*

Regarding visiting parks and open spaces, most interviewees opted to use cars because of the safety of their children. They prefer to drive their children to schools because of the safety factor and the long distance. Some interviewees, such as A7, and A10, who are a university student, and a government employee respectively, said that:

*A7*:

> *"I always use the car because of time considerations. I do multiple trips by car during the day for my needs, and if I walk it takes much longer. I have no other option except to drive my car".*

*A10:*

> *"Our car driver takes my kids to three different schools inside the neighbourhood. I go to the neighbourhood market for shopping using a car, because I cannot carry the many bags of shopping home alone".*

The above quotations highlight the fact that many residents in the neighbourhood favour the use of cars over walking for the aforementioned reasons. It also appears that long distances do not encourage some of them to walk inside the neighbourhood. It can be understandable that

some facilities are far enough to drive cars and their reasons are reasonable, however, some facilities are still within walkable distances, as we learned.

With regards to the interviewed women in Almoroj, most of them used cars only either with their male family members driving or by the family employed driver. The purpose of using cars was to go to school, mosques, parks, open spaces, visiting relatives and friends, and for shopping. Many of the reasons for using cars are similar to those explained by the interviewed men. Also, dependence on cars for most women was essential because, as some added, the neighbourhood unit did not have alternative modes of transportation. Women were asked about walking and the only options to walk for many is to the nearest facilities, such as the nearby open space or parks, but not for shopping at local shops. However, although all women interviewees acknowledged the benefit of walking as a healthy option, few walked to parks. There were only two women interviewees who acceded that they sometimes walk, while the rest only use cars because of other reasons, including privacy and easy access to cars. Two of the women interviewees, B2 and B5, a housewife and a university student, said differently than others that:

*B2:*

> *"I am a housewife and have time to walk. I walk in front of my house during night time. I also go to the park with my children on weekends for walking, but only late afternoon, because it is near to my home (200m)."*

*B5:*

> *"I am a university student, though I wanted to walk, I am scared to do so at night times, especially in the residential streets because it is quite dark, very quiet and unsafe. However, once in a week, I walk to the park but only with the company of my brother or at least one of the family members".*

It is certain from the above that some interviewees raised the importance of walking to some of the provided urban facilities in the neighbourhood. Walking for many of them is interrelated with security, hot weather, cultural issues, and lifestyle. The women interviewees preferred using cars because of one or more of these factors. Some participants said that residential streets are so quiet at nights that it makes the residential streets scary, hence preferring to walk as a group. Figure 8-4 show how some residential streets look very quiet at night.

**Figure 8-4: Some residential streets look very quiet and relatively darker than others at night.**

Moreover, there are some potential opportunities for women to walk that not many of them were utilizing. Unlike the majority of the interviewed men, most of the women interviewees stated that they do not often go to the nearby mosque, for example, perhaps because it is not obligatory for them to pray in mosques; instead they prefer to perform their daily prayers at home. With regards to other necessary needs like shopping, schools, and visiting others they mostly use cars. It is important to remember here that having a family driver has become like a kind of obligation for most middle class Saudi houses. The duties of a private driver include taking children to and from schools, assisting in shopping, taking women family members to meet their daily needs (e.g. shopping and family/friends visits) when the husbands, brothers, and fathers are at work or busy on something else. Realistically, women cannot be asked questions about cycling in the conservative Saudi society, as it is not part of the culture for women to ride a bicycle in public.

All interviewed teenagers maintained that when there is no car or a driver available in the house, they prefer to walk for short trips. This includes travelling to schools, mosques and open space, and even to the nearby shops. Almost all of the teenagers had used or were using cars as the main option when the car is available; the only exception was from one distinguishable respondent who admitted always preferring the option of walking but just to the mosque.

The explained reasons for the discouragement of walking by the interviewees were the same reasons discussed by the men and women interviewees, however, there is more emphasis on security this time such as the issue of road safety, and attractiveness of streets and public landscapes, especially by teenagers who are aged 15 and below. Even though these teenagers cannot drive, they prefer cars for most of their trips. Moreover, still these teenagers in particular are not restrained from walking, and they usually walk mostly for short trips. The longer trips are the responsibility of the family to take them using cars.

Concerning movements in the neighbourhood unit, the teenagers informed that they felt easy to move only within the quiet residential streets. Hence after, they were reminded about the popularity of using bicycles for, for example, going to school, mosque or open space. They said that there is no chance to think that their family would accept it. Some of them who are aged 18 and 19 mentioned that time is the main issue, as it is faster to end the trip by car, showing that to buy small things from the shops it will take longer when cycling or walking. They also indicated that during the daytime it is often very hot and the major streets are fully packed with cars and it is not advisable to take the option of cycling in the neighbourhood (see Figure 8-5).

**Figure 8-5: Car domination in major streets making movement difficult for cycling and walking.**

They added that the local residential streets are quiet, but they are still dangerous to cycle on**.** However, an 18-year-old teenager, C3, said that:

*C3:*

> *"I walk to the mosque and the Municipal open space, as these places are near my house. I was not allowed to use a bicycle in the neighbourhood because of my parents".*

Most interviewed workers used cars to attend work, do shopping, and travel for social and other multifunctional purposes. To many, this was because of the non-existence of a proper public transportation system that connects the inside and outside of all neighbourhood units in Riyadh. However, it was significant to realize that non-Saudi workers do have more transport options in Riyadh, considering the aforementioned primitive single bus line, which many Saudis refrain from. Thus, for most participants it is either walking or driving to reach work.

There are many problems associated with the use of the available single line bus. This is the only public bus in Riyadh and is insufficient to carry the large population of the city and does not link into the city neighbourhoods. There are no designated lanes on the ground for the movement of the few running buses. This in return causes chaos in the already very busy spine street. When they stop for people, they do not have a dedicated bus stop, which makes it unsafe for people to ride, and this discourages many people from using it, especially amongst Saudis. Sometimes they stop in the wrong points wherever they find people to pick up (see Figure 8-6). Most of the people using the bus system are foreign workers because of its affordability, as it is very cheap compared to taxis.

While at work, the Saudi workers asserted that they actually are not involved in many trips inside the neighbourhood, as most of the big companies are located on the edge (see Figure 8-7). This includes accessing the park and open spaces, where their responses suggest that they were unable to access the open space or parks due to *"time constraints and the long distance"*. However, the mentioned distance to the closest park was in the range of 500m, which is still walkable. On the other hand, two foreign workers stated that they go to the parks and open spaces, either by car or walking, as they live nearby (around 300m). In effect, most of the foreign interviewees walk for most of their daily trips inside the neighbourhoods, such as work, shops, mosques, and the Municipal open space, as they live within a radius size of 400m. For example, foreign workers, D1 and D3, said about travel options that:

*D1:*

> *"I live in one of the apartment buildings in Almoroj, which is near to shops, and I can walk to my job and mosque. I prefer to walk to the park, but only on weekends or on my off days."*

**Figure 8-6: Problems associated with the use of the single bus line in the main spine of Riyadh.**

(Sources: www.arabnews.com, 2013 (top); Ahmed Al Omran for The Wall Street Journal, 2014 (bottom))

*D3:*

> *"I frequently travel by car for shopping, attending mosque prayers, and sometimes go to the open space. I live really close to many of these facilities, especially shops. I use cars mostly for long trips outside the neighbourhood".*

It can be noticed that the workers who are foreigners live in the apartment buildings, and work in the major commercial streets inside the neighbourhood, which is not far from the mentioned facilities, taking advantage of living and working in the same area of the neighbourhood. Although it was discussed in chapter 7 that the weather is an issue, these workers walk because they do not have convenience options such as cars and the distance to

work is short. It is also important to report that use of cars for them is only for necessities and needs that are not walkable.

**Figure 8-7: Commercial buildings, companies, and offices on the edges of the neighbourhood.**

With respect to the travel modes available to visitors, all four visiting interviewees stated that they only use cars to visit their friends and relatives in Almoroj neighbourhood. Notably, none of them mentioned the use of the single bus lane, neither cycling, nor walking to access this neighbourhood. Rather, the visitors said that they use their cars for every single trip within the neighbourhood, even a distance as short as 200m. It seems that the street layout of the neighbourhoods makes easier access for more drivers to access each neighbourhood at the

expense of pedestrians, especially on the major streets dividing the neighbourhoods. This has apparently hindered the walkability of people to cross between neighbourhoods from around their borders.

In support of the argument that cars are given easier access between neighbourhoods than pedestrians, some visitors admitted that the easy access to use the neighbouring facilities by car encouraged them to drive through and even use the internal local shops. E3 is a visitor who had an entirely different view for using the car:

E3:

> *"I do not live in Almoroj, but I pass by this neighbourhood very often. When I go home from a long trip, I often stop at the shops in Almoroj to buy something important for my kids. I always use the car inside the neighbourhood. I park the car just in front of the shops, buy and straightaway return back to my car. I do not go walking at all, even if the next shop I need is as close as 100m."*

E4:

> *"I come to this neighbourhood to visit my relatives. I use my car when I come here and when I need something to buy while I am in Almoroj. I do not stop my car in one place then continue walking, even for the mosque, which is 300 m away from my cousin's house."*

There were three main reasons why visitors regularly come to drive through Almoroj: to see relatives, go shopping, and visit the neighbourhood schools. Notably, when they do so, some of the interviewed visiting drivers stated that they frequently stop on the major commercial streets at a few different shops that are close to each other, and in one case the distance between them is as close as 150m. The number of parking spaces that are mostly along the streets is not an issue for visitors and the residents (see figure 8-1 and 8-16).

Finally, the main traveling mode in the case study neighbourhood is car-based. Although Doxiadis thought of the rights of pedestrians in his initial design, it was clear that the urban development of this option seemed to have been ignored by Riyadh Municipality. Doxiadis stressed the need for a breakdown of functions within the community classes from V and under to encourage them to be easily reachable for residents. The size of the neighbourhood with the community classes, in conjunction with even distribution of key urban functions, justifies the need of acceptable distances and demonstrates the consideration of walkability. The analysis of accessibility, in chapter 6, explained how most of these distances allow people

to walk within about five minutes. Currently, however, with the fact that some urban facilities are still located within walking distance, many residents are not encouraged to walk and cycle for many experienced challenges. These difficulties are related to the physical conditions of the streets, as well as the obvious hot weather and other security and privacy based problems, hence the use of cars remains the easiest, and for most the only, convenient transport mode. The next sub-theme elaborates more on the conditions of street design and connectivity in the neighbourhood under investigation.

## 8.3 Streets Design and Connectivity

While it is expected that well designed streets and connectivity creates a pedestrian friendly environment, this section is devoted to looking at these aspects in the case study neighbourhood. Three urban elements were specifically analysed in Almoroj, these are: sidewalk pavements, street furniture, and the impact of building and urban blocks on the degree of interconnectivity. These are considered to be the most significant components of a respectable and sustainable environment, both environmentally-friendly and sociable.

### *8.3.1 Streets and Connectivity in the design of Doxiadis*

The design strategy set up a solid standard of streets that were separated clearly between pedestrians and automobile traffic, and characterized solid spatial units. In addition, the plan argued for sidewalks and pavements, as shown in the street sections in chapter 5, which include the idea of furnishing and green spaces alongside sidewalks. The typical clean straight rectangular pattern of streets converge visually in each neighbourhood towards a small open space or square in the front of the local mosque, as presented clearly in the Doxiadis' typical example of community plan in chapter 5.

In addition, the design strategy guaranteed that some Islamic and Saudi social and cultural aspects were preserved within the defined public spaces. Although Doxiadis' plans would physically demonstrate a connected streets network of cars and pedestrians to the facilities and services at the neighbourhood scale, his urban guidelines for the urban development planners do no explain the use of designs of blocks to guide the street paths and furniture in great detail.

The organizational hierarchy of road structures was established within the modulus. Traffic calming strategies were consolidated in the design through the avoidance of through traffic

rights of way through the district (CCV). For all new, suggested and prevailing communities such as the South Elyia community, typical road width guidelines were established along with dedicated green areas, pedestrian paths, on street parking and roadways (see the illustrated Riyadh roads hierarchy in chapter 5). For new construction or for the reconstruction of existing facilities a twelve foot (3m) lane width was recommended as standard. The road is used as a boundary edge by Doxiadis to define units of spatial areas across both micro and macro scales and clearly and physically bound all community class scales IV down. In Doxiadis' theory and model of Dynapolis, perception of road as an "active centre" was missing while in the case of many other sustainable urban form approaches, New Urbanism for example, they consider road as a central component, which helps in formulating urban life. According to Doxiadis, the main streets on the borders of Almoroj function as the main arterial roads of the city and this concept is similar to one of Perry's main ideas. His concept of introducing more eco-friendly transportation systems like bikes was inadequate. It only provided a simple guideline rather than a proper urban policy to be followed. However, bike lanes on streets were mentioned in the original design.

### *8.3.2 Development Stage: Riyadh Municipality Transport Plan*

The street design by Riyadh Municipality was unmistakably wide and seemed to be focused on vehicular efficiency alone. There is no evidence of further plans for pedestrians, footpaths, and related designs within the neighbourhood sidewalks. Also, it is unfortunate that there was no mention of planning for more sustainable transport systems during the earlier developed plans by the municipality.

The design of roads accommodates cars mainly, and there is no demarcation lanes for bikes and pedestrians, as suggested by Doxiadis (as seen in most of the street figures in this chapter). The criteria simply suggest that the streets should be developed as hierarchies, straight, rectangular and remarkably with T-junctions in the neighbourhood unit. There is no clear policy for urban street connectivity and development to be followed by the authorities to enhance the sustainability of the urban street. Some streets were changed in width and did not follow Doxiadis' street standard.

The streets have a hierarchy inside the neighbourhood, from the main streets (big Al-mafroka) down to minor streets (small Al-mafroka) then the local residential streets. However, some local residential streets are directly linked to the major streets on the edge of the neighbourhood that weaken the concept of enclosure, safety, security, and sense of

community. Generally, the streets are not directly connected to the surrounding areas and the main streets on the borders of the neighbourhood are considered to be the barriers (Figure 8-8).

Sidewalks were not stressed in the municipality developed urban policy, at least at the implementation, and as a result most sidewalks are left for landlords to define in Almoroj residential areas. Many are only 1m in width, and some are even missing in some cases. Consequently, there is no evidence of smooth street connectivity, both physically and visually within the developed urban fabric. This has led to hindering the residents' convenience in using pedestrian footpaths and bicyclists. Pedestrians and cyclists should have dedicated clear routes, with visible lines that are safe and easy to use, but unfortunately these conditions were not fully considered in the development plans to help maximizing the directness of journeys. Many of these sidewalks' concerns are evident in Almoroj, as many paved sidewalks are obstructed by, for example, unwell planted trees and garage accesses (see Figure 8-9).

Also, building developers did not put emphasis on enhancing the importance of utilizing the pavements for more ecological solutions, for example, using appropriately planted trees as buffer zones, which could make the streets in the neighbourhood more eco-friendly. Therefore, the consistency and connectivity of streets and pavements is affected, loosening the connections between the residential areas and the local open spaces, local businesses, mosques and other important facilities and services of daily needs.

Another sidewalk related problem is the fact that there are not enough considerations or care for pedestrians crossing the road, especially on large streets. Visible signs of crosswalks are totally absent from the neighbourhood roads, and people are putting themselves at risk to cross these roads from unexpected points. As a result, it was clear that many people are avoiding the danger of road crossing, and instead of walking they opt for the safer mode of transportation, cars, even for short distances.

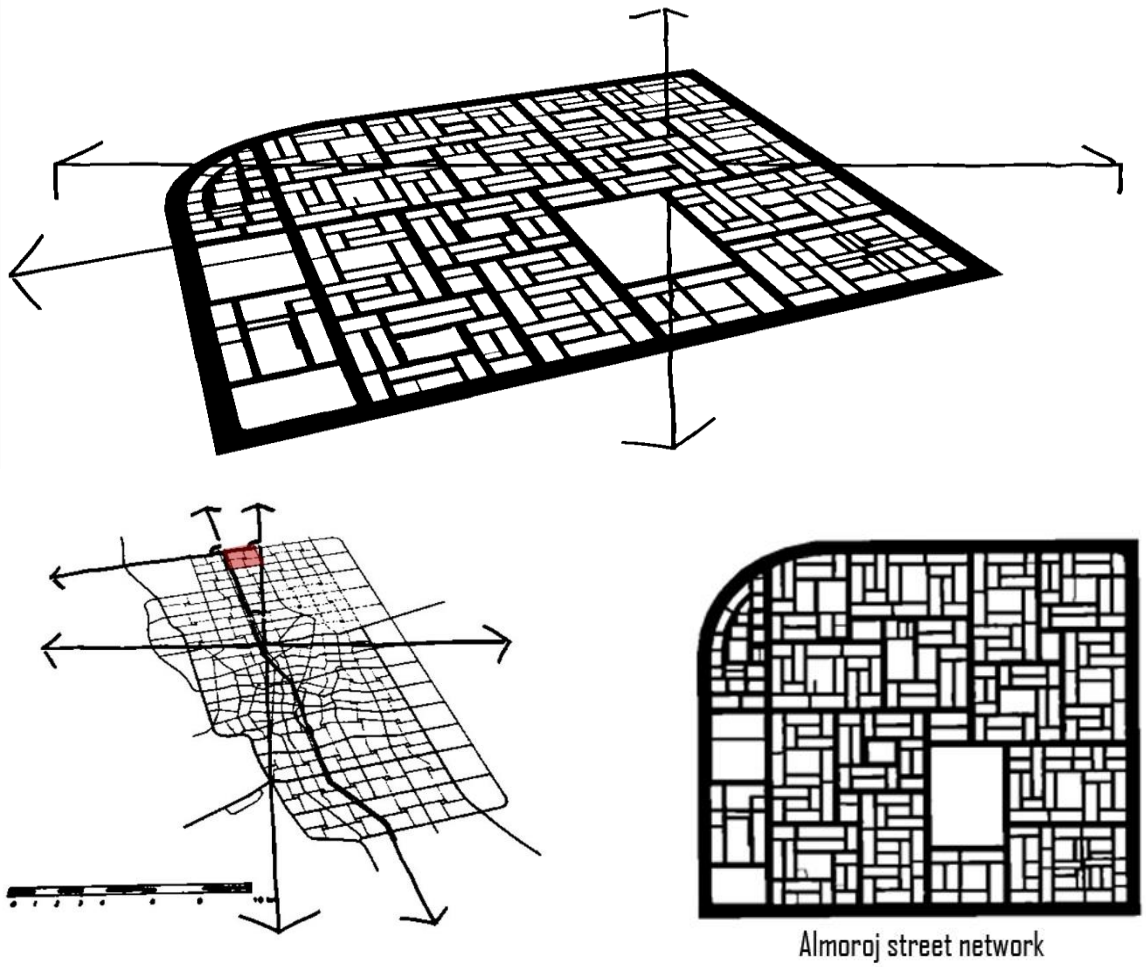




**Figure 8-8: Street hierarchy. The maps show the accesses from the major border streets to the neighbourhood through to the residential and commercial streets inside the neighbourhood.**

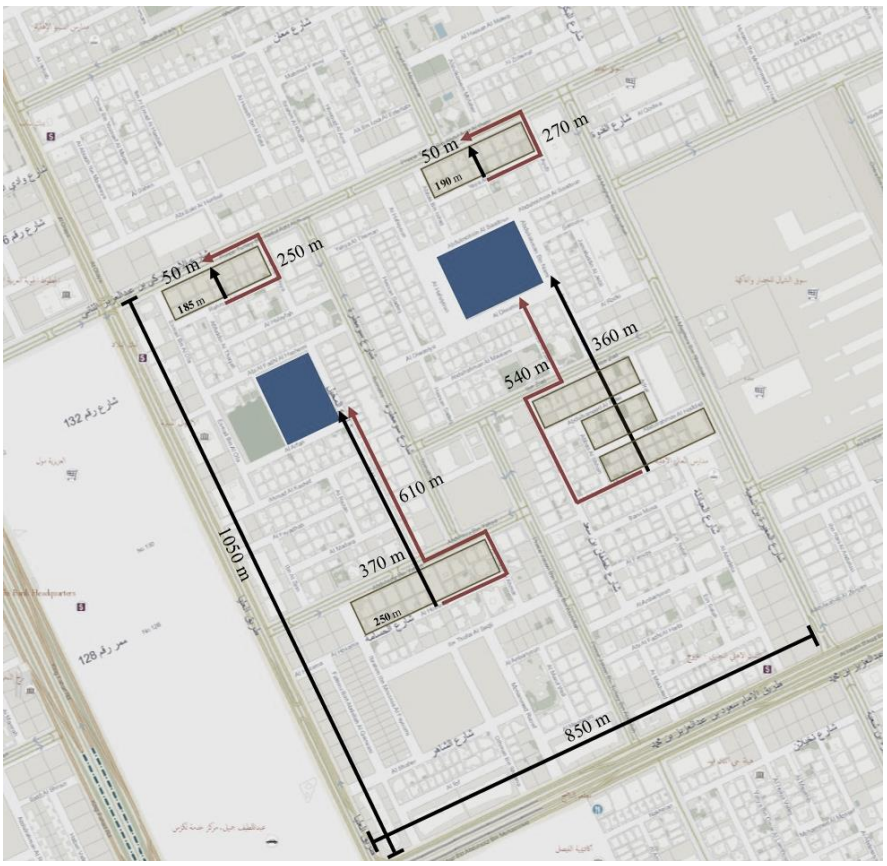
**Figure 8-9: Sidewalks obstacles**

(Source: Author)

Street furniture was found to be very helpful in encouraging more sustainable journeys in any neighbourhood. Good-looking and well organized street furniture, including lighting for example, increases the flow of pedestrians' and cyclists' facilities (Yücel, 2013). However, it was sadly observed that Almoroj streets were poorly furnished. The neighbourhood streets were missing any attractive and coordinated lighting, seating, waste receptacles, signage, and many proper landscaping features, all of which certainly discourage the residents from walking. Streets have been physically defined by high fenced walls that make the streets look boring for pedestrians. Some streets are quite dark and do not provide lighting and brightness (as seen in Figure 8-4 and Figure 8-10). This has a potential impact on the pedestrians' sense of security in the neighbourhood, especially on children and women. Eventually, the few available landscaping efforts were humbly used to beautify the properties outside walls rather than for the benefit of shading the short sidewalks, for example.

**Figure 8-10: Poorly functioned streets. The neighbourhood streets were missing any attractive and coordinated lighting, seating, waste receptacles, signage, and many proper landscaping features.**

Another important urban design factor affecting the mood and time of mobility within the neighbourhood is the length and layout of its developed urban blocks. It has been argued by many urban scholars, as will be discussed in the discussion section, that the length of blocks should not be long (not more than 400 feet) to make the interconnectivity increased, and as a consequence increase walkability within the neighbourhood. The provision of shorter walking distances and various penetrating routes would definitely encourage more walkability and connectivity (Ewing, 1999). However, the analysis of the developed urban structure reveals that most of the residential buildings and walled land plots are long and relatively large in size. The developed urban module of the Almoroj neighbourhood streets and blocks is rigid because of the adopted rectangular grid system. The longest width of a single urban rectangular plot can reach about 250m, with no mid-block passing through crossings. As a consequence, the overall driving and walking distances are certainly longer than if more soft curves and diagonal shortcuts were adopted within the local network of streets inside the whole neighbourhood structure (see Figure 8-11).




(a)

(b)

**Figure 8-11: a) Some long urban blocks make long distances to the neighbourhood amenities (absence of mid-block crosswalks), this is an example of long distances to local schools because of long blocks and it appears that with mid-block crosswalks, the distance is significantly decreased. b) The length of many blocks highlighted range from 550 to 820 feet (170m to 250m)**

(Source: Riyadh Municipality, www.alriyadh.gov.sa, drawings added by the author)

Another impact of the rigidness of the adopted rectangular network system is that the orientation of most streets is repeated, and frequently rotated with the blocks they confine, creating a recurring urban pattern that might in some areas feel as if there is no sense of place, especially with the existence of high walls, and subsequently perhaps even leads to the feeling of no sense of community. Moreover, some urban territories inside the community class V encountered redevelopment pressures by the authorities, i.e. re-zoned from residential to commercial development as in the case of the very large land of the fresh market (550m X 400m), and this change has weakened the street connectivity in Almoroj. The cul-de-sac system, which was one of Doxiadis' main design features, was used in MFA housing projects, it was not used to facilitate the circulation of cars. According to MOMRA (2013), it is believed that is a good solution for pedestrian movement.

In conclusion, the functioning streets in Almoroj are not highly advantageous for the urban benefit of its residents. The developed roadway infrastructure in the neighbourhood is dependent on the street rules that appeared to have focused more on the movement of private vehicles than the comfort mobility of pedestrians, with less attention paid to environmental and social aspects.

### *8.3.3 The Use Stage*

This section presents the responses of the interviewed residents of Almoroj regarding their perception and experience of using the neighbourhood streets. Of the men, only one of the interviewees conceded that he used to walk in the streets for many of his needs, whilst the rest said they do not walk except for prayers. The interviewees testified that streets do not offer facilities for walking. However, the only interviewee who used to walk added that if streets are not prepared for pedestrians why would they walk on them. A10, retorted that:

*A10:*

> *"Streets are quiet of cars and are not so dangerous, but not for kids, consequently, I took the advantage to walk in the street. I do not walk on the pavement areas in front of the houses because it is difficult to use them."*

When there is no traffic, there is no noise and people are noticeably absent on the residential streets. Some interviewees said that they do not feel comfortable stopping on the streets for talking and chatting with others. They explained that it would disturb the neighbours if they stop to do so, believing that this would be an indirect interference in their privacy. The absence of seats for pedestrians and other encouraging facilities is another reason. However,

the opportunity to stop and talk on the streets is still available. It has been observed that some residents share streets with cars, sit and lean on the body of cars or on the curbs of the street pavement during the few chatting chances in front of their houses and commercial streets (see Figure 8-12 and 8-13).

**Figure 8-12: Streets do not offer facilities to walk. Thin sidewalks (1.50m) adjoining the mixed use buildings.**

(Source: Author)

**Figure 8-13: Lack of decent footpaths, maintenance, and shaded sitting places in the streets.**

(Source: Author)

There were divided responses about streets' functions in Almoroj. Some participants argued that they never use sidewalks, due to lack of footpaths, big trees, lack of maintenance and

shaded sitting places in the streets. This simply reflects the weakness of street furniture in Almoroj (see Figure 8-13).

Most interviewees also openly criticised the street connectivity. In addition, they said that to join the main road from the neighbourhood, they had to cross through many turns and longer streets than the actual geographical distances. It has already been reported that the neighbourhood is 2km x 2km, and when accessing the major streets, some of the residents have to pass through many blocks. It has been observed, and as stressed earlier in the map analysis, that the streets' connectivity for pedestrians is weak and the block designs are not shortening the distances for some residents. One of the interviewees, A4, said that:

A4:

> *"I often walk in the streets, usually to the nearest mosque. The streets from home to the mosque are not straight. I have to pass through at least five streets and turns to arrive. Now it takes me about 7 minutes to reach the mosque."*

It appears that the block size is large and the arrangement of blocks in the neighbourhood is uneven, increasing the distances from the residents' houses to facilities such as the mosque that they often go to. The story of A4 is a good example about the aforementioned impact of long blocks of the walkability to residences. His house is actually about 380m from his local mosque. His current journey, which lasts about 7 minutes or 600m, can simply be reduced to less than 5 minutes if there was a shortcut passage through the urban residential block confining his house.

A12 said that:

> *"When I walk I share the road with cars in the residential streets. I know that the streets here are quiet, but still it is dangerous to do so. This is why I do not feel comfortable walking. As everyone else does, I also plant my own trees in the paved area in front of my house."*

The above quotes do support the proposition that Almoroj neighbourhood seems to have circuitous routes and pedestrians do not have easy cut-through accesses to their key urban facilities and services. Above all, it is also noticed that residents' safety is at high risk, especially when having to share the same street with cars.

The women interviewees stressed that streets within the neighbourhood are only used mainly for cars. Concerning the impact of the design and length of blocks, the interviewees indicated that it is rare for them to see someone, particularly women, play or convene any activities or even walking to the nearby services. There are many reasons why women do not walk and use the streets. Privacy and security are the main concern, but also because there are no appropriate facilities provided for them to feel comfortable to walk and stop to chat on the residential streets. Concerning chatting and walking with other women on the streets, almost all the interviewees did not agree to do so, except for one woman who admitted walking on the street but without conducting any socializing activities because, as she said, *"there is no space to stop for chatting"*. Therefore, there was a gap in understanding the relationships between women's socio-cultural needs and designing urban public spaces and this affects social sustainability.

Furthermore, it is acknowledged that women in the Saudi context are very conservative and the protection of their privacy is considered as a very important aspect of the society. For them, good quality of streets and landscapes provides more privacy and encourages them to use public spaces. Saudi women cannot, by law, drive for this reason so security (e.g. lights and quality sidewalks) should be taken into account when designing spaces for women. One might expect them to therefore walk more regularly instead. However, it was clear that only a few of the women residents use the streets to walk to the nearby services, for example. In reality, all the interviewed women declared that they use the streets for going to the major commercial streets, schools, mosque and other facilities but only by car.

