QATAR UNIVERSITY

COLLEGE OF ENGINEERING

PUBLIC SPACES AND USER'S COMFORT, HEALTH AND WELL-BEING: A STUDY OF IMPROVING SPATIAL QUALITIES OF PUBLIC OPEN SPACES (POS) IN CITY OF DOHA, QATAR

BY

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ABSTRACT

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Title: Public Space and User's Comfort, Health and Well-Being: A Study of Improving Spatial Qualities of Public Open Space (POS) in City of Doha, Qatar

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Sustainable Urban Development (SUD) directives significantly concentrate on treating factors that affect human comfort, health and well-being. Research has shown that Public Open Spaces (POS) are a valued and necessary component of urban city design (Habitat, 2014). Well-designed and well-functioning POS provide a variety of social, economic, environmental, physical and psychological advantages for populations, and thus play a substantial role in improving the quality of city life and contributing to liveability.

Cities in many countries are experiencing fast changes in their urban environments, demographic growth and economic development. This rapid growth has increased the effect of urbanization. This, in turn, has led to emergence problems related to the urban design qualities of POS. Most POS are rather uncomfortable because they were not designed to adapt to different environmental conditions. This has resulted in several issues related to the fact that such POS often discourage social interactions and intensify pollution.

The study was carried out in the city of Doha, a region of Qatar that experienced such POS issues due to its uncontrolled and rapid urbanization. Ultimately, this thesis aims to develop a set of design guidelines for sustainable POS

to ensure that Doha POS promote comfort, health and well-being and, in turn, achieve SUD. Guidelines are more specifically suggested for the reconstitution of the Museum of Islamic Art Park (MIA park), Oxygen Park and Msheireb Area (Barahat and Sahat Wadi Msheireb). The main objectives are to assess the physical and non-physical characteristics of these POS and examine how environmental parameters impact user comfort. To achieve these aims, different methodologies based on quantitative and qualitative methods were used including theoretical studies, questionnaires, field observations and interviews.

The initial results illustrate the major physical factors influencing user comfort. Furthermore, the findings reveal that comprehending the mutual relations among environmental conditions and psychological adaptation factors may prove significant for evaluating the design qualities of POS. Notably, the study found that the environmental factors of microclimate, noise level and air quality significantly affected psychological adaptation, user comfort and health.

The results and evaluation criteria will help urban designers improve POS and design better sustainable open spaces in Doha that more adequately address user needs by taking into consideration the region's microclimatic conditions. Ultimately, this thesis presents practical knowledge that will help to intensify quality of life in urban environments.

DEDICATION

I dedicate my work to

Saleh AL- Fadala

&

Sherifa AL- Fadala

My father and my mother who have supported me throughout my life. Their prayers, encouragement, and love enabled me to accomplish such success.

I also dedicate my thesis to my lovely sister and brothers for their patience and sincere love. Thank you.

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I would like to express my greatest thankfulness to Allah before and then to my lovely family for enabling me in continuing my education. I also want to thank all of the people who have helped and supported me by sharing their experiences, times, and knowledge throughout my Master's thesis journey.

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LIST OF ACRONYMS

POS	Public Open Spaces
SUD	Sustainable Urban Development
MIA	Museum of Islamic Art
UN	United Nation
QNV	Qatar National Vision 2030
QNDF	Qatar National Development Framework 2032
WCED	World Commission on Environment and Development
CO2	Carbon Dioxide
UK	United Kingdom
WHO	World Health Organization
US	United State
CCTV	Closed-Circuit Television
RH	Relative Humidity (%)
Temp.	Temperature
dB	decibel
EPA	Environmental Protection Agency
AQI	Air Quality Index
QF	Qatar Foundation
HBKU	Hamad Bin Khalifa University
AWCS	Automatic Waste Collection System

Introduction

This thesis is structured into six chapters and divided into three parts, as illustrated in Figure 1. Chapter 1 introduces the significance of the thesis topic, the aspects of sustainable POS and the aspects of societal health and well-being, situating these elements as necessary for determining how the physical characteristics of POS differently respond to environmental conditions and impact user comfort and psychological adaptation. In addition to presenting the research problem, this chapter states the aims and objectives of the thesis and articulates its key questions. Next, Chapter 2 performs a literature review and unfolds in three sections. More specifically, the chapter begins with an explanation of SUD, its definition and a summary of how the dimensions of SUD provide social, economic and environmental benefits, with an eye for SUD's relationship with POS. Along these lines, the second section of the chapter explores the concept of public spaces, focusing on how they are variously defined by both international organizations and researchers as well as POS production and types. This section also elaborates on the significance of public spaces and concludes by summarizing the relationship between public spaces and SUD. The third section focuses on the relationship between POS and comfort, health and well-being. It describes the activities and qualities that ameliorate POS. This section also explains the aspects of sustainable POS, identifies the physical and non-physical characteristics of POS, and details the parameters of the environmental conditions that influence user comfort in POS. Chapter 3 outlines the research design, methods and tools adopted in this thesis. Along these lines, this chapter presents a detailed explanation of the criteria developed for evaluating the aspects of POS and surveys the POS selected for study. In addition, this chapter discusses the quantitative-qualitative research approach and the instruments used for data and information

collection. The chapter ends by touching on data confidentiality. Next, Chapter 4 presents the data collected through the integrated method. It includes certain parameters that aid in the enhancement of POS. These parameters comprise both the physical and non-physical characteristics of POS including psychological adaptation and environmental conditions (e.g. microclimatic conditions, noise and air quality). The chapter also details the study's observational mapping of each POS. Chapter 5 explains and interprets the research findings. It discusses two principle factors that influence human comfort, health and well-being, namely: the physical and non-physical characteristics exemplified in the user's psychological adaptation and the influence of environmental conditions (namely, as stated above, microclimate, noise and air quality) on human comfort in POS. Last, Chapter 6 includes recommendations for best practices and thus a range of design guidelines set to enhance the POS network in line with integrated SUD in ways that promote user comfort, health and well-being.

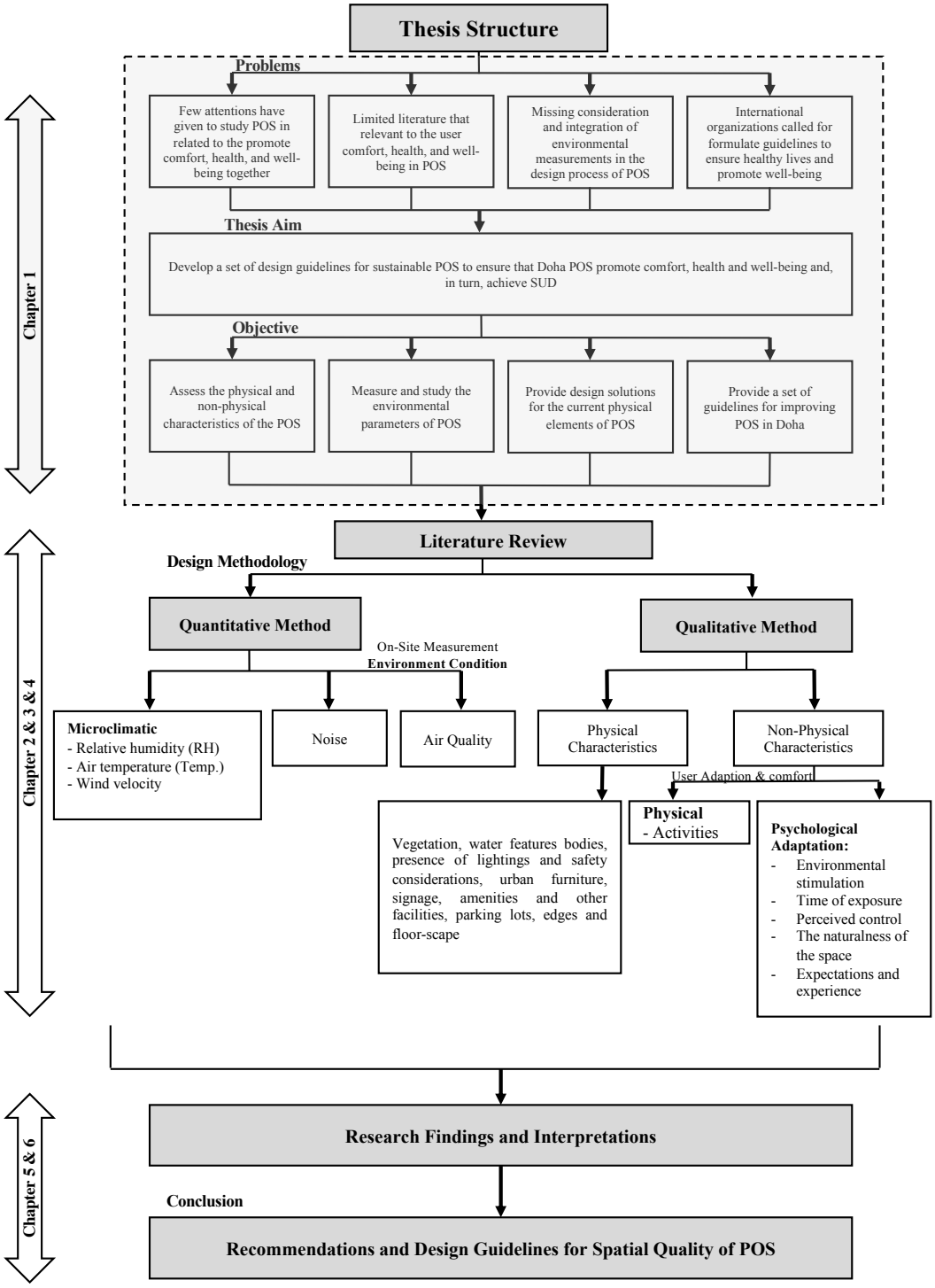


Figure 1. The structure of the thesis

Chapter 1: Introduction

As noted above, Chapter 1 introduces the significance of the thesis topic, the aspects of sustainable POS and the aspects of societal health and well-being, situating these elements as necessary for determining how the physical characteristics of POS differently respond to environmental conditions and impact user comfort and psychological adaptation. In addition to presenting the research problem, this chapter states the aims and objectives of the thesis and articulates its key questions.

1.1 Significance of the Research

Doha's rapid urbanization brought with it an increasing number of inhabitants and the implementation of many urban projects; these changes demand well-designed and well-functioning POS. Responding to this need, this study develops design guidelines for a sustainable POS by exploring the physical and non-physical characteristics of a few key POS as well as the ways in which environmental conditions impact user comfort, health and well-being—with an eye for accessibility, sociability, activities and user's comfort—in these POS.

The aspects and extracted characteristics of sustainable POS will be used to create guidelines to improve POS to enhance user comfort. The physical characteristics of POS include vegetation, water features, lighting and safety, urban furniture, signage, amenities and other facilities, parking lots, edges and floorscapes (e.g. materials, colors, soft landscape and hard pavement) (Carmona, 2008; Gehl, 2012; Mahmoudi, 2015). Meanwhile, the non-physical characteristics relevant to psychological adaptation include environmental stimulation, time of exposure, perceived control, the naturalness of the space, expectations and experience (Nikolopoulou & Steemers, 2003). This study unpacked relevant environmental

conditions by measuring microclimate variables—namely: relative humidity, air temperature and wind velocity—as well as noise and air quality.

In light of the need to measure the parameters of microclimatic conditions, it is helpful to note that solar radiation, humidity, air temperature and wind velocity directly influence external activities and human behavior (Brandenburg & Arnberger, 2001).By comprehending the microclimatic conditions and other environmental circumstances as well as user psychological adaptation for outdoor comfort by using the feedback forms and tools, this thesis develops a good overall sense of human comfort, behavior, preference, needs and standards as they relate to POS. Such work enables the study to fulfil its aim of enabling people to use POS by assuring the creation of well-designed POS.

In summary, this research studies POS in Doha, specifically in MIA Park, Oxygen Park, and Msheireb Area (Barahat and Sahat Wadi Msheireb). Some of these spaces were built under pressure and influenced by the region's rapid urbanization. As Doha is located within a region in the Middle East characterized by hot and arid weather, it is subject to specific environmental issues related to its microclimatic conditions. This is why it is enormously important to consider the region's microclimatic conditions in designing POS that give rise to a sustainable, vibrant and healthy environment. Moreover, there is a need to assess user psychological adaption as well as outdoor comfort to evaluate user preferences for the physical elements of POS as they relate to the region's environmental circumstances (Bruse, 2009). Ultimately, such work enables the development of effective guidelines for improved POS.

1.2 Theoretical Background

Gulf countries have been urbanizing since the 1970s when the region's crude oil exports increased national revenues. Recently, Doha has undergone incredibly fast urban development that dramatically expanded the city, which was founded in 1939 after oil was discovered (with oil exports beginning in 1949) (Weidmann, Salama, & Theirstein, 2012) (Figure 2).

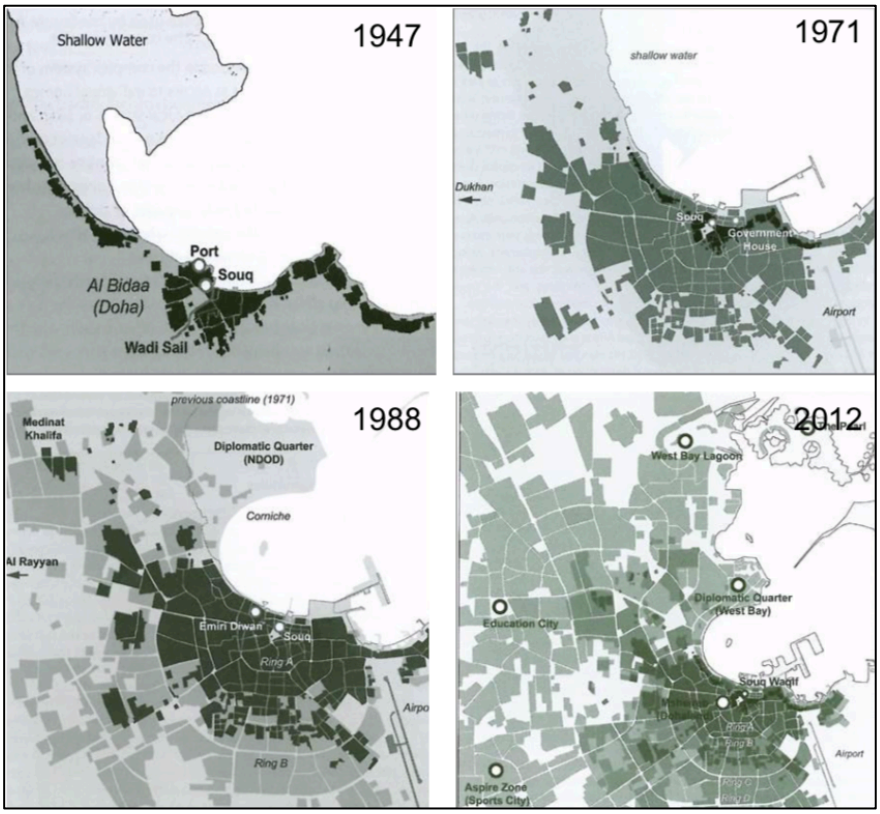


Figure 2. Doha city urban growth and expansion (Weidmann et al., 2012)

The deeper point here is that oil caused rapid urban growth and increased the number of inhabitants in the region (Salama & Wiedman, 2013). Therefore, this rapid urbanization is considered a negative trend that has notably resulted in several issues

such as environmental problems, poor infrastructure, lack of pedestrian space and a high rate of automobiles, to name but a few. In this context, urban outdoor spaces are essential—they help to increase the economic, social and environmental benefits of urban life (Johansson, 2006). And yet, POS in this region were very rapidly developed and built under pressure as Doha worked to quickly enhance its urban areas to serve society. As a result, the existing conditions of some POS do not meet user needs and expectations and thus it is important to consider how more sustainable, healthy and comfortable POS might be created in the region. Here, it is necessary to consider the urban fabrics of POS including weather parameters such as air temperature and wind velocity and determine the best materials for dealing with these factors to decrease the influence of the thermal environment and increase comfort. Further, it is also helpful to note here that the urban geometry of buildings (especially building height), technique-flow and wind direction may also influence air movement (Ragheb, El-Darwish, & Ahmed, 2016).

In areas impacted by fast urbanization, POS are mostly uncomfortable spaces, usually because they were designed by urban designers and planners without much awareness and knowledge of climate matters (Eliasson, 2000; Fringuello, 2008). It is necessary to expand the knowledge of designers and planners about microclimate, noise level and air quality if POS are to be better designed. Urban designers and planners must comprehend environmental conditions and consider user psychological adaptation to design a comfortable and healthy POS for well-being.

Globally, several international organizations have called for formulating rules and guidelines in this regard. As the United Nations (UN) argues in its Sustainable Development Goals—specifically, goals 3 and 11—sustainable development is about making cities—and, ultimately, all human settlements—inclusive, safe, resilient and

sustainable to promote well-being for all (Habitat, 2013). Proposed target 3.4 aims to increase the world's ability to prevent disease by 2030 by promoting physical and psychological health and well-being. Furthermore, proposed target 11.7 aims to establish safe access to public spaces— especially green spaces for children, women, the elderly and people with special needs—by 2030.

Locally, Qatar National Vision (QNV 2030 with the Qatar National Development Framework) outlines a strategic framework for sustainable development to reach this target. QNV 2030's main goal is to have "nature and man in harmony" (Qatar, 2008).

All of that, highlight the need to study POS in Doha to ensure that they promote sustainability, comfort, health and well-being. To be sure, Doha is already working to achieve this goal. Accordingly, there is a need to ensure that Doha's current design of MIA Park, Oxygen Park, and Msheireb Area (Barahat and Sahat Wadi Msheireb) contribute to making the environment healthier and comfortable.

1.3 Research Problem

Despite the increasing number of published studies regarding outdoor comfort—and especially thermal comfort—little attention has been given to the ways in which POS may promote comfort, health and well-being. Most of the research on this topic addresses thermal comfort and pays little attention to other environmental factors such as noise and air quality, which greatly impact human comfort and health. It is extremely necessary to gain knowledge about the levels of outdoor comfort according to environmental circumstances for designing suitable physical elements (Setaih, Hamza, & Townshend, 2013). Besides understanding how to ensure thermal comfort by unpacking microclimatic conditions, it is important to determine how to

optimize acoustic comfort by determining noise levels and, moreover, how to optimize air quality by determining air pollutants.

The limited amount of literature about user comfort, health and well-being in POS is the main reason this study was conducted. Few studies touch on the relationship between POS user psychological adaptation, microclimatic conditions, noise level, air quality and POS physical characteristics. Furthermore, processes of urban planning and design rarely pay much attention to the microclimate as an environmental factor (Johansson, 2006).

Researchers such as (Eliasson, 2000; Fringuello, 2008) found that poor urban design is a consequence of failing to integrate environmental measurements in the POS design process. Hence, literature affirms the need to convert such information and knowledge into design guidelines (Golany, 1996; Mills, 1999).

1.4 Thesis Aim, Questions and Objectives

This thesis aims to develop a set of design guidelines for sustainable POS to ensure that Doha POS promote comfort, health and well-being and, in turn, achieve SUD.

1.4.1 Thesis questions

The main research question (RQ) is:

How we can assess the aspects of POS in order to develop design guidelines for promoting comfort, health and well-being in Doha?

To answer this question, the thesis responds to the following sub-questions:

RQ1. How do the physical characteristics of the POS influence on societal comfort, health and well-being?

RQ2. How do the non-physical characteristics, including psychological adaptation and environmental conditions (microclimate, noise and air quality), influence user comfort and health in POS?

RQ3. What design parameters may improve the physical elements of POS in ways that enhance user comfort?

RQ4. What POS design guidelines best promote comfort, health and well-being?

1.4.2 Research objectives

The research objectives (RO) outlined below are based on the above questions.

RO1. Assess the physical and non-physical characteristics of POS as elements that influence social-cultural, physical and psychological well-being.

RO2. Measure and study the environmental parameters of POS and its impact on user psychological adaptation in appreciating comfort levels.

RO3. Provide design solutions for the current physical elements of POS.

RO4. Provide a set of guidelines for improving POS in Doha to aid in the creation of sustainable places for a healthy environment.

The following (Table 1) clarifies the relationship between the research questions and objectives.

Table 1. Research questions to the research objectives

Research Questions (RQ)	RQ1 & RQ2	RQ2	RQ3	RQ4
Research Objectives (RO)	RO1	RQ2	RQ3	RQ4

1.5 Conclusion

POS provide a variety of social, economic, environmental, physical and psychological advantages to populations by organizing physical elements in a way that improves the quality of life and contributes to liveability. In the case of Doha, the urban design qualities of some of the city's current POS do not cater to user needs or optimize comfort by dealing with different environmental conditions. These problems with Doha's POS result from the city's rapid urbanization. This chapter identified the main research questions—along with four sub-questions—that drive this thesis's study of POS. The findings uncovered in answering these questions will inform the creation of guidelines for designing better sustainable open spaces in Doha that address user needs.

Chapter 2: Literature Review

2.1 Introduction

Public spaces are essential ingredients of SUD and healthy cities. Thereby, the purpose of Chapter 2 to perform a literature review and unfolds in three sections. More specifically, the chapter begins with an explanation of SUD, its definition and a summary of how the dimensions of SUD provide social, economic and environmental benefits, with an eye for SUD's relationship with POS. Along these lines, the second section of the chapter explores the concept of public spaces, focusing on how they are variously defined by both international organizations and researchers as well as POS production and types. This section also elaborates on the significance of public spaces and concludes by summarizing the relationship between public spaces and SUD. The third section focuses on the relationship between POS and comfort, health and well-being. It describes the activities and qualities that ameliorate POS. This section also explains the aspects of sustainable POS, identifies the physical and non-physical characteristics of POS, and details the parameters of the environmental conditions that influence user comfort in POS.

2.2 Sustainable Urban Development (SUD)

2.2.1 Definition of SUD

In the nineteenth century, the term 'sustainable development' emerged to respond to the many serious environmental problems resulting from the rapid growth of the urban areas into natural environments. Authors such as (Meadows, Meadows, Randers, & Behrens, 1972), mention in their research that, in the coming decades, the global environment may be devastated if the current high consumption of resources and accelerating rate of human development continue. For this reason, a substantial

solution is needed to manage these trends; rules must be set to bring economy and ecology into symbiosis.

In 1972, the 'Human Environment' agreement was issued at a UN conference. This agreement stated that the-current development trends should be tackled and that more attention should be paid to preserving the environment and natural resources for future generations (Arbury, 2005). Following the UN conference, in 1987, the World Commission on Environment and Development (WCED) defined 'sustainable development' as (Assembly, 1987):

'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'

Similarly, SUD is a process of co-evolution with balanced integration between the subsystems (social, economic and environmental) that shape a city, which guarantees local inhabitants a non-contradictory level of well-being for a long period of time without complicating the potential for the development of the surrounding areas. More specifically, this is accomplished by minimizing the serious impacts of changes in the urban environment.

In the last few decades, intensive efforts have been made to achieve SUD in response to the detrimental effects of human-made settlements. Along these lines, the WCED advises that the consideration of sustainable city features can enable cities to minimize their environmental impacts and simultaneously enhance their liveability, ultimately promoting societal well-being (Chiu, 2008; Larijani, 2016). For this reason, SUD can be implemented by responding to the sustainability demands of three dimensions, namely: socio-cultural, environmental, and economic (Figure 3).

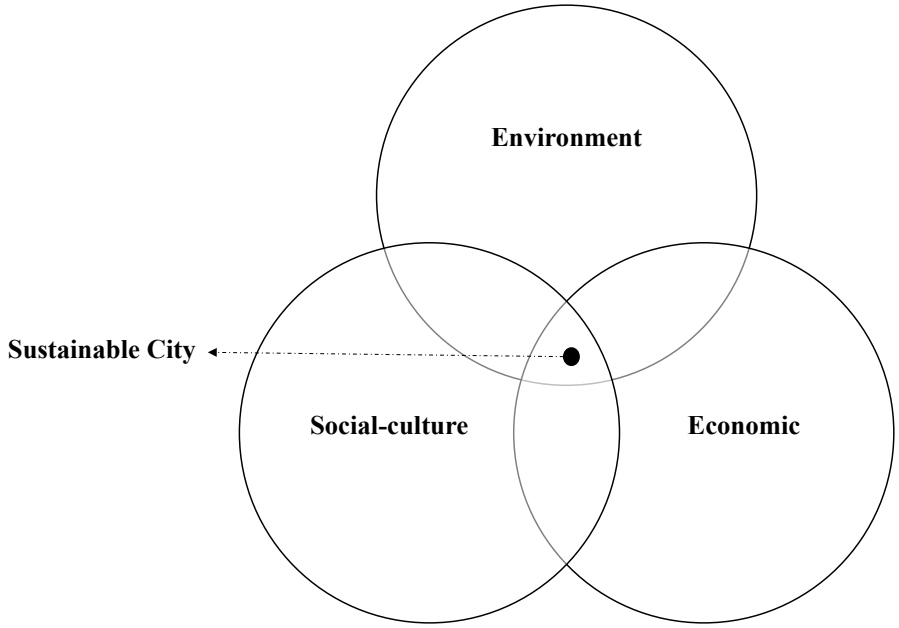


Figure 3. The dimensions of SUD

2.2.2 The dimensions of SUD

The WCED points out that the SUD strategy is an influential process in developing and promoting harmony between nature and humanity. From an urban perspective, sustainable development must realize this harmony by balancing social, economic and environmental sustainability (Silvius & Schipper, 2010), that is, by thinking carefully with demands for social interaction, environmental responsibility, and economic efficiency (Cafuta, 2015). SUD consists of three integrated dimensions, highlighted by the triple model of SUD: socio-cultural, economic and environmental sustainability (Figure 4). Each of these dimensions address different concerns in the urban environment separately (J. Lin & Yang, 2006).

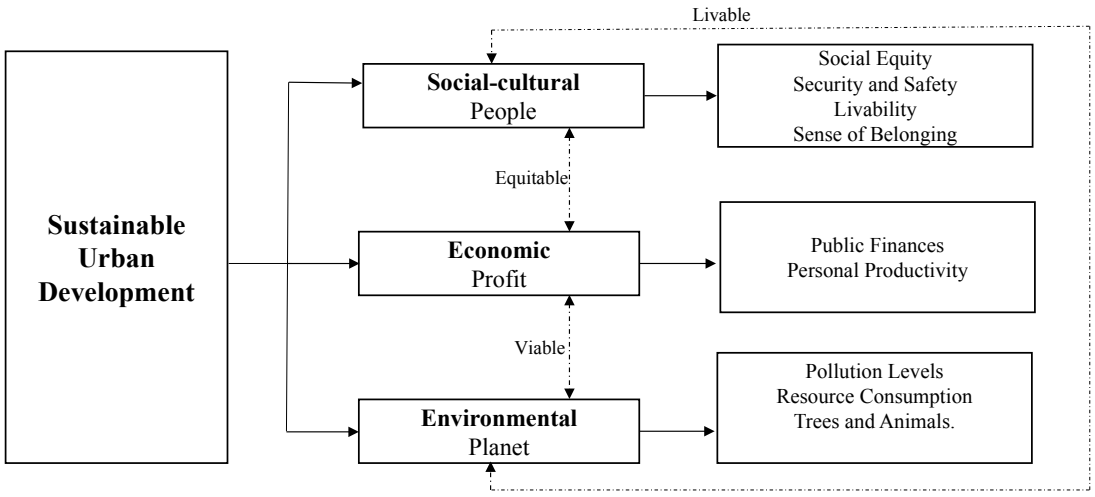


Figure 4. Integration the three dimensions of SUD (author)

The above graphic makes clear that SUD requires a shared focus on what is called 'triple-P': planet, profit and people. In other words, to achieve sustainability, urban development should reduce any negative effects on the environment (planet), encourage economic growth (progress) and improve quality of life across the board (people). This ensures that the development process balances environmental protection and ecological contribution (liveability), economic growth (viability), and social justice (equity) (Al-Shihri, 2013). In addition, recent research affirms that striking such a balance is important for securing sustainable human health and well-being (Minken et al., 2003; UN, 2012).

2.2.2.1 Socio-cultural sustainability

Socio-cultural sustainability refers to the ways in which local inhabitants behave towards the physical environment of the city. The main aspects of socio-cultural sustainability involve social equity, societal security, liveability and a sense of belonging (Figure 5) (J. Lin & Yang, 2006). This dimension more specifically

involves providing access to societal facilities (e.g. health, recreational and educational facilities), different transportation systems, green spaces and cycling and walking paths (Burton, 2000).

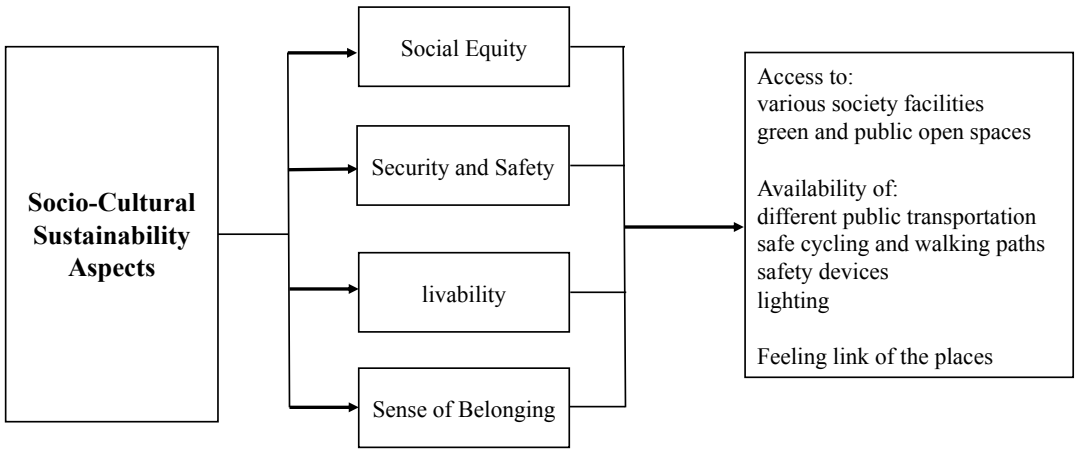


Figure 5. Aspects of socio-cultural sustainability (author)

Social equity is relevant to enabling accessibility to various facilities and services. It also deals with the satisfaction of living in an urban environment, social participation and interaction (Barton & Tsourou, 2000). On the other hand, security references the ability of inhabitants to move through their daily life without fear (Butterworth, 2000)—notably, feelings of fear limit one's desire to interact and participate with others in one's society. Here, it is helpful to note that developing diverse mixed land use, introducing safety devices and providing good lighting are necessary characteristics of a secure urban area. Along these lines, liveability requires good connections between living conditions, facilities and labour—ultimately, these connections can enhance social interaction within the urban environment and, with it, sense of belonging (Bramley & Kirk, 2005). Thereby, these aspects can be

accomplished by protecting human health from human-made pollution, providing the basic requirements for life and ensuring equal access to all facilities (Bleicher & Gross, 2010; Kopfmüller et al., 2001).

Furthermore, several researchers argue, with an eye for the environmental and social dimensions cited above, that urban form impacts SUD. Urban form signifies the intensity, size, shape and land allocation of human settlements. These dimensions are directly associated with the behavior of inhabitants towards the district's physical characteristics. Urban form and the built environment play important roles in the general health and well-being of society and social participation (Littig & Grießler, 2005). The relationship between sustainability and urban form has been illustrated by (Porta, 2001) (Figure 6). Social interactions that originate in the streets of an urban area show how urban form influences inhabitant behavior, contributions to social interactions and utilization of public spaces (Nurul, 2015).