Another question referred to the validation of the previous results, wherein missing street functions were the issue, and the interviewees again pointed out the similar missing functions, but the majority of the participants' reactions did not justify the sustainable transport system in the neighbourhood, as cars were the sole mode of transport system and strictly, the design of the streets is for cars. Two of the women, B2 and B12, said:

*B2:*

> *"I wanted to walk in the residential streets, but I could not due to the absence of footpaths on the sidewalk pavement. I try to walk as close as I can. The streets do not encourage us to walk on them, especially in the residential area. Commercial streets do not facilitate enough space for the residents to walk."*

*B12:*

> *"I do not feel that streets in residential areas attract people to walk or sit. I am not convinced that they have considered facilities for women walking and siting. I do not find chairs, benches or enough light at night time to encourage me to do so."*

It is important to maintain that the design of the streets in the neighbourhood do not consider the rights of people who would like/need to sit while others are on the move and walking. Most women, because of the weak provisions of street furniture, cannot confidently sit and walk in these streets. Concerning major commercial streets, the provided 1.5 metre sidewalks in front of the shops are too small to walk freely or sit. Clearly, the streets are not attractive and safely designed for pedestrians at all. It can also be realized that the streets are not designed with the social and environmental concerns in mind. For example, the commercial streets do not offer green trees along them, whilst any well-chosen and placed trees could provide a buffer zone between cars and those who walk on the sides (see Figure 8-14). The deficiency of street lights at night is another mentioned reason for minimizing the walkability of women in Almoroj at evening times.

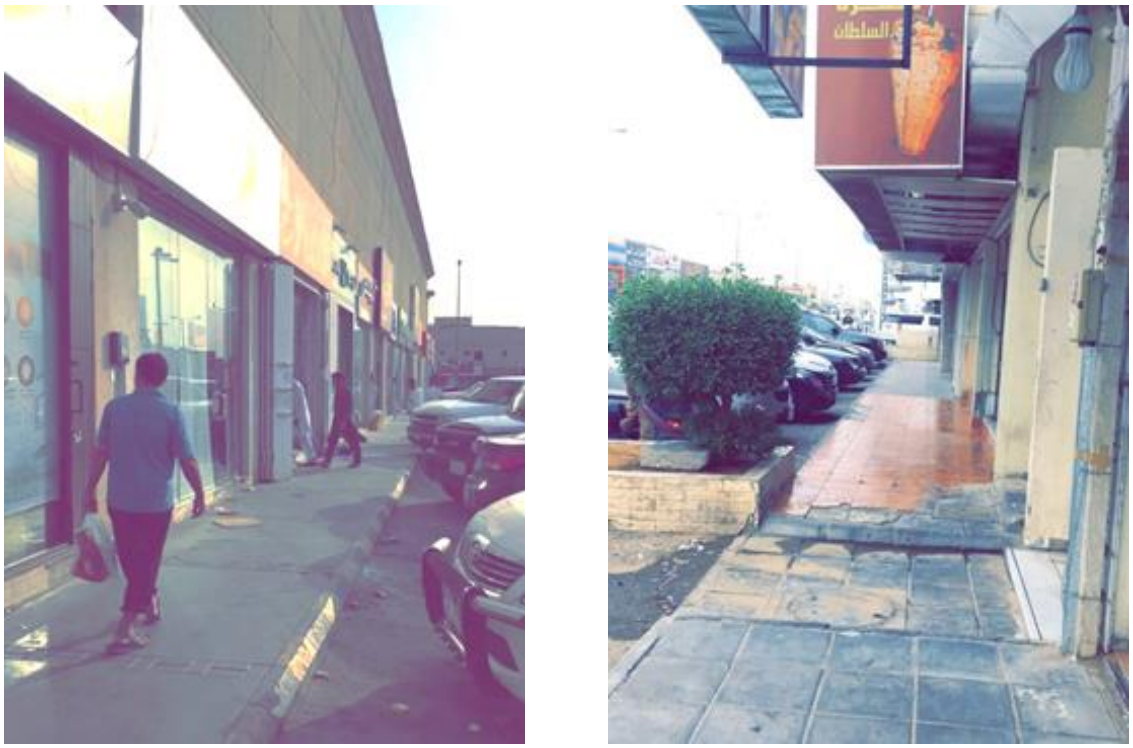


**Figure 8-14: Unfriendly small sidewalks (1.5 metres) and the absence of buffer zone between cars and pedestrians**

(Source: Author)

The interviewed teenagers also declared that when they walk or talk with others it is always on the streets, not on the paved sidewalks. Teenagers, aged 15 and under, were constrained by their parents from walking alone because it is considered unsafe. Those aged 18 and 19 said they sit sometimes on the commercial streets, but it is considered socially as inappropriate gatherings. The street facilities were not unnoticed by the

teenagers and the reasons were the lack of appropriate streets designs, as discussed earlier. The street fronts were rarely used by the teenagers, and they did not like to sit in the streets. A few of them socialize in public, but not on the streets. Divided responses were obtained from them, as nearly half of them acknowledged the absence of street functions, while the rest objected to the street patterns, as the streets failed to attract more pedestrians. Some interviewees, C3 and C2, explained the experience of using Almoroj streets as:

*C3:*

> *"I sometimes meet my friends in front of my house door and even sit with my friends in the street. I go around in the residential streets by cycling, where the residents drive their cars. I sometimes go to the shops on my bike in major commercial streets, but I was crossing the roads unsafely."*

*C2:*

> *"My parents do not allow us to walk or drive my bicycle in the streets, they say it is dangerous. Also, they said do not sit with your friends in the front streets because this might be disturbing our neighbours. The routes were easy to drive through but only to the near facilities. It is hard to drive to the far facilities because the streets have no crossings and the cars are driving very fast."*

It is important to value the views of C3, regardless of the raised fears, as his use of the residential street with cars raises another important design issue. The behaviour of this resident teenager highlights the significant absence of facilities designated for cycling. Actually, the city streets are not divided into sub-functions for other transportation modes, including bikes (see Figure 8-15). It is also noticeable that teenagers tend to sit on the street because of the early mentioned lack of sitting facilities in the residential streets.

Most of the interviewed workers limited their walking and sitting chances on the streets to near their workplace, as some said that there is not enough time and opportunities to do so. The foreign workers who live in apartment buildings have more walking opportunities for many daily trips and chats on the streets than the Saudis do. The reason is that they spend their time at work and live in mixed land use streets near the main commercial streets. They walk to shops and the parks because they are near (about 250m), however, other than these places they have to use cars. The streets in the neighbourhood were escalated because they do not offer clear demarcation for walking across the different lanes to separate them from those of cars. The response of the following workers, D2 and D3, do support this conclusion.

*D2:*

> *"I do not feel comfortable walking from my workplace in the major streets to the local shops inside Almoroj. Time is my main issue and I cannot stay long in the commercial street due to my job responsibility. The commercial streets do not*

*encourage me to sit or enjoy walking during my break time. I drive a car inside the neighbourhood when I need something."*

**Figure 8-15: Unsafe behaviour of cyclist and absence of designated bike lanes on streets.**

While D3 believed that:

*"I do not let my children walk alone in the streets because they look unsecure. However, we walk together when needed to nearest shops. I see that the sidewalks are a big problem in the neighbourhood. Parks and the Municipal open space in Almoroj are better furnished comparing to the main and internal streets."*

The two non-Saudi workers live close to the major commercial street and the open space is at a walkable distance for them. They walk for their needs within the local residential streets sharing the driving cars. This attitude also has been observed by the researcher. It has been observed that the residential streets are so quiet and there is no big danger for the residents or workers to walk within the residential streets, but not the major commercial streets. As discussed in chapter 7, there is a lack of parks but it was observed that the quality of the provided parks was recognised and appreciated. However, they are not well-connected to residences because of the weak landscaping.

As the former interviewees criticised the street design, it is as important to mention here that one participant stressed that some current corner neck downs (curb extensions) seem to have caused some car accidents in the streets (see Figure 8-16). It is clear now that the overall design of the streets has been rejected by many participants for similar traffic problems that caused the connection between the key urban facilities in the neighbourhood to be more complicated, and even dangerous.

Some visiting interviewees from other neighbourhoods emphasized the significance of missing links in the commercial streets. They pointed out the absence of designated footpaths for pedestrians to cross most major streets in-between neighbourhood units, and the non-existence of street furniture. The visitors do not spend time in the commercial streets, as they think they are unattractive and do not encourage people to walk all the way for shopping, and the parking of cars is not a big issue for them because commercial streets offer parking facilities on a massive scale. E1 is a visitor to the Almoroj neighbourhood, and in his own words he said:

*E1:*

> *"I drive my car and park in front of the neighbourhood shops. I still use my car to even visit a relatively close distanced shop in the area. Sometimes I do my shopping on the way to my destination, passing and cutting through this neighbourhood. Overall the streets are not attractive to stop and walk for shopping or any other destinations."*

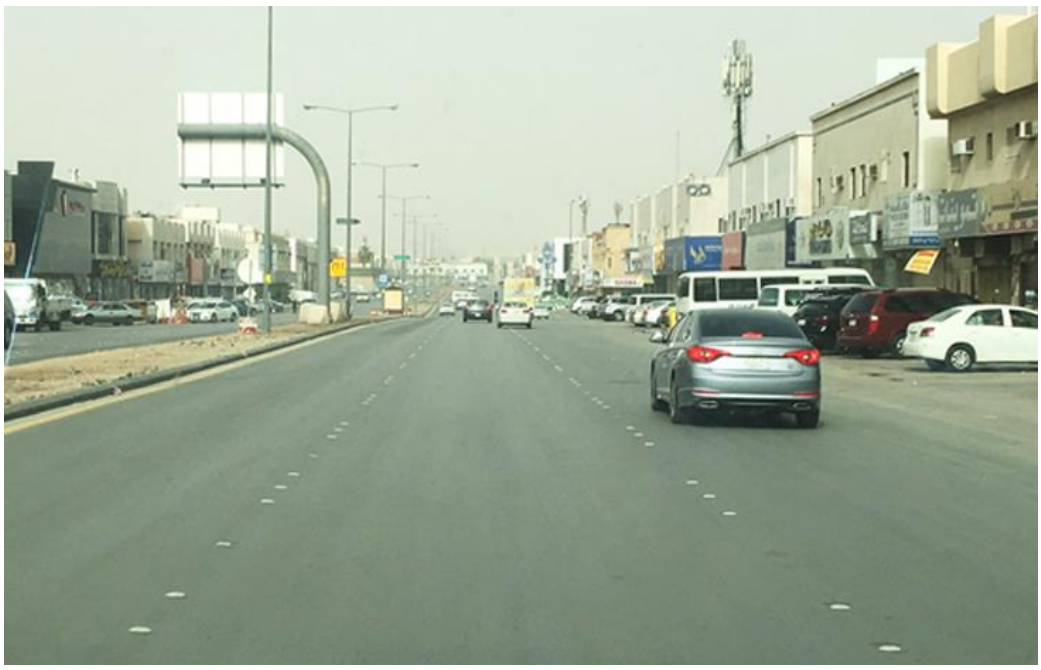


**Figure 8-16: Hard access between the two sides (absence of walkable features all the way such as curb extensions for crosswalk and easy connections)**

One of the significant issues to raise from the above is that there is not enough space for sidewalks in the residential streets. When present, sidewalks are criticised for being very narrow, unattractive, and there is no buffer zone to improve safety for pedestrians in commercial streets.

Many participants agreed that the pavements in front of the houses are used as a private space by the property owners, where residents plant trees and different kinds of greeneries (see Figure 8-17). These green features are kept within 1 to 1.20 m wide plots, deducted from the land that was supposed to be dedicated for public sidewalk pavement. As a result, residents are obstructed by these privately planted landscape features. Also, some unlevelled garage accesses seem to hinder people from walking on sidewalks, even when empty. It was also noticed that the sidewalks in the commercial streets do not encourage the residents as well as the visitors to walk along the commercial streets for shopping, causing several customers to use cars reaching to close shops, with less than 50m distance. Furthermore, it is pointed out that the neighbourhood is designed in such a way that it does not offer adequate transit systems in the residential streets. This is resulting in more presence of vehicles as well as congestion in the streets, all of which is affecting the living conditions of the local residents. Overall, it seems that there is an issue of defining the boundaries between public and private spaces outside this neighbourhood's houses, which lead to the discouragement of the walkability and thus sociability of many sectors of Almoroj residents.

**Figure 8-17: Common narrow 1.2 m pavement in front of a house is used as a private space by the property owner**

## 8.4 Discussion

### *The Implications of the Excessive Use of Cars as the Main Option of Transportation*

The presented findings show that almost all the participants stressed the dependency on cars as the main mode of transportation in Almoroj, and Riyadh in general. There are many likely environmental, economic, and social implications of the excessive use of cars in any city.

Economically, the results highlighted the high number of owned cars per household in Riyadh, with an average of more than 2 cars per house (ADA, 2016). The demands of having more than this average of cars are most certainly increased dramatically, considering the increased numbers of youngsters in the city. It is likely that families can afford to buy more cars for their growing children, especially when taking into account the very cheap price of fuel in Saudi.

Socially, the results can also support the argument that due to the sole transport option of cars in the neighbourhood unit and city, it is actually challenging for residents to meet more often, reducing chances for interacting when walking and interacting more in public, possibly minimising the opportunities to socialise. Providing another reliable and sustainable transport system, such as buses and a metro network, could provide a more economic and healthy

option of transport for the residents. These propositions are comparable to George et al. (2011) who argued that transport facilitates social connections by enabling contact, both causal contacts and stronger ties, as social connectedness is about the interactions, networks and relationships between people.

There was a clear lack of social cohesion among the studied residents, and many witnessed and interviewed participants did not often communicate much with their neighbours, so the research results therefore share Litman's (2014) assertion that the lack of alternative transportation systems can possibly affect community cohesion. Meanwhile, unfortunately, the current absence of multiple transport options and the explained lack of social interaction, even between neighbours, forces the conclusion that transport sustainability in the studied neighbourhood is very weak, and is rather waiting to be achieved.

### *The Change of Lifestyle and Travelling Culture*

The results of this research on the current nature of transportation in Riyadh, and Almoroj neighbourhood in particular, suggest a change of lifestyle and travel behaviours, which often favour the constant use of cars and discourage walkability under the present absence of alternative travel options. In a broader perspective, the weakness of Almoroj street design might be one reason that affects some of the interviewees and some residents walking for more distances than they do now.

It is also quite clear that, the lately developed limiting urban transport policies adopted by the decision makers for this neighbourhood might have impacted negatively on the travel behaviour of residents. However, it is also believed that had more transport opportunities been offered for different travel options more residents might not have been criticised for the aforementioned extensive purchase and use of cars, and in this case cars might have been a secondary option perhaps less constantly. These outcomes are comparable to Zhong et al. (2016), who discovered that to understand urban dynamics in a city and its transport systems, policy and management plays a central role. They further pointed out that travel behaviours might be changed through amenable experiences. The residents in the studied neighbourhood preferred the use of cars as the main option because of the decisions made, and this over time imprinted on their lifestyle. Nevertheless, it is also important to indicate that the authorities who developed the plan at that stage knew the extent to which the people might not use the alternate modes of transportation such as buses or metro because of cheap oil. Hence the

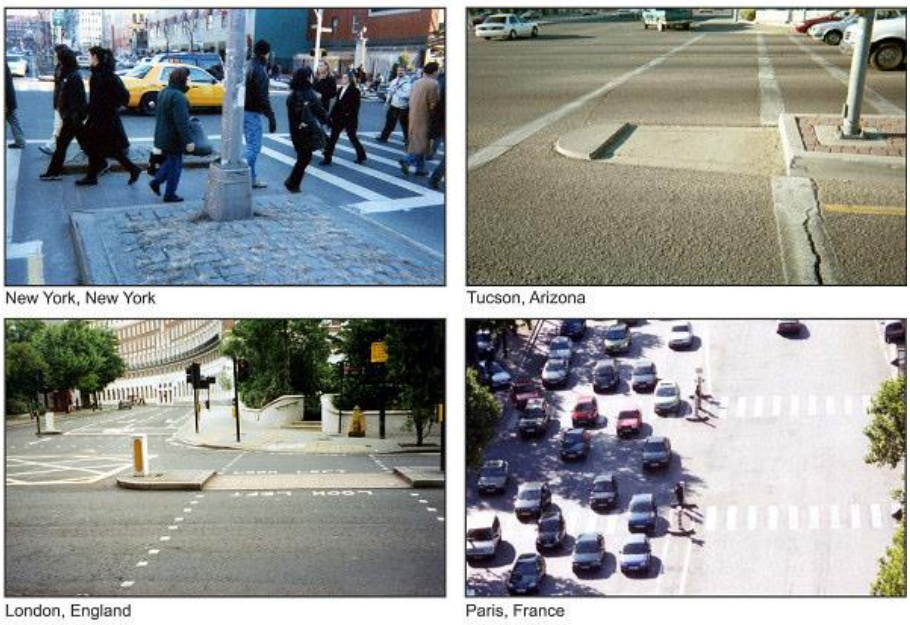
authorities did not bother to invest more resources for the different modes of transportation that they thought would have less chance to be fully used.

The way the larger populations can access the transport systems is a leading issue that can be resolved through the densification and intensification of the land use. While adopting this approach, the communities in one specific area or neighbourhood unit might take equal benefits of the transportation systems, argued by Curtis (2009), while contrary to that, the authorities who developed neighbourhood units did not consider the aspect of benefitting the people through opening doors to promote more communication and interaction socially in public spaces, as discussed by Gonzales (2008) regarding the allocation of city space to multiple transportation modes.

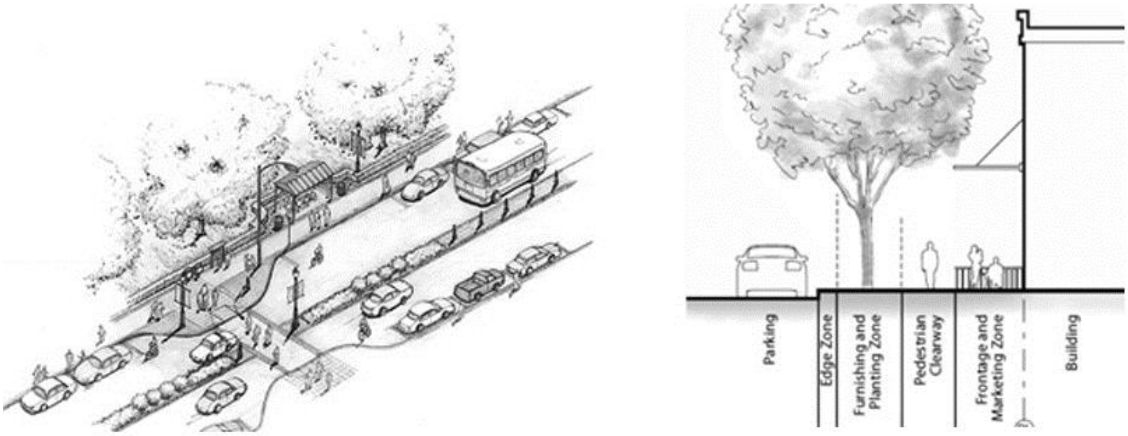
### *Challenges of Walkability: Pedestrians and Streets Problems*

This chapter presented the original general and limited plans of Doxiadis for the city transport system and the developed changes introduced by MOMRA and Riyadh Municipality. It was emphasized that the later developments failed to exactly incorporate the right vocabulary into their decision-making to develop what is now known as a more sustainable transport system within the neighbourhood unit. It was found that the existing streets do not conveniently reassure the residents to walk, cycle and repose, even within the neighbourhood streets. The authorities responsible for developing criteria could have used the approach of Daganzo and Cassidy (2007), wherein they emphasized deploying lanes for high occupancy vehicles in urban areas. This could have offered opportunities to expand the transport infrastructure extensively. Contrary to that, the developed transport system does not indicate the lanes for high occupancy vehicles including bus lanes or even bicycles.

Furthermore, no street furniture and facilities have been placed alongside major and local streets, such as chairs and benches, for old and young people to sit on. The studied streets' sidewalks required more attention in terms of landscaping and pedestrian regulations that would motivate the residents to walk more. Many residents were unable to walk in these streets due to natural discomfort, but most importantly because of the physical presence of many obstacles and absence of decent walkable footpaths compared to better designed standards of streets in many developed cities (see Figure 8-18 below). When found, it was observed that the streets' texture and design layout are not well defined.




**(a)**




(b)

**Figure 8-18: Example of street design standards that give more respect to the movement and connectivity of pedestrians on the streets. Unfortunately, none of these standards are found to have been developed in the studied streets.**

(Sources: Timothy, 2007(a) Rehan, 2013(right) and Kimley-Horn and Associates. Inc (left) (b))

The results explained the lack of street attractiveness and the negligence of pedestrian's footpaths in some key areas as being among the main reasons for the discouragement of residents to walk. This has many negative consequences on the overall wellbeing of the community, one of which is the aforementioned social impacts. In this respect, these results agree with Farias et al. (2014), who stated that based on users' perceptions and urban design guidelines on the pedestrian scale, social interaction can be better enhanced by the provision of facilities that encourage walking within the designated spaces in focus. Also, when considering the conclusion of Heinrich et al. (2007), individuals with greater access to more physical activities, including streets' connectivity, had better physical health comparatively. It is then worrying that the omission to develop better walkability and connectivity motives in

Almoroj neighbourhood might forbid many residents from gaining such physical welling consequences.

In an interesting relevant study of the virtues of walkability in Riyadh city, Ledraa (2015a, 2015b), compared a number of traditional neighbourhoods in the core with other lately developed ones distributed around the city and found that:

> *"The inner city (Deerah) traditional neighbourhood forms tend to perform far better than any other neighbourhood form in the city in terms of walkability, social interaction and neighbouring…The neighbourhood subdivision patterns of the traditional core area in Riyadh presented far greater pedestrian accessibility than the more recent neighbourhoods with modern conventional design patterns scattered all over Riyadh City"* (Ledraa, 2015b:27).

The neighbourhoods that tend to encourage walking are those that are more mixed-use, more compacted and densified, and most importantly that have more interconnected streets. The two neighbourhoods (Deerah and Shmeasey) in the traditional urban core had higher overall scoring of walkability values (on a developed quantitative method used GIS indicator, Ledraa, 2015a) than the other blocks of neighbourhood units such as Maseef (Table: 8-1 below presents all the scores). Ledraa's results also explain that the *Deerah* area in the city core showed greater internal and external connectivity, measured by road network intensity. More recent neighbourhoods, those in the zone where Almoroj is located, have lower connectivity, but tend to have larger block sizes 10849. 78 $m^2$ and lot sizes 676.88 $m^2$ than the block sizes of 4001.09 $m^2$ and lot sizes of 248.88 $m^2$ found in the *Deerah* neighbourhoods (Ledraa, 2015b).

Ledraa's (2015a: 10) findings echo what is mentioned in the literature that neighbourhoods with Traditional Neighbourhood Development (TND) design layout *"are pedestrian friendly,"* due to the fact that:

> *"The housing units in these neighbourhoods are clustered around some shared common places that usually serve for socialization and gatherings of local residents. It must also be mentioned that these common pedestrian spaces enjoy complete sidewalks, informal surveillance, often well maintained and taken care of, which provide a sense of security and feeling of safety."*

Nonetheless, these urban aspects are not seen in Almoroj neighbourhood at the moment. It was observed that there is no clear special hierarchy that makes pedestrians move gradually from private to semi-public and then to public spaces. As seen in the presented figures, there is a clear jump from private to public spaces. This affects the aspects of comfort and sociability of activities for women in public.

**Table 8-1: Average Walkability audit scores along different street segments of studied neighbourhoods in Riyadh.**

(Source: Ledraa, 2015a: 8)

| Neighborhood | Density | | | | % public open space | Average block Length & Width (m) |
|---|---|---|---|---|---|---|
| | Residential Dwelling units/ha | Street m/ha | Block density units/ha | Commercial density (m2/ha) | | |
| Deera | 36.8 | 335.5 | 2.7 | 154.4 | 26 | 131 |
| Shmeasey | 54 | 493 | 4.8 | 454.3 | 35 | 106 |
| Badeea | 14.5 | 236 | 1.3 | 560.3 | 85 | 183 |
| Olaya | 5.9 | 217.0 | 1.3 | 2216 | 36 | 213 |
| Sulaymaniya | 15 | 251 | 1.6 | 687.1 | 33 | 171 |
| Al-Jazeera | 20.3 | 134 | 0.6 | 0 | 37 | 389 |
| Hamra | 6.9 | 162.5 | 0.6 | 0 | 29 | 273 |
| Maseef | 13.1 | 253 | 1.6 | 586 | 32 | 171 |
| Waha | 12 | 222 | 1.4 | 138.4 | 31 | 176 |
| Mohamadiya1 | 25.3 | 246 | 3.9 | 0 | 48 | 115 |
| Mohamadiya2 | 6.2 | 255 | 1.5 | 581 | 34 | 167 |
| Sahafa | 4 | 196 | 1 | 794 | 41 | 200 |

Moreover, the importance of the length of urban blocks in promoting walkability is highlighted by many scholars (Ewing, 1999; McNally, 2010; and Choi, 2012). For example, McNally (2010:11) convincingly explained that:

> *"Typically, shorter block lengths lead to greater accessibility throughout an area for pedestrians. Shorter block lengths allow for increased opportunities for crossings and provide more direct routes for pedestrians, as well as limiting the time automobiles have to accelerate after intersections. Shorter block lengths also tend to disperse traffic, resulting in fewer roads that are heavily congested by automobiles."*

In order to encourage more walkability in urban areas it has been recommended that the lengths of the blocks should be in the range of 300 to 400 feet, according to Ewing (1999). This recommendation is, however, low behind what is found in the case study neighbourhood where the lengths of some blocks can reach up to 820 feet, without mid-block crossings and pass-through.

It can be argued that the characteristics of the form of the urban neighbourhood are clearly related to the level of walkability. Neighbourhood forms that have mixed land use, compactness, higher density and interconnected streets encourage walking. Mixed-land use is an important element for future sustainable development, therefore planners should focus on

more diverse and interconnected neighbourhoods. The previous concepts are design and policy-relevant and can be used to inform subdivision regulations, for example, to select the location of schools and other services with well-connected landscapes and streets to all residences in the neighbourhood.

Therefore, the developed street designs in the developed case study do not currently stand for goals to achieve a more sustainable neighbourhood, as reviewed in the literature review chapters. The encouragement of walkability by solving the above listed problems would give better social and environmental performance. This is the 21st century where cities and neighbourhoods would benefit from more efficient transport systems to contribute towards the wellbeing of the increasing number of urban dwellers. A sustainable neighbourhood unit remains incomplete without the presence of a viable sustainable transport system, and one which lessens movement and helps tackle negativity of traffic (Clercq and Bertolini, 2003). More sustainable urban forms must offer better ways for people to walk, cycle, and provide well organized public transportation methods than work within more compact urbanisms to encourage social interactions (Elkin, 1991).

## 8.5 Conclusion

The Doxiadis design plan offers a variety of travel options that included cars, bicycles, buses, and pedestrian movement. This means the designers thought of social and environmental aspects of their design. Providing different kinds of transport gives opportunities for people to interact socially, save energy, and produce less pollution. The original plan did not have details for designing the transport systems such as buses or bicycles, as well as defining the separation between cars and pedestrians as was just suggested in street sections. These were guidelines and should have been turned into policy and a detailed urban plan. The design placed more attention on the movements of cars because it was the oriented modern movement in Saudi Arabia.

The development ignored many of these suggestions by Doxiadis and planned just for cars. No evidence of separation between pedestrians and automobiles was found. Streets were clearly designed for cars and the sidewalks were used for private plantings and not for pedestrians. Riyadh Municipality was not responsible for creating the sidewalks in the residential streets and it was the responsibility of private owners of individual land. There were no compatible bus systems and bicycle demarcations in the streets. Some of the facilities and services were within walking distance. However, the streets are not well connected to the

facilities and services for walkability. Some facilities were near the residents but the length of the blocks and the streets and no detailed landscape plan make the distance longer. The streets were clearly designed for cars that threaten the environment, and which produce less social interaction.

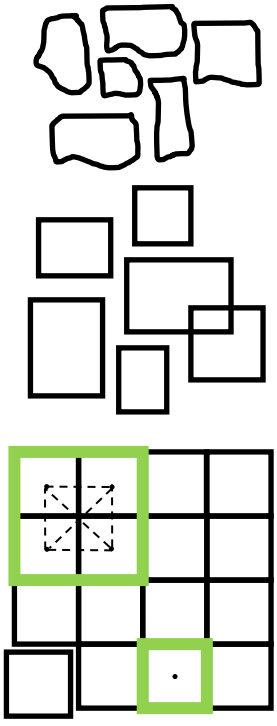
The residents practise unsustainable use of transport. They drive cars for almost every short trip within the neighbourhood. This might be because there is no choice or because the street design does not encourage them to walk. Even though some facilities are within walking distance, a car is the only option. It was only to the mosques that some people were willing to walk; however, most were non-Saudi workers. The streets show no safety and sidewalks, and therefore there is no respect for pedestrians, especially for women, who thus keep away. Sidewalks would provide safety and privacy for women to walk to nearby facilities and encourage them to interact publicly. Although the residents do not prefer to walk because of the reasons mentioned, still such facilities should be provided. In this context, there is no promotion for walking and cycling in the neighbourhood that has led to the dependence on cars, and has become a travelling culture.

# Chapter 9 : Diversity

**Contents**

## Chapter 9 : Diversity





## 9.1 Introduction

This chapter investigates how the neighbourhood meets the last point of the identified criteria of diversity, in order to continue the process of assessing the sustainability of the selected Almoroj neighbourhood unit in Riyadh, Jacobs (1961) popularized the diversity dimension, which was subsequently adopted and became broadly accepted through numerous planning approaches, such as intellectual growth, sustainable development, and new urbanism. The chapter is divided into two sub-themes: mixed land use and the variety of housing, demographics, and social activities and again each sub-theme is examined based on the three stages and framework developed.