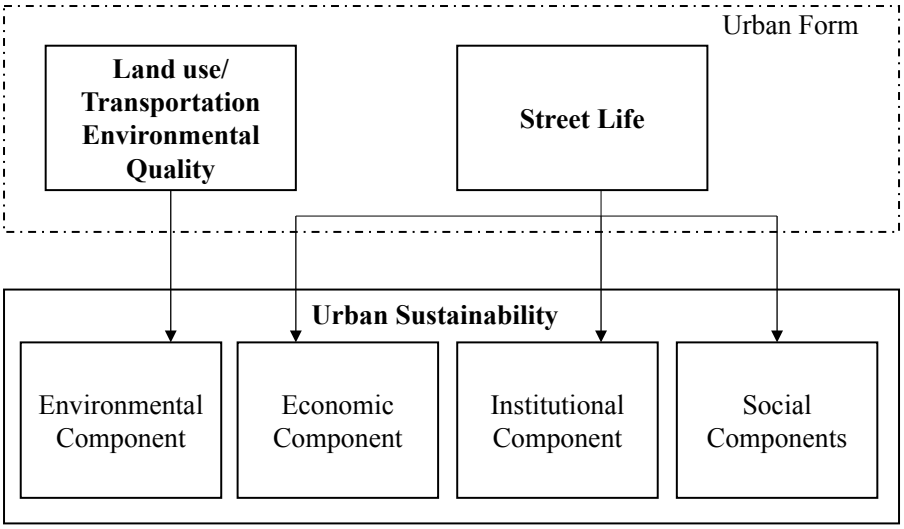


Figure 6. The connection between SUD and urban form (Porta, 2001)

2.2.2.2 Economical sustainability

Economical sustainability aims to improve public finances and personal productivity (Figure 7). The most relevant sustainability goal in this domain is independent living. Every person has the right to choose their job, reduce variance and improve economic performance (Bleicher & Gross, 2010).

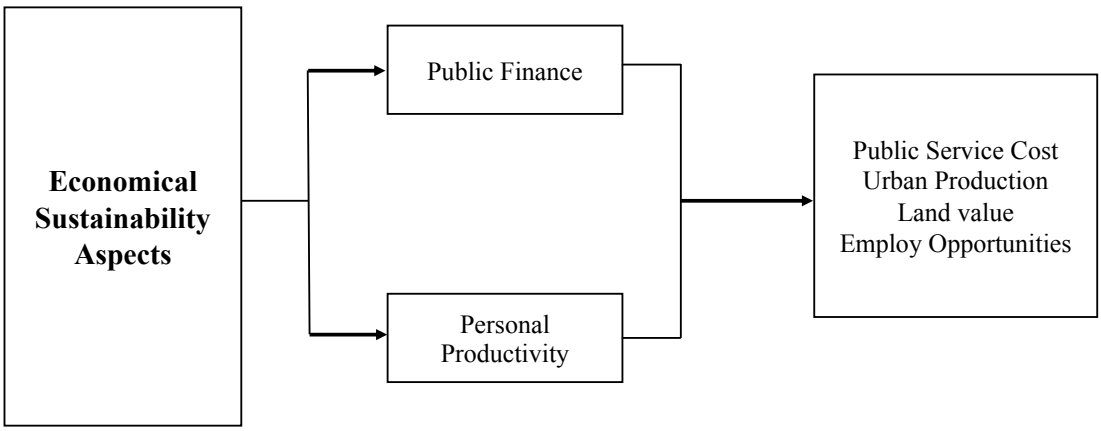


Figure 7. Aspects of economical sustainability (author)

While all sustainability domains are equally important, (Krueger & Buckingham, 2012) present a tripartite diagram that situates economic sustainability as the main concern enclosed by the other domains of sustainable development (Figure 8).

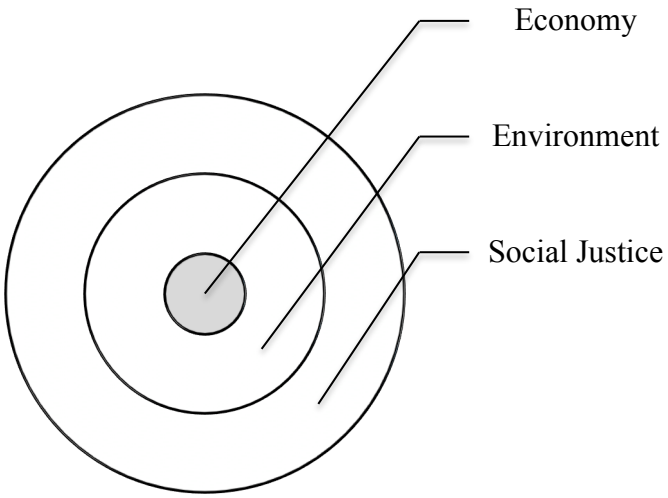


Figure 8. The formulation of urban sustainability (Krueger & Buckingham, 2012)

Of late, many developing countries have been grappling with rapid economic and social development. The fast growth of the economy, reconstitution and globalization increased the impacts of urbanization. As a result, these countries started to promote the three SUD domains to minimize the effects of urbanization , affirming an equal commitment to each (Subeh & Al-Rawashdeh, 2012). In reality, sustainable improvements depend on sustainable economic growth: economic activities greatly impact social conditions and the urban environments with which they are in a mutually formative relationship.

2.2.2.3 Environmental sustainability

Environmental sustainability is a core domain, often given priority to reduce pollution levels, protect animal and plant species and normalize the efficient use of resources (Figure 9). This domain involves the measurement of pollution levels and resource consumption (J. Lin & Yang, 2006). From the perspective of natural resources, environmental impacts depend on how natural resources are arranged for

use, how the energies produced for consumers are transformed and the amounts of pollution and waste generated by consumption. Researchers such as (Chiu, 2012) situate urban sprawl and spatial segregation as responsible for most of the current environmental problems in urban areas.

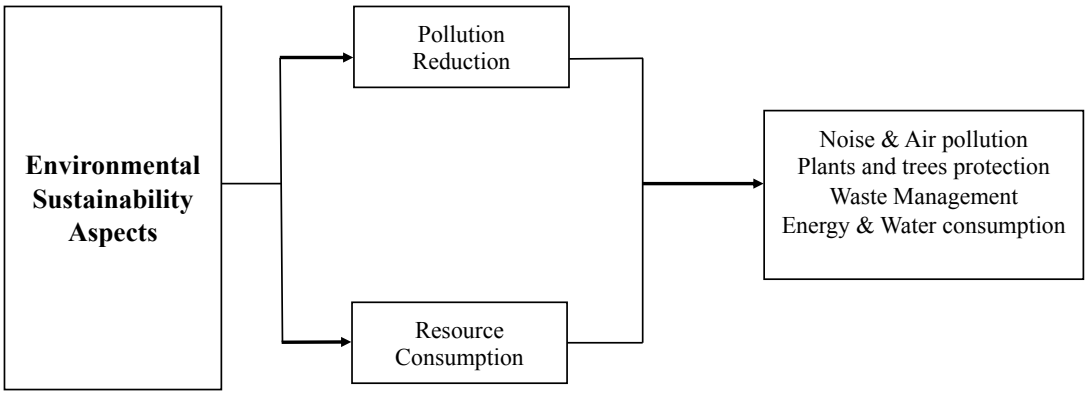


Figure 9. Aspects of environmental sustainability (author)

To be sure, air pollution is an environmental problem. Here 'air pollution' refers to the phenomenon of carbon dioxide (CO2) emissions—produced mainly by human activities—emerging as major pollutants in urban areas that affect air quality. Changes in land use and fossil fuel consumption are mainly responsible for 70% of all CO2 emissions today (Ho & Kean, 2007). Several urban scientists address these concerns, noting the continuous and fast growth of CO2 emissions. Many researchers point out that the emissions of recent decades are due, at least in part, to population and economic growth. According to (Shi, 2001), a 1% increase in inhabitants can yield a 1.28% increase in CO2.

Further, CO2 can also be emitted from construction materials and processes, such as the cement production process and fuel-burning, both of which therefore have

negative environmental effects. Thus, formulating policies for building construction materials and processes may help to decrease air pollution. Moreover, other efforts such as enhancing compact urban growth can help fulfil the environmental goals of SUD (Abdullahi & Pradhan, 2017).

Taking a wider perspective reveals that air quality might be improved by creating policies for low air pollution that work to control urban growth, tightly regulate fuel and automobile consumption and emissions—such policies will foster more healthy and comfortable cities. Hence, developing sustainable urban forms, such as those that emerge from transit-oriented development (TOD) and compact planning, are effective approaches for reducing carbon emissions.

According to (Kopfmüller et al., 2001), environmental sustainability can be accomplished by diminishing the negative effects of human activities and natural disasters, controlling the utilization of renewable resources and moving away from disposing of urban waste in the natural environment.

In brief, SUD efforts concentrate on understanding factors that affect human comfort, health and well-being in urban areas. Public spaces are fundamental in urban cities. The next section defines public spaces and discusses their production and types. Moreover, it also clarifies the relationship between SUD and public spaces.

2.3 Public Spaces

2.3.1 Definition of 'public spaces'

Public spaces have been defined by international organizations, governments and researchers. The Charter of Public Spaces by (Habitat, 2015) offered the most recent definition (Figure 10):

'All places publicly owned or of public use, accessible and enjoyable by all for free and without a profit motive.'

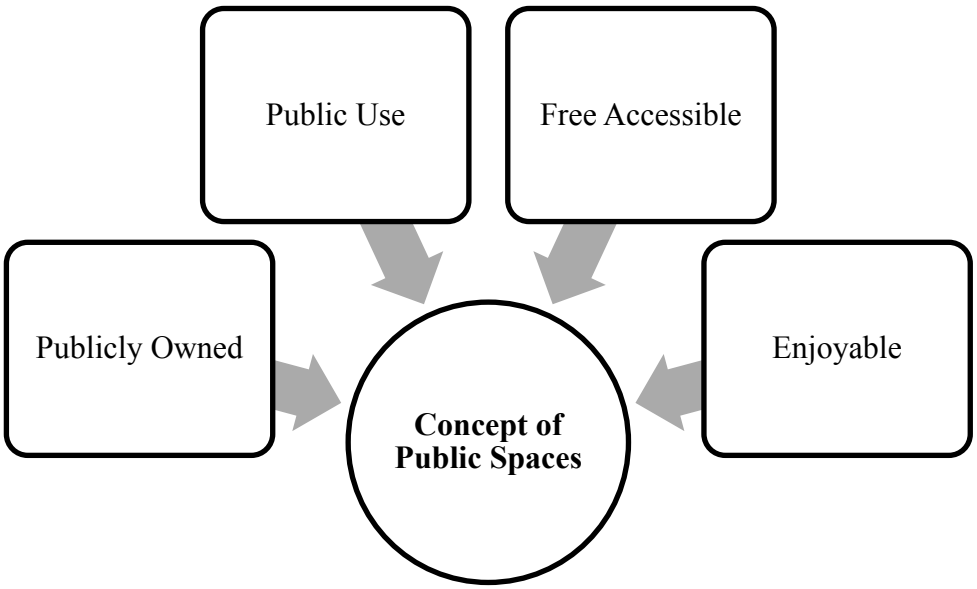


Figure 10. The UN-Habitat definition of public spaces (Habitat, 2015); author

The government of the United Kingdom (UK) also introduced a definition for public spaces (Committee, 2011):

'Public spaces relate to all those parts of the built and natural environment where the public has free access. It encompasses all the streets, squares and other rights of way, whether predominantly in residential, commercial or community/civic uses: the open spaces and parks; and the 'public/private' spaces where public access is unrestricted (at least during daylight hours). It includes the interface with key internal and private spaces to which the public normally has free access.'

On the other hand, Stanley and others define public spaces as spaces that are accessible for everyone, free of charge, and that contain covered as well as uncovered spaces (Stanley, Barbara, Katrina, & Michael, 2012).

2.3.2 The production of public spaces

Henri Lefebvre, a French philosopher, outlines a theory of the production of space (Soja, 2000). In his book, 'Production of Space', Lefebvre suggests connecting physical space, social space and mental space. Crucially, this spatial triad is constituted by spatial practice (perceived), representational spaces (lived) and the representation of space (conceived) (Figure 11).

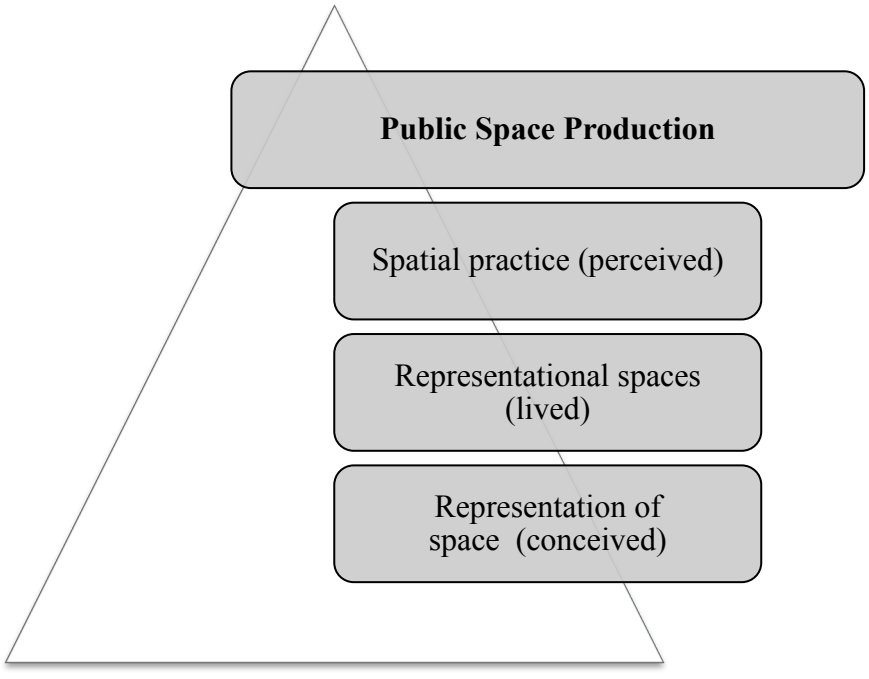


Figure 11. Production of public space (Goonewardena, Kipfer, Milgrom, & Schmid, 2008); author

To start with, ‘spatial practice’ signifies perceptions of physical space; ‘representational space’ is related to the interaction between urban form, the symbolic dimensions of space and the social space of the built environment; and ‘the representation of space’ signifies the space conceived by urban planners with spatial science (Apostol, 2007; Goonewardena et al., 2008).

2.3.3 Type of public spaces

In the 1990s, Lefebvre’s theory was affirmed as a method for understanding the processes of urbanization as well as their conditions and consequences for social situations—from the urban scope of daily life to the flows of capital/people. This theory highlights urban design pattern and various practices by connecting a critique of urbanism, an analysis of urban areas and the new type of public spaces that were then emerging in contemporary towns. In addition, Lefebvre describes such spaces as social spaces, that is, spaces with more or less suitable spots for social interactions—thus, such spaces are, for Lefebvre, social products (Lefebvre, 2009).

Sociologist DePaule, along with architects Castex and Panerai, introduced the productivity of Lefebvre’s approach in ‘Formes Urbaines’, which studies European cities, concentrating on the social and spatial-physical influences evident in the conversion of traditional old homes into open buildings compatible with modern design. These thinkers categorize urban space into three types: public, private and semi-public spaces (Figure 12). Each type is linked to a particular form of public use. Public space includes roads, parks, squares and government buildings; private space includes privately-owned buildings and semi-public space includes business buildings such as shopping malls. Further, the studies impress the need for physical boundaries between these types of spaces (Claessens, 2005 ; Madanipour, 2003).

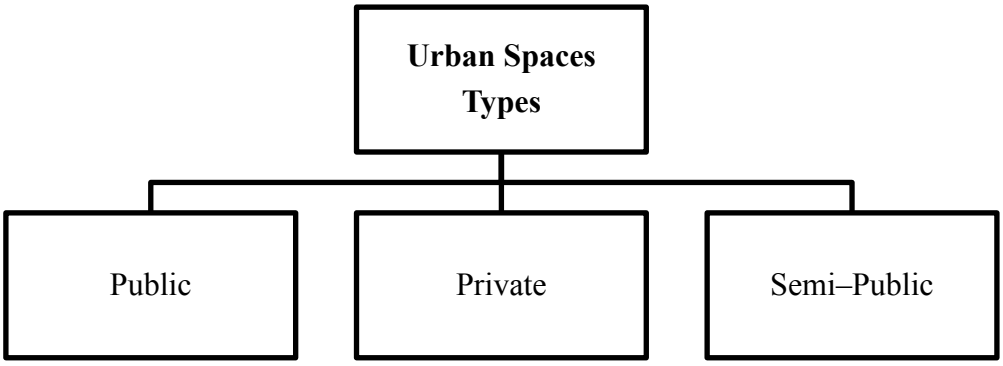


Figure 12. The type of urban spaces (Madanipour, 2003); author

The concept of public spaces articulated by DePaule, Castex and Panerai expands the assumptions of several of humanistic and sociological disciplines and has been taken up by many of these disciplines in their own interest. For example, sociologists, turn to this work to deepen their sense of how the historical structure of old buildings informs their subjective value, while urban designers take it up to get a better sense of place (Mensch, 2007). For our purposes, what is important to note here is that such work establishes three types of public spaces, as Table 2 details:

Table 2. The three types of public spaces (Carmona, Tiesdell, Heath, & Oc, 2010)

Types of public spaces	
External	Open external places accessible to the public (e.g. plaza, squares, roads and parks).
Internal	Internal places accessible to the public (e.g. transportation facilities (airports, train stations) and public institutions (libraries, museums)).
External and internal	Both external and internal places accessible to the public (e.g. university campuses, cinemas and restaurants); also involves privatized external public spaces.