The first sub-theme studied the mix of uses and urban functions in the neighbourhood. This theme should provide an understanding of the diversity in terms of land use and to see the way in which the urban functions are divided and mixed. When there is not sufficient concentration of diversity in an area, people may be forced to use their vehicles in order to access basic needs. The mixed land use concept was planned by Doxiadis and was changed and partially implemented by the policy of RM and MOMRA, and the needs of residents will be discussed in more detail in this chapter.

The second sub-theme studied the variety of housing types, sizes, cultures, activities and income. This sub-theme examines these elements at the neighbourhood level to see how Almoroj is achieving social equity. This sub-theme is an important criterion to measure the diversity of the neighbourhood and it brings many benefits for social sustainability. It outlines how the urban policy contributed to achieving mixed use community, and how the development is providing further desirable urban and architectural features for communities.

## 9.2 Mixed land use

Heterogeneous zoning or mixed-use provide an opportunity for compatible land uses to be located nearby one another and, hence, make travel distances notably shorter (Parker, 1994). It shows the diversity of functional land uses such as commercial, residential, institutional, and industrial, and those associated with transportation. In terms of this case study, the neighbourhood needs to be able achieve a high degree of mixed land use development to bring people closer to their daily acquired functions. This means that it should combine a variety of different land uses for its users (both residents and workers), merging: residential, offices, commercial/retail, public spaces and entertainment, cultural, institutional

(administrative/ government), and/or industrial uses together in the same reachable area. By doing so it is then highly anticipated that the available places and spaces in the neighbourhood would be more socially, economically, and environmentally liveable and sustainable.

### *9.2.1 Design Stage: Diversity in Doxiadis' plans*

Table 5-1 (in chapter 5) presented Doxiadis' original guidelines for mixed land use in the neighbourhood unit. Accordingly, the neighbourhood must include: residential, commercial, education, religious, and recreational spaces, in addition to health and other services, in order to design a self-contained community classes in Riyadh city. The resultant functions are organised spatially according to Doxiadis' Ekistic scale of CCs. The functions were therefore been broken down and distributed based on the limits of each service area of the identified community classes.

The initial plan illustrates horizontal mixed land use, and was less concerned with vertical mixed land use buildings inside the neighbourhood unit, including residential and commercial buildings, in the original plan. However, the design suggested vertical mixed land use in the adjacent main spine and in the central area of the neighbourhood (CCV). The land zoning suggested by Dioxidis in Riyadh was for South Olaya neighbourhood, as discussed in chapter 5, which could be used to understand his vision for land zoning for all other neighbourhoods. More specifically, the following land zones were classified: C3, R12, R21, P1, and S1. C3 means commercial, cultural and administration; R12 is residential, single family one- or two-storey dwellings; R21 is apartment or maisonette buildings; P1 is parks and recreational spaces; S1 is schools and kindergartens (see Figure 9-1 below). See Table 5-2 for details of building regulations associated with these classifications.

The boundary edge pertaining to the modulus is set out in zones for residential apartment buildings, which line the street and residential detached villas on the periphery of the central commercial area of the neighbourhood. The hierarchy of the community classes' functional program does not entail the defined commercial and civic centres and their respective functions are not included in the design schemas.

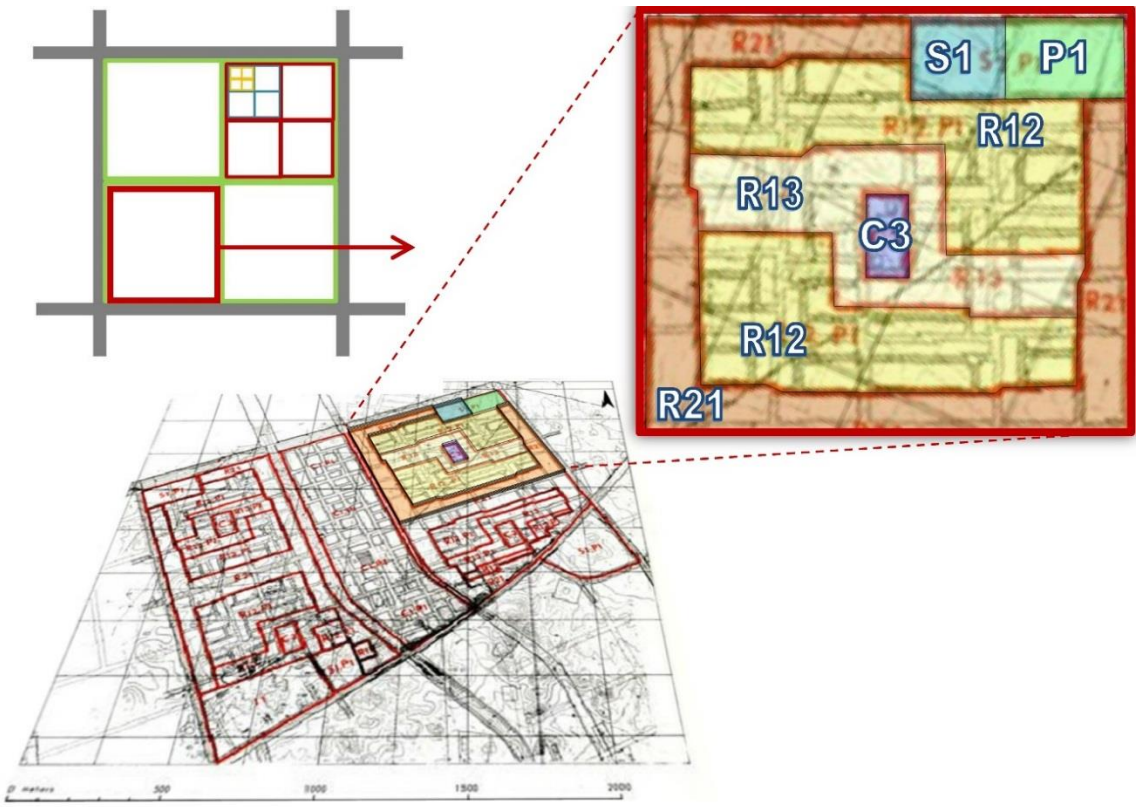



**Figure 9-1: Zones of land use at the neighbourhood level modified according to Doxiadis' plans for South Olaya Neighbourhood in Riyadh, 1971.**

It can also be seen from Doxiadis' plans for South Olaya in Riyadh, that he kept S1 (schools) and P1 (large parks) in the corner of CCIV. Since the area of neighbourhood CCV contains 4 CCIVs, it appears that the aim was to gather the four corners of CCIVs together in the middle to make the CCV more independent, and thus more reachable by all residents in the neighbourhood (the furthest is about 1km, 10 minutes walking). In this regard, the neighbourhood unit seems to achieve the concept of mixed land use, horizontally, but there is no evidence to suggest high level of vertical mixed use (i.e. clues of recommending mixed use buildings). Nevertheless, much of the reviewed sustainable urban approaches required the adaptation of both horizontal and vertical concepts for fully mixed-use urban forms.

Moreover, the housing type and form (villas), and privacy needs, might affect the need for vertical mixed use when considering the fact that Saudi Arabians tend to live in separated villas. Perhaps this cultural fact was also considered in the initial plans and that it was designed to limit the use of vertical mixed land use. In this case, as all residents in the neighbourhood would be within the catchment areas in relation to the facilities and services, the horizontal mixed land use might not have been considered a particularly problematic issue.

### *9.2.2 Development Stage in Almoroj Neighbourhood*

The earlier mentioned land zoning suggested by Doxiadis for South Olaya neighbourhood was used by Riyadh Municipality for Almoroj, using the same zoning details C3, R12, R21, P1, and S1. However, studying the current urban conditions of the case study neighbourhood it is clear that it does not follow the exact same land zoning illustrated in Dioxidis' plan. In Almoroj, it can be seen that the Ministry of Municipal and Rural Affairs along with Riyadh Municipality developed more diverse facilities and services in the neighbourhood. Therefore, it is argued that the concept of diversity has been considered in Almoroj, but different to the initial plans.

The developed land use zoning regulation did not fully follow Doxiadis' plan. The land use map of the current neighbourhood conditions demonstrates a considerable degree of mixed land use that includes horizontal and vertical, regardless of some missing functions (Figure 9-3 and 9-4) and (Table 9-1).

Table 9-1 explains that the residential use covers 35. % of the total neighbourhood while the commercial use is 9.3%. The mixed land use covers 6.5% and it includes commercial and residential use. The percentage of residential use would be raised to 41.6% if the residential use within the mixed land use is added on, while commercial use would be 15.8%. Thus, the residential use covers a large part of the neighbourhood unit.

**Table 9-1: Percentage areas of land use (services) in Almoroj (ADA, 2004 updated by the author)**

| **Service (Land Use)** | **Total area ($m^2$)** | **Percentage %** |
|---|---|---|
| Residential | 1,409,015 | 35.1 % |
| Commercial | 376,769 | 9.3 % |
| Mixed land use (Commercial - Residential) | 246,221 | 6.5 % |
| Educational | 124.837 | 3.1 % |
| Parks and open spaces | 38,158 | 0.95 % |
| Mosques | 33,001 | 0.83 % |
| Health centres | 1,810 | 0.25 % |
| Streets | 1,502,547 | 37.6 % |
| Industrial | 0 | 0 |
| Governmental (Includes Parking) | 14,300 | 0.35 % |
| Storages | 8,487 | 0.20 % |
| Public services | 28,929 | 7 % |
| Ministerial | 0 | 0 |
| Private Cultural | 9,486 | 0.24 % |
| Agricultural | 0 | 0 |
| Vacant Lands | 215,000 | 5.4 % |
| **Total** | **4,008,560 (4$km^2$)** | **100 %** |

The results of the mixed land use developments undertaken under the municipal planning and streets policy, as discussed in chapter 5, can be seen in the existing conditions (Figures 9-2). Figure 9-3 presents the map analysis of each land use on a separate map to help better understand the distribution and zoning of the main urban functions and services in Almoroj.

Both figures indicate that residential lands were the most dominating land use in the four parts of the community class IV, and are shown in yellow. It appears that the streets' network in the neighbourhood cover a very high percentage of land (37.6%), compared to the other essential services. However, mixed land use buildings (in orange) present the buildings with both commercial and residential functions, where usually the ground floor is dedicated for businesses and the upper floors are for living. The mixed use buildings are located on Al-mafroka streets within community class V (Large Al-mafroka) and a few on Almafroka streets in community class IV (Small Al-mafroka). The mixed land use buildings are two to three and half storey buildings in the main streets, allowing these streets to be more attractive and liveable than the inner streets in the neighbourhood.

In addition, contrary to the original plans of Doxiadis, on the borders of the neighbourhood unit and the centre, there are mostly commercial areas and some mixed use buildings (see figure 9-2 and 9-3 in red). The reason for developing massive commercial areas on the external ends of the neighbourhood unit refers to the policy of Riyadh Municipality of street functions, which encourages the separation of these functions from the residential blocks from the rest of the neighbourhood unit. On the one hand, developing commercial areas at the external ends means that the residents are not disturbed, while on the other hand, this seems to have led to weakening the liveability in the centre, as the commercial areas are not concentrated in one area in the core of the neighbourhood or in CCIV, and this seems to affect the diversity in land use at a smaller scale.

Looking at the overall locations of the key urban facilities and services, such as schools, mosques, health centres, parks and open spaces, the development of Almoroj can be criticised in the sense that these land uses are not distributed evenly within the four residential areas and Al-mafroka commercial streets.

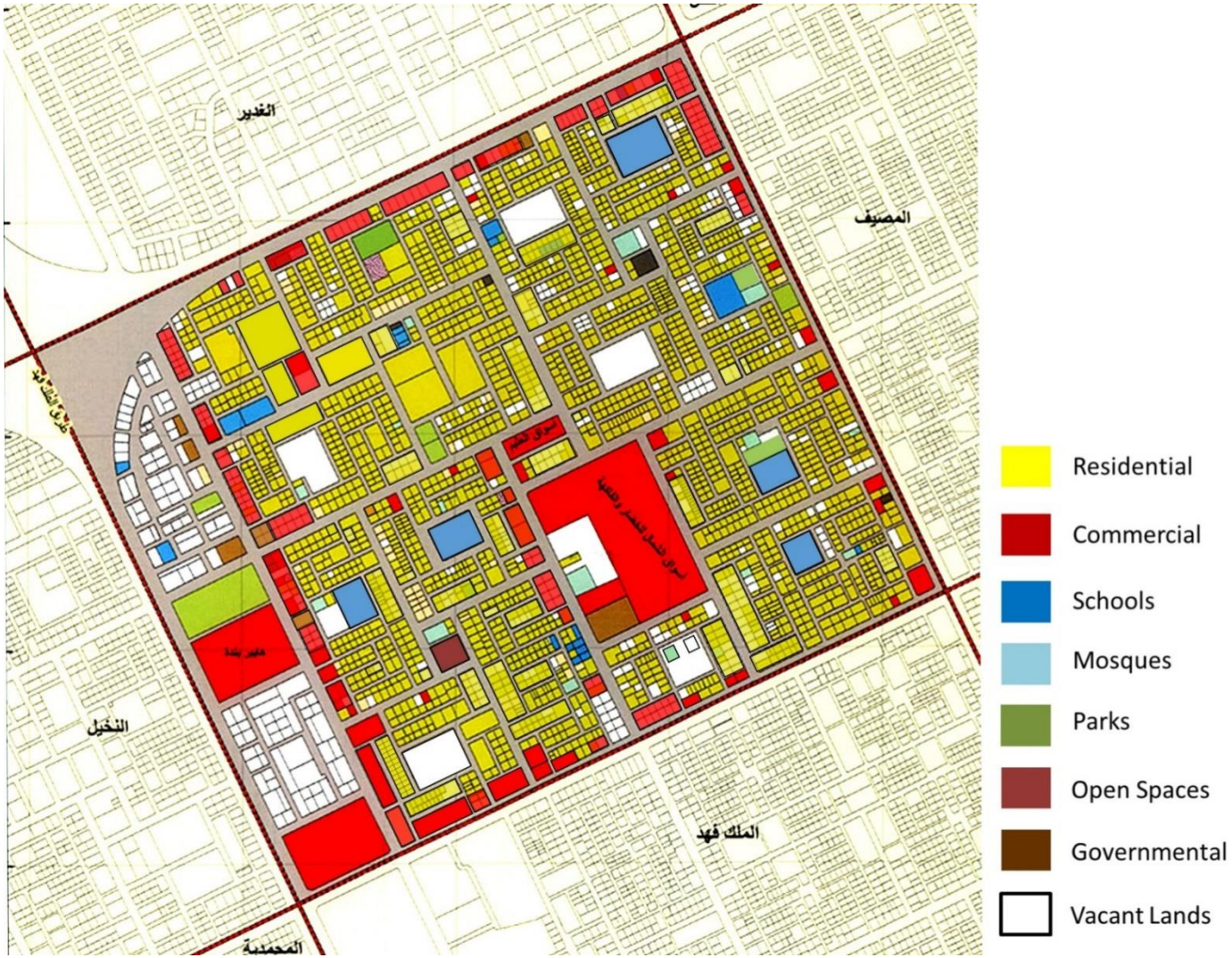
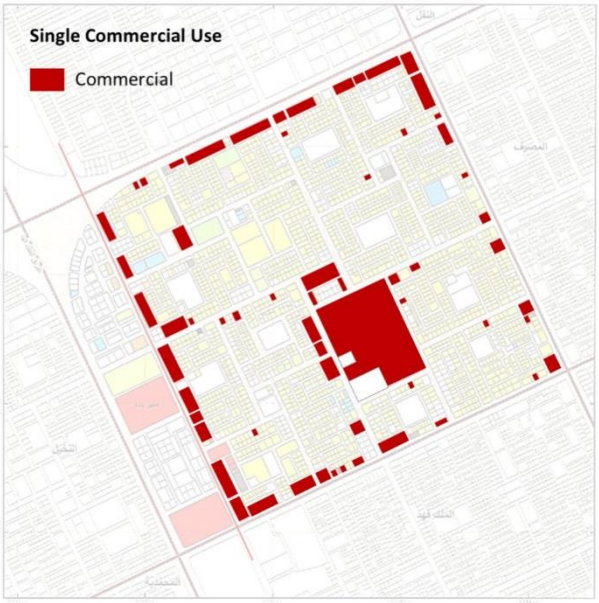
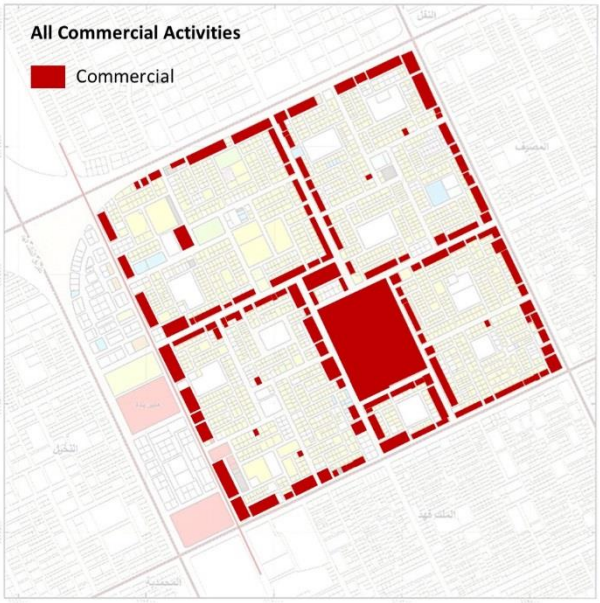
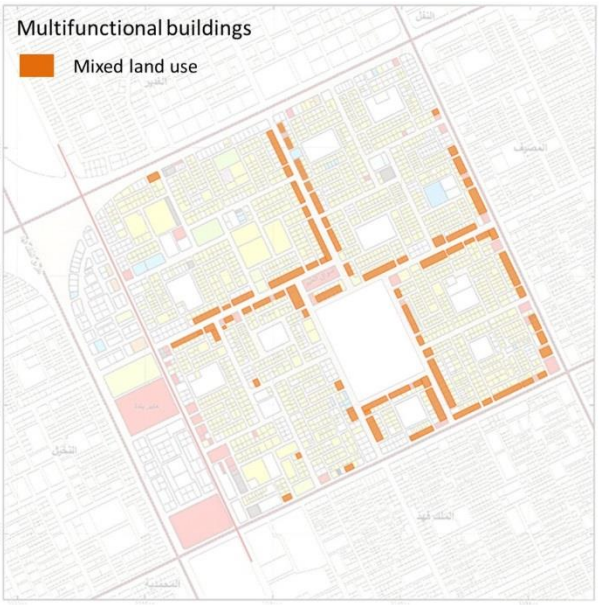



**Figure 9-2: Present land use map of Almoroj neighbourhood**

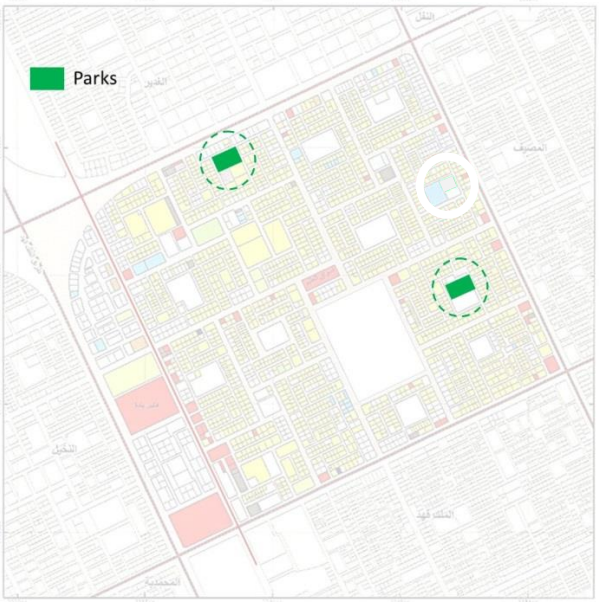
(Source: ADA, 2004, updated by the author in 2016)

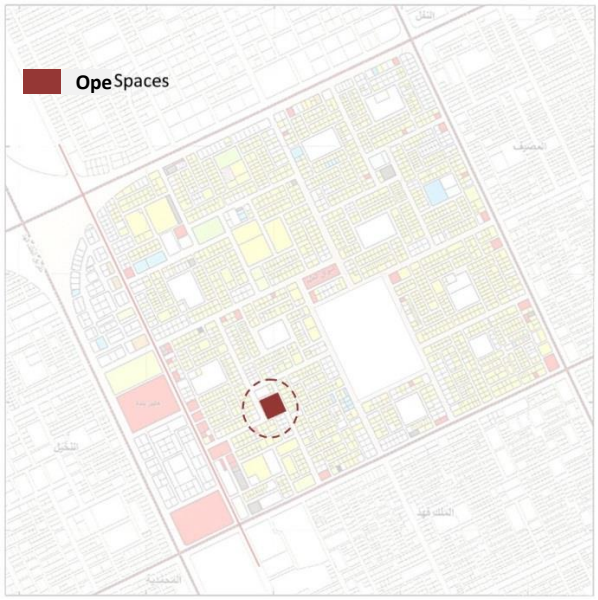

Single Commercial Use
Commercial


All Commercial Activities
Commercial


Multifunctional buildings
Mixed land use


Health Centers


Parks


Ope Spaces

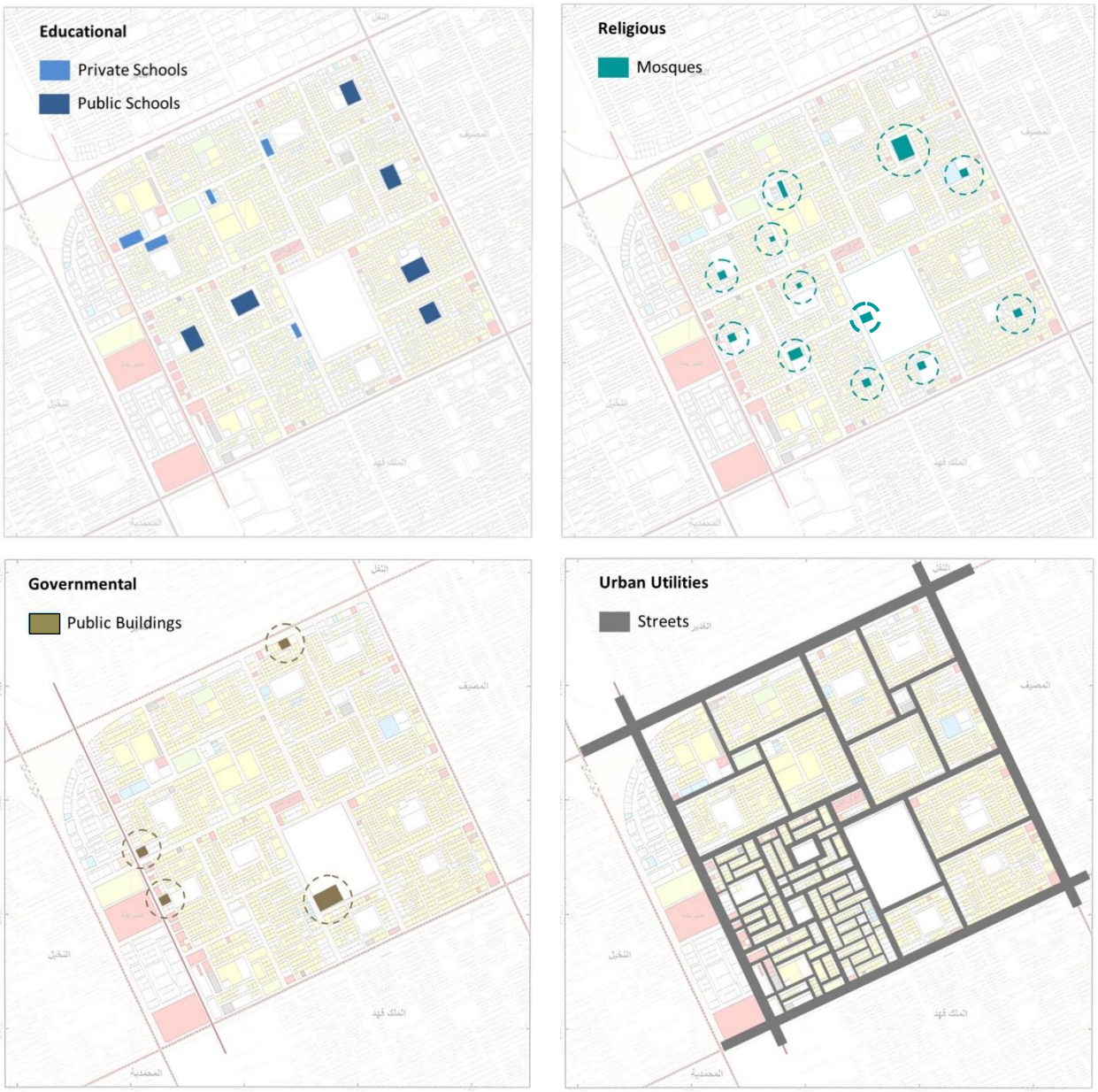



**Figure 9-3: Layers of the current different land use functions in Almoroj**

For example, Figures 9-4 and 9-5 illustrate a zoomed in example of the neighbourhood, which show the south western CCIV of Almoroj (highlighted in red). The detailed map analysis of the urban form demonstrates how this section of the neighbourhood is short of some very important land uses such as parks (P1) and other key public services at its core (C3, like health and government centres), compared with the aforementioned concept of CCIV in Doxiadis' plans. However, the selected example still offers a great deal of mixed land use that covers the everyday requirements of the neighbourhood residents without the need to travel a long distance on foot (see sections in Figures 9-6). Nevertheless, the proximity of facilities and services to residences, which in return increases the possibility of having more social

activities, interaction and viable community life, remains a controversial subject for future development.

The developers seem to attempt to increase the possibility of land use investments by offering more commercial land at the expense of the relatively non-profitable public facilities (Ministry of Municipal and Rural Affairs, 2013). As a result, because of these consecrated commercial activities, people are drawn to the main Al-mafroka streets of the neighbourhood. The neighbourhood centre and the sub-centres have therefore become poorer and apparently unattractive. This also causes a considerable amount of traffic on the main streets outside the neighbourhood.

Another concern is that the urban area of the community class V has undergone redevelopment pressures from authorities to be rezoned from residential to commercial development, as can be seen in the large area of the fresh market (the largest land in red in Figures 9-2 and 9-3). A stated by UP1, *"some other small lands were re-combined to form a large plots, usually for commercial use on the border of the neighbourhood."* The consequence of this kind of sudden act affects the juxtaposition of jumbling urban scales and capacity with a definitive loss of the better grain, urban fabric and community, class, clarity and definition inside of the modulus, as well as loss of sense of community and social cohesion. Mostly, it affects the concept of mixed land use by covering large areas of the neighbourhood for the use of a single dominating function, usually commercial.


**Figure 9-4:Comparing the current land use development in Almoroj with the CCIV zoning concept of functions in Doxiadis' plans**

(Source: Author)


**Figure 9-5: 3D illustration of the current condition of Almoroj (commercial and residential streets and buildings, parks and open spaces)**

(Source: Author)

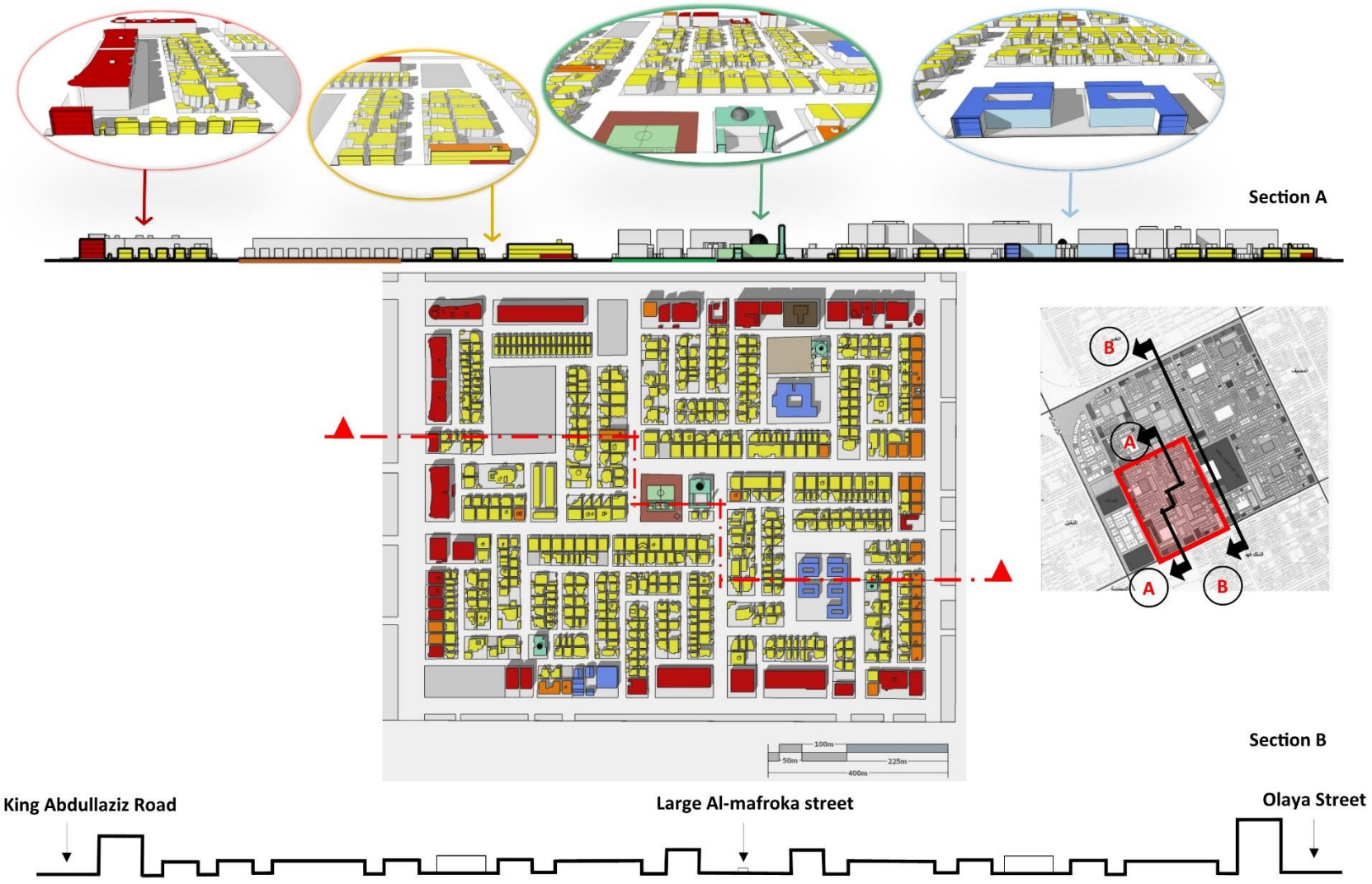



**Figure 9-6:Section of a 3D model of the neighbourhood showing an example of current vertical and horizontal mix use**

(Source: Author)

### *9.2.3 The Use Stage*

This section investigates the residents' experience of the diversity of land use in the neighbourhood according to their daily needs. It also aims to understand whether and how the neighbourhood meets the residents' needs.