On the other hand, the Global Public Spaces Toolkit by UN-Habitat (2015) specifies a range of categories for the public spaces that form urban areas. However, public space attributions can differ between regions and cultures. In general, public spaces can be organized into four categories: streets, public open spaces, public urban facilities and conventional public spaces (Table 3).

Table 3. The four categories of public spaces (Habitat, 2015)

Categories of public spaces	
Streets	Often intensely utilized by people on a daily basis. Include streets, highways sidewalks and bicycle paths. Streets can be home to open-air markets and other activities. This category thus reflects multi-use of public space and thus accounts for the most versatile publicly-owned area, accessible all day free of charge.
Public open spaces (POS)	Include parks, squares and plazas. These places are normally publicly-owned and can be entered by all on daily basis for recreational use free of charge. However, accessibility is sometimes restricted to daylight hours.
Public urban facilities	Include building that are usually accessible during operating or daylight hours by all users, such as museums, beaches, public sports facilities and privately-managed space.
Conventional public spaces	Include marketplaces (shopping malls and bazaars), civic centers and public libraries.

As this thesis focuses on POS category, it can be understood from the previous explanations that POS signify outdoor areas accessible to the public such as parks, streets, community gardens, plazas and so on (Carr, Francis, Rivlin, & Stone, 1992; Lynch, 1972).

2.3.4 Significance of public spaces

The public spaces are important for creating and fostering urban areas. They represent a holistic view of cities and entry points for all people to multi-functional

public environments. Therefore, integrating public space networks with urban planning can help support economic prosperity by optimizing multi-functional socio-cultural and environmental domains to yield secure, healthy and vibrant community landscapes (Hepcan et al., 2006).

The (Habitat, 2014) summarizes the importance of public spaces as follows (Figure 13):

Public spaces help enhance social interaction and cohesion by serving as a meeting place for social and cultural interaction that thus yields a sense of belonging, or a cultural identity. Open public spaces provide a democratic forum for local societies irrespective of age, gender and ethnic origin.

Public spaces promote security and safety; poorly designed cities with privatized publicly-accessible spaces tend to be more segregated. The result is a polarized city susceptible to the eruption of social tensions and, relatedly, increased violence. For example, women and children often restrict the daily activities they would otherwise conduct in POS due to fears of violence or crime. Thus, designers of POS would do well to consider physical changes and how to best develop vibrant mixed spaces that reduce fear and attract users.

Public spaces foster economic prosperity: public spaces that create a well-connected matrix enhance the productivity and sustainability of the economy by improving the competence of the supply chain, generating income, increasing value and reducing costs. Increasing competition between cities to attract investments and generate funds by creating good streets, squares and other open facilities has created dynamic business. Furthermore, good public spaces may increase the land values of adjacent properties. Thus, well-designed public places are likely to attract entrepreneurs and, in turn, services and customers to the region.

Public spaces also make transportation networks more efficient: if designed to enable different modes of transportation and prioritize paths for cycling and walking, public spaces can reduce traffic congestion and travel time. Along these lines, it is helpful to note that one primary function of public space is to allow users to move in and around places and to have access to work, homes and other facilities by car, public transport, bicycle or by foot. Thus, a well-designed POS creates a secure environment by encouraging cycling and walking, thus reducing dependence on vehicles.

Moreover, public spaces improve the urban environment: today, many cities are formulating strategies for enhancing the creation of compact liveable areas by designing public spaces that integrate green spaces, cycling and walking paths and public transport networks. A lack of green areas and intensity of paved hard surfaces can result in negative consequences such as higher temperatures. Therefore—and from the perspective of environmental sustainability—public spaces play an extremely role in ecological management. Creating parks in urban areas yields environmental benefits such as biodiversity and increased adaptability to climate change (by absorbing air pollutants and cooling the atmosphere).

Last, it is helpful to note that public spaces promote public health and well-being: good public space networks can improve human health and well-being. Generally, providing a comfortable, safe and enjoyable environment encourages users to engage in physical activities (such as walking and play), a practice that reduce mental illness.

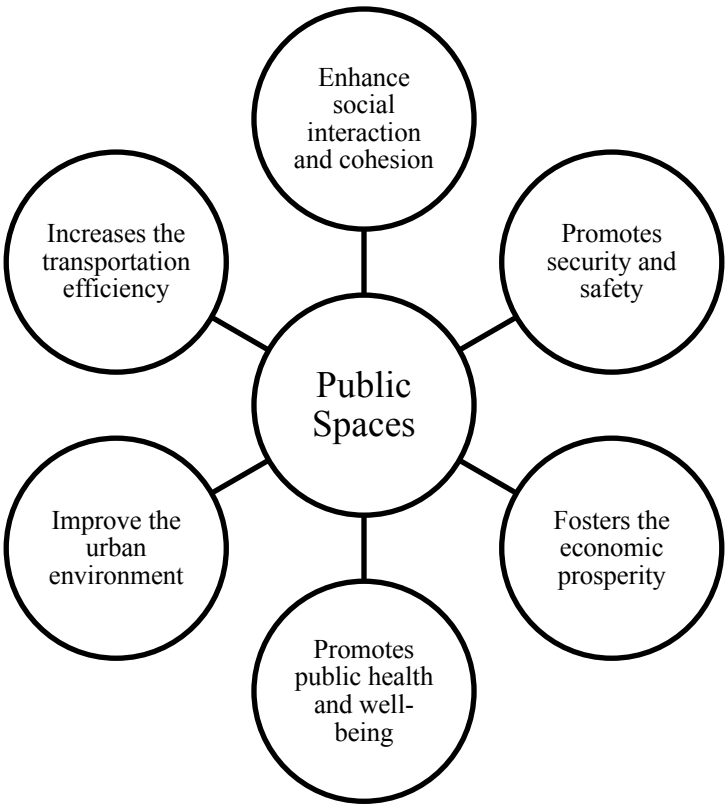


Figure 13. The significance of public spaces

2.3.5 The relation between public spaces and SUD

Public spaces are main components of cities. Cities that continually improve quality of life achieve higher prosperity levels and may ultimately become more advanced in their sustainability dimensions. Social equity and gender equality, for instance, promoted through increasing access to the public good and urban facilities, ameliorate quality of life and restrict or prevent private appropriation. Mostly, cities with clear understandings of the concept of the 'public' appear to feel an obligation to improve quality of life by creating or maintaining green spaces, parks, good streets and other outdoor public facilities (Habitat, 2013).

This efficiency of public spaces helps create a sense of place, civic culture and identity. Additionally, it supports social capital, community revitalization and

economic development. In another respect, situating public spaces constantly as a public good makes the city an attractive area for life and work and often delivers an urban environment that is well-managed, safe and healthy.

The link between public spaces and the dimensions of SUD is significant and must be approached from a legal framework to avoid a lack of public spaces or the creation unmanaged public spaces. Moreover, this link can also lead to sustainable public spaces. Therefore, ensuring that public spaces are planned and developed prior to obtaining a license can lead to positive urban development (Habitat, 2014).

Lastly, ensuring a city-wide supply of public spaces is a way for governments to reassign benefits and decrease inequalities. Hence, there is an advantage in developing city-wide strategies and policies for the creation and protection of high-quality public spaces. Unclear strategies and policies may cause local governments to encounter difficulties in prioritizing resources, defining public space value and reducing the negative effects of the interventions (Cecilia, 2016). Thus, such strategies and policies must situate the planning, design and management of public spaces within various scales geared to nurture comfort and well-being.

POS comfort, health and well-being are discussed in the next section, which also explains the types of activities and related quality. Further to unpacks the aspects of a sustainable POS, the physical and non-physical characteristics of POS and the impact of environmental conditions on user comfort, health and well-being.

2.4 Public Open Spaces (POS) and User Comfort, Health and Well-Being

POS for the purpose of this study can be identified as any land that opens onto outdoor space accessible by all, including parks, plazas, squares, etc. These spaces are normally publicly-owned and can be used by all on a daily basis for various activities

(Nochian, Tahir, Maulan, & Rakhshanderoo, 2015).

The term ‘comfort’ is synonymous with ‘well-being’. However, while comfort is a wider holistic concept, well-being is primarily deployed to signify psychological and spiritual health. Comfort is defined as ‘the immediate state of being strengthened through catering the needs for relief, ease, and transcendence addressed in the four contexts of comprehensive human experience: sociocultural, environmental, physical, and psycho-spiritual’(Kolcaba, 2003). Meanwhile, the term ‘health’, as defined by the World Health Organization (WHO) in 1948, signifies ‘a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’ (WHO, 1948). Comparatively, ‘well-being’ signifies ‘the presence of positive emotions and effects (e.g. happiness, contentment), the absence of negative emotions (e.g. anxiety, depression), satisfaction with life, fulfilment and positive functioning’(Pintoa, Fumincellic, Mazzoc, Caldeirad, & Martins, 2017). Well-being is defined in the Oxford English Dictionary as ‘the state of being comfortable, healthy, or happy’ (Oxford, 2019).

2.4.1 POS activities

2.4.1.1 Types of activities

POS provides a space for recreational, physical, social and cultural activities such as outdoor cafés, festivals, sports activities and exhibitions (Gehl, 2007). When the climate is moderate, POS can be used for more extended hours, enabling activities through the evening and thus providing users with more opportunities to socialize in outdoor places. More specifically, outdoor activities can be categorized into three types: (1) social, (2) necessary and (3) optional, as shown in Figure 14, (Gehl, 1996). Each type places different requirements on the physical environment.

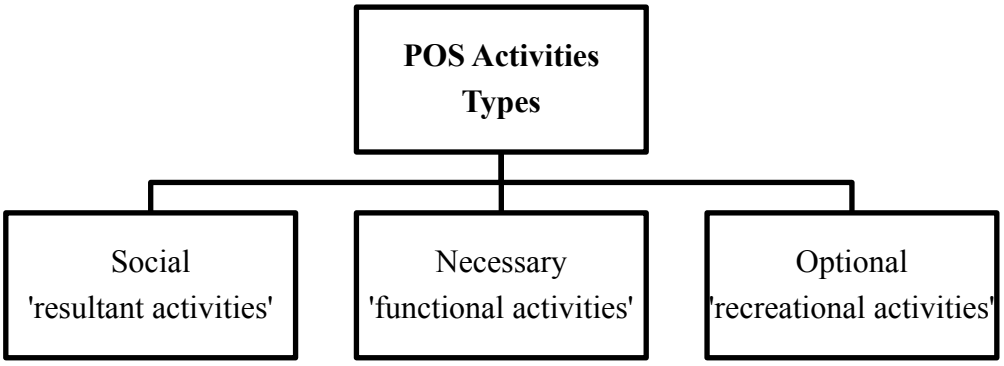


Figure 14. The outdoor activities types in POS (Gehl, 1996); author

First, the social type (resultant activities) is rooted in POS users. This type ordinarily occurs when users meet in an appointed place to sit, talk, play, drink and eat, to name but a few social activities. Second type, the necessary type (functional activities) refers to walking taking place with fewer options in all cases all year, such as, waiting for a bus, going to work or school and shopping. Last, the optional type (recreational activities) is associated with setting and usually occurs if the time and place is suitable for it to happen.

2.4.1.2 Quality and activities of POS

According to (Gehl, 1996), there is an obvious relationship between outdoor activities and POS quality, which mainly emerges with social and optional activities. When open spaces are of poor quality, they limit the activities that may occur there to necessary activities. On the contrary, the same activities will occur if such areas are of good quality. Ultimately, the stronger the physical environment the more likely it is that more human activities, such as recreational activities (optional), will occur, as

the place enables users to walk, exercise, play, sit, etc. Figure 15 clarifies the link between POS quality and the occurrence rate of outdoor activities.

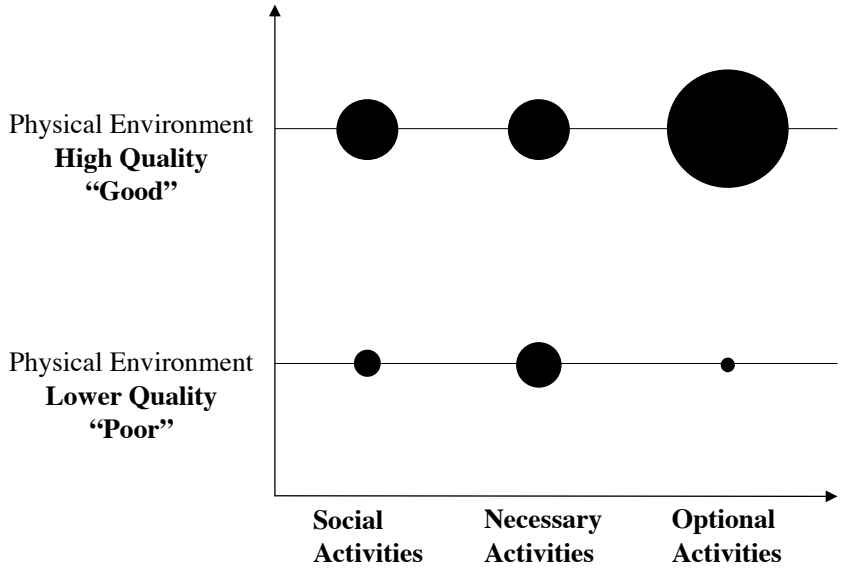


Figure 15. The link between POS quality and the occurrence of outdoor activities (Gehl, 1996); author

Furthermore, an additional element useful for measuring the relationship among quality and outdoor activity besides its effectiveness is the development of the activities, which is evident by the constitution of a group of participants, the duration and time of their use and the scope of their use. It is worth noting that the sustainability of a POS is not determined by the quantity of users but instead by the number of minutes users spent in the external place. Therefore, when a large number of users spend a long time in an outdoor space, a variety of activities may result. Gehl, 1996 uncovers a connection between the level of physical activity in a POS and user health and well-being. This link is more evident in social and optional activities, which only take place when a POS's physical elements facilitate sitting, walking and cycling.

2.4.2 The impact of POS on society health and well-being aspects

As clarified in the first section, the dimensions of SUD are socio-cultural, economic and environmental. These dimensions reflect the connections between POS and health and well-being. Notably, social and environment elements are most closely related to public health and well-being, and thus they are the primary focus of this study (Durie, 1994).

Figure 16 makes clear that POS yield socio-cultural, environmental, physical psychological benefits by:

- enhancing social interaction and cohesion (socio-cultural well-being),
- fostering physical activity (physical well-being) and
- enhancing relaxation and reducing stress (psychological mental well-being).

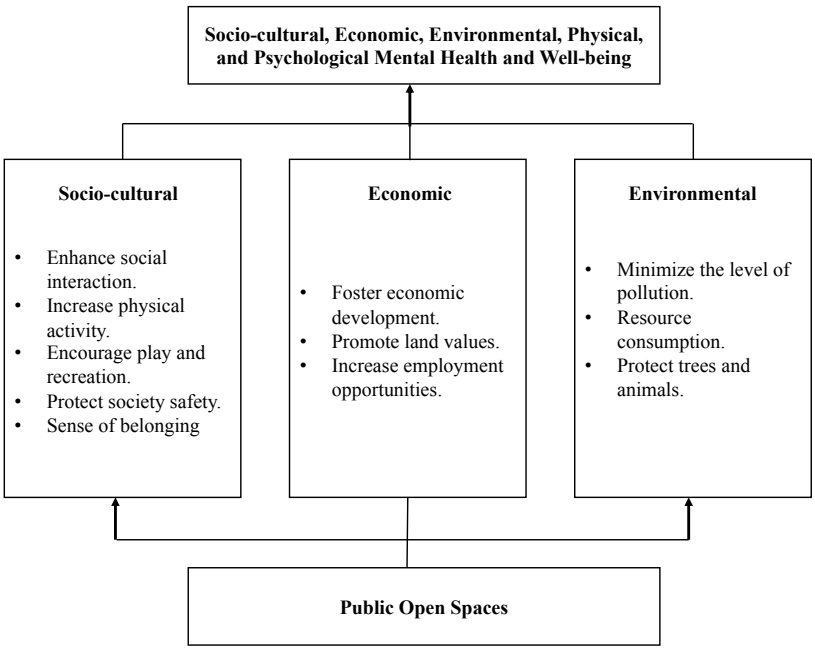


Figure 16. Connection between POS and health and well-being through the dimensions of SUD (Health, 2010); author

2.4.2.1 Socio-cultural well-being

Social well-being involves enhancing social interaction and cohesion in society. POS are ideal settings that contribute to creating liveable urban environments. For example, parks provide a common place shared by people living throughout the surrounding area and thus where these people can gather for several purposes. They provide adults and youth alike with opportunities for exercise, walking and recreation (Scotland, 2008). However, realizing such an ideal depends on the POS realizing high levels of safety and accessibility. In this regard, good health is associated with promoting 'social capital', that is, with ensuring that benefits are not restricted; that such a space is accessible to all (Frances, William, Coley, & Brunson, 1998).

A number of studies confirm that POS can influence social well-being. For example, a UK study explores the ways in which parks enable several cultures to gather together for informal contact and thus facilitate multiculturalism (Dines, Cattell, Gesler, & Curtis, 2006). Meanwhile, a study in Chicago, in the United States (US), uncover that the levels of trees and vegetation in a shared place impact social ties (Frances et al., 1998).

Meanwhile, spiritual or cultural well-being—that is, 'the sense of connection to the environment, the experience of shared meeting, and access to cultural heritage integrity' (Kingi & Durie, 2000)—encompasses mental and social well-being. When people feel safe in their cultural identity, they demonstrate a full sense of well-being. In the urban environment, a sense of place—which Hoskins clarifies as where person connects to place by experience with respect for other connection to the same place (Hoskins, 2008) —is vital to well-being. Thus, POS that honour cultural heritages can yield an inspirational sense of society and landscape (ICIMOS, 1999).

2.4.2.2 Physical well-being

The use of POS can be manipulated to address diseases and health problems. From the perspective of physical well-being, POS can encourage people to engage in physical activity and protect their health. In recent decades, the normalization of a sedentary lifestyle has increased obesity and, with it, the incidence of cardio-vascular disease and diabetes, to name but a few of the various problems associated with this shift. Therefore, the physical settings of POS might be optimally designed to encourage active lifestyles, that is, to encourage people to develop healthy behaviors (Health, 2010).

Walking and cycling are effective ways to ameliorate physical health and well-being. Many health consultants advise brisk walking and cycling to maintain a healthy body and realize benefits such as cardio-respiratory fitness, weight loss and muscle strength. Notably, such physical activity positively impacts mental well-being (Morris, 2003). Here, it is helpful to note that the most commonly reported physical activity, in New Zealand is walking, a trend that emerges as a result of the country's environment. While walking does not require special equipment, the provision of comfortable facilities for walking (e.g. tracks, footpaths), aesthetic elements, accessible places to walk to (e.g. beach, cafes) have been found to encourage walking and thus to increase levels of physical well-being (Owen, Humpel, Leslie, Bauman, & Sallis, 2004).

2.4.2.3 Psychological well-being

The use of POS is important for psychological health because it can help relieve stress and anxiety and, relatedly, enhance restoration and relaxation (Scotland, 2008). The WHO estimates that mental health disorders constitute ten percent of

universal diseases. Studies also estimate that by 2020, this percentage will increase to fifteen percent, with depression emerging as the largest global health problem (Murray & Lopez, 1996). Therefore, various studies focus on the effect of POS—especially parks—on mental health. In 1979, Ulrich indicated that after being exposed to nature scenes, Americans experienced decreased levels of stress and discomfort. In contrast, urban scenes characterized by the absence of natural features increase sadness (Ulrich, 1979). Meanwhile, a Swedish study reveals that people who spend more time in green space feel more comfortable and less stressed, regardless of gender and age (Grahn & Stigsdotter, 2003). Here, it may be helpful to note that more studies have been done on the psychological advantages of green spaces than on their social advantages (Bedimo, Mowen, & Cohen, 2005).

While different green spaces can differently impact mental health, it is clear that they can significantly encourage mental by facilitating exercise, outdoor activities and outdoor aesthetic experiences (Scotland, 2008). Notably, parks can facilitate restorative experiences because they provide a sense of being part of the environment and in harmony with nature. Moreover, environments that are easily accessible can help mitigate stress (Kaplan, 1999), Thus, sufficient green spaces are essential for enhancing psychological wellbeing.

Briefly, it is also important to ensure that POS are made sustainable in ways that promote comfort, health, and well-being. The following section discusses these aspects and their related elements, situating them as critical determining points for defining sustainable, functional and effective POS.

2.4.3 Aspects of a sustainable POS

The aspects of a sustainable POS are not reducible to those that might emerge with a personal sense of the use of a POS but instead must accommodate the basic requirements for an extensive scope of practical standard. There are numerous aspects of an efficient POS which incorporate creative activities and stimulate use such as those that of accessibility, connectivity, sociability, activities and user comfort. This section elaborates on these ideas and explains why they are necessary to distinguish a POS as sustainable and effective for enhancing comfort. Accordingly, these aspects may be used as a checklist for evaluating a POS.

2.4.3.1 Accessibility and connectivity

Accessibility and connectivity are crucial for a POS. Fundamentally, they enable all people to travel easily and access a desired place made visible from a distance. These elements are created by integrating a diversity of land uses (services/ places) with a variety of accessible transportation system including good and safe street networks, bicycle lanes and pedestrian routes (Ageing, 2009). This connection with the surrounding area of a POS can bring the places and services close together, thus increasing physical activity and people's preferences for moving by cycling or walking, enhancing society cohesion and reducing air pollution. Otherwise, encounters in this environment would deteriorate due to traffic congestion, pollution from noise and fumes, the limitation of pedestrian spaces and the increased fears of pedestrians (Spaces, 2018).

Table 4. Aspects of a sustainable POS: accessibility and connectivity

Accessibility and connectivity	Integrated and diverse land with a variety of accessible transportation systems.
	Good signage system.
	Space physically and visually connected with adjacent buildings
	Accessible parking lots that do not interfere with bicycle traffic and pedestrian movements.
	Equal access for all people by fulfilling the requirements of persons with special needs.

2.4.3.2 Sociability

POS are social spaces that are accessible to all users without any restrictions related to gender, age or nationality. They are thus democratic places that allow users to socialize freely. Additionally, they can emphasize local identity by offering a local cultural character of the area and natural landscape (Soltanian, 2015) as well as the legibility of space. Numerous research projects studying the aspects that make a sustainable POS evidence that sociability is the main aspect that POS fulfil. In this regard, (Whyte, 1980) illustrates that a social space makes a sustainable POS. He demonstrates this in his project 'Street Life', for which he installed time-lapse cameras to record and observe day-to-day patterns in a POS. He noticed that the presence of a high percentage of users in groups indicates selectivity, as they wanted to come to the place based on their personal selection, which also indicates the preferred uses of the POS. The perception of (Whyte, 1980) has been supported by (Madden & Schwartz, 2000), who argue that a high percentage of users is an index for the good use of a POS. When users gather and see their friends and feel comfortable speaking with

strangers, they tend to feel a strong attachment to the place and society that enhances their activities.

Table 5. Aspects of a sustainable POS: sociability

Sociability	Accessible for everyone irrespective of gender, age and nationality.
	High proportion of users in groups.
	Emphasizing local identity.
	Legibility of space; the visibility and ease of finding the area.
	People meet and see friends.
	Feeling comfortable speaking with strangers.

2.4.3.3 Designing a POS for specific uses and activities

Designing a sustainable POS requires focusing on the uses and activities it will serve. A POS should accommodate all user needs, that is, should serve as a lively place utilized by everyone that always presents something to do and gives users a good impression that encourages them to visit frequently. Indicators of a healthy place include: that the place is inclusive to groups of people of different ages, that the place enjoys a high proportion of users in groups and that the place experiences a balance between men and women as well as a diversity of activities (Madden & Schwartz, 2000; Whyte, 1980). Diversified activities stimulate POS utilization, with famous places offering more opportunities for things to do than those that are less well-known. Additionally, to realize user needs, a POS must also consider how to facilitate active participation (enjoyment and discovery, physical engagement) and passive

participation (enjoying the POS without the need to engage). Furthermore, (Francis, 2003) situates a sustainable POS as one that is 'lively…and well-used by people'.

At once, it can also be said that, while the level of use of a POS is important, it alone is not reliable evidence for classifying and evaluate the sustainability of a POS. There are other signs that indicate the sustainability of POS such as the people who are using the place and the time spent users spend at the place. Francis Tibbalds describes this in his book 'Making People-friendly Towns', in which he argues that a POS ought to be 'a rich, vibrant, mixed-use environment that does not die at night or at weekends and is visually stimulating and attractive to residents and visitors alike' (Tibbalds, 1992). Meanwhile, (Stiles, 2012) underlines that the level of use does not just depend on the attraction of the area but instead also on the amount of users in outdoor space. On the other hand, (Gehl, 1996) emphasizes that POS sustainability is not evidenced by the amount of individuals or events but instead the minutes spent outdoors. In brief, use increases when the number of users and the duration increase.

Table 6. Aspects of a sustainable POS: designing for specific uses and activities

Uses and activities	Lively, attractive environment for visitors.
	Utilized by everyone (a group of people at different ages, a high proportion of users in groups, a balance between man and women).
	Recreational places that activate the space and enable diverse activities (walking, exercising, sitting, relaxing, eating/drinking, playing, etc.).
	Active participation
	Passive participation
	Time spent at place

2.4.3.4 User comfort and well-being

The process of designing POS should reconcile with user expectations, comfort and emotions to satisfy various groups of users (Carr et al., 1992). Everyone may face outdoor aspects in a specific place and time (Erell, David, & Williamson, 2011) outline that a sense of discomfort and the presence of negative emotions (e.g. depression) may emerge from a person's state of mind or degree of physical activity. Accordingly, comfort can be understood as the states of mind that express thoughts or feelings regarding satisfaction with an area (ASHRAE, 2004). Moreover, comfort levels can be applied to show physical prosperity, mental state and satisfaction.

Consequently, user comfort is a significant aspect that must be met by the outdoor environment to secure health and well-being. It comprises users perceptions of safety, the provision of places to sit, the provision of amenities, aesthetic elements, microclimate conditions, noise and air quality (Spaces, 2018).

'Safety' refers to both actual and perceived safety and is a necessary indicator, as it affects the way people use a place. Safety can be increased and guaranteed with accommodative elements such as artificial lighting oriented towards faces and surfaces (Gomes, 2012; JACOBS, 1995), surveillance equipment (closed-circuit television (CCTV)), visibility (sightlines), security personal able to address any safety concerns (Carmona, 2008), visible pedestrian routes and signage. As such, these elements enable society members to meet and strengthen social ties (which are related to social well-being), which ultimately enhance feeling of physical and psychological well-being by increasing physical activity levels (e.g. walking), decreasing levels of stress and thus generally improving the health and well-being of the society (Foster & Giles-Corti, 2008; Whitzman, 2008).

The provision of places to sit refers to the availability of seating areas in both

the shade and in the sun to enable users to select freely. A good POS will contain a lot of seats and shading devices. The absence of these appealing elements prevents users from having an adequate place to sit (Whyte, 1980). Therefore, the availability of seats, shelters and access to the sun are central elements in POS (Bosselmann, 1983). In another respect, the provision of basic amenities such as public toilets, parking lots and coffee shops can promote comfort and thus encourage users to staying longer in POS (Carr et al., 1992).

The aesthetic elements of a POS notably involve elements related to cleanliness. This indicator should be looked carefully as it influences a POS's impact on quality of life and, not unrelatedly, human health. Hence, ensuring that a POS is beautiful and clean requires well-arranged elements such as trash bins, vegetation, edges and floorscapes. The availability of these elements plays a role in attracting many people and thus in increasing user levels of social, physical and psychological well-being and satisfaction ("Healthy Spaces and Places," 2009). In contrast, poor building maintenance, waste, bad quality streets and furniture and poor lighting can yield bad user experiences. To achieve this, designers must link the landscape and the architectural quality, the attractions that characterize the unique experiences users will have in a particular POS and the city's specific use of the POS (Gehl, 2012).

The microclimate is an essential dimension of physical comfort. More specifically, the microclimate includes humidity, air temperature and wind. A POS design should consider these parameters and strive to create large 'comfort zones', that is, places that provide comfortable conditions in many different kinds of weather. For example, in warm weather, appropriate shelter should be provided that shields against intense sunlight and wind (Marcus & Francis, 1990; Whyte, 1990). Averting high-rise buildings can result in secluded nooks. In contrast, medium buildings and

networks of sinuous streets can offer protection from strong winds (Gomes, 2012). Notably, (Gehl, 1996) interprets a connection between microclimate and level of comfort in a POS, emphasizing that the outdoor condition determines the activities type that take place within the POS.

Noise and air quality are environmental conditions that can influence user comfort and health. Noise refers to the undesirable or excessive sound that can impact user comfort—especially user relaxation and user ability to converse with others—in a POS. While air quality is a condition of the constitution of the air and pollutant concentration. Together, the sounds generated from traffic or outdoor construction activities—that is, noise pollution—and pollutant emissions influence human health. Therefore, POS designs should include a sufficient number of plants and trees to help reduce the impact of noise and air pollution.

Table 7. Aspects of a sustainable POS: user comfort

User comfort	Meeting expectations to satisfy user groups.
	Safety can be improved by installing lighting oriented towards faces and surfaces, CCTV and security personals.
	Provision of places to sit and amenities: seats (in shade/in the sun) arranged and connected with the activities encouraged in the place, directed towards good views and connected with pedestrian routes and public toilets.
	Cleanliness and aesthetic: well-arranged trash bins, vegetation, edges and floorscapes.
	Microclimate: air temperature, humidity and wind.
	Noise and air quality

2.4.4 Physical POS characteristics

POS physical characteristics can be studied and examined through usage and perception. Criteria include but are not limited to elements such as urban furniture, edges and floorscapes (Madanipour, 1996; Makdii, 2011). Meanwhile, a questionnaire survey of physical characteristics can be used to determine users' perceptions of particular elements of a POS and their influence (Mahmoudi, 2015).

The framework of the identified physical elements of a POS include: vegetation, water features, lighting and safety considerations (CCTV), security personal, urban furniture (seats in sun/in shade, shade devices, trash bins), signage, amenities and other facilities (public toilets, prayer room, coffee shop), parking lots, edges and floorscapes (materials, color, soft landscape, hard pavement). This framework can determine the physical problems of a POS and enable investigations into their the quality and liveability (Carmona, 2008; Gehl, 2012; Mahmoudi, 2015).

(Sauter & Huettenmoser, 2008) argue that while the problems of POS cannot be solved, they can be prevented by improving the physical environment. Such improvements may include the provision of furniture, changes to existing floorscapes and bodies of water (hard pavement, soft landscape, change in level and change of material and color), the provision of proper vegetation and other elements that serve and satisfy users (Figure17).