Of the total men interviewees, the majority agreed that the neighbourhood unit offers diversification in residential and commercial areas, including public and open spaces. Many found that the current diversity of their homes, services, and schools, for example, fulfil their needs in the neighbourhood. Most of their trips for shopping, taking children and teenagers to schools/mosques were within the neighbourhood. Therefore, they do not have to go out of the neighbourhood unit, especially on weekdays. Most said that they only go out of the neighbourhood to places that they do not need often such as for mechanical services in a place called "Senaia am alhammam" designated for fixing cars, or to hospitals (about10 km away). Such places cover general needs of all the north side of the city, provided at a regional level.

For sport activities, many do sport activities, go to the gym and visit restaurants in the neighbourhood, but going out of the neighbourhood only happens occasionally at the weekends. Two of them like to play football in better fields out of the neighbourhood on grass and not hardscape ground as in the neighbourhood, twice a month.

For daily trips, they go to university or work every day out of the neighbourhood. Most universities are not more than 10 to 15 km from the neighbourhood and their work distance varies from 5 to 25 km, however, the majority are less than 15 km. Some men aged in their 50s visit their parents' houses who live in the next neighbourhood or in close neighbourhoods, as they prefer to live nearby.

The results indicate that residents do not prefer to live in buildings that are mixed with shops. They like to be separated and living in villas, which is a horizontal concept. The residents' preferences to live not in vertical mixed use buildings but horizontal ones are because of privacy considerations, and because they prefer more wide spaces and rooms, as well as having private open spaces such as small garden. A7, a university student, gave her opinion on the neighbourhood through the concept of mixed land use by saying:

> *"I can say with confidence that there are a good mix of residential and commercial buildings in this area. In my view, there are shops, mosques, schools, playgrounds and parks. I find a variety of services such as medical dispensary as well as*

*supporting services with different functions. I feel that I do not need to go out for most of my needs, especially on weekdays".*

The interviewees were also asked about the missing functions and the concern of travelling long distances to approach recreational public spaces like green and open spaces that include playing fields. Their responses indicated that open space and parks were not enough, but in effect they did not seem to care too much of their existence. It seems that parks and open spaces in the neighbourhood are not considered as a recreational environment for men due to alternative preferences in socialising that will be discussed later. All the four units of community class IV in Almoroj do not have competitive recreational public spaces, unlike the Municipal open space that includes playgrounds for all ages. However, it is realised that Almoroj, to a great extent, is considered a diverse neighbourhood for the residents, regardless of some other missing facilities, such as health centres. The one provided health centre seemed to surprisingly be enough to most interviewees, although some of them travel to the next neighbourhood for this critical services.

Two interviewees raised other issues related to problems of mixed land use regarding the cars parked by workers in the big companies nearby. Some of these large buildings of companies are near to villas and do not have enough parking spaces on site, hence some employees park their cars in the internal residential streets, which disturbs residents in terms of car parking spaces and privacy. Those cars take over the residents' parking spaces in front of their houses and lead to a lack of safety and insecurity, particularly for women and children who may be unsure of the unknown employees. Another issue is that these companies with tall buildings break the secrecy of their surrounding houses, as it look over their private open spaces inside.

Concerning daily needs, many interviewees found clear connections between home and services, and this establishes that the residents could easily find the shops they need in the neighbourhood. A12 a resident, who is an employee of a private company, graded the neighbourhood under the theme of mixed land use and said:

*"I find different schools, shops, mosques, residential, and commercial areas in this neighbourhood. I can access the services and facilities to meet all my needs. I do not go to next neighbourhood because I find all possible services in here".*

However, it has been observed that some urban functions are provided but are not used by the residents. For example, some residents study at schools in the next neighbourhoods because of quality and reputation and other reasons. Quality of private schools is an important factor

that the residents refer to. However, it depends on affordability, and most of the residents who can afford them prefer private schools; of course, not all interviewed residents can afford them, as is discussed in the next section. This means that the existence of private schools beside public ones provides the residents inside the neighbourhood with their needs instead of forcing them to travel to outside schools. By having different types of schools, this indirectly achieves the concept of mixed land use.

Responding to the raised diversity issues, most interviewed women claimed that the neighbourhood unit demonstrates a good range of awareness of the diversity in mixed land use. Their conclusive reactions indicated that provision of schools, mosques, commercial area, shops and public spaces as well as residential areas in the neighbourhood emphasize this reality. However, there were some concerns about some missing functions such as the absence of some designated places for the women to walk and use open spaces and places, like parks and places where they can perform healthy activities (i.e. private gyms). For example, many of them said that they prefer fully furnished open spaces or a popular pedestrian path in the city (see Figure 9-7).


**Figure 9-7: The walking track 1km long in King Abdullah Road. It is one of the main spines of the city.**

(Source: WUF, 2005)

In addition, some of the women interviewees also hinted at the lack of parks, and that if such facilities were there, the women of all ages could have visited the open space. It is evident that, two of the women who live near to the open space in the neighbourhood are happy because of the facilities provided in the open space, for example, the provided facilities for public use in parks seen earlier in Figure 9-5. In this sense, these individuals are considered privileged compared with many residents in other areas in the same neighbourhood, as discussed earlier. One of the interviewees, B2, who is a housewife, said:

> *"I find many functions in the neighbourhood unit in the form of shopping area, my children can go to schools, I find a health centre and park near my home. I therefore say that the area has all facilities. I go to the supermarket in this area, I need not go to another area".*

Shopping malls, and popular restaurants and cafes are the most desirable places for women in the Saudi context, especially in Riyadh. The results of this research highlight this reality. Some of these places and spaces are located in the neighbourhood, in major streets, and mostly at the edges of the square neighbourhood units in Riyadh, often in the main spine area (see Figure 9-8). Women and families visit these places at least two to three times a week. They also mentioned some desirable restaurants and cafes in one place. It is gathered from interviews that women in Riyadh meet their friends in popular restaurants or cafes as well as meeting or getting together in their relatives' or friends' houses during major activities. All these places mentioned are appeared to be indoor spaces.

Most of the women interviewees developed their social connections out of the neighbourhood such as women aged 19 to 24 from universities, women who work who developed friendships at work, and housewives who are close to their relatives and some with their neighbours. Housewives are considered by most of the interviewees to be more sociable indoors, especially with their neighbours, meeting mostly at homes. It was obvious that homes are the first choice most women think of for socializing.

The meetings of women for socialization out of the neighbourhood does not mean that this neighbourhood does not offer popular restaurants and near shopping malls. The presence of such services should always be at the city level but not always at the neighbourhood level. It was observed that big recreational and socialization indoor spaces (i.e. shopping mall) are mostly located on the major roads on the border of neighbourhood units. This therefore means that at present the neighbourhood still maintains the concept of mixed land use. As one of the interviewees, B8, reported that:

*"I am a university student and can understand the existence of functions as well as facilities in the neighbourhood. I find all things in the neighbourhood but still socialize more with friends and relatives in popular restaurants and a shopping mall elsewhere".*

**Figure 9-8: Shopping malls on the city's main spine. The city now has multi spines, and they are mainly distributed on these spines. Some of them are placed on the borders of the neighbourhood units**

(Source: www.alriyadh.gov.sa)

It has been observed that many women use the open space just for walking and sitting in green areas. They do not feel comfortable to play in open public spaces or parks and the reason is that privacy is the main concern and presence of strange men would break their privacy. It means the parks and open spaces offer some recreational facilities for the residents but they limit the activities of women. Concerning missing functions and activities, some of the women did not notice that the neighbourhood has two parks and one open space. It was clear that, some of the women were more aware of the park or open space inside the circle of the community class VI. Some facilities that are provided beyond the scale of CCIV were not noticed by most of the interviewed women in Almoroj. This means that parks or open spaces need to be recognised at the level of CCIV to be more readily visible to residents. Also, to further strengthen the mixed land use concept in Almoroj, the proximity of residents to the identified missing facilities must be rethought as it is one of the main factors that achieves mixed land use.

Continuing the results regarding the perception of mixed land use, the majority of teenagers remained uncertain. However, when the topic was clarified and discussed further, they highlighted differences between residential and commercial areas including public places. They explained the rationale of mixed land use in the neighbourhood by recognizing the balance in the provided land uses of schools, mosques and shopping areas in the neighbourhood. They stressed using and finding most facilities they need in the neighbourhood. Most of the teenagers interviewed study in the neighbourhood schools, and many of them buy their school requirements and daily needs of, for example, food from the same neighbourhood. Regarding their recreational activities, mostly they play at home and a few of them in the open space or park near to their home. Teenagers aged 16 and under are more restricted from hanging out in the neighbourhood by their families due to security concerns. Some of them go with their families to visit shopping malls to play, depending on their families' free time.

One of the teenagers, C5, a school student explained that:

> *"I live and study in the neighbourhood. I meet my friends at home or in my school. I find all my needs from the neighbourhood, from its shops, schools, and medical clinics. I go with my father to the mosque in the neighbourhood, and all the functions are near and not more than a few minutes' drive".*

The perception of C5 clearly and directly supports the concept of mixed land use in the neighbourhood. He seemed to reflect the voice of many other teenagers when he mentioned

that homes are the preferable place for meeting friends. It was also observed that homes in Saudi Arabia are the best choice for the family to gather for social activities and enjoy their time. The home is considered the backbone of the family. It is the first place they think of when they have special occasions or even any gatherings or events, especially for those who are in the age group of 15 and below, as well as women. Homes in Saudi indirectly enhance the mixed land use concept by offering many facilities inside the houses, which means less travel for public parks and open spaces. It must be noted here that modern homes are more flexible architecturally for the needs of young people in Saudi Arabia, as most now have various functions, such as play area/rooms for teenagers to enjoy, and some even have swimming pools too.

The younger teenagers, above 18, use more free time moving, usually driving, around within the neighbourhood, hence they seem more familiar with the location and services of most urban functions and places in the neighbourhood unit. They gather in their friends' houses whether in the neighbourhood or out of the neighbourhood. Most of them have friends who live out of the neighbourhood and they have low social connections with their neighbours or even with the residents in the neighbourhood. Many made their friends from schools and their relationship remains intact and they arrange to meet even after schools and universities.

It is worth mentioning that teenagers from 15 to 19 years old develop their social relationships from schools and universities, then they start working and at work they develop more social connections until retirement. That does not imply that they must develop social connections with their neighbours. A few of the interviewees who developed social connections with their neighbours started from mosques. However, many of the residents pray and leave the mosque straight away. Residents appear to participate less in the mosques' activities because of busy schedules.

The teenagers explained the missing functions in the neighbourhood. Most were not convinced that parks and open spaces offer enough opportunities to undertake the activities they require. This seems to be the reason for them to stay at home and do indoor games. Almost all daily needs of the teenagers were fulfilled by their parents. The teenagers looked certain that the privacy of their homes was important to them, and this is why they think that homes should be separated from the shops. When homes and shops are mixed in one building, this, in their opinion, would cause noise to neighbours, which would not be socially acceptable. Saudi residents who live in mixed use building apartments do not prefer to last

dwelling in them for long, because of the lack of enough space for daily activities, particularly for those with children. However, some teenagers said that the good thing about them is that shops are very close to them, downstairs. A15 year old teenager, C2, said that:

> *"I need more facilities in the neighbourhood, the current functions, though enough, I still cannot benefit from the existing facilities. I also need to see shops separated from homes but to be close to the parks or open spaces. However, I still play more at home with my friends."*

It can be realized from the responses that the missing functions weaken the concept of mixed land use. Therefore, the neighbourhood needs more specific functions such as parks and open spaces to satisfy the residents' needs. The shops are poorly connected to the open space and parks, thus they are not close enough for them to safely visit. As earlier discussed, shops are placed on the major streets and most parks and playgrounds are placed within the residential areas, with no proximity. The location of the only corner shop near the open space was highly appreciated by the teenagers.

The interviewed workers living in the neighbourhood appreciated the separation of homes and shops, and also conceded that their daily needs were met. They did not hesitate to go to the shops twice or three times each day. The two foreign workers identified the neighbourhood as being built under the concept of mixed land use through the provision of all the services. In particular, a Saudi worker, D4, who works for a private company, simply said that:

> *"During the day, I come from a different area to work. I can find my needs in the commercial streets if needed. I do not know the rest of the functions in this neighbourhood, however, I realise that there are some big retail buildings and there is no need for me to go far whenever I need something".*

Whereas the foreign worker, D1, argued about mixed land use in the neighbourhood by saying:

> *"I feel certain that this neighbourhood offers all facilities I need, such as a park for walking, a mosque to pray, and shops for shopping. I also recognise that there are various other facilities that are generally needed by the residents. I can also identify some of my country fellows/friends who live in different buildings who come to me for visiting the municipal open space nearby. I am happy that I live upstairs in a building where my work is and other shops downstairs."*

It can be argued that from a broader perspective, the Saudi worker did not show his concern either to appreciate or to identify the missing functions. This is due to the fact that he does not live in the neighbourhood and his needs would be less. On the other hand, the foreign worker reported that his friends, who live in the next CCIV, visit his area only to go to the municipal open space. This is an indication that some of the neighbourhood CCIV sub-unit do not provide all the necessary functions in where they live. It was observed that many foreigners who live where a park or an open space is missing use the parks in the other sub-units in the neighbourhood. In addition, the foreign interviewees who work in the neighbourhood mostly live in these flats to be near their work place and many other foreigners who work in shops.

Mostly, Saudi workers do not work in local shops but they work in big companies and governmental sectors and these are distributed within the city. Most of them would not prefer to live in mixed use buildings except the foreigners because they do not have cars and mostly apartments are more affordable than villas. The interviewees agreed that apartment buildings offer multiple uses such as floor to rent for a shop and first floor for living, where actually foreign workers and Saudi early career professionals live (Figure 9-9 below). It appears that the mixed use buildings enhanced the diversity concept in Almoroj, and make the occupied workers benefit more from this diversity.


**Figure 9-9: A typical example of a mixed land use building in the neighbourhood**

The visitors were very well acquainted with the concept of mixed land use. They elaborated their answers by adding that the neighbourhood demonstrates the existence of mosques, schools, commercial shopping centre, and parks. They said that when they need something they find it in the neighbourhood. Accordingly, the visitors did not think of the missing functions as an important factor. Some of the visitors stated that they just come to the open space in the neighbourhood to play football and/or basketball once a week or a month, as this facility is not available in their neighbourhood. Another said that some members of my family study at a school in Almoroj, while another said that they come for some specific shops that their neighbourhood do not have. Therefore, indirectly it can be argued that the visitor's neighbourhood was not relatively built on the theme of mixed land use so they had to drive out to Almoroj neighbourhood. One visitor, E2, a university teacher, presented his point of view as:

> *"I live in the next neighbourhood. I visit this neighbourhood to see my friends, and in case I need a particular item I need for my home, which I can easily buy here. I can say that this neighbourhood and my neighbourhood together offers all the necessities of daily needs".*

It was noticed that visitors come to the neighbourhood for different reasons, however, it does not mean that all facilities are missing where they live. If there are some missing facilities visitors go to the next neighbourhood and use it. For example, the open space in the neighbourhood was used by people who live in the neighbourhood and in the next neighbourhood for sport activities.

It can be concluded that the results show that Almoroj neighbourhood achieves a great extent of diverse mixed land use, vertically and more so horizontally. The provision of many reachable urban functions at the neighbourhood level (CCV) overcomes the few mentioned missing functions at the sub-unit (CCIV) level, not all within approximate walking distances. It was observed that using cars make it easy for residents to use the facilities that are not provided within the neighbourhood CCIV in where they live.

## 9.3. Variety of housing, demographics, and social activities.

In addition, a variety of the housing types, sizes, and forms facilitate more diversity and help achieve a vibrant communities. Nonetheless, it turns out to be a many-layered phenomenon (Turner et al., 2001). Diversity appears to be "a multidimensional phenomenon", which advances desirable urban features, embracing the enormous amount of building densities,

housing types, ages, household sizes, incomes, cultures, and offers different activities (Turner et al., 2001, cited in Jabareen, 2006: 320).

> *"If development is not diverse, then homogeneity of built forms often makes a place unattractive, with a lack of housing for all income groups, class and racial segregation, and job-housing imbalances that lead to increased driving, congestion, and air pollution"* (Wheeler, 2002:328).

This section is an attempt to present the research results on these aspects of diversity in the case study neighbourhood. It studies the diversity of the local context based on these elements using different methods and sources to see to what extent the neighbourhood supports social and environmental performance.

### *9.3.1 Design Stage: Diversity in Doxiadis' plans*

The study of Doxiadis' plans clearly indicate that the urban structure of his vision of neighbourhood units was designed for different community groups. This is because of the fact that his plans demonstrate different averages of plot sizes that are not similar throughout the city. This in return implies that inhabitants can live in different sizes of houses. It is likely that this is related to his attempt to consider different income groups around the city, particularly within the general guidelines for community class V scale.

Doxiadis planned different lot sizes for the neighbourhoods in the city, between a minimum of 150 $m^2$ in the city centre of Riyadh to a maximum average of 1500 $m^2$, as mentioned in chapter 5. The Doxiadis plan also suggested different housing types and sizes, which are semi-detached buildings, detached villas, and apartment buildings.

Around the city borders, where Almoroj neighbourhood was sited during the time of Doxiadis involvement with the master plan, it appears that the average lot size for the whole neighbourhood was 400 $m^2$. This suggests that Doxiadis somehow thought about segregating the higher income class groups of residents to the periphery of the city, as the furthest neighbourhood from the centre of the city would mean larger houses. Nevertheless, this does not suggest diversity among the residents of the same neighbourhood, as higher and lower income communities do not reside within one neighbourhood unit. It appears that the division of the classes gives rise to the differences in between the community classes in one neighbourhood.

It is likely that Doxiadis' approach was to bring the communities together at the level of service uses, insisting that all key services and facilities must be commonly provided, including mosques, schools, parks and playgrounds. These urban services utility must be

equally provided and accessed for all residents in one neighbourhood, regardless of their cultural background.

Doxiadis in the original master plan did indicate that the people's needs should be focused at the neighbourhood level, but left to the authorities concerned to conduct detailed research to be finally included in the master plan. This includes the gathering of empirical data concerning social and cultural aspects for the detailed spatial spaces and places. For example, there was not information available at the time for the urban designers in the City Planning Office part of MOMRA to be used to for planning for the needs of women's leisure centres and women's community centres in the master plan.

Nevertheless, Doxiadis planned for general facilities and opportunities for different activities and for different ages (as listed in Table 5-1), which shows the application of Ekistic theory about places for different activities for Riyadh, but did not emphasize dedicating facilities specified for women or any other group activities in the same neighbourhood.

Last but not the least, Doxiadis took great care to show diversity amongst the community classes, however, his initial plans did not seem to have fully studied the cultural and social aspects of the Saudi Arabian context and expected changes in society.

### *9.3.2 Development Stage*

Throughout the entire development stage and until recently, it has been clear that the Riyadh Municipality regulations and policy did respect the concept of Doxiadis' plans for the housing types, which were categorised into apartment buildings, attached and detached villas. The only exception perhaps is the fact that the percentage of single detached villas has considerably increased.

Currently, the typical plot sizes for residential areas in Almoroj vary from 250$m^2$ up to about 3,000 $m^2$. Small houses range from 250$m^2$ up to 400$m^2$, medium houses are between 500$m^2$ and 700$m^2$, large villas are from 1,500$m^2$ to 3,000$m^2$, and the average size of flats is between 150 m2 and 200m2 (see Figure 9-10 below). However, there is no policy that controls the sizes of the apartments in the neighbourhood. Nonetheless, there are a few exempted residential units (mansions) that can significantly exceed these averages, reaching up to 20,000$m^2$ and usually occupied by some wealthy extended families.

In conclusion, the calculated average size of residential plots in Almoroj is approximately 600 $m^2$, which is very high compared with what was expected by Doxiadis. It is worth mentioning that the Riyadh Municipality varied the plot sizes and housing types within the same

neighbourhood to ensure that different income classes and household sizes are able to meet their habitation needs without any apparent social discrimination. However, until today there is no housing strategy for housing Almoroj's labour force, such as affordable small residential units. The few available are provided by individual developers or landlords. This has pushed some workers to use sharing apartments with few rooms in and outside Almoroj.

According to the researcher's personal experience and from the observation of the existing condition, the neighbourhood unit can also be considered as a diverse community in its different cultural and economic aspects. According to the ADA (2004: 1), the number of male Saudi residents in Almoroj is 12,935 (0.7 % of the total population in Riyadh city, which contains 204 neighbourhoods) and this covers around 40 % of the total population in the neighbourhood. The number of female Saudis is 10,068 covers around 30.5% of Almoroj residents. The total of male and female Saudis is 70.50% of the whole neighbourhood. The male non-Saudis are 5,803 people (about 17.5 %) while female non-Saudis are 4,055 and (12 %), thus the total of its non-Saudi population is 29.5 % of Almoroj neighbourhood. It can be seen from these statistics (and those presented in chapter 4, Table 4-1) that the number of non-Saudis in the neighbourhood is quite high compared to the number of Saudis, and that the percentage of the population of non-Saudis in Almoroj is almost the same of that of the entire city (35 %). The results therefore show more evidence to support that Almoroj includes diverse genders and different ethnicities.

The total workforce in Riyadh is 2.3 million, where the percentage of Saudis is 44% (n= 993 thousand people) and 56% for foreigners, generally of Arab and Asian nationalities. As seen in the table of official statistics (chapter 4), the rate of the young population is considerably high, as it reaches 30% from age 0-14. From the official population pyramid, it seems that the young population composition takes a large part of the city's population and will stay for long periods to come (ADA, 2004). This is expected to affect the future developments of recreational and educational activities in the city and particularly in this relatively highly valued neighbourhood.

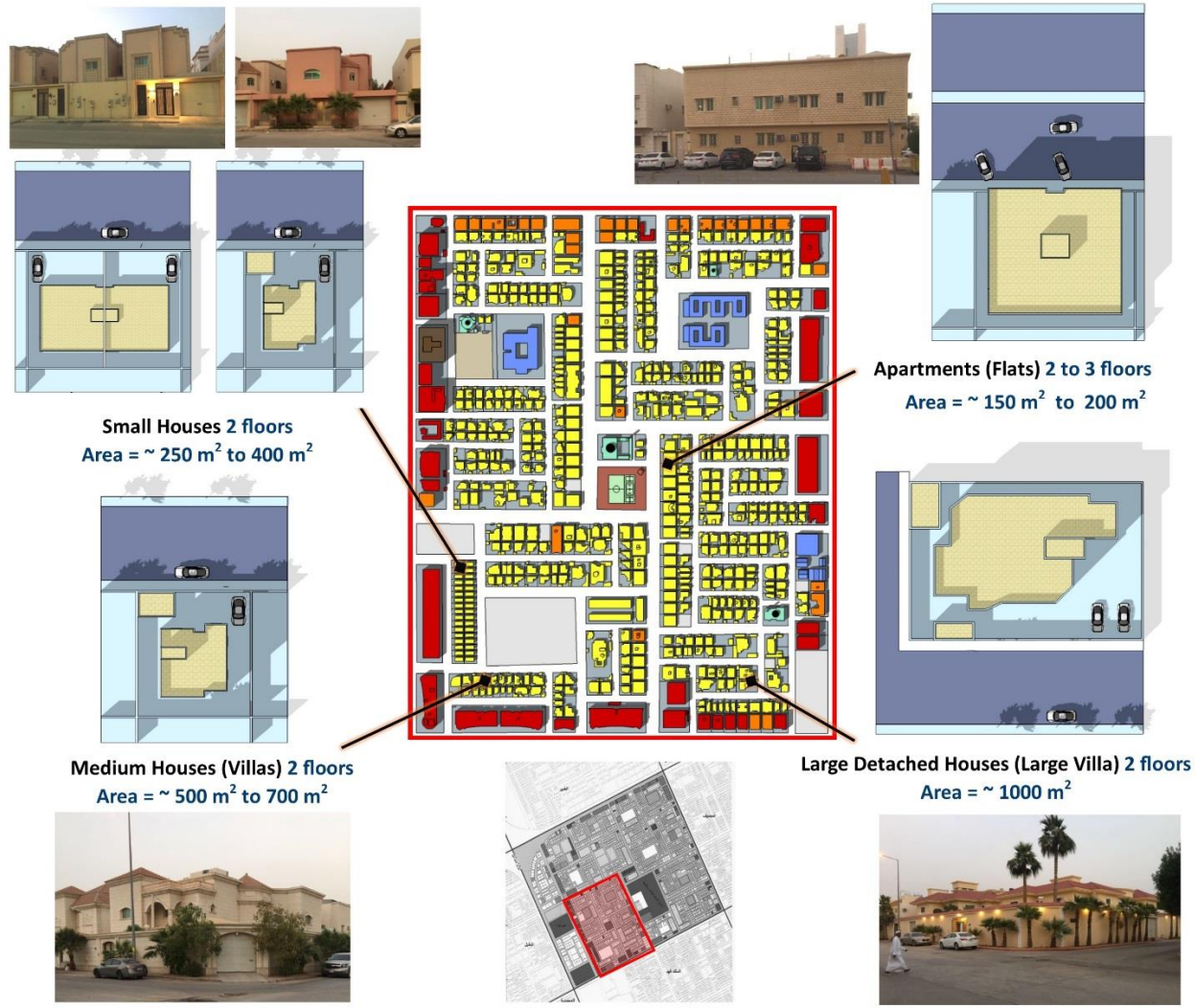



**Figure 9-10: The variety of building types of residential buildings in Almoroj neighbourhood drawn by the author**

With regards to the variety of levels of income in Almoroj and North side neighbourhoods, the authority data shows the percentage of each low, medium, and high class individuals in the neighbourhoods (CCV, 2x2km) by their income data as follows (see Figure 9-11):

1) Those who are considered as low-income class live in 20% of the neighbourhood area;
2) Those who are considered as a medium-income class live in 68% of the neighbourhood area; and,
3) Those who are considered as the high-income class live in 12% of the neighbourhood area.

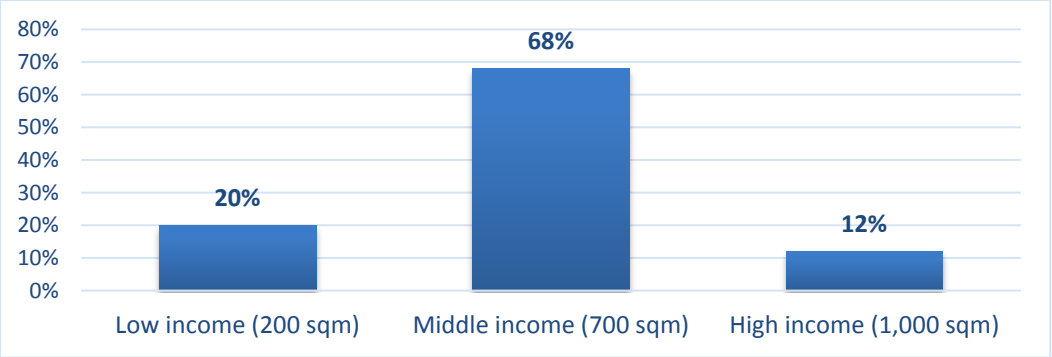



**Figure 9-11: The relationship between levels of income and land size in Almoroj and Northern neighbourhood units**

(ADA, 2012)

The average monthly income of Saudis in Riyadh is 11,250 Saudi Riyals (about £2,250) while the non-Saudi (non-professional workers) is about 3500 SAR (see Table 7-2 below). Those who live in apartment buildings, usually young Saudis and non-Saudi residents, pay less rent compared to villas and other residential buildings, depending on affordability. In most cases, Saudis in general prefer to live in separate houses and villas. Those who do not occupy houses or villas tend to live in apartments, but rarely in mixed use buildings because of the noise in major streets. It seems that some foreign families can afford to rent an apartment in Almoroj neighbourhood depending on their income and the available tenancy prices.