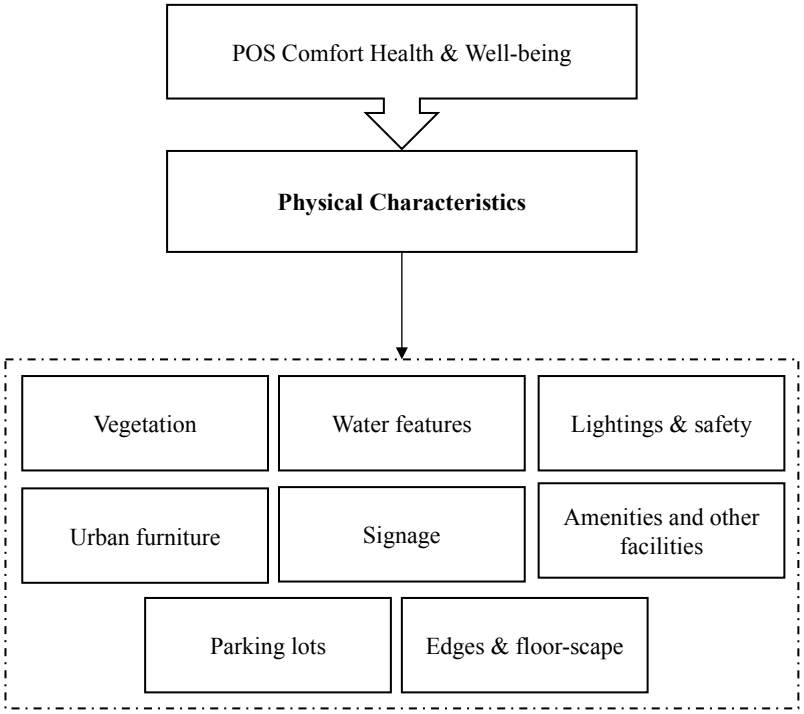


Figure 17. The physical elements of a POS (author)

2.4.5 Non-physical POS characteristics

2.4.5.1 Psychological adaptation

Psychological variables affect user perceptions of comfort in a space. Outdoor environmental conditions determine the influences of psychological adaptation, which is notably subjective because based on outdoor comfort conditions. There are five major variables that constitute the framework for evaluation, namely: environmental stimulation, time of exposure, perceived control, the naturalness of the space and expectations and experience (Nikolopoulou & Steemers, 2003). Hence, the identification of the variables that determine psychological adaptation explains the conceptual implications of the framework.

The insights gleaned from the relationships amongst the five variables of psychological adaptation not only clarify the dependencies of each variable on mutual

and comparative effects, but also specify the impacts of structural design considerations and decisions on the variables (Nikolopoulou & Steemers, 2003). Figure 18 explains that, while some variables acquire a one-way relationship with psychological adaptation, others realize mutual dependencies. While the interdependencies of those relationships vary, urban designers may employ different methods of addressing these nuances to optimize psychological adaptation and comfort to ensure the corresponding efficiency.

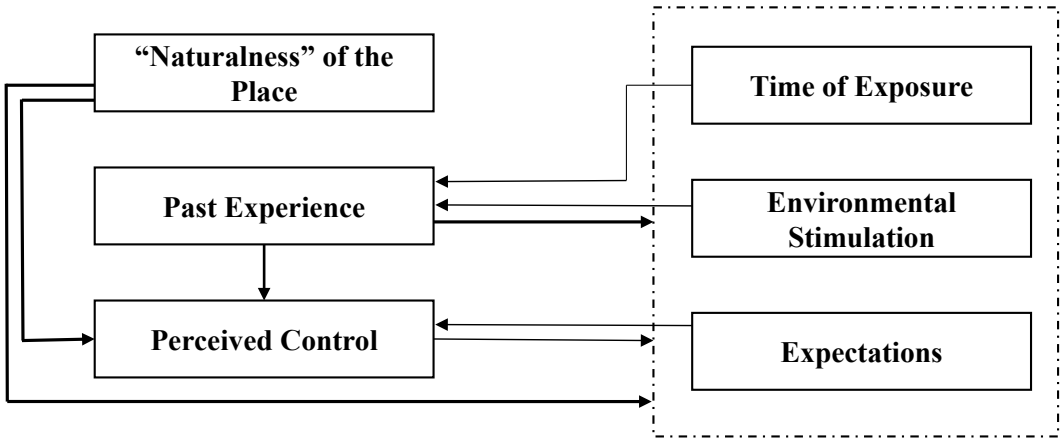


Figure 18. The relationship between the variables that influence the psychological adaptation (Nikolopoulou & Steemers, 2003); author

2.4.5.1.1 Environmental stimulation

Environmental stimulation refers to the ability to experience surrounding internal and external stimuli despite the negative or positive nature of the stimulation, thus explaining why humans are able to interact with an outdoor environment. Humans acquire a high ability to experience various types of outdoor conditions (e.g. climatic) based on interactions with outdoor environmental stimulations, thus eventually allowing more people to spend more time outdoors. In other words,

outdoor inspiration satisfies the tendency to avoid discomfort. Here, it is helpful to note that the ideal conditions of thermal comfort require a high level of outdoor climatic flexibility and at once the rejection of a consistent environmental stimulation (Nikolopoulou, 2011). Hence, flexible environmental stimulations—such as trees, water and birds—generate the comfortable conditions of outdoor experiences.

2.4.5.1.2 Time of exposure

Time of exposure refers to the amount of time that an individual spends outdoors in a specific environment. The time of exposure is dependent on the perception of the individual who practices outdoor activities (Nikolopoulou & Steemers, 2003). For instance, an individual may have a longer time of exposure to outdoor practices when their thermal comfort level provides ideal conditions that make them feel comfortable. In fact, the number of individuals and the amount of time spent outdoors influences time of exposure, thus determining the intensiveness of outdoor activities (Gehl, 1996). In this way, highly intensive activities are likely to probably cause discomfort because they involve a large number of individuals in a certain outdoor space over an extended time. A short time of exposure would ensure that such issues of discomfort would not bother the individual.

2.4.5.1.3 Perceived control

Perceived control is a psychological concept that allows an individual to control their inside behavior, feeling, and place to ensure a condition of comfort. In fact, perceived control enhances the ability to endure a source of discomfort. Further, it generates a psychological status that controls personal anger, thus decreasing unexpected negative emotional reactions. In this way, perceived control and amount

of outdoor time are interdependent. While an individual may spend a short time under the summer sun without any shade, they may spend more time in the same region with shade. Thus, perceived control plays a significant role in outdoor practices because humans cannot control discomfort over long time (Nikolopoulou & Steemers, 2003).

2.4.5.1.4 The naturalness of the space

While naturalness is a relative concept that defines the extent of natural appearance without artificial presence, individuals usually acquire a higher level of tolerance when the environmental stimulation is not artificial (Griffiths, Huber, & Baillie, 1987). For instance, an individual is able to better tolerate the same level of decibels of bird noises than human noises in a park. Unlike the indoor context, the outdoor environment constitutes a significant environmental stimulation that takes place with the naturalness of the space. Thus, individuals who spend a long time outdoors are better able to endure physical changes to the environment such as changes in humidity (Nikolopoulou & Lykoudis, 2006). In this way, tolerance of environmental stimulations depends on the naturalness of the space, thus extending the limit of an individual's psychological adaptation.

2.4.5.1.5 Expectations and experience

Expectations focus on the required prospects instead of the realistic nature of the environment, thus influencing the individual perspective. On the other hand, experiences influence personal expectations. For instance, thermal comfort levels rely on the different temperatures of the four seasons. While individuals experience low temperatures during winters, the expectation of similar winter temperature determines thermal comfort, thus constituting a lower perceived control in the hot climate.

2.4.6 Environmental conditions impacting user comfort

Environmental condition variables impact user perceptions of comfort, health and well-being in a POS. Outdoor environmental condition parameter include microclimatic conditions, noise and air quality.

2.4.6.1 Micro-climate

Microclimatic conditions refer to the sets of atmospheric elements that connect the climate of metropolitan areas and civil activities (BojinSki & VerStraete, 2014). Basically, there are several categories of climate types, such as cold-wet, cold-dry, moderately wet, moderately dry, hot-wet and hot-dry. Doha has a hot-dry coastal climate, typical of the Arab Gulf, with long sunshine duration, extreme solar radiation, clear skies and low precipitation (Dahl, 2010). In this way, the significant difference between daytime and night-time temperatures constitutes the ideal climatic elements for investigating the relationship between microclimatic conditions and outdoor comfort, especially those related to thermal comfort with regard to relative humidity, air temperature and wind velocity (Figure 19). Thus, the design of outdoor spaces needs to carefully consider the relationship between human activities and microclimatic elements to ensure the efficiency of urban designs.

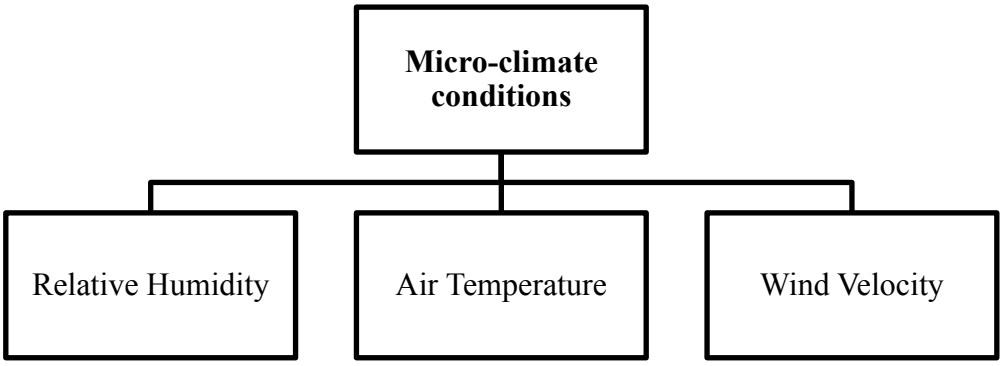


Figure 19. The variables of the microclimate (author)

2.4.6.1.1 Relative humidity (RH)

While 'humidity' signifies the atmospheric water vapor originating from the evaporation process of the water surface and other moist components, 'relative humidity' (RH) describes the water vapor ratio, which is dependent on the water pressure in the air and the specific temperature conditions (Konya, 1980). On one hand, high levels of relative humidity in the air create thermal discomfort through the external evaporation of human bodies, thus expanding the surface of sweat coverage to proceed with the evaporative effects. Thick apparel traps sweat on the surface of the skin, thus increasing external body heat and humidity in ways that make individuals feel uncomfortable. A low level of relative humidity also creates an extreme aridity in the air that causes dry lips and sore throat, which influence the health and comfort of users (Clark & Edholm, 1985).

2.4.6.1.2 Air temperature

Air temperature is the second microclimatic element that determines outdoor thermal comfort. This factor combines with other climatic elements, such as relative humidity and wind velocity. In fact, mere air temperature has a subjective nature that does not ensure objective evaluations. For instance, although the outdoor air temperature may be 24°C, a shaded and windy region may be home to a different level of thermal comfort than the region without wind and shade. In other words, the same air temperature may constitute both outdoor thermal comfort and discomfort. Hence, while air temperature alone is not an indicator of thermal comfort, climatic elements may function dependent variables that must be assessed as combinations. Moreover, humans may adjust outdoor air temperature by using several practical urban design techniques. On one hand, designers may use plants and water to create shade and facilitate evaporation in an outdoor environment, thus reducing the air temperature.

In another respect, the employment of dark materials to improve solar exposure and windbreaks to reduce cold wind flow may increase the outdoor temperature. Practical techniques in urban design illustrate the interdependent relationship between outdoor air temperature and other climatic and construction elements. Still, urban designs do not always have significant impacts on air temperature, and thus their impact on outdoor thermal comfort can be minimal (Yang, Lau, & Qian, 2010). Hence, urban designers may take advantage of the technical management of construction materials in outdoor environments to control air temperature to realize expected effects on the general comfort level.

2.4.6.1.3 Wind velocity

The nature of wind has both advantages and disadvantages for outdoor comfort. While a cooling breeze in the hot summer creates thermal comfort, a cold winter storm is a great discomfort (Dahl, 2010). In this way, mere wind velocity does not have a direct impact on outdoor thermal comfort. Thus, urban designers may employ trees to control wind velocity. Moreover, wind velocity is also dependent on the structure of the constructions. While a strong wind speed in small acreages, such as doors and windows, may cause thermal discomfort, urban designers may enlarge an acreage's surface to reduce wind speed. In addition, designs need to consider the different shapes of wind in various structures, such as the front and the corners, to ensure a moderate level of wind speed.

2.4.6.2 Noise

Noise is an important public environmental problem. It signifies undesirable sounds in outdoor environments that negatively impact human comfort, health and well-being. Exposure to environmental noise activates the nervous system in ways that produce stress-associated hormones (Casiccia, 2019). According to the WHO, noise pollution is the second-highest cause for illnesses after air pollution (WHO, 2018). In Western Europe alone, approximately a million person are lost every year because of traffic noise (WHO, 2011). Further, people who live in dense areas are most affected; this will only worsen if urban populations continue to grow rapidly.

A sound or noise level is measured by decibels (dB). Table 8 below details the categories and values related to harm to hearing. After 70 dB, noise starts to harm hearing (Audiology, 2009).

Table 8. Level of noise in decibel (Audiology, 2009); author

Category	**Decibel**
Faint	20
Soft	30 – 40
Moderate	50 – 60
Loud	70 – 80
Over 85 dB for long period can cause loss	
Very loud	90 – 100 - 110 (Dangerous over 30 minutes)
Uncomfortable	120 (Dangerous over 30 seconds)
Painful and dangerous	130 – 140

Accordingly, to deal with noise levels in urban areas and achieve acoustic comfort, governments, urban designers and planners should take noise pollution into account when developing urban living environments—from indoor to outdoor public spaces. An easily accessible and silent POS that all inhabitants can enjoy during their daily life is thus a valuable part of a busy urban environment. In addition, it is helpful to note that people cannot always depend on social isolation or nature to relieve stress and relax (Casiccia, 2019). Thus, implementing various physical interventions, such as the addition of trees and plants, and using acoustic materials to stop noise pollution, can help reduce noise to an acceptable level and in turn ameliorate air and enable healthy lifestyles.

2.4.6.3 Air quality

Air quality refers to the condition of the air and the degree to which it is free from harmful pollutants that impact human health and generate many environmental problems (Lanzafamea, Monfortea, Patanèa, & Stranoa, 2015). Air quality is

considerably impacted by air pollution, that is, by the presence of toxic substances in the air. Air pollution is due to human activities as well as natural phenomena (e.g. volcanic eruptions) that cause serious damage to the living environment and the welfare of human beings (Omasa, Saji, Youssefian, & (Eds.), 2002). Both definitions make clear that air quality signifies the degree to which the surrounding air is clean, and conducive to plant, human and animal life.

Many countries have paid more attention to air quality because of the growing concern of environmental problems caused by increasing the pollutants in the air and the rising need to reduce emissions to levels that decrease their risks for human health. Therefore, they have developed their own indices. In the 1970s, the US government formed the Environmental Protection Agency (EPA). Ever since, responsibilities for controlling air pollution and air quality have been assigned at the national and regional levels: community legislation, international agreements and protocols. In 1999, EPA developed the Air Quality Index (AQI) to estimate and monitor the overall state of the level of air pollution and human health (EPA, 1999). This index enables daily reports of air quality by measuring the concentrations of pollutants in urban areas and showing their associated health effects. An increase in the air quality index indicates increased air pollution and threats to public health.

The AQI considers five key air pollutants, namely: nitrogen dioxide (NO2), particle pollution, carbon monoxide (CO), sulphur dioxide (SO2) and ground-level ozone. EPA outlines national air quality standards for each of these pollutants to protect human health (EPA, 1999). Particle pollution and ground-level ozone constitute the major pollutants that pose a risk to the environment and human health. Thus, it is essential to monitor and reduce pollution levels.

For the purpose of understanding air quality's impact on human health, the

AQI is divided into six categories that range from 0 to 500. A high AQI indicates greater air pollution levels and increases the possibility of health concerns. Table 9 illustrates the AQI category, colors, health concern and meanings.

Table 9. AQI health concerns, values, colors, and meanings (EPA, 1999)

Levels of Health Concern	AQI Values	Colors and Meaning
Good	0 to 50	Air quality is good and there is little or no potential that it will impact public health.
Moderate	51 to 100	Air quality is acceptable; however, a moderate health concern may exist in that some pollutants will affect a very small number of people (e.g. people sensitive to ozone may suffer respiratory symptoms).
Unhealthy for Sensitive Groups	101 to150	The general public is not likely to be affected; however, sensitive people may experience health effects. For example, older adults, children and people with lung disease are at greater risk as a result of exposure to ozone, while older adults, children and people with heart and lung disease are at greater risk as a result of particular air particles.
Unhealthy	151 to 200	Every person may start to experience some harmful health effects, while members of sensitive groups may experience more serious effects.
Very Unhealthy	201 to 300	Every person may experience serious health effects (health alert).
Hazardous	301 to 500	Air quality in this range is life-threatening for all inhabitants—this is an emergency condition that demands health warnings.