**Table 9-2: The population study in the city of Riyadh in 2016 (ADA, 2016)**

| | |
|---|---|
| Saudi Arabia's per capita average income worker in Riyadh | 135 thousand Riyals per year, (up by 35% in 2004)<br><br>About £27,000* |
| Income of non-Saudis in Riyadh city level | 42 thousand Riyals per year (up by 73% in 2004)<br><br>About £5,000* |
| *_ The average rate used is 5 SAR = 1 GBP | |

Figure 9-12 below illustrates the official average costs of renting and land values of residential properties on the map of Riyadh's neighbourhoods. According to ADA (2009) in Ulaya municipality, where Almoroj neighbourhood is situated, the average land value for a residential land is about 1,629 SAR p/$m^2$. The average rent of apartments (flat) is about 26,953 SAR per year (2,246 SAR p/m). Some villas were developed to be separated into two floors, both floors are separately rented. Renting one floor in a villa would cost about 415,161 SAR annually (34,597 SAR p/m), while the average annual rent of an entire villa is about 75,085.7 (62,570 SAR p/m). The size of a villa was not mentioned but this most likely would be based on the average size of the villas in each urban area.

From the presented data, it is understood that the rent would cost Saudis about one third of their monthly income, while for non-Saudis apartments would be around 65%, and renting a floor in a villa would surprisingly be about 95% of the average income of the normal (non-professional) worker. Thus, it seems that most of the non-Saudis living in Almoroj are from the high income class and their income could be above the average income mentioned earlier. Small rooms and shared apartments for low income workers are also available for rent in Almoroj, costing an average of about 10,000 SAR/A for a room and 6,000 SAR/A for each person in a shared room of an apartment (R1).

However, this type of accommodation is not offered enough and it seems that many labours live out of the neighbourhood. Furthermore, a number of real estate agents and owners have built rooms on the top floors of commercial buildings. This enables labours and any worker to live close to their work, instead of living far away in low rent neighbourhoods.

Regrettably, the results from the above data do not suggest where the different income groups of residents live and meet on the neighbourhood map. Such information would enable a greater understanding of the level of social and cultural variety in the neighbourhood community through investigating to what extent this multi-cultural diversity promotes social interaction in the same neighbourhood, between Saudis and non-Saudis.

It seems that lower income and probably non-Saudi workers live in the major streets where there are flats and higher income workers live inside the residential areas where villas can be found. However, those who are non-Saudi workers with a high income can still live in villas or larger flats.

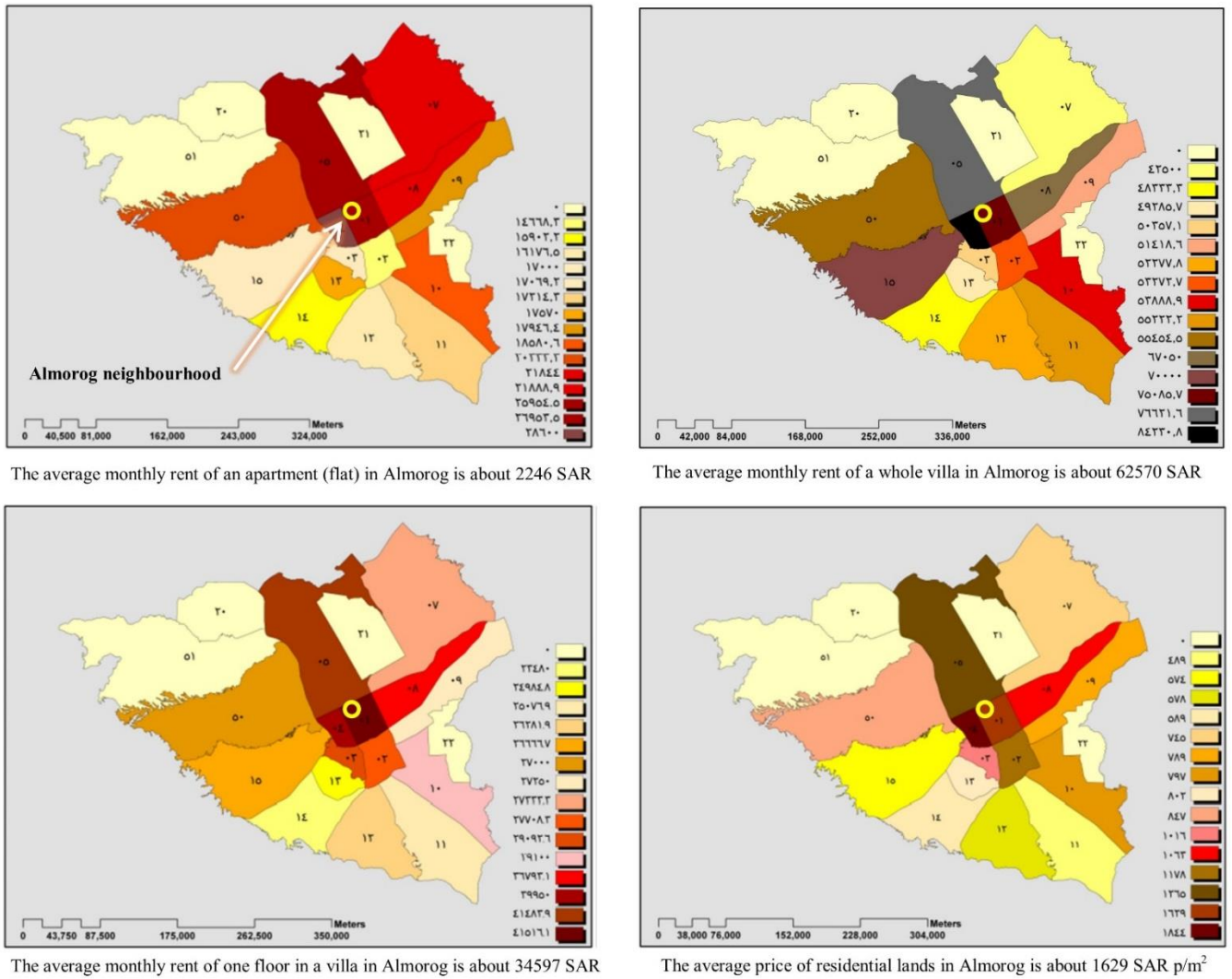



**Figure 9-12: Maps of Riyadh presenting the average costs of rent and land values of residential properties. Almoroj neighbourhood, in Ulaya municipality, is highlighted in yellow**

(Source: ADA, 2009).

At this point, it is observed that workers do connect socially within the diversified functions explained earlier in this chapter, and yet, it seems that the developed neighbourhood somehow failed to encourage the different groups of residents to interact socially by providing more appropriate equal public realms with close proximity to the local residential and commercial buildings of the neighbourhood.

Finally, the municipality officials can be criticised for somehow ignoring the designer's recommendations for studying the social and cultural specificity of the local community. Women, in particular, could have been addressed when developing the city's neighbourhoods. When analysed narrowly, it appears that the rights of women to have their own private activity centres is not considered in Almoroj neighbourhood, despite their preference of enjoying indoor activities, and this clearly negates the main concept of diversity. In practice, the city planning office could have stressed that each neighbourhood must develop better facilities and create public spaces that are compatible with women's social activities. Improvements and additional facilities such as these could increase social interaction at least among women within the same neighbourhood.

### *9.3.3 The Use stage*

The interviewees were asked about diversity in many various aspects, including housing types, sizes, ages, cultures, income, and the variety of social activities carried out by the residents.

Almost all the men participants ratified the neighbourhood unit with its distinct diverse community and functions. It is evident from their responses that they live within the aforementioned different types of housing with different size households and varieties of incomes and activities. It was noticeable that most Saudis and foreigners live together with and work with those people with whom they share the same cultural values. Distinguishably, A1, who is retired, A2, a government employee, A5, an Imam (leader of prayers), all expressed their views regarding the diversity of the varieties in the neighbourhood as follows:

*A1:*

> *"I do not go to work – retired. I live in a villa, about 600 metres square with 6 family members. I meet my friends either at home or in the nearby mosque during prayer times. I see many people from different cultures prying at our nearby mosque".*

*A2:*

> *"I am nearly 50 years old, living in this area for the last 15 years. I live in a detached villa, with a plot size of 300 metres square. I meet most of my neighbours at the mosque during the prayer times".*

*A5:*

> *"I am responsible for leading the prayers in the neighbourhood mosque. I live in a villa next to the mosque, with a plot size of about 300 metres square. Since I have to be at the mosque five times a day, I meet all my friends in the mosque or invite them to my home, or meet them in their homes".*

As regards social activities within the neighbourhood and with neighbours, the results indicate that most of the men participants only meet their neighbours at the mosque during prayer times. Four interviewees admitted that they had never planned to meet their neighbours anywhere in the neighbourhood whilst two acknowledged having met neighbours accidently, either in mosques or on the street. One interviewee had met with friends in a planned manner at home whereas another said that he meets his neighbours on a monthly basis. A10, a government employee, and A12, who is a private company employee, also referred to the diversity of the social activities:

*A10:*

> *"I study in the university and live with my spouse in one flat in the apartment buildings. The apartment size is 160 metres square. We are a couple who married two years ago. We do more social activities outside the neighbourhood (e.g. some large parks or shopping malls)".*

*A12:*

> *"I work for a private company, and have never met my neighbours. I do not know my neighbours, and it is rare for us to see each other accidently in the street. I only visit my family friends but not very often other than on some special occasions".*

Moreover, it is significant to note from these results that the participants do not have a variety of options for participating in longer lasting social activities outside of homes and mosques. Perhaps this is because the neighbourhood does not offer quality public realm for such social needs. There is a clue in the following quotation that would support this notion. Interviewee A6, who is a government employee living in Almoroj, argued that:

> *"I cannot meet my neighbours during week days, because I remain busy in my job and then come home to spend the rest of the day with my family. However, just on the weekend I meet some friends where we gather together in an 'Isteraha'. On special occasions I do meet my neighbours".*

One of the aforementioned main socialising activities takes place in a place called ‘Isteraha’ (a relatively small rented rest house, and sometimes an owned house). These places are generally located on the periphery of the city, and in this case, around 10 to 15km North of Almoroj. The layout of rest houses includes a walled piece of land that houses one to two built rooms, one kitchen, one bathroom, and a small garden in the open space between the built rooms and its outer walls. They are varied in size and price, depending on their location, quality, and finish. The concept of Isteraha is becoming more popular in modern Saudi culture, especially among many young men who gather together in such indoor social rooms, playing games, watching TV, and participating in outdoor activities, such as barbecues.

The idea of Isteraha has been around for about 30 years, but it was not popular until recently. Currently, many Isterahas are built and under construction, and it seems that there is a high demand of Isterahas in Riyadh. About 30 years ago, Isterahas were distributed in the city, and mostly people built them near their houses. It has been found that the origins of Istreaha started as a simple idea of an old man who built for his family a shelter around the house and used it to have fresh air and for entraining purposes, whether with family or friends. The idea then became socially acceptable and changed. This concept has changed along with the high population, changing culture and social needs. Isterahas are being built in a group of buildings in specific areas that the urban developments have not yet reached. When the urbanization expanded and reached Isterahas, they moved to non-developed urban areas. It is believed that these groups of Isrehahas could not be mixed within residential areas any more, as this is mostly related to the increased levels of urban noise and traffic. People have started to have more luxurious lives and their homes are not suitable for men’s social activities. Adults, particularly men, meet regularly in Isterahas, and they believe that this would be more comfortable than meeting in someone's house. For example, smoking shisha might bother the man who hosts. Separation between men and women is another reason. Men stressed that rented Isterahas make them feel more at home because they share the responsibilities and needs. Every member can have control, such as hosting other friends and staying as long as they want or spending the night.

Although not all the interviewed men declared in words how much their salaries were, most of them felt themselves fall into the medium-income class. This was obvious from observing the size and condition of the property and possessions they owned. They also indicated that the prices of houses in Almoroj varied, but most properties were considered amongst the most highly valued in Riyadh, which also supports the aforementioned data in the previous section. A8, a private company employee, stated that:

*"I work for the government as an engineer. I am well paid and I think many of the residents living here in Almoroj are from the 'middle class' and above."*

The majority of the interviewed residents, therefore, can still afford to rent small to medium houses (size 700 $m^2$ and below). Nevertheless, they have all bought their own villas. It is realised that the prices of lands and houses in Almoroj have been increased, and the prices now are most likely to be affordable to buy by upper-middle class people. It has also been observed that the family lifecycle of a Saudi middle class man resides with his parents until the age of marriage, and then moves to a rented apartment or one floor of a villa until he is able to afford to buy his own house, which will mostly depend on the income and wealth of his family. Furthermore, it is understood that young couples typically live in the cheaper newly developed neighbourhoods in whatever size of house they can afford. It is important to remember here the mentioned government changes to minimum sizes of residential plots to encourage new affordable houses.

With regards to the responses of women interviewees, there is a clear variety of people and housing types in Almoroj. However, they described that this neighbourhood unit offers a range of high price houses overall, asserting that houses on the North side of the city are relatively highly valued, and it is likely that any new development will be situated in the North. Most interviewees live in different sizes of house, as well as apartments. The majority, however, prefer to live in villas, even if they are small. The reason for this choice is that they can have a front yard or backyard, which are considered to be convenient private open spaces, usually used for gardening or to practise multifunctional social activities with family members. In contrast to the private space, some ladies noted that, they see mostly foreign women in the public spaces such as parks and streets. One non-Saudi interviewee said that many foreigners live in apartments in the neighbourhood and two interviewees B2 and B9, both are housewives argued that:

*B2:*

*"I have my house, which is not small and not very big. In my view, the prices are high in the neighbourhood, based on our income, however, we managed to buy a house that is 500 $m^2$ in size. I can recognise different housing types, plot sizes, and different people with different incomes living around. I meet many of my friends at home. I find people with different cultural backgrounds in the park and streets, but do not communicate with them, as I do not socialize in public."*

*B9:*

*"I live in an apartment building in this neighbourhood. I basically come from Egypt but my husband works here in a construction company. I go with my teenagers to*

> *open spaces and see many women from different backgrounds. I cannot accommodate more than one family as visitors because my accommodation is small. I can recognise that there are a variety of housing types and my friends live in different house sizes."*

The perceptions of women here suggest that there is a big gap of social activities, which needs to be bridged. They were asked how they undertake various activities in the neighbourhood. The women enjoy meeting with their relatives and friends inside their houses. They see homes as a more flexible meeting place than the available public spaces and religious centres, for example mosques, in the neighbourhood. As highlighted previously, there is no such social centres dedicated for women in the neighbourhood, but there is a small centre next to mosques for teaching the Quran, which some seem to use as meeting places, though not in this neighbourhood. Eight of the interviewees believed that the preference for having indoor activities is due to privacy and cultural lifestyle. One of the women, B6, who works in the university, explained:

> *"I prefer to stay at home for most activities, especially social. I do not find places to meet women friends for social activities except at home. I feel very comfortable while staying with friends at home, it makes it easy to communicate in private. I have my own home facilities near such as the kitchen. I sincerely feel that unless there is a special occasion I would not go to the park".*

The interviewed women unanimously agreed that though the neighbourhood meets most of their needs, there was a large gap in the provision of diverse simulated activities that understood women's styles of interaction and which would increase their social interaction. They further demanded the creation of facilities in the existing open space and parks so that they might become the beneficiaries of such facilities. They added that, they would appreciate more lighting during the night in parks and open spaces, as well as the provision of shops for drink and food. Some of them prefer to go to a popular walking track in the north side of the city. According to most interviewed women, good design landscapes and more comfortable public spaces would solve the concerned issue of privacy and make them more engaging in outdoor activities. All urban issues discussed in chapters 6, 7, 8, and 9 show that there is a clear need to design comfortable public spaces for Saudi women.

In addition, the majority of women explained that they did not meet their neighbours. Only two mentioned that they had met their neighbours on special occasions, and one claimed that she always arranges to meet her neighbours in the open space or at home. They explained that their social interactions with other women residents are rare except during large private and

national seasonal occasions, such as weddings and/or the Eid celebrations and during Ramadan in mosques for short intervals. An example of how an interviewee expressed her concerns about meeting neighbours and visiting parks, is represented by B12 and B2 below:

*B12:*

> *"I am 24 years old, graduated from the university and currently staying at home. I do not meet my neighbours because there are no girls of my age living nearby. I have friends that I have made in the university. I meet with them at my home or at restaurants out of the neighbourhood, or when I visit them in their homes. I prefer to visit the most reputable park, at the city level, and not the ones in the neighbourhood".*

*B2:*

> *"I go sometimes to the open space just for walking and I see a few women walking too. However, there are not many activities for women to do other than walking and sitting in the green spaces. I do not know my neighbours. My driver also park very close to the shops' door for me to buy then leave".*

From the above, especially the response of interviewee B12, it is important to highlight the lack of social cohesion between the community members in Almoroj in the neighbourhood, particularly amongst some young people where the communication with their friends is directly affecting the relationships with their neighbours. Moreover, it is worth mentioning that women in general are not often seen in the commercial streets, as there are not many women in public, as they move from the car and directly into the shops. Another example of this lack of participation can be found in the fresh market, where many people, even from different neighbourhoods, come to buy their fresh food. Usually, Almoroj residents come to the fresh market during weekdays by car spending about half an hour shopping and then leave. It is important to notice that the car-base design of the fresh market seem to have led to limit the pedestrian movement of most women.

The residents' responses show that many seem to have weak social connections with their local community and many women and men disliked the public spaces in the neighbourhood, meaning most men and women rarely socialized in the public and open spaces of the neighbourhood. According to Dempsey (2006), it is evident in theory, practice and policy that high quality physical environments promote and encourage social activity. Rad et al. (2013) also said that fundamental opportunities for social interaction should be provided in public spaces. He postulated that people would feel stronger bond with community and space when they closely interact with others. This can be seen by the amount of existing varieties of social groups in a space and their daily social life. Whyte (1980) stressed that the quality of

functions exists in public spaces highly attracts people for interaction. It is believed that streets and public spaces define the character of a city, but it was observed that the public spaces and streets in Almoroj are not sufficiently or sustainably used and this might be related to the design and contradiction of the social sustainability dimensions aforementioned.

The six interviewed teenagers live in different types of houses. Two of them live in apartments whilst the other four live in villas and tend to socialize less in public spaces. Most of the teenagers communicate more with the same age group than others. When the teenagers were asked about social activities in the neighbourhood with friends or neighbours, they responded that they meet up with their friends in school, houses, and other unspecified venues whereas some of the teenagers said they only meet neighbours in school, and some of them preferred to meet in their houses. The teenagers mostly invite their friends and relatives to their homes.

Concerning the variety of available activities for young people in Almoroj, some of the teenagers observed that they do more sporting activities with their friends at home and less in public spaces. The teenagers' responses for meeting people in parks suggested that sporting facilities were not adequate enough to undertake activities. Only one of the teenagers asserted that he goes to the open space but he only meets with young people he already knows. One of the teenagers, C3, said:

> *"I am 18 years old and study in high school. I meet one of the teenagers who lives next to me every morning, though my school is different from his. I live in a villa, and my school friends come to my house to play games, especially on weekends. I have one room in my house where all my friends sit, chat, and play games. I do not prefer to go to the open space and parks".*

Some users from out of the neighbourhood come to play football in the municipal open space for two to three hours once a week or monthly. It appears that the football and tennis fields are required mostly by teenagers in Almoroj, but the lack of facilities limits the access of the teenagers to the parks, hence they prefer to do some activities at home. It was also observed that the most users of the municipal open space are the teenagers who live very close to it.

It is also noticeable that almost every house has to have one extra room separate from the rest of the house, but still within the same vicinity of the outside walls, for teenagers, mostly males, to carry out their own activities. In most cases, this room has become a cultural norm for teenagers to spend their leisure time in this space. Parents feel more secure when their teenagers are playing in the house, but this of course reduces their use of public spaces, and

subsequently diminish the potential social interaction between teenagers in public spaces in the neighbourhood.

The workers were asked about how diverse they think Almoroj is, and in general they seem to agree that the neighbourhood offers a great deal of diversity regarding people and functions. In addition, the workers said that they are satisfied with their work environment and to them, it is a multicultural one. The two foreign workers also talked about variability in the activities undertaken by the residents. The foreign workers do most of their social activities in the parks on weekends. It is observed that most of the users of the parks are foreigners and the reason for this is perhaps because most of them do not have enough space to socialise or do activities at home. Also, there is no entry cost to public parks in the neighbourhood. Another likely reason is that most of them do not have relatives, and so it is a good place to make friends and gather with others. D1 said that:

> *"I often visit all parks and playgrounds in the open space. The reason I do is that my kids love to play and do different relaxing activities there. They also meet other neighbours and socialize with them. We know many different people from different cultures who gather there. I have noticed that many non-Saudi families go there as well. I live in a decent flat closer to the park that is good for my budget. I wish to have a bigger and new-built apartment, but they are quite expensive. I believe that many labours with low incomes live out of Almoroj."*

The foreign workers equally found diversity among the house sizes and types. The foreign workers showed concerns towards affordability of the houses. The interviewed resident workers in Almoroj showed inability to buy new houses, but they can afford to rent apartments. This confirms the aforementioned relatively high income community living in Almoroj, and yet, to live close to their work seemed a priority for many of them. Though the neighbourhood offers small and big houses for rent, the cost of houses was still high because of the location of the neighbourhood (neighbourhoods in Riyadh located in the North are expensive compared to East, South and West).

The interviewed Saudi workers are not generally involved in any social activities in the neighbourhood as they mostly stay in their working place. They live close to the neighbourhood and one of them moved to the next neighbourhood, but still he lives close to his workplace. D2 and D4, Saudi workers, explained:

D2:

> *"I tried to find a house to rent or to buy but find no difference in the prices. I was keen to have a house near my workplace. I understand this is the North side of the city and prices here are higher. I also understand that different housing types*

*attract more than similar types of houses. I can recognise different nationalities who live and work in the neighbourhood. I do not do any activities other than working. In the company where I work there are different people from different cultures and ages."*

D4:

*"Many houses in the neighbourhoods in the North side of Riyadh have similar prices. I found the house that meet my needs and budget but prefer to live in between my family and my work."*

It seems that the interviewees who do not live in the neighbourhood are less concerned about any of the activities available in the place where they work. Regarding housing types and cultures, including ages of the residents, the participants recognised variability. It has been observed that the workers have more relationships with the edges of the neighbourhood the internal cores, where many big companies, banks, and retail shops are placed than inside the neighbourhood. Some Saudi workers do not usually move to live in the neighbourhood where they work, and this seemingly due to family ties, as they prefer to live near their parents, and apparently because the residential units inside the local areas of the neighbourhood have more design qualities. However, regardless of this, most workers found the neighbourhood to be diverse and where residents' needs could be met.

The visitors confidently stated that the neighbourhood unit had residential streets with different size houses, and different building forms in the commercial area than in residential streets. Moreover, with regards to housing types, this is very similar to other neighbourhoods, but urban functions with each unit are varied. The participants did appreciate the diversity and variability of schools and public spaces. This is due to the fact that their friends and families were living near these facilities and in different types of houses, apartments and mostly villas. Concerning affordability of houses, they were confident that though prices were high, some people could afford the expenses in the neighbourhood. However, the visitors were mostly from the outer most neighbourhoods, but nevertheless, they still had the understanding of this neighbourhood, especially the shops on the major streets that connect Almoroj with the surrounding neighbourhoods. Most distinctively, one of the visitors, E4, who visits this neighbourhood to play in the playgrounds in its municipal open space, differentiated this neighbourhood as:

*"I come to this neighbourhood to play in the open space. Though my neighbourhood does have this facility, it is far from my home, about 900 metres, while the open space of this neighbourhood is only 500 metres far from home."*

Another visitor, E2, who comes to study in one of the private schools in Almoroj, said:

> *"I come to Almoroj neighbourhood to study in one of the private schools. This school is near to me and it has a better quality than the schools in my neighbourhood. Another reason is that my friends study at this school. My sister also studies in one of the neighbourhoods next to our neighbourhood but not in Almoroj for the same reasons. My friends and I go to one of the restaurants in Almoroj that has very nice burgers".*

It is clear from the quotation above that there are some visitors coming to Almoroj to benefit from its activities and public spaces, suggesting that the neighbourhoods where these visitors live do not seem to offer similar facilities. Also, it was discussed that some residents use the facilities provided in the next neighbourhoods. However, before jumping to conclusions the next section will shed some light on the issue of how a cluster of neighbourhoods in Riyadh work together. For now, it can be concluded that the neighbourhood has a variety of housing types, sizes, cultures as well as diverse incomes. Many of the foreign workers live and work in the neighbourhood that make it diverse in culture.

## 9.4 Discussion

***1) Is Almoroj an independent neighbourhood unit?***

All services in the city's neighbourhoods are expected to be compatible to those found in Almoroj, and this is what was expected to be achieved by Doxiadis and the later developers, Riyadh Municipality. Nevertheless, this raises another important question: to what extent are these neighbourhoods dependent on each other? In short, is Almoroj neighbourhood fully independent in its variety of necessary urban services and facilities? This section is an attempt to discuss these enquiries.

It has been established that a fully independent neighbourhood promotes a compact urban form. Facilities, services, and functions must be provided for people's daily needs. Good distribution and near distances of facilities are important to enhance neighbourhoods' independence. The urban planning policy at the neighbourhood level was, nevertheless, not concerned with modern-day sustainable issues to make it highly compact and diverse, considering human scale and residents' needs in the provided urban designs. Contrary to the original plans of Doxiadis, we found that the neighbourhood of Almoroj is partially independent, thus not fully self-sufficient. The local urban facilities provided generally kept the residents in, instead of encouraging them to go out to other neighbourhoods. Thus, there were few motives for the residents to use nearby facilities and services and not travel for those in the nearby neighbourhood.

It has been found that the absence of the suggested effective hierarchical facilities and services, recommended by Doxiadis, within the neighbourhood community classes are affecting the independence of Almoroj. There is enough evidence from the conducted interviews on site to suggest that the core open space and schools in Almoroj, for example, are attracting more regular users and visitors from other neighbouring neighbourhoods. Many people who live whether on the edge of a neighbourhood or in the middle can benefit from most of the available facilities in any nearby neighbourhood, including schools, parks and open spaces. One reason for such movement is that there is an easy access, by car, between one neighbourhood unit and another. Another reason is that it seems there is an understandable uneven provision of good quality facilities between some neighbourhoods, especially in the relatively richer neighbourhoods in the North. For example, the good quality of schools in Almoroj, some of which are private, seem to attract some students from other different neighbourhoods, regardless of the provision of private schools in their neighbourhoods, and vice-versa.

A map analysis of the location of all schools in Almoroj and in all surrounding neighbourhoods (Figure 9-13 below) shows the clear random spread of schools on the neighbourhood map. There is no systematic planning order or urban pattern that distinguishes the distribution of schools around each of these neighbourhoods. This suggests that there is an apparent deficiency in providing the required educational needs in some local parts on top of others, causing some residents to travel to the next closest neighbourhood to fulfil this necessity. However, it is recognised that people might still decide to register their children in those schools for many different reasons when there is no authoritarian restriction stopping them from doing so. Also, it is worth mentioning here that the level of education in the city is high and still increasing. Illiteracy in Riyadh is declining and has been recently reduced to 4 % (down from 8 % in 2004 according to the High Commission of the Development of Riyadh, 2016). This is a clear indication for the necessity of increasing the number of schools around the city, especially around the more condensed neighbourhoods, as seen in Figure 9-13. More precisely, the urban policy of the provision and locations of schools, including the primary ones, were not planned with equal opportunity of catchment areas, because most of the percentage of land use were kept for residential and commercial functions. As aforementioned, the dedicated 33% of land use for public facilities and services, which is not exactly implemented, did not help Almoroj in becoming self-contained.