In urban design and planning, and with the aim of protecting human health and comfort, there are a number of design elements that can be implemented to lessen negative impacts and reduce air pollutions such as the integration of green infrastructure, trees and other kind of plant species, the development of cycling and walking routes and investment in public transport networks. These applications can improve air quality in POS, and eventually satisfy human comfort and well-being.

2.5 Conclusion

This chapter establishes that POS contribute to creating liveable and sustainable urban environments. The sustainable aspects of POS and related characteristics are important in the design of outdoor spaces that meet the needs of human comfort, health and well-being in outdoor spaces. This thesis takes the elements, parameters and variables this literature review outlines into consideration to examine the existing conditions of POS and create a design methodology; the following chapter details this work.

Chapter 3: Research Design, Methods, and Tools

3.1 Introduction

Chapter 3 explains the research method, design, and tools. Combined methods were adopted in order to realize the main aim. More specifically, this study used both quantitative and qualitative methods to collect data to measure and assess the current conditions of Doha's POS and their impact on user comfort, health and well-being. These approaches are rooted in the above-mentioned four aspects of a sustainable POS, that is, the evaluation criteria delivered from the literature review in order to recommend guidelines for comfortable and healthy urban environments.

Thus, this chapter presents a detailed explanation of these criteria, the POS selected for study and the instruments used to collect different data and information. Generally, the study is based on questionnaire surveys that sought to understand how the aspects of a POS, including its physical elements, may be enhanced according to user perceptions as well as the environmental conditions, including microclimatic conditions, noise and air quality and their impact of user comfort, health and well-being. The study is also based on field observations and mapping, which yield experience with and knowledge of real-time situations. Furthermore, semi-structured interviews were held with design experts and professionals in POS. This chapter ends with a statement on data confidentiality.

3.2 Research Method

Little work has been done on the relationship between user adaptation (qualitative) and microclimatic condition parameters (quantitative) in POS (Eliasson, 2000). Responding to this gap in the scholarly archive, this study stretches beyond an evaluation of the physical elements of a POS to assess user adaption parameters and

environmental conditions, including POS microclimatic condition parameters, noise and air quality to determine how different designs variously fulfil and fail sustainability requirements.

The study employs both a quantitative method—a combined methods approach, valuable for its investigative nature—and a qualitative method—a standardized questionnaire—to realize its purpose. Therefore, this study aims to explore ways of developing design guidelines for sustainable POS. Thus far, this thesis has established that such a design must optimize accessibility, sociability, user activities and user comfort—a task that requires a strong understanding of the impacts that physical and non-physical characteristics and environmental conditions (i.e. microclimatic conditions, noise and air quality) have on user comfort, health and well-being. The environmental conditions analyzed for this purpose were collected from on-site measurements and questionnaires survey, as demonstrated below (Figure 20).

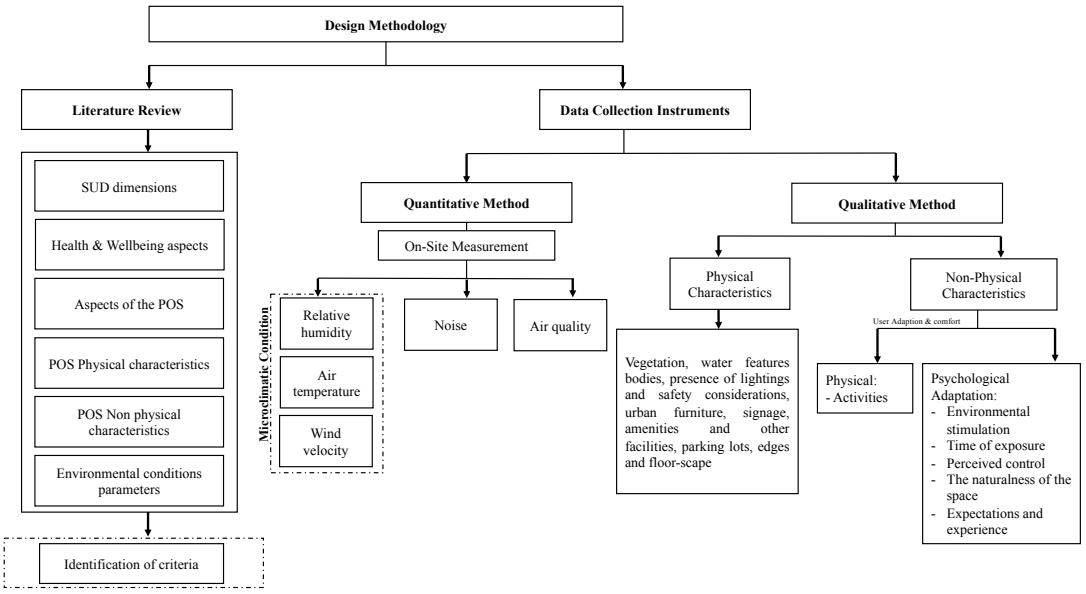


Figure 20. The design methodology applied in this thesis

3.2.1 Criteria developed for evaluating the aspects of POS

The explained literature review has given a precise understanding of the 'Public Open Spaces,' the sustainable POS and its relation with promoting users comfort. The following table shows the POS evaluation criteria that have been used for this study. The criteria inclusive four different aspects and criterions to evaluate the current conditions of the identified POS, as shown in Table 10.

Table 10. Criterions for evaluating the aspects of the POS

Aspects	Criterions
Accessibility and connectivity	Integrated and diverse land with a variety of accessible transportation systems.
	Good signage system.
	Space physically and visually connected with adjacent buildings.
	Accessible parking lots that do not interfere with bicycle traffic and pedestrian movements.
	Equal access for all people by fulfilling the requirements of persons with special needs.
Sociability	Accessible for everyone irrespective of gender, age and nationality.
	High proportion of users in groups.
	Emphasizing local identity.
	Legibility of space; the visibility and ease of finding the area.
	People meet and see friends.
	Feeling comfortable speaking with strangers.
Uses and activities	Lively, attractive environment for visitors.
	Utilized by everyone (a group of people at different ages, a high proportion of users in groups, a balance between

	man and women).
	Recreational places that activate the space and enable diverse activities (walking, exercising, sitting, relaxing, eating/drinking, meeting, playing, etc.).
	Active participation
	Passive participation
	Time spent at place.
User comfort and well-being	Meeting expectations to satisfy user groups.
	Safety can be improved by installing lighting oriented towards faces and surfaces, CCTV and security personal.
	Provision of places to sit and amenities: seats (in shade/in the sun) arranged and connected with the activities encouraged in the place, directed towards good views and connected with pedestrian routes and public toilets.
	Cleanliness and aesthetic: well-arranged trash bins, vegetation, edges and floorscapes.
	Microclimate: air temperature, humidity and wind.
	Noise and air quality

3.2.2 Selection of study area and POS

This study analyses three types of POS, namely, a park, a square and a plaza, visited by both international and local people: MIA Park, Oxygen Park and Msheireb Area (Barahat Msheireb and Sahat Wadi Msheireb) (Figure 21).

Figure 21. The study areas and POS locations (GoogleMaps, 2019); author

The current condition of the physical elements of these POS were assessed to determine guidelines for improvements. Throughout the study, the researcher focused more on observing the number of users within the space, patterns of use and types of activities. Further, the different types of POS selected enabled the researcher to create a framework for how each particular style of POS listed here may be broadly improved to optimize user comfort and health. Moreover, since the study thus sought to explore external the environmental elements that users most preferred, POS were chosen based the justifications indicated in Table 11.

Table 11. Summary of the selected POS in Doha and justifications

Sr.	POS	Justifications
1	MIA Park	- Strategically located in Doha. - A famous park in Doha. - Frequently visited and used by various age groups, different nationalities and genders. - Contains diverse activities. - Involves urban design aspects and features that can be improved. - Ideal for improvements in line with the aspects of a sustainable POS.
2	Oxygen park	- One of the most attractive parks in Doha. - Newly developed, with urban design aspects and physical elements. - Popular with users. - Frequently visited and used by various age groups, different nationalities and genders. - There is room for additional improvements.
3	Msheireb Area (Barahat Msheireb and Sahat Wadi Msheireb)	- Newly developed area that contains many outdoor spaces. - Many users from varied age groups, different nationalities and genders have begun to visit the space. - Urban design aspects and physical elements were considered.

3.2.3 Site analysis

Several site visits were carried out for the study areas with the aim of developing an overall understanding of the areas in terms of their current conditions as well as to gather information necessary for analysis. The site visits helped to direct

the domain of the research and define the kinds of information and data needed to fulfil the purpose of the site analysis. In addition, the study's research questions and literature review quickened its information and data collection by focusing evaluations of the real-time situation of the current condition of the POS with relation to the user's comfort, health and well-being in real practice. Furthermore, it also enabled the exploration of possible ways to introduce improvements.

3.3 Research Data Collection Instruments

3.3.1 Quantitative method

Quantitative analysis produces objective measurements which are thereafter usually used in research that reflects the quantitative usage. In this study, objective measurements are fundamentally utilized to measure POS microclimatic conditions, noise and air quality. Such measurements were taken by identifying the parameters and standardizing the tools utilized for the aim of the study. The outcomes of these measurements from the site were simply explicated by performing pertinent analytical comparisons about the comfort, health and well-being of the user. Comprehending the overall environmental conditions was important in determining how to realize external psychological adaption and user comfort. For this purpose, a quantitative experimental methodology was used, which takes measurements on-site. The experimental aspect contains measurements for the climate parameters, noise and air quality of chosen areas in which the outdoor comfort of the user was evaluated. The following microclimate parameters were measured: (1) relative humidity, (2) air temperature and (3) wind velocity. Microclimate monitoring was conducted for the measurement of air temperature and humidity by checking the weather patterns in order to ensure the validity of the study result. In addition, noise and air quality were

measured based on the noise level standard and AQI, respectively. All measurements related to the environmental parameters were done by using small data devices; air quality alone was measured using a mobile application. Within the study areas selected, these small devices and mobile application were used to determine the parameters in the months of April and May 2019 (moderate season), on weekdays and weekends, from 8 am to 9 pm, for six selected days, as illustrated in below Table 12.

Table 12. The days selected for taking the all measurements

Days No.	Date/ Day	Day Pattern	Study Areas Location
1	23/04/2019	Weekday	MIA Park
2	24/04/2019	Weekday	Oxygen park
3	28/04/2019	Weekday	Barahat & Sahat Wadi Msheireb
4	26/04/2019	Weekend	MIA Park
5	27/04/2019	Weekend	Oxygen park
6	04/05/2019	Weekend	Barahat & Sahat Wadi Msheireb

Concerning measurement devices, three devices were used to measure and read the data (Figure 22). The first one is called the Multifunction Environment Meter (CEM DT-8820). This device performs four functions that measure light, temperature, humidity and sound. It was utilized for recording the readings of the climate parameters selected (temperature and humidity) and noise. The second device is called the Kestrel 4500 (Pocket Weather Tracker), which was utilized for measuring wind velocity. The third device used was the iPhone, fitted with an application called the Airvisual App (IQAir), which tracked air pollution and measured the air quality.

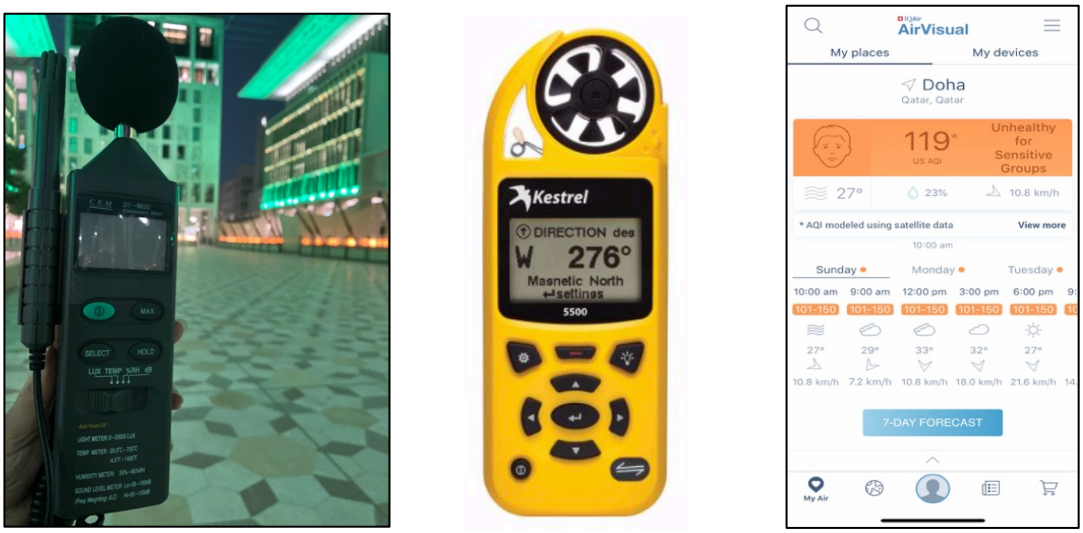


Figure 22. The multifunction meter-Kestrel 4500-AirVisual App

The CEM DT-8820 is a data tool capable of providing a precise reading; thus, this device has the ability to give highly accurate results. The CEM DT-8820 is sturdy and designed to be used in outdoor applications. On the other hand, the Kestrel 4500 (Pocket Weather Tracker) was used in a low-wind tunnel at roughly 300 fpm (1.5m/s). Meanwhile, the Airvisual App (IQAir) was mainly used to learn real-time air quality.

These measurement devices were used in the most active areas of the sites, that is, those areas that were most vibrant and lively spot, where the diversity of activities happened and with high levels of pedestrian movement. Measurements were logged every hour.

After taking the measurements needed for the microclimate parameters, a calculator was used to obtain an overall sense of the weather measurements (TranssolarKlimaEngineering, 2019). This calculator was available for free online and not require any approval for academic purposes. For noise and air quality, outcome values were calculated based on the standard explained in the literature review.

3.3.2 Qualitative method

Qualitative analysis produces subjective measurements of a real-time situation. These measurements are conducted in order to obtain a better understanding of the design aspects of POS, comfort levels, perceptions, emotions and human behavior. These measurements also are helpful in fostering the study analysis results and determining their applicability because they make interpretations more realistic. In addition, they enable users to express complex points of view. Hence, the main techniques used to make these measurements were a questionnaire survey, field observations, observational mapping and interviews.

The researcher prepared the questionnaire based on formal observations. The questionnaire was primarily designed to collect subjective responses and understand the user attitudes in each selected area. As noted above, field observations were conducted in each study area to investigate user behavior such as use and activity patterns. Therefore, the observation checklist was formulated and filled by the researcher in the study areas. Further, observational mapping was used to observe and monitor user patterns and behaviors. Additionally, it also helpful to note that semi-structured interviews were organized with local authorities. Moreover, secondary data, such as online references, journal articles and books, were collected from the literature review.

The following part elaborate on the use of the questionnaire, field observations, observational mapping and interviews as study techniques.

3.3.2.1 Questionnaire survey and its design

To measure and evaluate the aspects of the POS extracted from the literature review, user perception and experience were a primary source of data. Therefore, a

questionnaire was a significant methodological technique for the POS chosen in this regard. The questionnaire form is mainly designed for people visiting and using the POS selected. The questionnaire was prepared in both Arabic and English and contained five sections. Questions were created for each of the three selected POS that exemplify different contexts and trends (Appendix-A). Two question styles were used: 1) close-ended questions, adopted to improve understanding and clarify the measurements carried out for environmental conditions, mainly climate parameters and their relation to levels of user outdoor comfort, and 2) open-ended questions, prepared to gather information to clarify the real-time situation. This questionnaire assisted the researcher in realizing high-quality outcomes and determining guidelines and recommendations.