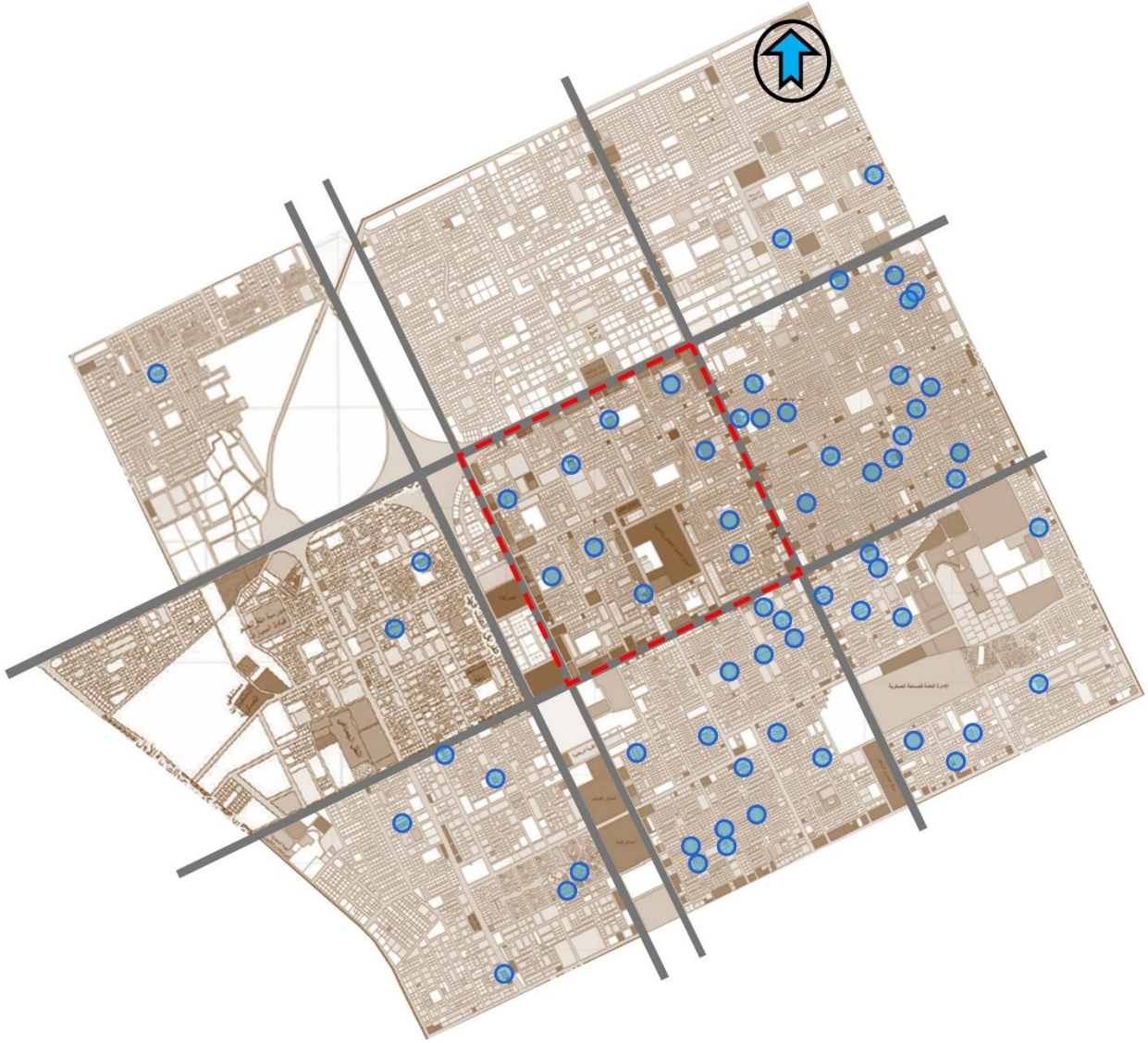


**Figure 9-13: Example of inconsistency in locating the neighbourhood shared schools, which are supposed to be independent.**

Another example that affects the independence of Almoroj is that the parks and open space in this neighbourhood are found to have been attracting visitors from long distances. Unlike mosques, which were found to support the concept of independence, as they are all walkable and faultlessly distanced, some of the parks are closer to the residents in the next neighbourhood than the residents who live in Almoroj.

The urban space analysis of Almoroj discussed in the analysis chapters has also proved that this neighbourhood unit is partially independent and there is a moderate level of interdependency between neighbourhoods. Ideally, the bounded streets that form each community class would physically enhance the containment of their associated services regarding the scale of each community. However, the missing functions in each community make them dependent and the design and plan of the neighbourhood has not fully achieved a great sense of enclosure, as there are many entrances from major streets confining Almoroj. This has led to weakening the sense of community and safety within the residential areas because of the lack of a clear hierarchy of streets and urban use spaces. Shops, for example, are placed on the major streets on the borders of CCIVs, causing people to flow from the residential areas of all CCIVs in the neighbourhood to the commercial major streets. This encourages residents in the next neighbourhoods and visitors to seemingly prefer to use their neighbouring services, which also helps to keep urban life quieter inside the CCIVs, which lead to poor urban life.

Finally, according to RM, the provision of facilities and services was based on the neighbourhood unit scale of 2x2km that proved to be a relatively large size for human scale design. Such a size seemed a significant element to start the design for a sustainable neighbourhood. Yet, this fact was unfortunately not considered even at the development stage by RM and MOMRA. As per Doxiadis' idea, the 2x2km was set to be a city scale, and it should have been planned with the hierarchical communities in mind, with related urban functions based on the size, scale, and population available to make them self-sufficient.

Though important, it is also realised that the issue of scale and independence in this case is not enough on its own to make the neighbourhood sustainable. The individual behaviour of the residents still plays a complex role. It is therefore argued that a sustainable neighbourhood unit might not be efficient enough to generate a sustainable urban form for the city unless both the physical urban form and users' behaviours are in harmony with the essence of sustainability.

***2) How diverse and socially active is Almoroj neighbourhood?***

It is clear that the current urban form of the neighbourhood is more diverse than the original plan of Doxiadis, from comparing the design and development stages of Almoroj neighbourhood. Most presented results show that mixed land use, both horizontal and vertical, provide several urban functioning residences and highly accessible commercial advantages for residents. However, the design of public spaces and places such as streets are not socially and culturally harmonized with the residents, especially women. Thus, it can be said that, the context has not been fully and locally understood to design urban spaces that can be more socially used and sustainable. Despite this, the new lifestyle of people and new villas types of dwelling can be judged as socially acceptable because of the residents' socializing habits.

Empirical research conducted in the west of England identified eight services and facilities most frequently used locally. These everyday eight daily needs are: food shops, newsagents, open space, post offices, primary schools, pubs, supermarkets, and secondary schools. Other services to which theorists claim residents need frequent local access include doctor/GP surgery, chemist, café/restaurant/takeaway, bank or building society and community centre (Dempsey et.al, 2009). In the case of Almoroj, the above results suggest that there appears to be a high level of diversity in the neighbourhood unit, as it meets most of the residents' needs, despite of the insufficiently provided key services, such as primary schools and health Centres. These services, though some are different according to the obvious differences in the culture and social context, are covered according to most of the interviewees' needs. It is concluded that, the local key service and facilities exist in the neighbourhood and are used by residents on a regular basis.

Several researchers in sustainable urban related studies, according to Jebareen (2006), agreed that mixed land use, both horizontal and vertical concepts, provide several advantages regarding social and environmental aspects. For example, it promotes social interaction, less travel, and overall brings life to the community. The results have shown that the residential areas in the case study neighbourhood are quiet due to the relatively low number of cars and people inside the local streets, and they do not seem to promote the mentioned social advantages for the neighbourhood. This is opposed to the argument that Jacobs (1961), along with Talen (1999), makes claiming that high-density and mixed-use streets are required to promote greater opportunities for social interaction with an increased number of individuals (and motivations) utilizing the streets. In Almoroj, there are social impacts of the outside walls of houses, fenced walls in front of all detached houses in the neighbourhood, used for

privacy and security, which exclude the residents from the outside world including their neighbours, and do not encourage a sense of community. It has already been debated that the diversity in the neighbourhood does not show high levels of social interaction. The results regarding this aspect are compared to Karuppannan and Sivam (2011), who studied three dissimilar neighbourhoods in Delhi, India. The results suggest that good accessibility to the public realm and social infrastructure play an important role in increasing the social sustainability of the neighbourhood. Nevertheless, the respondents had reasons for not easily accessing the parks and the open space and not walking in the streets, but still the behaviours of the residents and housing design elements, such as fenced walls and poor public landscapes, did prevent them from social activities in public. This reality seems to encourage the feeling of segregation rather than inspiring more social interaction possibilities within the community. This is a crucial concern that should be considered when trying to develop a more coherent and lively environment in the future Riyadh city.

There are obviously many conditions that affect people's behaviour in conducting social activities in urban public, even when their neighbourhood is considered fully diverse. It has been found, for example, that most of the interviewees and some observed residents in this study who visit their local mosques, leave straight away after finishing their daily prayers without exploiting the gathering opportunity to get involved in socialising, preferring more private spaces for conducting such activities. This observation has also been acknowledged in Riyadh neighbourhoods by (Choguill, 2008). Without proper social interaction, residents dwelling in a given place can be characterized as a group of people living separate lives, with little sense of pride, community and place attachment (Dempsey, 2006). Youngsters, and women in particular, are amongst the most users of indoor social activities in the neighbourhood unit. These results contrast with what Vries (2013) stated when he established that local residents could improve their social cohesion by having more physical activities in public. So, the poor urban design and the lack of diverse social activities in the neighbourhood's public spaces affect the overall social cohesion of this community.

Another important point is that the studied houses in Saudi, specifically in Riyadh, provide a variety of compatible private functions to those that can be found in public. Playrooms and small private gyms are good examples that people often construct inside their properties. As a result, some people might not find themselves in great need to be out of these private social spaces.

Finally, our results show that in the neighbourhood unit, though diversity exists in building forms and types, different cultures, ages and genders of the residents, residential and commercial uses, owing to the lack of some facilities, low levels of mixed use buildings and high levels of single use as residential as well as excessive automobile use, the neighbourhood unit did not offer social cohesion and interaction amongst the residents.

The results are partly in agreement with Hillier and Hanson (1984), who established that in developing a space, social logic of the residents should be given priority. In this case, spaces/places for carrying out activities were created but human scale design (i.e. the consideration of the right of pedestrians) is missed out and the behaviours of the residents in the neighbourhood still needs to be changed through a community development approach. The design of public spaces such as streets are not socially and culturally harmonized with the residents' social and cultural context, especially women. Therefore, the context has not been fully understood to design urban spaces that can be socially used. However, the new lifestyle of people and new types of dwelling (villas) can be judged as being socially and environmentally respectable.

## 9.5 Conclusion

This chapter has presented the research results about the diversity of Almoroj neighbourhood. It was found that diversity was an important factor in Doxiadis' designs of Riyadh, and it is closely compatible with the highly advanced new sustainable approaches. The original design clearly structured the neighbourhood into community classes, which would have a mix of uses of diverse urban functions. The neighbourhood plan designed the urban functions horizontally, and there was less emphasis on vertical mixed land use. A mixture of key services and commercial areas were expected to be placed on the outskirts of the local residential areas, making the entire neighbourhood an independent centre for its residents. Thus, the design stage offered a variety of mixed land use, housing types, sizes, and activities within the neighbourhood unit.

The development of Almoroj, therefore, offered a diversity of functions. The mixed land use buildings are developed horizontally and vertically. The main streets consisted of mixed-use buildings, of both residential and commercial use, all of which have enhanced the proximity between these two functions. Some of the poor sub-centres of CCIVs are not used as public spaces for social activities, but for residential use. Moreover, in general, the developed urban functions of the neighbourhood offered in each community class presented a variety of

activities for all ages of the community. However, there was little concern for and emphasis on women's activities in public spaces. Many urban design features need to be locally studied and developed to offer more quality of life for the local residents. The missing facilities not only affect social cohesion in the community, but can be a clear environmental threat because people have to travel a significant distance by car to reach the next available alternative. The plan of Almoroj offers a range of various housing types, sizes, incomes and cultures. It has been found that there are a variety of land sizes, the average size of plots for housing in Almoroj today is 600 $m^2$. It is worth remembering that Doxiadis' standard of minimum size of plots for single houses was 400 $m^2$, which seems to have caused an element of social segregation between communities, and that the current minimum size of plots has been reduced by RM to 300 $m^2$ in order to be more affordable to most Saudi income groups. The available housing options are more affordable for middle-class and upper-class residents. Although different sizes of land for villas were offered, apartment buildings were the most appropriate for young Saudis and foreign workers. Most low-income workers, including foreign non-professional employees who work in local shops, lived outside the neighbourhood.

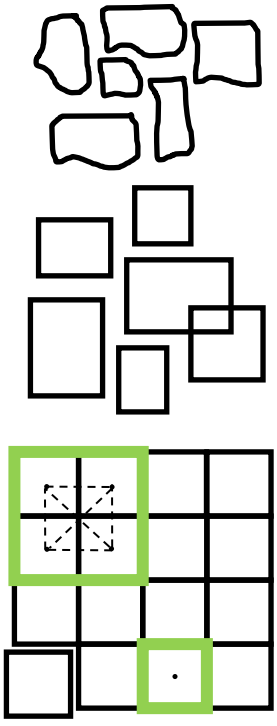
The interviewed participants form Almoroj proved that the neighbourhood, in their opinion, is diverse. Most of their needs are met, so most of their daily trips are within the neighbourhood boundaries. However, many of them are not interested in using many of the provided public spaces. Therefore, parks and open spaces are not heavily used by Saudis and are mostly used by foreigners. Most of the residents prefer to do indoor activities. Women and teenagers mostly stay at home for gathering with family and friends while men and male teenagers tend to rent a distant rest house out of the neighbourhood for social gatherings. It was clear that many people of other neighbourhoods do regularly visit Almoroj for its good quality services. Many of its private schools, for example, are considered the good choice for many residents of the nearby neighbourhood. Nevertheless, some of the residents in Almoroj use facilities and services in adjacent neighbourhoods, thus allowing the residents to be more dynamic and not restricted by the boundaries of these squared neighbourhood units.

# Chapter 10 : Conclusion

## Contents

### Chapter 10 : Conclusion





## 10.1 Introduction

The main aim of this study was to evaluate the urban form of Riyadh city for its social and environmental sustainability. The main research question asked: *How sustainable is the current urban form of Riyadh?* In order to be able to answer the main research question, this thesis has dealt with the following three sub-questions:

1. What criteria and methods for sustainable urban form can be used to analyse the current urban form of Riyadh city?
2. What are the main characteristics of Riyadh's urban form today and how have they been developed?
3. To what extent is Riyadh's urban form sustainable, according to the developed criteria and methods?

To answer the first sub-question, the four sustainable urban form criteria of compactness, climate related design, sustainable transport, and diversity, were developed from the conducted literature review in chapters 2 and 3. The identified criteria were the result of the three studied sources: traditional urban form principles, Doxiadis' main ideas, and design concepts of sustainable urban form. The result of each main criterion was used in separate chapters, 6, 7, 8, and 9 respectively, and each one has two sub-criteria.

As Riyadh is planned to be a city of neighbourhoods by a modular grid structure, the case study neighbourhood of Almoroj was selected to be investigated in more depth. The answer to the second part of the first sub-question regarding the methodological process for each of the four identified criteria is divided into three stages, including design, development, and use, to understand how each stage is involved in each sub-criteria.

In the design stage, the city structure and framework of the selected neighbourhood unit was originally planned by Doxiadis, which was based on his Ekistics theory and model of Dynapolis (the city of the future) and Modulus (the new dimension for the city, referring to the importance of his concept of community class V). It is evident that his plan did not involve an in-depth design of all internal urban spaces of the city's neighbourhoods. His systematic plan was logically structured, suggesting clear urban guidelines and planning criteria based on small cities and which were later considered to be neighbourhood units. Thus, in the development stage, the conducted developments by Riyadh Municipality were investigated in detail, studying the alterations for the urban planning standards of the Almoroj neighbourhood, including the changed building and zoning regulations. RM's plan and

changes resulted in some social and environmental implications that were important for the evaluation analysis of the researched urban life in Riyadh. Finally, the use stage examined how a sample of the residents in Almoroj are now experiencing the use of the available urban spaces and functions in the neighbourhood. This has allowed for better understanding of the quality of urban life and its present challenges, all of which are expected to enhance local research and practice in the area of urban design and planning in Riyadh.

The second sub-question regarding the characteristics of Riyadh's urban form was answered by reviewing the development of the master plan of Riyadh and its neighbourhoods. As mentioned, the plan was originally based on Doxiadis' grid and his square super blocks of 2x2km neighbourhoods are still maintained and being constructed. It also presents how the typical Modulus of Doxiadis in Riyadh was meant to be and how a typical Modulus of RM was supposed to be implemented. This investigation has covered the changes made to land use, building and street regulations by both Doxiadis and RM.

With regards to the third sub-question, this study then examined the sustainability of the neighbourhood of Almoroj according to the identified criteria and the developed methodological framework of design, development and use. Each sustainable urban form criterion in this research has produced interesting results that will be discussed under the three identified stages in the next section, before summarising the overall judgment about how sustainable the city is. This study also analysed whether a neighbourhood unit can be sufficient on its own to deliver a sustainable urban form. The neighbourhood plans are meant to be independent units; however, a key finding derived from this study revealed that the neighbourhood units are not fully independent. Many units seem to be sharing and dependent on some facilities that are found in the surrounding neighbourhoods, as is explained in the summary of key findings below. Finally, the last three sections present the study's contributions, limitations, and offered recommendations for policy, practice, and further research.

## 10.2 Evaluation of Urban Sustainability in Riyadh

This section summarises the key findings of the methodological process for evaluating urban sustainability, focusing on the selected case study of Almoroj neighbourhood, under the developed four criteria to examine the current urban form for its performance in social and environmental sustainability. It is very important here to consider that though Doxiadis' designed general structure of Riyadh has been influential in shaping the city, the way these designs were later implemented during the development stage had equal impact on what the

city is like now. Also, the way the residents use it, the use stage, is as important as the first two stages. All these following three elements are therefore equally important for the outcomes as Doxiadis' ideas.

### *10.2.1 The Design Stage: Critical Review on Doxiadis' Neighbourhood Plan in Riyadh*

From the study analysis of Doxiadis' master plan in Riyadh, it seemed clear that his neighbourhood urban planning ideas were generally influenced by those of Perry's1920s' and Stein and Write's 1928 scheme of neighbourhood units. His matured concepts of well-connected hierarchical urban community classes and urban functions seem to have also inspired more contemporary comprehensive spatial planning approaches of compact and well-connected cities, which are not necessarily following a linear growth approach, as in his plan of Riyadh. For example, his idea is also a basis for some recently advanced ideas, such as the Urban Task Force concept. The hierarchy of the community classes of Doxiadis is comparable to the hierarchical scale for urban communities by the Urban Task Force (Final report the Urban Task Force, 1999). Compared to Doxiadis' plans, their concepts have more details in linking urban communities in modern urban planning.

In almost all Doxiadis' master plans, including in Riyadh, his concept of neighbourhood unit (the idea of Modulus in his Ekistics theory of human settlements) created a spatial logic that seem to have established successful functional and hierarchical urban forms of community classes, transport systems, and logistic infrastructures. The systematic patterns in the division of the territory and zoned structures in his plans were to focus the community as an urban spatial element, which defines the city growth. The modulus system allowed for greater flexibility in design and further division of space into residential, commercial and other civic zones. This contributed to the city urban design and process of planning development, offering a mechanism that is not only spatially flexible but also applicable for varying expansion and change. However, to what extent this physical achievement can be actually successfully applied to the non-physical (i.e. social) urban life is still questionable.

In spite of the functionality and rationality of his 1970s dynamic plan of the city, his integrated Dynapolis approach, which shaped the urban form structure of neighbourhood units in Riyadh and has proven to be successful in accommodating its major urban expansions and administration for more than four decades, has received criticism. From the reviews given of Doxiadis' plans in different global cities (as in the case of his work in Tehran and Brazil, discussed in chapter 2), his work in Riyadh is criticised as a 'ready-made solution' that lacks the specific understanding of the local context in many ways.

Firstly, though clear and organised, and physically and functionally comprehensive, Doxiadis' plans lack the exact details of how the non-physical urban aspects of the local society, mainly social and cultural, should work. His recommendations for further research on such important matters to the client authority do not free him from his responsibility to apply this information in the design solutions in the first place.

Secondly, it can be argued that Doxiadis' proposal in Riyadh, again as in the reviewed case of Baghdad, has failed to predict the massive demographic changes in the Saudi society in Riyadh from the late 1970s onwards. It is believed that this shortcoming has opened the door for the later failures to address the needs of these changes in the implementation stages, as it gave the city planners and developers less guidance on how to accommodate more affordable mixed land uses inside the residential zones, especially in the more fortunate neighbourhoods put in the city's peripheries in the initial plan.

Thirdly, though his work in Riyadh responded to the local climate at the overall scale of the city in his consideration of the geographical orientation of its main streets, as in his plans in Baghdad, his general urban planning guidelines were abstract and failed to appropriately address the local climate at urban micro-scales. For example, his proposal for building regulations did not explain the urban and architectural vocabulary needed to respond to the local climate.

Fourthly, Doxiadis' almost standardised modern-style strict urban grid seems to have caused the neglect of Riyadh's traditional core and historical cultural identity of the local society in Riyadh, both in its old architectural and urban character and size. It has become obvious that the previously existing design of public spaces that strongly respect human social life in the traditional city has been replaced with the unparalleled huge modern scales of wide streets and large urban plots and detached houses, all influenced by Western-style urban prototypes and built mostly around the speedy movement of cars.

Finally, the following is a summary of the critical reviews on Doxiadis' plan in relation to urban sustainability in Riyadh based on the results of the analysis of the study's four developed criteria.

***Compactness***

Doxiadis' proposed design of the city neighbourhood units (CCV) indicates his consideration for the sustainability of the compactness element. For example, his figures for the population limit of 50,000 for each unit (125 p/h), his restriction for building heights (maximum of 3

storeys), and his setting of average sizes for land plots (400 $m^2$ in Almoroj), all show Doxiadis' consideration of achieving an acceptable level of compactness. This is also evident in the plan's answer for accessibility, as it considers the level of proximity, provision, and equal distribution of the key urban facilities, especially within the smaller and walkable friendly human-scale size of CCIV (1x1km) residences. In his diagrams it was clear that the neighbourhood populations are all within the catchment areas of the facilities provided, such as schools, health centres, mosques, shops and parks. To exemplify, the suggested primary schools in Doxiadis' plan for each CCIII consider the longest walkable distance for any children to be within 250m. Therefore, it can be concluded that the initial designs put forward by Doxiadis for the urban form for Almoroj, if they had been followed, could have been more compact, accessible and sustainable.

***Climate related design***

Unfortunately, there were no detailed designs in the master plan that specify how Doxiadis considered the city neighbourhood units, its streets, and building forms in relation to appropriate thermal comfort, as in the case of Baghdad. However, Doxiadis' layout of the urban structure in Riyadh was oriented to apparently avoid direct east and west solar radiation and to minimize the effect of sand storm exposure, with the aim of capturing the north and occasional south– southeast breeze. The slight rotation of the north-south direction seems to work very well naturally and geographically with the location of the existing valley of Wadi-Hanifa in the west. It is also realised that while doing so the city orientation can achieve other specific climatic, spiritual, and natural objectives of the local context, so that the west-east axes can direct to the spiritual direction of Mecca, the Qibla axes. This is somehow comparable to what Doxiadis did in the presented example of his work in Pakistan (discussed in chapter 2); however, as aforementioned, this was generally applied at the city and not the neighbourhood unit level. Therefore, one of the notable shortcomings is the lack of landscaping policies that explains the details of how and where green areas should be provided to overcome the sun's strong heat in Saudi Arabia. Moreover, Doxiadis' suggested percentage of green spaces in a neighbourhood unit was 4 $m^2$ per capita. It is worth remembering here that the reviewed minimum expectable standard of greenery in an urban form is recommended to reach 9m2 per capita to be classified as sustainable. It is therefore arguable that Doxiadis' policy for greenery in Riyadh could not be considered fully sustainable.

***Sustainable transport***

Doxiadis' proposal for Riyadh was originally designed for cars and pedestrians, putting clear consideration for the rights of people to walk. This was evident in his urban design approach for making clear separation between the paths of pedestrians and automobiles, and suggesting to leave room for development for public transport and cycling. Furthermore, his proposed street and connectivity measures appeared to facilitate smooth circulation of people and cars, which could make more sustainable choices. There was evidence of footpaths on sidewalk dimensions in residential and major streets as well as pavements and buffer zones to improve safety and walkability for pedestrians. However, it is worth mentioning other important measures of walkability, such as the length and size of the urban building blocks seem to have been ignored in the plans' urban policy and general guidelines. In general, Doxiadis in Riyadh seems to have thought of the need to make the city's transport system, which connects all its neighbourhood units, more sustainable in today's terms.

***Diversity***

The mixed land use strategy at the neighbourhood level in Doxiadis' plan was focused more on horizontal expansions. Vertical mixed land use ideas were suggested to be at a low degree in Doxiadis' design. However, the breakdown of urban functions within the community classes V to I is a strong factor in terms of the diversity to support the liveliness of the neighbourhood streets and inside its smaller urban cores. This has the potential to encourage the provision of the variety of functional and social services for all residents to share, with different incomes and cultures. However, considering the fact that, in his initial plan, Doxiadis suggested the range of plot size in the traditional urban core to be 150 m2 and this average can reach up to 1,500 m2 in the city's periphery, this has been criticised on the grounds that it can cause a clear socio-income segregation between the city's different classes of people. For this reason, it is difficult to judge Doxiadis' plans with regards to the diversity criterion in Riyadh to be fully sustainable.

### *10.2.2 The Development Stage: The Implemented Neighbourhoods in Riyadh*

As explained in chapter 5, Riyadh Municipality embarked on constructing Doxiaidis's plan of super grids of Modules, maintaining the original shape of the city neighbourhoods (CCV, 2x2km urban units) and keeping the form of Almafroka street structure, which defines the hierarchy of the smaller community classes (CCI,II,III,IV). However, most of Doxiadis' urban guidelines, planning policies and building regulations in the master plan were not fully

implemented. As a result, existing zoning and building regulations prior to the Doxiadis plan were used instead of providing new specific standards for the city that support sustainability.

The results show that the initial 1970s regulatory plans were perceived merely as a broad framework. The design of a neighbourhood of CCV was flexible and allowed for later necessary variations and modifications. For example, the specific land subdivisions within the smaller scales of community classes (under V) were developed under later development stages.

The later developed urban form by RM and MOMRA paid limited attention to urban sustainability, but it was found that later planning considerations seem to have seen a slight improvement recently. Following Doxiadis involvement, the appointed SCET planners in 1978 and the currently active MEDSTAR strategy planners since 1996, all were involved in revising Doxiadis' plans to tackle the developed urban challenges, including solving the city transportation, infrastructure, and the rapid population growth.

At the neighbourhood level, the results showed that some land subdivisions and key functions have not been fully developed in accordance with the Doxiadis plan. Mainly, the breakdown of urban functions of Doxiadis for CCV were not precisely followed. The current urban centres have not been equally developed to support more lively urban life within the community classes. This has led to clearly weak connections between the hierarchical scale of urban communities within the studied neighbourhood, and seemingly at the regional scale of the city. The main reasons for these changes were economic, socio-cultural and technical, as discussed in Chapter 5. Also, the urban functions and facilities were primarily provided based on the limited percentage of 33% of the neighbourhood land, and this was later improved to 40%, but the specification of how much each service should be was not precisely identified. Moreover, new street policies and standards were introduced and followed in the current neighbourhood, which are now mainly wider and different in some of its functions to those suggested by Doxiadis.

The current regulatory plan is limited to land subdivisions founded on zoning laws. Their aim was to achieve a certain number and size of plots and standards of street design along with parking areas. This has resulted in default unplanned densities, land uses and building profiles, based on floor-area ratio, height and setbacks. Unfortunately, it is clear that this plan and urban policy failed to come up with an urban form that was conscious of environmental and social aspects.

Generally, the super urban blocks became commercially exploited in several developed neighbourhoods, including Almoroj, as the lands' subdivisions focused on offering as much commercial and residential land for private development as possible, compared to the lower investment in urban facilities such as public spaces. As an indirect consequence, it was obvious that there was a gap between the planning process and the practice of urban design in Riyadh. In order to address this issue, MOMRA recommended the adoption of general principles for its urban design concept. The goal was to repair the gap in planning framework and implementation thereby resulting in a proactive approach to meet local needs, enhance quality of life and capitalize on the possibilities for sustainable development. However, these guidelines were not considered in the planning process of developing the city neighbourhoods; they were not, and still may not be, strict enough or were not followed. So, urban design concepts and sustainable urban planning criteria should be developed into serious urban policy for developers to be easily considered, controlled, and ultimately implemented.

The following is a summary of the examined case study of Almoroj based on the results of the analysis under the developed four criteria of sustainable urban form.

***Compactness***

The result shows that the current population density in Alomoroj is 85 persons/ha and 16 residential units/ha. However, the lately introduced urban policy of a minimum 300m$^2$ land size and the rising building density to 3.5 floors instead of 2, have enhanced the intensification and more efficient use of land, and would promote more compact urban forms in the future. Almoroj is therefore considered to be moderately dense, compared to other neighbourhoods in Riyadh, Saudi and Arabic cities, and international cities like Barcelona. The dominating use of villas, large land sizes, and limited heights were the main reasons that somehow weaken the overall compactness in the neighbourhood. The predominating large single (detached) villas, limited height of two storeys for all houses, and inequity of distribution of relatively dense residential buildings led to some sprawling urban areas within the neighbourhood that weaken proximity.

It was found that Almoroj, to some extent, is compact because of the level of proximity, provision, and distribution of some facilities, mostly mosques and shops. However, there were others that were not well distributed and remain unreachable, especially within the smaller and walkable human-scale friendly size of CCIV (1x1km) residences. The provision of urban functions focused on the large scale of Almoroj (CCV), but the breakdown of facilities

dependent on the scale of community and size of population was not considered by the authorities. All facilities and services provided should be accessible and within walkable distance, and yet, a large percentage of the neighbourhood population are out of the catchment areas of some facilities and hence, distances become greater for reaching facilities in some deprived areas. Many facilities such as schools, health centres, and parks are not equally distributed and provided between the community classes, and the missing urban functions within walking distance weaken the accessibility in Almoroj. For example, parks are not evenly provided for all of CCIV in the CCV. The park in the south-western CCIV in Almoroj is missing, which means accessibility to the nearest parks is affected. More significantly, in another example, the suggested primary schools by Doxiadis in each CCIII, which allow children to walk less than 250m, were not provided according to the initial plans. Therefore, it can be concluded that the developed urban form in Almoroj does not follow the apparently more sustainable accessibility strategy.

***Climate related design***

The result showed very few small parks were developed according to the 1970s plans, and there is a clear lack of trees and vegetation in many streets and pedestrian pavements today. There is no encouraging policy to support more greenery in front of the houses, as this is considered to be the residents' responsibility. Therefore, the use of green spaces on the sidewalks in front of the houses gives a sense to the public that these are private spaces. Green spaces in Almoroj occupy a very low percentage nowadays. Riyadh Municipality planning criteria do not support the provision of decent green spaces in Almoroj, as it is currently less than 1% of the total area of the neighbourhood. This is a very low percentage compared to the initially suggested figure of 4% in Doxiadis' plan. It is therefore obvious that Almoroj in its current situation has not yet achieved the criteria of a fully sustainable urban form concerning this category.

The Municipality of Riyadh, instead of creating building standards that work well with the specific climate and location of the city, followed the old existing building regulations and standards derived from the early plan of Al-Khobar and Al-Malaz neighbourhoods to regulate the building setbacks, heights and floor area ratios. No strategy was used in making thermally comfortable public spaces, as the streets are extremely wide in conjunction with low rise buildings and lack of shade. The design of public spaces and streets, as well as building form, in relation to the local climate conditions was therefore not sensitively addressed. Consequently, shadows in the streets are not consistent enough for people to walk comfortably. The wide street makes the residents feel hot. This seems to keep them inside

buildings for most of their social activities. As a result, excessive use of cars and air conditioning lead to more energy consumption, leading to significant environmental issues in Almoroj. It is evident then that residential buildings have the highest percentage of energy consumption, and 70% of the energy consumed is for cooling.

***Sustainable transport***

Although the city was initially planned for both cars and pedestrians, at present it is only car-based. Sustainable transport ideas, such as the provision of sustainable public transport and bicycle lanes that are recommended by various sustainable urban form approaches, seem to have been ignored during the early developing stage. The results show that the recommended pedestrian paths by Doxiadis were not implemented in Almoroj, and even were asphalted in some cases such as in the neighbouring King Fahad neighbourhood. Limiting urban transport policies adopted by the decision-makers for this neighbourhood might also have impacted negatively on the travel behaviour of residents.

It was not just the behaviour of the interviewee residents that did not support urban sustainability, but the developed street and connectivity appeared to hinder people from making more sustainable choices. Pedestrians were not given the concern they deserve and hence became a second priority in the design stage of Riyadh Municipality. Many walking facilities were not designed nor obviously implemented. There is no evidence of footpaths on the sidewalks in residential and major streets. The sidewalks in the internal streets are thin and difficult to walk on and mostly used as a private space. Pavements are criticised for being unattractive, unfriendly, and there is no buffer zone to improve safety for pedestrians in commercial streets. Moreover, the block length and size was another issue that affected walkability in Almoroj. Many blocks are long causing longer walking distances. Some services are about 300m away, but the length and arrangement of some blocks made the journey about 600m because of the lack of connecting midblock crossings passing through larger blocks.

In summary, excessive use of cars and the results of energy consumption prove the need for a sustainable transport system in the city to link its neighbourhood units. More recently, a city-wide metro and bus system is now being constructed for a more sustainable lifestyle, however, walking facilities at the neighbourhood level have not been managed nor translated into an urban policy from the general urban guidelines.

***Diversity***

The research results support the conviction that Almoroj is currently to a great extent a diverse neighbourhood. However, mixed land use is provided more at a horizontal than vertical level. It can be argued that the neighbourhood is not providing a high level of mixed land use to be fully mixed (e.g. city centre of some UK cities), nor can its land use be considered segregated to be compared with, for example, the renowned American suburbs. The multi-storey mixed-use buildings cover 6.5% of the total land use area in Almoroj (mostly on major streets), which is considered small to support the liveliness of the neighbourhood streets, as it appears that mixed land use makes major streets more liveable compared to other areas in the neighbourhood. Moreover, the need for more private lifestyles, the building of more villas, and the strict limited land policy of 33% for public facilities, seem to have a significant effect on the provision of non-profit facilities and choice of having more mixed land use buildings within the residential areas.

Subsequently, the diversity strategy in the neighbourhood is affected because of the weak human-based design. What is more, the urban policy by MOMRA and Riyadh Municipality stated that commercial uses are only placed on major streets with 30m width and wider. This means that there is no chance to develop any commercial uses within the internal residential streets. This limits the vertical mixed land use all over the neighbourhood, a part of the major streets. Some of the sub-centres in CCIVs are not used as a hub for the communities, for example schools, mosques and commercial activities; this has led to poor urban centres in Almoroj.

On the other hand, Almoroj neighbourhood does offer an acceptable level of variety of housing types and sizes, residents' incomes and cultures, and recreational and social activities. Many of the studied types and sizes of houses varied from semi-detached, detached villas, and apartments. Sizes of most residential units start from as small as 150 m2 up to 10000 m2. Therefore, there is an opportunity for people with different incomes to live in affordable sized spaces. However, Almoroj is considered to be a neighbourhood of middle to high class people, and there is little opportunity for low income people to live there. There are some mixed use buildings offering affordable flats, but these are mostly used by foreign workers and young Saudi couples in the neighbourhood, providing more diverse people of different cultures and income.

### *10.2.3 The Use Stage: Experiencing the Current Urban Spaces and Functions of Almoroj Neighbourhood*

After the evaluation of Doxiadis' plans and the changes made during the followed developing history of the city to date, this section is the third element of the research examination

process. It gives a summary of the experiences of the study participants towards the urban spaces and functions in the case study neighbourhood of Almoroj. Again, the results are presented under the four developed criteria of sustainable urban forms.

***Compactness***

The perceptions of the interviewed residents support the view that the major streets are busier and higher in density than the much quieter internal residential streets. Undoubtedly, the active business and commercial activities are what drive most residents and visitors living around Almoroj to fulfil their daily needs. However, it is realized that this perception does not completely represent the actual population in Almoroj. Another reason for the quieter internal residential streets was the domination of the villa type houses, where people stay mainly indoors. This was also evident in the gathered answers of the perception and experiences of different participants living in Almoroj regarding how accessible the neighbourhood facilities are. Many residents were found living out of the catchment areas, feeling disadvantaged in terms of using the key facilities provided. Finally, most of the residents, specifically women and teenagers, are not using the public facilities such as parks and open spaces, which limits social interaction in public spaces.

***Climate related design***

Most interviewees believed that most of the streets are unattractive and harsh to walk through. The RM along with many residents were not interested in growing shadowed trees on sidewalk pavements. It is, however, important to note that shortage of water and hot weather do not help maintain them for longer. Moreover, it has also been noticed that there is a misconception that green spaces on the sidewalks in front of the houses are considered to be more private than public equity; thus, it is the responsibility of the landlords to look after their sustainability. Inside the property, some interviewees preferred to nurture their own private green spaces and seemed to enjoy them more than the few public ones, especially women who mostly do so because of privacy and comfort reasons. The women interviewees said that trees provide more safety and privacy in outdoor public spaces. It was also noted that many newly designed villas give a green space feature a priority at the design stage. Other interviewees, who mainly live in flats or very small villas, do not have space for growing greenery at home, and complained about the low level of green spaces in the neighbourhood.

The houses and buildings in the neighbourhood with their main elevations facing the sun most of the day (south to south-west) and especially those facing dusty winds, make the residents

feel uncomfortable. Most of the houses and buildings have no tailored architectural features and devices to provide enough shade to protect from the sun and winds. Many residents were unaware of the benefits of climate related designs and often ignored the need for natural sources for cooling. For example, the private open space between the house and its outer walls is highly exposed to the sun making it a thermally uncomfortable space. The residents used steel and/or plastic shutters to protect themselves from sun and provide privacy. The aforementioned reasons show architects design houses and buildings without consideration of the climate condition.

***Sustainable transport***

Most of the interviewees used their cars for almost every single short trip. Although some facilities were as close as 200m, the participants' first transportation option was still the use of car. However, many facilities are not walkable and far beyond 500m. In short, the use of cars over time seems to have been imprinted on their lifestyle and behaviour. The pedestrians and cyclists are sharing the streets with cars and that threatens their safety. The unfurnished streets do not encourage participants to use available sidewalk pavements. At night, some streets are less equipped with street lights, and so they are dark to walk through, especially for women. Pavements are not consistent and pedestrians are obstructed by randomly privately planted trees, unlevelled garage accesses, and pavements in some areas are missed. These pavements are not well connected with the crosswalks in which pedestrians could move comfortably. All these challenges seem to have contributed to the lack of will to walk in Almoroj.

***Diversity***

The results from the interviewees show that most of the residents' basic daily needs are satisfactorily met within Almoroj. This makes them feel that it is a diverse neighbourhood. However, some facilities are not within walking distance, but cars make them easily reachable. Many of the studied types and sizes of houses were validated by the interviewees varying from semi-detached, detached villas, and apartments. Though Almoroj is considered as one of the city's richest neighbourhoods, it was noticeable to find that there is still an opportunity for people with different incomes to live in some affordable size apartments.

Many of the interviewee residents, especially women, prefer indoor activities. Consequently, the house for them is the main place for social activities, while most men gather in private rest houses that have become more popular in Saudi modern culture. Outside rooms within the vicinity of houses are notably built for teenage members of the family for recreational and

social activities. Villas seem to offer more of these indoor facilities and spaces. This was considered to be one of the main reasons why there were less social interactions between people in public spaces like parks and open spaces, especially among Saudis. Foreign residents seem to use public spaces more than others in Almoroj. One reason is that they usually live in apartments that are not large enough with no private open spaces or gardens for recreational activity.

## 10.3 Final Remarks

Overall, from the above summary it can be concluded that the urban form of Almoroj is not fully sustainable and some of the identified sustainable criteria that were examined were found to have achieved more sustainable qualities than others. Precisely, some elements in Almoroj strengthen the compactness of the neighbourhood unit while other elements are weakening this concept. Provision, distribution distances of facilities and services, catchment areas and population show that Almoroj is not fully accessible. The density of Almoroj proved to be low compared to other studied urban areas due to its building form and style of villas, which are large in size in this residential unit. If these elements were taken into account, the urban form would be more compact.

Additionally, the current urban form of Almoroj is not adequately climate sensitive. The design and orientation at the outward building and street level do not efficiently respond to the climate, as they proved to be highly exposed to the sun, thus not fully thermally comfortable. Air conditioning and mechanically controlled rooms are mostly used and preferred. Most of the interviewees prefer to have indoor social activities, for example, at home and therefore this has led to high energy consumption that is environmentally harmful. A lack of green spaces and trees at the neighbourhood and street level lead to less use and quality of spaces, which seems to have contributed to weak social interaction. The use of green spaces at housing, street, and generally at the neighbourhood level is directly affecting the thermal comfort measures of Almoroj.

The neighbourhood is a car-based unit and is generally not walkable. Some facilities and services are within walking distance, but the residents generally prefer to use cars for most trips within the city. This high usage of cars is not helped by the fact that the streets are not well connected and are not sensitive to climatic conditions, as aforementioned, and the length of the blocks and pavements are not well designed for walking. Pavements were used as a private space, hence the relationship between the public and private spaces are not well-defined and this leads to dis-connectivity, inconsistent sidewalks, and unsafe urban spaces.

This all has led to increased dependency on cars and decreased overall walkability to local facilities.

Despite the heavy reliance on cars, the neighbourhood does to some extent achieve diversity and mixed land use. Almoroj has a variety of housing types and sizes as well as income, ages, and cultures that support the concept of diversity. As has been argued, the planning criteria of 33% kept for providing facilities and services including streets, is very low. This leads to a very low percentage for public facilities and services. Moreover, the later amended 40% is also questionable due to the finding that it still does not cover the actual neighbourhood needs. The results gathered from the research qualitative data and observations showed that Almoroj covers most of the daily needs that are provided within the scale of 2x2km. The hierarchical urban function and community scales planned by Doxiadis would be more efficient than a static percentage for public services. The mixed land use concept is not fully applied at the building and street level and mixed-use buildings are located only in the main streets. They are less utilized in the sub-centres of the CCIVs and smaller urban communities. Finally, the single building type of villa is dominant in Almoroj, making it a less mixed neighbourhood.

Throughout the analysis of Almoroj, it was noted that self-containment at the neighbourhood level is important to achieve sustainability. However, this is true to a limited extent, because there are other not less important factors that have to be considered in this analysis: firstly, the importance of the urban form scale of the neighbourhood unit, and secondly, its interdependency with the other neighbourhoods, as well as the behaviour of its users.

Thus, the question here is whether the scale of the neighbourhood 1x1km or even 2x2km, can be fully sustainable alone or not. It should be questioned as to whether it may still be independent so that all its residents are able to use it sufficiently or not, as well as whether a design based on these multiplicity of cells (CCV) would be sufficient enough to generate a sustainable urban form for Riyadh based on the above summarised results.

One of the main points that support the view that Riyadh is a city of comparable modular neighbourhood units, is the fact that all the neighbourhoods should follow one standard of the neighbourhood urban planning criteria, building regulations, and street patterns. Hence, Almoroj reflects the overall picture of all other 2x2km neighbourhoods in the city. However, different neighbourhoods may have different effects on sustainability. The neighbourhood unit system in Riyadh was therefore planned so that each unit could be independent, but many

factors affected the sufficiency of the studied neighbourhood, as it became partly dependent on the surrounding neighbourhoods in some aspects and vice-versa. The current urban policy, planning criteria, and urban special arrangements reduce all the planning considerations in Doxiadis' plan and the theory of neighbourhood unit as well as sustainable urban form concepts studied in this research to a very limited range. So, in that sense, it is less able to shape a sustainable urban form.

It appears that the adopted scale of the neighbourhood units of 2x2km is too large for a neighbourhood unit, and therefore, not useful in terms of achieving sustainability. The quarter size of this neighbourhood unit proved to be a more useful dimension to generate a sustainable urban form and sufficient neighbourhood. As discussed, the behaviour of the residents is unsustainable and there is a mismatch between the behaviour and urban form even though there are some sustainable elements in the current urban form. It is believed that the relationship between form and behaviour of the residents is very important for achieving sustainability as one can of course affect the other.

The results of the interviews, observation, and urban space analysis present some factors that drive many visitors to come to Almoroj, and some of its residents to use facilities in the nearby neighbourhood. It was evident from the conducted interviews on site that the core municipal open space and schools in Almoroj are attracting more visitors from other neighbouring areas. Also, the urban space analysis, presented in chapter 9, provided more evidence why Almoroj and its adjacent neighbourhoods are not totally independent, when it comes to sharing key urban public facilities. The map of the neighbourhood proved that there is no systematic planning order or urban pattern that distinguishes the distribution of schools around each of these neighbourhoods. It was found that these heavily used public facilities were not equally distributed around the urban communities. Firstly, some very necessary facilities and services were found to not be sufficiently provided where they should be, such as schools and parks. Secondly, the quality of some facilities and services are not evenly maintained, such as between private and public schools. Thirdly, the presence of many high street connections with many entrances and easy accesses between neighbourhood units encourages random penetration of drivers crossing through the neighbourhood streets to make shortcuts to their different destinations. Fourthly, the distances to some key urban facilities, such as parks and primary schools, are not walkable and easy to reach within the same neighbourhood, especially when it can be more reachable in the next one.

Finally, the early discussed urban considerations of scale, independence, and relationships between behaviour and form, and the implementation gaps have weakened the social and environmental performance of Almoroj and seemingly other neighbourhood units in Riyadh city. It has been argued that the right sustainable scale and independence of neighbourhood units in Riyadh would not be sufficient enough to deliver a sustainable urban form for the city. It must also be understood that sustainable urban form and planning are only parts of the equation and that more is needed to truly achieve urban sustainability. It should also be noted that even in the presence of perfect forms and efforts made by planners, the behaviour of the inhabitants, their traditions, culture, beliefs will have a very significant impact on the levels of sustainability of the urban area in use. In short, urban form appears to be a crucial contributor to urban sustainability, but it does not determine the behaviour of users, and is not sufficient enough to achieve urban sustainability alone. Thus, even in the attainment of urban sustainability, inhabitants need to cooperate to make the overall sustainability successful.

## 10.4 Research Significance

Firstly, the findings of this study about the establishment of the modern urban form of the Saudi capital city of Riyadh and its sustainability contributes to the already reviewed research effort of the application of his urban plans worldwide. The thorough evaluations of Doxiadis' original designs and how they were developed and used in Riyadh, which seemed to have been omitted from the literature, adds significantly to the understanding and critical review of Doxiadis' work in Arabian developing cities.

Secondly, this study has developed significant criteria for evaluating urban form sustainability in the Middle-eastern and Arabian context. Each analysis and discussion of the four main sustainable criteria and the eight sub-criteria, has contributed to a comprehensive understanding of the social and environmental issues of the case study neighbourhood. These issues are related to the planning criteria and policy, urban design, building regulations, and ultimately how people use the neighbourhood. For example, the urban analysis used in evaluating some of the sub-criteria such as the accessibility will help to identify more concerns of inaccessible spaces and facilities in neighbourhoods. This will assist the authorities to realize how this neighbourhood, as well as others, can be more compact and efficient. The results of the analysis will also provide guidelines to improve these strategies to have lively and safe communities in the city. Also, the findings can potentially help in designing better solutions that take into consideration the cultural and modern lifestyle needs of the specific Saudi context and users, and particularly women.

Additionally, the study used 3D modules to analyse and illustrate the urban form of Almoroj neighbourhood unit to provide a comprehensive understanding of the relationship between the designed and modern day development of the case study neighbourhood. It contributed to the understanding of the physical urban form and design concepts.

Finally, this research is expected to serve as a basis for future studies on the evaluation of Saudi urban forms regarding their sustainability in the future. This study would provide further specific knowledge for interested researchers, local urban designers and planners, architects, decision-makers, and developers, to better understand the studied modern built environment. More specifically, it will provide the necessary focus for the improvement of urban community living conditions and sustainable urban living. It also attempts to fill the gap in investigating the challenging social and environmental aspects involved in a modern neighbourhood urban form in Riyadh.

## 10.5 Study Limitations

Although the research has achieved its aims, there were some notable limitations. Owing to the modular structure of the city and the large size of the city's neighbourhoods, research findings were gathered from the selected neighbourhood Almoroj, the author's hometown, so as to have easy access and minimize the limited resources for this research.

The complexity of the data analysis of one neighbourhood limited the research to looking for information beyond one neighbourhood unit. Shortcomings of the data of the surrounding neighbourhoods restricted the evaluation and examination to see to what extent Almoroj is dependent on the next neighbourhoods. Despite this, the research has attempted to gather information on the most used facilities in the adjacent neighbourhoods. The findings of these facilities reveal that Almoroj is not fully independent.

It is realized that there are many more sustainable urban form criteria and design concepts in the literature that can be utilized to achieve sustainable urban forms. However, the most feasible and applicable ones are those developed in this thesis, to evaluate the current urban form in Riyadh in more depth. The investigation of each of these sustainable concepts can be a separate dissertation on its own. Each sub-theme was limited to the most important problems that emerged from the fieldwork experience that are closely related to the subject under question.

It has to be mentioned that there are limitations in gathering the secondary data for the intended design and development stages. Firstly, the old planning criteria by City Planning Office were difficult to find in one piece in the several available archives, thus most of the cited references to this key document were gained verbally through key informers who studied it before. Secondly, the approval of the neighbourhood design was done by two urban planners who were found to be retired or no longer with us.

Also, the original archival documents on Dioxidis's plans (28 thick volumes) are stored in Athens and were difficult to reach, due to time and resource limitations. Moreover, some expected specific data to the neighbourhood unit plans in Riyadh could not be obtained by shipments or other online means. The head office of Doxiadis Associates, though they were contacted several times, did not offer long distance assistance to deliver more documents. Thus, the only source obtained was the exceptional original comprehensive master plan, and the final report, which was shipped to the UK and was vital to the work of this study.

Privacy was another limiting issue for the gathering of research data. The tall walls of houses in the Saudi culture restricted the researcher from conducting the necessary observations and taking photos as evidence. Access to these spaces would have saved so much time and would have helped to further understand to what extent these private spaces are valuable for the residents compared to public ones. Another important issue to consider is that it was impossible to approach unknown women in the streets, and the participant women in this research were the only conceded interviewees. To some extent the prearranged interviews seem to have overcome these issues through the contact of relatives and friends, but not completely. The researcher as a member of Almoroj community seemed to play an important role in facilitating many aspects of the research in the limited fieldwork trip.

## 10.6 Study Recommendations for Policy, Practice, and Future Research

This research has highlighted the need for evaluating the current urban form of Almoroj neighbourhood for its sustainability; it is therefore important to continue the assessment to include all other neighbourhood units in Riyadh to contribute to more sustainable urban forms in the city.

***Recommendations for Policy and Practice***

Further research is required to understand how sustainable regulations can be adopted along with traditional and sustainable principles for the modern-day needs of Riyadh's built environment and its neighbourhoods. It is important to improve the existing limited neighbourhood planning criteria, policies, and building regulations to be strongly adherent to sustainable design concepts to help recreate a quality built environment, which will create social and environmental homogeneity in the whole city.

To exemplify, the relaxed service catchment area for each urban facility should follow the sustainable urban standards reviewed in the literature. Accessibility strategy should, therefore, be precisely measured and introduced in the planning criteria and taken into account during the design stage of future neighbourhood units, in order to achieve equal distribution of facilities and services to everyone. For example, 500m to secondary school, and 250m for primary schools, as a parameter of accessibility, would encourage walkability, and promote viable and efficient use of urban spaces.

New urban policy for providing quality green spaces in the neighbourhoods should be researched further to provide more accurate standards to the Riyadh Municipality planning criteria. However, this should be studied locally because of, for example, the differentiation in climate and cultural conditions. It is suggested that some landscaping strategies, such as the provision of locally resistant trees and vegetation, would be very effective and part of the solutions in some flourishing examples in Riyadh, such as in the DQ neighbourhood. The design, setting and size of these green spaces need to be studied to reduce the social and environmental impact. Also, the functions of their ecology include the application of sustainable drainage, they provide a better microclimate, shade, air filtration and enhance biodiversity. Moreover, green spaces on the sidewalks within the residential areas should be managed by public government to enhance the unbalanced sense of public against private. Also, there should be enough detailed standards and dimensions for the landscaping of these particular areas. These types of strategies would provide more attractive, comfortable, safe, social and friendly environmental urban spaces.

More research is still required to develop a clear strategy that can ensure thermally comfortable urban spaces at all levels; the neighbourhood, streets, and housing, as the design of the neighbourhood was not fully sensitive to the hot arid climate. Some architectural techniques that could reduce energy consumption particularly in a hot climatic urban space are not utilized at the building level. Some successful examples of traditional elements in modern narrow streets and self-shaded facades, as in the case of Masdar city in Dubai, could

be learned from and applied in Riyadh. Awareness should therefore be promoted among people, urban designers, and architects to consider thermal comfort practices, for instance, for shadowing, such as the use of trees and green areas as well as architectural devices. The studied sustainable urban form principles that help to reduce high energy consumption at the level of buildings and urban form scale are not applied. However, social behaviour needs to be studied in order to identify better sustainable social behaviour solutions.

The findings present significant sustainable design concepts that should be considered for walkability. Length of blocks, street furniture, and sufficiently connected pavements with clear detail, for example, in the dimensions for footpaths and green buffers, need to be taken into account. Additionally, design assessments and optimisation are needed for measuring and securing the safety of pedestrians on the street layout to encourage walkability, as most pedestrians are currently sharing streets with cars. Pedestrians' movements should therefore be improved by separating pedestrians from cars, as well as imposing restrictions on the use of private cars in some areas. This would help reduce air pollution, use less gas, and increase safety.

Offering a variety of travel modes means giving opportunity to people to use alternative options. The new bus and metro systems would definitely lead to more sustainable living according to the reviewed literature, mostly in Western cities. However, in a city like Riyadh, social and cultural aspects should be specifically studied to promote better usability, regardless of the importance of many other aspects.

***Recommendations for Future Research***

Additional research should address the influence the new lifestyle and culture of Saudis have on using public spaces in neighbourhoods, especially that of women and teenagers. The investigation of the use stages in each criterion has revealed that people prefer to do indoor activities for many reasons, and the villa type of dwelling they live in offers them many more facilities than the public counterparts would. This has created an imbalance of qualities between the private and less attractive public places. The quality of design of public spaces, in all neighbourhoods, is a considerable matter. Well-connected landscape as well as green areas would affect people's use of public facilities. Therefore, future in-depth research should acknowledge the changes in modern Saudi lifestyles and examine to what degree the private spaces of houses affect the quality and use of public spaces in Riyadh today, and how and why, using common urban design methodologies of using public spaces. As the preference of indoor social activities by the residents along with culturally and socially weak design of

public spaces leads to environmental and social consequences, there is, for example, high energy consumption in using more private spaces and less social interaction in public. It is believed that these types of research question will have tremendous social, environmental and economic benefits and will most likely help make the city public spaces more compatible to private facilities in villas to encourage the sustainable living of residents.

Similar to other Riyadh neighbourhoods, building density in Almoroj has risen in some selected main streets only, but not in the residential areas that are dominated by villas, to raise the overall density. We learned that increases in density might take a certain form of buildings, for example high rise buildings that might not be culturally and socially acceptable. In the case study example this is still socially and culturally acceptable, however; there is a need to understand what is deemed to be sustainable in terms of denser and more highly compacted urban areas that promote high social and environmental performance. Therefore, there is a need for future research on questions like: How do single detached villas cope with the design concepts of a sustainable urban form? Increases in the socio-economic status of Almoroj inhabitants have influenced people's choices regarding housing, showing preferences for single detached villas, which may present a grave challenge when trying to create a compact, dense and diverse community. A great level of variety of housing, cultures, and social activities has been realized, and yet, there is low affordability for low-income people to be equally accommodated. It is believed that a sustainable neighbourhood would include a diverse set of people, and would not segregate urban areas based on levels of income, but the question here is how to address this dilemma on the grounds of the current neighbourhood units of Riyadh today?

Finally, further research is also needed to collect more evidence about the dependency of services in the surrounding neighbourhoods to study how a cluster of neighbourhoods functions. The challenge here is to find the appropriate methodological approach to measure such phenomena. It is believed that such a research design will be based mostly on focused qualitative methods, to understand the social, economic, and other needs for crossing between the city's different neighbourhoods. This in return could help in understanding the human needs within the identified scale of urban units to help design future urban spaces, which are comfortable, friendly walkable, socially liveable, visually attractive, and closely integrated and compact urban forms and spaces.

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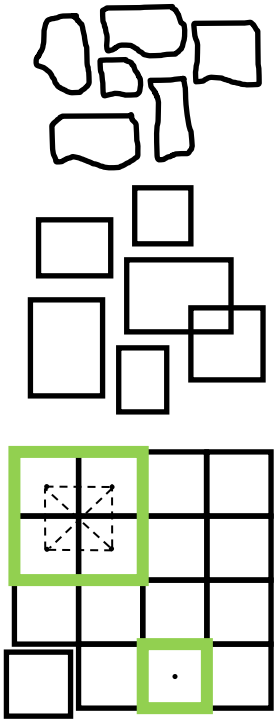

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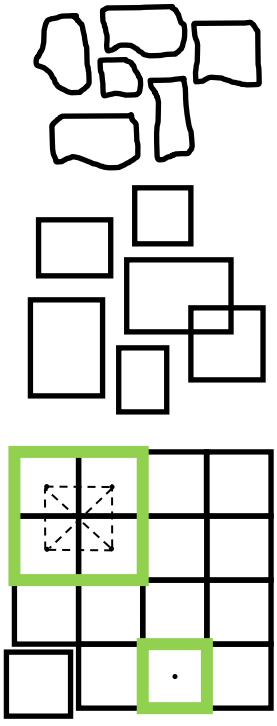
# Appendices



# Appendix A: Interviews Questions and Codes

## The residents' interviews

| Criteria<br>**1-Compactness** | Interview Questions<br>(with the residents) | Literature Review |
|---|---|---|
| 1.1 Density | - How does it feel in the neighbourhood? Is it quiet, or crowded and noisy with people and cars in the residential streets and major streets in the neighbourhood?<br>- Are there some people who come to the neighbourhood because what they need is not available in the other neighbourhoods next to them?<br>- Do you meet your neighbours? Is it planned meetings or accidental? How often and where do you meet them?<br>- Is the feeling in terms of the space being crowded or quiet the same as the city or different? | The building and residential density is considered a main factor of sustainable urban form alongside housing form and design quality (Jenks & Jones, 2010; Shin, 2010). |
| 1.2. Accessibility | - Do you use public spaces or parks? How often and why?<br>- What do you think of the locations of schools, Mosque, open spaces?<br>- Are they placed in good locations, which can be easily reached from any place in the neighbourhood?<br>- Do you feel you have easy access to facilities, services, schools, mosque, parks, and other open spaces? How easy or hard is the access to them? Do you walk or go by car? Why? | Accessibility is considered as an effective measure of social equity and environmental performance |
| | | Availability of services and avenues within a short distance also significantly reduces commute time by car or public transport |
| | | |
| | - Does it take a long time to reach services, facilities, schools, Mosque, parks, and other open spaces within the neighbourhood?<br>- Does this neighbourhood cater for all or most of your needs (facilities, services, schools, mosque, parks, and other open spaces)? | Area schools must be located at central neighbourhood unit's point as they are considered at high level of preference for residents. |

| | | |
|---|---|---|
| | - Do you go to schools in your area or out of the neighbourhood?<br>- How is the distance from your house to services, facilities, schools, Mosque, parks, and other open spaces within the neighbourhood?<br>- How is the size of the Neighborhood unit? Is it small or big or a good size? Do you feel there are clear borders of it?<br>- How are the locations of the local shops and health centres within the neighbourhood? | Local shops or shops and apartments were to be located at the outer corners of the neighbourhood or at traffic junction, and adjacent to similar district of adjoining neighbourhood. |
| **2-Diversity** | | |
| 2.1. Mixed Land Use | - How is the neighbourhood in terms of the mixed land use (residential-commercial- public spaces? What are the missing functions that you need? (Functions should be at the neighbourhood level).<br>- Do you feel your home is separated from your daily needs? Do you think many services are located within a short distance and nearby each other so that you can do multipurpose trips and activities?<br>- How are the services of the facilities and shops? | The following services, for example, used on a regular day-to-day basis are: doctor/GP surgery, post office, chemist, supermarket, bank/building society, corner shop, primary school, restaurant/café/takeaway, library, sports/recreation facility, community centre, facility for children, and public open/green space. |
| 2.2. Variety of housing types, household sizes, ages, cultures, activities, and incomes | - Do you think there is a diversity of housing types and sizes, household sizes, ages, cultures, and activities?<br>- What activities and housing types or sizes do you think should be included in the neighbourhood?<br>- Are there affordable houses based on your income? Does the neighbourhood offer houses for low and high income people?<br>- Do you meet different cultures and ages of people in public spaces such as streets and parks?<br>- Where do you mostly do your social activities?<br>- What kind of social activities do you do? | Jacobs asserted that this is vital for any urban system, and make it more liveable, and diverse development promotes social interaction. |
| **3- Sustainable Transport** | | |

| | | |
|---|---|---|
| 3.1. Variety of travel modes | - What kind of transport do you usually use to make your trips inside the neighbourhood, such as shopping, prayers, schools, and open spaces? and why?<br>- Is there an opportunity to travel by different options?<br>- Do you normally walk to short distance facilities? Why?<br>- If yes, would you prefer to have a variety of travel options?<br>- How is the traffic and activities within the routes within the neighbourhood (internal and major streets)? | Newman asserted that having smart transportation is an essential factor to achieve a sustainable urban form. It means creating and designing places in terms of using various transportation modes to reach destinations, whether by walking, bicycle, car, train, or subway. |
| 3.2. Street design and connectivity | - Do you feel comfortable using the streets, for example, walking, chatting with people, or sitting? If not, why not?<br>- How do you use the streets within the neighbourhood? Do you do any activities in the major and residential streets?<br>- What do you think of the design, length, turns of the streets in terms of connectivity to facilities, services, schools, mosque, parks, and other open spaces?<br>- What are the missing street functions? Is there any particular element missing? | Sustainable urban form encourage walking. Length of blocks sidewalk pavements and dedicated pedestrians paths are the most important elements. |
| **4-Climate related Design** | | |
| 4.1. Thermal comfort conditions | - How does it feel in the public spaces, streets and open spaces in terms of the sunlight and ventilation?<br>- Do you feel your house is exposed to the sunlight and do you feel it is too warm in the house?<br>- Do you like the form of your house? Does it meet your needs and desires? Would you like it to have a different form, for example, the traditional elements such as courtyards?<br>- Do you feel the relationship between your house and the streets is good in terms of the setback in front of your house, privacy wall, and garage? | Siting, layout, landscaping, design, and orientation stand as featured elements of solar gain to avoid the need for space cooling or heating of buildings and urban form (Owens 1992). |
| 4.2. Green spaces | - How do you use greenery in your house? Why do you use them?<br>- Do you think there are enough green spaces and trees in the neighbourhood?<br>- Do you mostly use trees at the front of your houses? Why do you have them? | |

**Professionals and Experts**

| Urban Form elements | Documents and Archives | Interview Questions (With experts and professionals) |
|---|---|---|
| **1- The neighbourhood unit concept and urban functions** | | |
| 1.1. The initial and developed concept of the neighbourhood unit | Archives, the current situation, and the comprehensive master plan (Doxiadis (Dox) and MEDSTAR (MED). | What was the concept of the neighbourhood based on?<br>How was the neighbourhood designed? |
| 1.2. Density and population | Archives, the current situation, and the comprehensive master plan | What was and is the density now? What is the intensification strategy you have? |
| 1.3. The scale of a neighbourhood unit | Archives, the current situation, and MED | Is this the right scale of a neighbourhood? |
| 1.4. Location and distribution of the urban functions | | What is the policy for the location and distribution of schools**,** Mosque, parks, open spaces, health centres, and local shops? |
| 1.5. Green spaces | Archives, the current situation, and the comprehensive master plan | What is the green strategy at the neighbourhood level?<br>What is the planning criteria for the green spaces? |
| **2- Land use** | | |
| 2.1. The urban policy of land use in the neighbourhood | Documents : Old and Current policy | What is the idea of mixed land use? Why? |
| 2.2. Mixed use buildings | Documents : Old and Current policy | What is the idea of mixed use building? Why? |
| 2.3. Land use zoning | Documents : Old and Current policy | How was the land use zoning developed in relation to other neighbourhoods? |
| **3. Street patterns** | | |
| 3.1. The streets patterns, width, types and orientation | Documents : Current street policy | What are the standards for commercial and residential streets? |
| 3.2. Transportation system | Documents : Transportation policy | What other transportation systems were approached, and how have they been developed?<br>What is the strategy for walkability and connectivity? |
| 3.4. Sidewalks and pavements | Documents : Urban policy | What are the standards for streets' sidewalks and pavements?<br>What are the pedestrians' paths concept? |

| **4. Housing** | | |
|---|---|---|
| 4.1. Housing and building policy | ADA and Dox Documents : Current policy | How can this policy be linked to compactness? |
| 4.2. Housing form | ADA and Dox Documents' analysis | How can the housing form help to achieve a compact urban form and sustainability? |
| 4.3. The types and form of urban block and plot | ADA and Dox Documents' analysis | How do the urban blocks help achieve connectivity? |

**Direct observations and Urban Space Analysis**

| **Criteria** | **Direct Observation and Documents** (In the site) | **L.R** |
|---|---|---|
| **1-Compactness** | | |
| 1.1 Density | What arethe density of these elements?<br>1- Residential density 2-Housing density, 3- Population density (gross density). | The building and residential density is considered a main factor of sustainable urban form alongside housing form and design quality (Jenks & Jones, 2010; Shin, 2010). |
| 1.2. Accessibility | Documents : Maps and urban space analysis | Accessibility is considered as an effective criterion of social equity |
| | | Availability of services and avenues within a short distance also significantly reduces commute time by car or public transport |
| | | |
| | | Schools must be located at central neighbourhood unit’s point as they are considered at high level of preference for residents. |
| | | |
| | | local shops or shops and apartments were to |

| | | |
|---|---|---|
| | | be located at the outer corners of the neighbourhood or at traffic junction, and adjacent to similar district of adjoining neighbourhood. |
| **2-Diversity** | | |
| 2.1. Mixed Land Use | Documents : Mixed land use Map | The following services, for example, used on a regular day-to-day basis are:doctor/GP surgery, post office, chemist, supermarket, bank/building society, corner shop, primary school,restaurant/café/takeaway, library, sports/recreation facility, community centre, facility for children, and publicopen/green space. |
| 2.2. Variety of housing types, building densities, household sizes, ages, cultures, activities, and incomes | Direct observation: Photographs | Jacobs asserted that this is vital for any urban system, and make it more liveable, and diverse development promotes social interaction. |
| **3- Sustainable Transport** | | |
| 3.1. Variety of travel modes | **Direct observation: Site Visits and Photographs** | Newman asserted that having smart transportation is an essential factor to achieve a sustainable urban form. It means creating and designing places in terms of using various transportation modes to reach destinations, whether by walking, bicycle, car, train, or subway. |
| 3.2. Street design and connectivity | **Documents : Map** and **Photographs** | |
| **4-Climate related Design** | This concept reduces the demand for energy. This concept uses the sun's energy for heating and cooling living spaces (neighbourhood scale). | |

| | | |
|---|---|---|
| 4.1. Thermal comfort conditions | Documents : Other studies (literature review)<br>Direct observation: Photographs | Siting, layout, landscaping, design, and orientation stand as featured elements of solar gain to avoid the need for space cooling or heating of buildings and urban form (Owens 1992).<br>In urban form, the type of built form significantly has effects on urban microclimate and consequently on ventilation (air movement) and sunlight within the built form.<br>The street's width to height ratio and orientation influence the process of cooling and warming.<br>Green spaces have many social and environmental benefits and achieves sustainability. |
| 4.2. Green spaces | Documents : Other studies<br>Direct observation: Photographs | |

**Professionals and Experts**

| Designation/Name | Place of work | Positions |
|---|---|---|
| **UP1 and DM : Abdullah Al Babtain** | Riyadh Municipality- RM | Urban Planer and decision maker |
| **UP2 : Ibrahim Al Eid** | High commission for the development of Riyadh<br>Or Arriyadh Development Authority- ADA | Urban Planer |
| **UP3 : Saleh Al Saif** | High commission for the development of Riyadh- ADA | Urban Planer |
| **UP4 : Ahmed Al Selem** | Riyadh Municipality- RM | Urban Planer |
| **UP 5: Mohammad Alqarni** | Riyadh Municipality- RM | Urban Planer |
| **Arch: Mansour Almohana** | Ministry of Municipal and Rural Affairs -MOMRA | Architect |
| **E1 and DM1: Saleh Al hathloul** | King Saud University- KSU | Doctor and decision maker |

**Description of Men**

| Codes | Professions |
|---|---|
| **A1** | Retired |
| **A2** | Government Employee |
| **A3** | Private Company Employee |
| **A4** | University Student |
| **A5** | Imam (leader of prayers) |
| **A6** | Government Employee |
| **A7** | University Student |
| **A8** | Private Company Employee |
| **A9** | University Student |
| **A10** | Government Employee (live in apartment) |
| **A11** | Army Employee |
| **A12** | Private Company Employee |

**Description of Women**

| Codes | Professions |
|---|---|
| **B1** | House wife |
| **B2** | House wife |
| **B3** | High school Student |
| **B4** | Teacher at school |
| **B5** | University student |
| **B6** | Work at administration in University. |
| **B7** | University student |
| **B8** | University student |
| **B9** | House wife |
| **B10** | Student at university |
| **B11** | House wife |
| **B12** | Non -worker girl 24 years old |

**Description of Teenagers**

| Codes | Professions |
|---|---|
| **C1** | High School |
| **C2** | Secondary School (15 years old) |
| **C3** | High School (18) |
| **C4** | Secondary School |
| **C5** | High School |
| **C6** | Secondary School |

**Description of Workers**

| Codes | Professions |
|---|---|
| **D1** | Works in local shop (Foreigner) lives in the **NH |
| **D2** | Works in bank (*S. National) lives out of **NH |
| **D3** | Works in local shop (Foreigner) lives in the **NH |
| **D4** | Works in private company (*S. National) lives out of **NH |
| * = Saudi, **NH= Neighbourhood | |

**Description of Visitors**

| Codes | Professions |
|---|---|
| **E1** | Works in Ministry of Municipal and Rural Affairs - He lives in the east of Riyadh |
| **E2** | University Teacher, lives in next NH |
| **E3** | Unknown visitor, lives in near NH |
| **E4** | Who comes from next NH, met him in the open space |

# Appendix B: Sustainable Urban Development in Middle East

There are a large number of obstacles facing the Middle East in their abilities to achieve sustainable development and these include economic, political and even social challenges. However, the most prominent amongst these challenges are the regional disputes, conflicts, foreign interference into domestic issues, rapid increase in population, lack of infrastructure, backward agriculture sector, and most significantly illiteracy. In recent years, almost every country in the Middle East has gone through some significant changes, which have had adverse effects on the sustainable development in the region. These changes include unemployment, demographic modification, the Arab Spring, financial issues, natural calamities and also migration. Apparently, these issues seem to be faced by a large number of other countries in the world but for the Middle East they have become a major obstacle in the way of sustainable development (ESCWA, 2011).

In order to find a way to solve these issues, the League of Arab States came forward and presented the idea of a complete regional approach with the name of *"The Sustainable Development Initiative in the Arab Region",* also known as the SDIAR. This approach was basically designed to start a regional agenda for the achievement of sustainable growth in the Middle East region (LAS, 2013).

The Arab Ministerial Declaration approved political plans to ensure sustainable development in the Arab region with the continuous application of the suggested plan, Sustainable Development Initiative in the Arab Region, both at domestic and national levels (ESCWA, 2013). As far as the role of Arab governments is concerned as regards this project, their contribution is comparatively small. In broader terms, the underlined issue is more crucial from the prospect of future development strategies for a large number of countries in the Middle East region. The Gulf is the a significant area among them as it is more in need of sustainable development because of its lack of energy resources; this region has relied heavily on gas consumption along with severe pollution in large cities, and so, out of all the issues, the first and foremost that needs to be solved as a matter of emergency is stopping the decrease or harm to the ecological footprint (Smeets and Bayer, 2012).

Almost every large city in the Middle East is facing environmental issues and Abu Dhabi is one of them. After the discovery of oil resources in the region, Abu Dhabi soon became popular as one of the most rapidly growing cities in the Middle East. As the capital of United Arab Emirates, this city is working on the creation of advanced and up-to-date infrastructure along with a credible framework to achieve sustainable growth for future generations. Many projects have been started in this regard and city administration has taken into consideration some large projects based on quick classification of community in order to guarantee the high quality of public dominion and most importantly to pay attention to the need for infrastructure (Abu Dhabi Council of Economic Development, 2008). The *"Estidama Program"* is the best incorporated plan for the accomplishment of sustainable growth in the area.

Technically speaking, the driving force behind the *Estidama Program* is to derive a sustainable living standard for all people living in the Arab region. The underlined program of Estidama serves more than just an initiative, as it symbolizes a dynamic visualization of good supremacy along with authentic community development. With the formation of this plan, Abu Dhabi has come forward as a role model global capital among others. This program consists of many other future growth plans for sustainable development in order to not only protect but also to save the natural environment. The ate Sheikh Zayed Bin Sultan Al-Nahyan was the man who first saw the dream of a sustainable Emirates state and thereafter every program or plan in this context has acted as an inspiration to dynamic governance by emphasizing environmental development (Madden, 2006).

In broader terms, it is important to specify that Estidama is not just a simple plan; rather it is an improved and advanced system of rating by the public, which actually represents the need and desire of the Arab population for a sustainable life style. The main objective of the Estidama program is to protect and fully support the geographical and cultural identity of Abu Dhabi along with an improved life style for its residents. Every resident of this city, including local people, designers and administration, needs to contribute to the sustainability development program by bringing changes to their general approaches towards the design and planning procedure**.**

The government of Abu Dhabi has realized the fact that the Estidama Program is essential if they want to preserve their unique identity, culture, climate and economic conditions. The Estidama program is further initiated to adopt the fast changing global trends and then to utilize them in the fields of environment, society, culture and economics. Thus, everyone in the region is working together to achieve this dynamic vision of the future with the help of the latest sustainable growth program (Madden, 2006). In stark contrast, it was not long ago that the Middle East region was seen as an area unconcerned with being eco-friendly or environmentally friendly but now this is set to change.

From a geographical point of view, a large part of this area is covered by desert. Therefore, it can be said that the environment here is in fact a combination of hard weather conditions whilst also a region remarkably rich in natural gas and oil resources. With globalization, many countries of the Middle East have realised the fact that they must search for energy alternatives, for over- dependence on natural resources is not only harming their natural environment or eco-system, it also can lead to major difficulties for future generations (Subeh, Ali, and Al-Rawashdeh, 2012).

Saudi Arabia, Qatar, and United Arab Emirates are the prominent states in the Middle East who have taken serious steps towards sustainable development by promoting environmentally friendly projects. Globalization has led to many infrastructural changes in these regions, as they are taking the lead in sustainable structural designs. The modern sky-scrapers of the Middle East are the best example in this regard, as they not only promote green technology but also set a positive trend for the rest of the world. There are many construction sites and large projects in the Middle East including thirteen hundred buildings authentically approved and certified by LEED, also known as *"Leadership in Energy and Environmental Design"* (Aina *et al*, 2013).

In future projections, it has been estimated that approximately $4.3 trillion will be used up for the sustainable progress in the region. In addition, recently, Qatar won the official bid for the FIFA World cup in 2020 and so, numerous projects under the supervision of world-class architects have already been started. Such stadiums are supposed to be designed not only to utilise energy efficient techniques but also to protect players and the audience from the severely hot climate of Qatar. Another incredible project worth mentioning here is the creation of the first sustainable city in the Middle East region, *"Masdar City"* near Abu Dhabi (see Figure, 1). This project was started back in 2007 with an area of 600 hectares utilising the energy resources of traditional Arab architecture and design. It is hoped that, Masdar will gain in popularity not only in the Middle East but also all across the globe for being the first zero carbon emission city, which will be entirely dependent on green energy. This project is planned for completion in 2020 (Lau, 2012; Wagle, 2014).

**Figure B-1: Masdar City. The city adopted traditional Arabic city designs, using narrow streets, natural shading, high density, low rise living, walkable, mixed use, friendly public spaces.**

(Source: Wagle, 2014)

Masdar would be a role model, rather than an ideal city, for the rest of the world, especially for those countries who seriously want to attain sustainable development. A personal speedy transit system including pod cars will replace the common transport, as cars of all types will be strictly forbidden in Masdar city. An entirely different exterior of buildings made of dynamic glass are constructed in order to maximally utilise natural sunlight and absorption of heat to be converted into energy. The other significant feature of this ideal city is rooftop gardens, natural water systems and environmentally friendly building structures. The underlined construction project reflects the incredible initiatives of the governments of the Middle East countries in the context of green architecture (Lau, 2012).

Practically, the huge investment of the Middle East countries in sustainable progress reflects the drastic change in the attitude and behaviour of governments towards environmentally friendly techniques. For instance, the structure or building design followed here consumes only forty percent of the total energy and raw material used in the same projects in the United States of America. For a safe and sustainable future, all such initiatives including eco-friendly buildings, cars and architecture must not only be praised, rather they should be followed as a model to be recreated. Over the last decades, the objective of sustainable growth and development has become the first preference of governments in Dubai, Masqat, Beirut, Amman and Cairo because larger issues have occurred as a result of various sustainable practices and developments as well (Subeh et.al, 2012).

In the early 1980's, policy makers were in search of such patterns, which could lead them to the achievement of sustainable growth and development in the Middle East region (Sorensen et.al, 2004). However, the rapid expansion in geographical areas of cities along with rising population has become an obstacle in the way of progress. The significant process of sustainable growth in the Arab region is still a dream, as all the related issues involving political, economic, social and environmental matters need to be solved according to different scales. From a global point of view, sustainability is said to be one of those emerging issues, which need to be addressed as a matter of urgency. To summarise, it can be said that to achieve urbanisation it is compulsory to deal with the local economic, social and environmental issues of today's cities.

**Sustainability in the Case of Saudi Arabian Cities**

Saudi Arabia is one of those major states in the Middle East, which are working on major projects for sustainable urban design and planning. Many projects have been started throughout the country and among them the Mashaier Metro project is considered to be one of the most significant (see Figure, 2). This project was designed to improve the transportation system in the Holy city during the yearly pilgrimage commonly known as Hajj. The large Mashaier train system has the capacity to carry approximately 550,000 pilgrims between the holy places and sites. This project supports the government's initiatives for the sustainable urban design by decreasing carbon production. It is intended also to promote the transit-oriented development, as these trains will substitute fifty three thousand buses in the city (Barry, 2009). With the incredible success of this project, the government is now moving to start similar metro trains in the other big cities of Jeddah and Riyadh. Additionally, another project has been planned to start a Haramain Metro between the Holy cities of Makkah and Medina.


**Figure B-2: Mashaier Metro project in Makkah.**

(Source: DCOMM)

Apart from these metro projects, another initial project is the *"King Abdullah University of Science and Technology"* campus (see Figure, 3). It was the first project to be awarded the LEED certificate in the Kingdom of Saudi Arabia (Almatawa et al., 2012). The reason behind awarding the campus project was the fact that it was designed under proper consideration of sustainability principles, as they approved a geographical design first for the site along with monitoring of sustainability limitations.

**Figure B-3: The campus building of King Abdullah University of Science and Technology**

(Source: http://www.hok.com)

Al-Hemaidi (2001) noted that this project is going through a lack of coordination, as the main emphasis remains on the traditional designs. A second challenge for the government was to bring changes in the overall behaviour and attitude of people towards sustainable urban design in their areas.

Many scholars have pointed out these challenges and among them the most highlighted one are Aina (2005) and Choguill (2008). They have explained the need and significance of changes in the life style of mass audiences for the achievement of sustainability development. Therefore, it can be said that practical implementation of the fundamental principles of sustainability are compulsory but they are not the only feature for a successful sustainable growth.

The aforementioned projects highlight the role of the Saudi government in sustainable growth and give it a push towards practically applying the principles of a reliable urban design within the geographical boundaries of the country. The next challenge to the administration is to run similar projects in other large cities as well using the same successful pattern by fully relying on the adoption and application of fundamental principles of sustainability.

To conclude, it is important to specify that like all other countries worldwide, sustainable development is very much needed in the Middle East region, particularly Saudi Arabia. When it comes to the planning of urban areas, sustainability is gradually moving from being the core consideration in cities to being a vital element in neighbourhoods. Many factors play a key role in this regard, which can be further divided into two main categories. The first one covers the physical or phenomenal factors while on the other hand, the second category is related to the non-physical factors. Apart from their classification, both of these factors are equally important and can be applied to any sustainable plan or project. The most common examples of the first category or the physical factors are the environmental factors, ecological factors and the geographical factors. The examples of non-physical features are various traditions, religion, culture and history. These factors simultaneously create and reshape the modes of society by involving the social features of art and architecture. This is so because culture plays the most significant role to shape the way human beings interact with each other (Zahadi, 2012). It can be said that a combination of these factors like ecological, geographical, traditional and religious is compulsory while planning any project on sustainable development or growth. It can also be said that there is a demand for specific urban and architectural designs that best fit the Middle East region, and considering the climate and cultural identity of the society. Islamic style is the best option to incorporate and apply in the basic design and planning solutions in the development of a new and sustainable urban plan or project. However, it is worth highlighting here that religion alone is not the only factor, as regional and national social and cultural trends also play a significant role in this matter.

# Appendix C: Consent and Application Forms

## Consent Form (English Translation)

My name is Faisal Bin Suleiman, a PhD student in Newcastle University, United Kingdom. I am doing a research study to evaluate the current urban form of Riyadh for its performance in social and environmental sustainability. Almoroj neighbourhood is selected as a case study. The interviews aim to achieve two objectives which are why and how the current urban form meet the identified sustainable urban form criteria. The research provides knowledge for people to understand the built environment studied in terms of social and environmental aspects. More specifically, it may provide the focus necessary for the improvement of peoples' living conditions. The research represents a contribution to the research community by identifying the urban form social and environmental urban issues, examining to how far Almoroj is sustainable, and how these issues affects the qualities and characteristics of spaces. Also, this study aims to fill the gap regarding the social and environmental aspects involved in the modern urban form. The research seeks to provide a comprehensive understanding of the relationship between the use of spaces and developmental features of urban design.

I, the undersigned, confirm that (please tick box as appropriate):

| | | |
|---|---|---|
| 1. | I have read, listen and understood the information about the project, as provided in the Information above and verbally. | ☐ |
| 2. | I have been given the opportunity to ask questions about the project and my participation. | ☐ |
| 3. | I voluntarily agree to participate in the project. | ☐ |
| 4. | I understand I can withdraw at any time without giving reasons and that I will not be penalised for withdrawing nor will I be questioned on why I have withdrawn. | ☐ |
| 5. | The procedures regarding confidentiality have been clearly explained (e.g. use of names, pseudonyms, anonymisation of data, etc.) to me. | ☐ |
| 6. | If applicable, separate terms of consent for interviews, audio, video or other forms of data collection have been explained and provided to me. | ☐ |
| 7. | The use of the data in research, publications, sharing and archiving has been explained to me. | ☐ |
| 8. | I understand that other researchers will have access to this data only if they agree to preserve the confidentiality of the data and if they agree to the terms I have specified in this form. | ☐ |
| 9. | Select only **one** of the following:<br>• I would like my name used and understand what I have said or written as part of this study will be used in reports, publications and other research outputs so that anything I have contributed to this project can be recognised.<br>• I do not want my name used in this project. | ☐<br>☐ |
| 10. | I, along with the Researcher, agree to sign and date this informed consent form. | ☐ |

**Participant:**

| | | |
|---|---|---|
| Name of Participant | Signature | Date |

**Researcher:**

| | | |
|---|---|---|
| Name of Researcher | Signature | Date |

## Consent Form (Original in Arabic)

**نموذج الموافقه**

اسمي فيصل بن سليمان، انا طالب دكتوراه في جامعة نيوكاسل، المملكة المتحدة. وأعمل دراسة بحثية لتقييم الشكل الحضري الحالي في الرياض للأداء الاجتماعي والبيئي من ناحيه الإستدامة. تم تحديد حي المروج كحالة دراسية. تهدف المقابلات لتحقيق هدفين والتي هي أولا: كيف الشكل الحضري الحالي يلبي الاحتياجات الاجتماعية للأشخاص التي تعكس نمط حياة جديد للناس والثاني كيف الشكل الحضري يتوافق مع المعايير البيئية المستدامه. يوفر البحث معرفة للناس أن يفهموا البيئة المبنية. وبشكل أكثر تحديدا، فإنه قد يوفر التركيز اللازم لتحسين الظروف المعيشية للشعب. يمثل البحث مساهمة في الأوساط البحثية من خلال معرفة إلى أي مدى توصل الشكل الحضري إلى مفهوم الإستدامة في الرياض، وكيف أثر الشكل الحضري الجديد وسلوك المجتمع على جودة وخصائص الفراغات وعلى الإستدامة ككل. كما تهدف هذه الدراسة إلى سد الفجوة فيما يتعلق بالجوانب الاجتماعية والبيئية المعنية في الشكل الحضري الحديث. يسعى البحث إلى توفير فهم شامل للعلاقة بين استخدام الفراغات والميزات التنموية للتصميم الحضري.

- للتاكيد ضع علامة صح للمناسب ثم ضع توقيعك أدناه:

| | | |
|---|---|---|
| ☐ | لقد قرأت، واستمعت وفهمت المعلومات حول المشروع، على النحو المنصوص عليه في المعلومات أعلاه وشفهيا. | 1. |
| ☐ | لقد أعطيت الفرصة للمشاركه في طرح أسئلة حول المشروع. | 2. |
| ☐ | أنا أتفق للتطوع للمشاركة في المشروع. | 3. |
| ☐ | أنا اعرف انني قادر أن انسحب في أي وقت دون إبداء الأسباب، وأنني لن أعاقب لإنساحبي ولن أكون متساءل عن سبب الإنسحاب. | 4. |
| ☐ | وقد تم شرح الإجراءات المتعلقة بالسرية بشكل واضح (مثل: استخدام أسماء، أسماء مستعارة، السريه من البيانات، الخ) بالنسبة لي. | 5. |
| ☐ | الأدوات التي استخدمت في المقابلة لتجميع المعلومات من تسجيل أو فيديو شرحت وتوفرت. | 6. |
| ☐ | شرحت لي استخدام البيانات في البحوث والمطبوعات والأرشفة . | 7. |
| ☐ | أنا أفهم أن الباحثين الآخرين قادرين الحصول على هذه البيانات ولكن يجب أن يحافظوا على السرية والشروط المحدده. | 8. |
| ☐ | اختيار واحد فقط مما يلي:<br>• لا أمانع من استخدام اسمي في البحث كما سيتم استخدام جزء من هذه الدراسة في التقارير والمطبوعات ونتائج البحوث الأخرى بحيث أن أي شيء سوهم فيه يجب أن يدرك.<br>• أنا لا أريد اسمي أن يستخدم في هذا المشروع . | 9. |
| ☐ | انا أوافق مع الباحث على التوقيع في هذا النموذج. | 10. |

**المشارك:**

| | | |
|---|---|---|
| الاسم | التوقيع | التاريخ |

**الباحث:**

| | | |
|---|---|---|
| الاسم | التوقيع | التاريخ |

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**REQUEST FOR COPIES**

**(Fields marked with an asterisk (*) are required fields)**

| | |
|---|---|
| **First Name*** | Faisal |
| **Last Name*** | Bin Sulaiman |
| **E-mail Address*** | f.f.s.bin-sulaiman@newcastle.ac.uk |
| **Mailing Address*** | Address in the UK was provided |
| **City*** | Newcastle Upon Tyne |
| **Zip/Postal Code*** | Postal Code in the UK was provided |
| **Country*** | United Kingdom |
| **Contact Phone Number** (include area code) | Tel/Mobile numbers were provided |
| **University - School** | Newcastle University |
| **Type your inquiry here (please be as specific as possible)** | A photocopy of the Arabic report of Riyadh final master plan |
| **Reason for Research*** | Evaluation of the social and environmental performance of the current Riyadh urban from |
| **Resources consulted (Where have you looked already?)** | Ministry of Municipality and Rural Affairs in Riyadh city (MOMRA) and Arriyadh Development Authority (ADA) |
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