Questionnaire sections were structured as follows:

- Section 1 collects introductory information related to the participants to evaluate their socio-conditions. It includes general information about gender, age, nationality, education level and area of residence to get a sense of who is using the POS;
- Section 2 is most important section of the survey—it seeks to obtain more data on the current conditions of the aspects of POS from different user perspectives to identify physical design elements (e.g. vegetation, water features, lighting and safety considerations (CCTV, security personal), urban furniture (seats in sun/in shade, shade devices, trash bins), signage, amenities and other facilities (public toilets, prayer room, coffee shop), parking lots, edges and floorscapes (materials, color, soft landscape, hard pavement));
- Section 3 aims to gather more information about the behavior of the

participants and place perceptions through understanding a number of issues such as behavior, reason for selecting the place, purpose of visit, experience of the place, time spent, expectations and attitude across the space at time of interview;

- Section 4 seeks to gather information about the present level of user psychological comfort and well-being and satisfaction and as well as about user preferences of climatic condition such as humidity, air temperature and wind velocity;
- Section 5 was designed to collect information about the user's level of general satisfaction and their perception of the physical characteristics and the related elements of the current POS.

The questionnaires were prepared using an online survey and dispersed personally by the researcher to users of MIA Park, Oxygen Park and Msheireb POS (Barahat and Sahat Wadi Msheireb) to ensure that the main purpose of the thesis was clearly explained and to clarify the questions. The researcher collected responses by using an iPad tablet. The questionnaire employs a non-probability sampling technique, targeting only those people who visited and used these POS for various purposes. The participants were of different ages, genders and nationalities. Participant age groups ranged from 18–25, 26–35, 36–45, 46–55, and 55 and above. During both weekdays and weekends, the surveys were conducted in each study area. The questionnaire survey was conducted in the morning, afternoon and evening. In total, 250 questionnaires were used and collected. Uncompleted questionnaires were excluded, and thus a total of 245 questionnaires were used from all of the study areas: 95 for MIA Park, 75 for Oxygen Park and 75 for Msheireb.

3.3.2.2 Field observation

Observations were carried out by the researcher to investigate the type of users, user behavior and the types of activities within the study spaces. An observation checklist was formulated for this purpose (Appendix-B). The researcher filled the checklist in the study area for the duration between 10am and 6pm. The checklist was developed to aid in establishing a background concerning respondent type, activities, weather condition, noise and air quality. The checklist contains closed-ended questions in order to classify the data easily for more valuable clarifications.

The observation checklist includes general information composed of the site of the study area, date, day, time and weather conditions (dusty, sunny, rainy, cloudy). The questions of the observation checklist were designed to facilitate comprehension of the types of users (male, female, child, security, cleaners), and activities to get a stronger sense of the participants. In each surveyed location, the researcher worked to observe the number of people, whether users were alone or in groups, activity types (e.g. walking/ exercising, cycling, sitting, eating /drinking, waiting, children playing) and whether participants were sitting in sun or shade. Such activities, along with related user behaviors, must be noticed to better comprehend the type of preparation adopted by them to achieve comfort and well-being in the POS. In addition, in each observation time, photos were taken to support the observations.

3.3.2.3 Observational mapping

The last part of the observation checklist form includes a site plan for one area, chosen for all the three POS (Figure 23, 24, 25). These areas were selected because they were central, active spaces in which many people gathered and various activities took place. The site plan was applied to the checklist form to follow and map out user

behaviour, movement and location and, moreover, to explore user patterns within the chosen boundary such as where users were coming from, where they walk and sit and what they do in this space. On-site observational mapping targeted two periods for the both weekends and weekdays: morning (10am) and evening (6pm).

Figure 23. Site plan and selected POS in MIA Park (GoogleMaps, 2019)

Figure 24. Site plan and selected POS in Oxygen Park (GoogleMaps, 2019)

Figure 25. Site plan and selected POS in Msheireb (GoogleMaps, 2019)

The mapping codes for on-site observation were developed from the work of (Whyte, 1980), and the below legend was utilized (Figure 26).

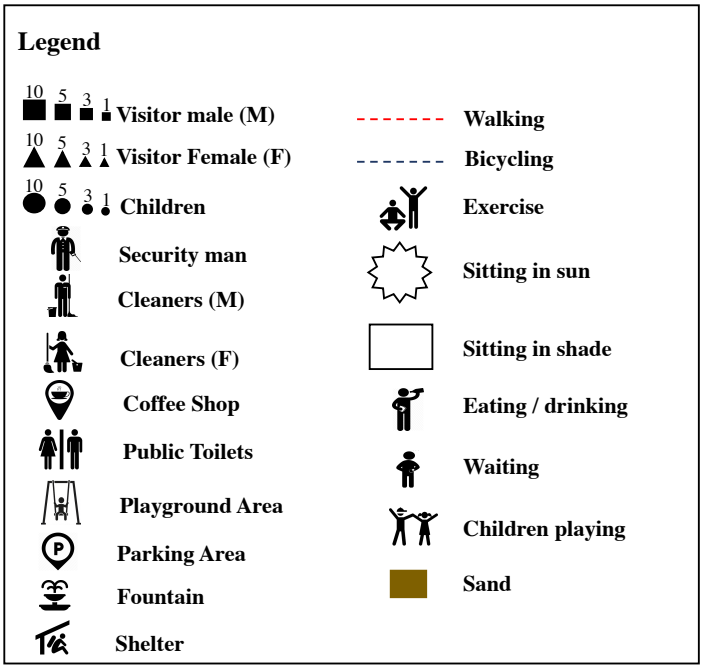


Figure 26. Legend codes used in the observational mapping

3.3.2.4 Interviews

Interviews were one of the data collection instruments. As noted above, the interviews were semi-structured and conducted with specialists in the field of the urban design of POS from two local authorities aiming to improve Doha POS, namely: Qatar Museums (MIA Park) and Msheireb properties. The purpose of the interviews was to investigate the knowledge of the local authorities on the topic studied in the thesis and discuss the existing design of the POS as well as the future enhancement process. Interviews were arranged with participants via email invitations attached with a brief study abstract and a list of the questions to be asked in the interview.

Participants had been asked whether they desired to be interviewed. All interviews were conducted at interviewee work offices. Interviewee information (i.e. organization, names, position, date/place) is shown below in Table 13. A list of the interview questions discussed with the participants is available in Appendix- C.

Table 13. The interviewee information

Sr.	Interviewee	Positions	Authorities	Date/Place
1	Yasser Shazly	MIA Park Engineer	Qatar Museums	24/06/2019-Yasser Office
2	Fatima Fawzy	Manager Design	Msheireb properties	30/05/2019-Fatima Office

3.4 Data Confidentiality

The researcher investigated and analyzed all data collected from questionnaires, field observations, observational mapping and interviews. For the interviews and questionnaires, approval was obtained from the Institutional Review Board (IRB-QU) at Qatar University by proving that the questionnaire and interviews met all requirements and free from any research ethics (Appendix-D). Also, prior to becoming involved with the study, participants had to fill out a consent form, which was sent in advance or, in the case of the questionnaire, at the same moment. Participants also were informed about the aim of the study and data confidentiality. Moreover, concerning the interviewees' information, an official letter was issued from the university directed towards the respective authorities to ask permission to facilitate interviews and data collection (refer to Appendix- E).

3.5 Conclusion

This chapter outlined the information and data resources used in this study. An integrated methods approach, including both quantitative and qualitative methods, was adopted and used to validate the research study. The quantitative method involved on-site measurement of the identified parameters by using different devices (i.e. Environment Meter CEM DT-8820, Kestrel 4500 and Airvisual App). Meanwhile, qualitative methods involved a questionnaire survey, field observation, observational mapping and interviews, which sought to obtain a better understanding of user comfort level, perceptions of place, behaviour and activity patterns. The outcomes of both methods assisted in comprehending the relationship between environmental parameters and the data collected in the POS from participants to define the outdoor level of comfort and well-being. Additionally, this chapter's detailing of the study's design methodology contributes to the thesis's purpose of creating a strategy of data collection to facilitate the gathering of raw data as interpreted in the next chapter.

Chapter 4: Data Collection and Analysis

4.1 Introduction

This study identifies a comprehensive approach for improving the conditions of POS to promote comfort, health and well-being. More specifically, Chapter 4 presents the case study of Doha POS—the heartbeat of this research— namely MIA Park, Oxygen Park and POS in the Msheireb area (Barahat and Sahat Wadi Msheireb). In line with the aim of this study, data about the selected POS were collected and analyzed in relation to the aspects of a sustainable POS, that is, accessibility, sociability, user activities and user comfort. The findings highlight the specific parameters that support the POS in question by making visible their physical and non-physical characteristics, including the psychological adaptation and the impact of environmental conditions on user comfort. These parameters are as follows (Figure 27):

- Physical characteristics include vegetation, water features, lighting and safety considerations (CCTV, security personal), urban furniture (seats in sun/in shade, shade devices, trash bins), signage, amenities and other facilities (public toilets, prayer room, coffee shop), parking lots, edges and floorscapes (materials, color, soft landscape, hard pavement), to name but a few (Carmona, 2008; Gehl, 2012; Mahmoudi, 2015).

- Non-physical characteristics: psychological adaptation parameters include environmental stimulation, time of exposure, perceived control, the naturalness of the space, and expectations and experience (Nikolopoulou & Steemers, 2003).

- Environmental conditions include the microclimatic variables,—relative humidity, air temperature, and wind velocity (BojinSki & VerStraete, 2014)—noise and air quality.

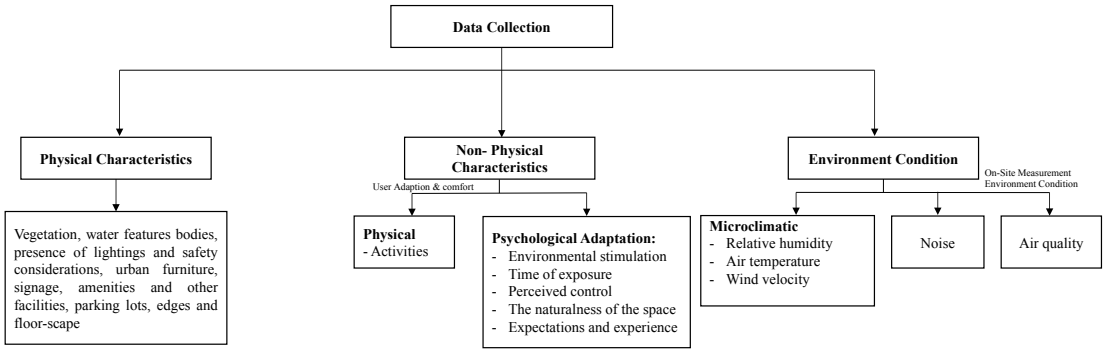


Figure 27. The parameters used for data collection

The researcher used different instruments to collect the data and information, such as questionnaires, on-site observations and mapping, on-site measurements of specific environmental conditions and interviews. All required data were collected from each location on weekdays and weekends between April and May 2019. The data collected (both numerical and observational) was presented through photos and statistical data analyses (e.g. tables and graphs) to determine the trends and patterns necessary for evaluating the comfort of a POS. In addition, for comparative purposes, data is shown separately for the weekdays and the weekends.

The researcher worked to validate the observations related to user gender, activity, behavior, etc. by observing and monitoring crowd behavior to comprehend crowd quality and quantity. This allowed the researcher to find correlations between adaptive activities and comfort levels (especially those related to the thermal and acoustic comfort of the user).

4.2 Museum of Islamic Art Park (MIA Park)

Museum of Islamic Art Park (MIA Park) located in Zone 18, within the boundaries of the Museum of Islamic Art, which was built on artificial island. For this reason, MIA Park earns its name from the Museum of Islamic Art. The park was designed by Pei Partnership Architects-New York and was implemented by Qatar Museums. The park opened in 2011 with an area of approximately 280,000 m2. MIA Park aims to provide a space where the visitors of all ages can socialize, interact, relax, play, exercise and discover outdoor artwork. Key locations around MIA Park include Doha corniche, dhow harbour, the flour mills building, the Ministry of Municipality and Environment and the Council of Ministers General Secretariat (Figure 28).

Figure 28. The location map of MIA Park (author)

A study of aerial maps reveals that the form of MIA Park is unique: the park is a curved crescent extending from the Museum of Islamic Art and surrounded by Doha Bay. The curved crescent is one kilometer long and extends to Doha Corniche. Within the boundary of MIA Park, different types of medium-rise buildings exist such as those of the Museum of Islamic Art, the Education Centre, the Al Riwaq Exhibition, and the Kiosk (Figure 29).

Figure 29. The type of buildings within the MIA Park boundary

MIA Park is a space accessible to all people. The park is easy to find because it is located on Doha's corniche. Three main streets connect the park: Corniche, Jabr Bin Mohd and Meena. The park is gated from two sides: one gate is for visitors and the other for staff (Figure 30).

Figure 30. Three main street and the gates of MIA Park (author)

MIA Park has two children's playground areas that differ in the number of games they offer and in flooring materials. While both use rubber flooring, one has sand—neither of the playgrounds are shaded (Figure 31).

Figure 31. Children's playground area in MIA Park

MIA Park has a distinctive walkway that encourages physical activities such as walking and running (Figure 32). However, there are no bicycle lanes. The absence of this element impacts users who are walking and performing other activities.

Figure 32. The walkway in MIA Park

MIA Park users are of varied nationalities, ages, genders and cultures. The majority of users who visit the park are there to walk, exercise and have a snack on weekday mornings and to walk, play, relax and use the park recreationally on weekend days, during which most users are families with children. Users also visit the park to gather and meet friends, an activity that was often observed extending from the afternoon until the evening during weekends.

4.2.1 POS physical characteristics assessment

MIA Park demonstrates some of the physical characteristics and elements highlighted in the literature review. These characteristics and elements were also been discussed during the interviews with the MIA Park section specialist at Qatar

Museums and, moreover, were also visually observed. The existing physical elements and related observations of MIA Park are as follows:

- MIA Park has a lot of plants, attractive shrubs and palm trees scattered all around it. There are also different types of seasonal flowers.
- MIA Park oversees the sea, giving it significant character. It also has water features such as fountains that create a beautifully landscaped environment (Figure 33).

Figure 33. The water feature in MIA Park

- The lighting system is not very effective in some spots, especially in the walkway and in the main space near Al Riwaq (Figure 34). This was observed in the evenings. Further, there are security personnel everywhere, yielding a sense of control and safety for users. Families, especially women and children are likely to feel more comfortable in these conditions.

Figure 34. Lightings in walkway and main space near Al Riwaq

- All around the park, there are few concrete seats under the trees (Figure 35) in non-visible areas; moreover, no other seats are provided for visitors. The only existing seat type is for the children playing and these seats do not have shading devices.

Figure 35. The concrete seats and the colored chairs

Further, there is a sufficient number of trash and recycle bins, as shown in Figure 36. However, the recycle bins were in bad condition.

Figure 36. Trash and recycle bins in MIA Park

- MIA Park has a limited number of signs and an unreadable signage system (Figure 37). This impacts wayfinding in the park for all users.

Figure 37. The signage in MIA Park

- In terms of facilities, the whole park has only two public toilet cabins (Figure 38). Each cabin is divided into three toilets for males and three for females. However, the toilets are located far from the main area and are

not visible from the main area (Figure 38). It has been observed that mothers and children avoid these toilets. In addition, another public toilet exists for males and females near the kiosk.

Figure 38. Public toilets and their location in MIA Park

A small porta cabin is used for praying by women and men. It has been observed that users tend to wait until find space or pray on the grass (Figure 39).

Figure 39. Porta cabin mosque and some users waiting and other praying outdoor

Adding to this, one kiosk is available in the park that serves all users. However; the kiosk is far from the main area and not affordable for all users. It has also been observed that there are temporary food trucks sometimes set up in space (Figure 40).

Figure 40. The kiosk and temporary food truct in MIA Park

- The parking lots serve both staff and visitors. They have a capacity of 580 cars. This capacity is not sufficient; it has been observed that parking is always full during the weekends.
- The surface of the ground in MIA Park is mostly flat, with three artificial hills near the kiosk. Light-colored hard concrete flooring characterizes the walkway and routes, as shown in the above photos.

Further, based on the results of the survey, participants were questioned about which of the above physical design elements they would most like to see improved, as shown in Figure 41. Significantly, the highest percentages were for public toilets (87.37%), signage (78.95%), seats (75.79%) and parking lots (67.37%). Thus, the

majority of users articulated that the current public toilets and parking lots must be reconfigured to accommodate all visitors and, moreover, that signage and seating must be improved. Meanwhile, participants were largely satisfied with other current physical elements, such as vegetation, lighting, water features and security and gave these elements different percentages based on their perception of the presence for studied elements. Vegetation, security and coffee shop had the lowest percentages and were classified by participants as positive elements of MIA Park.

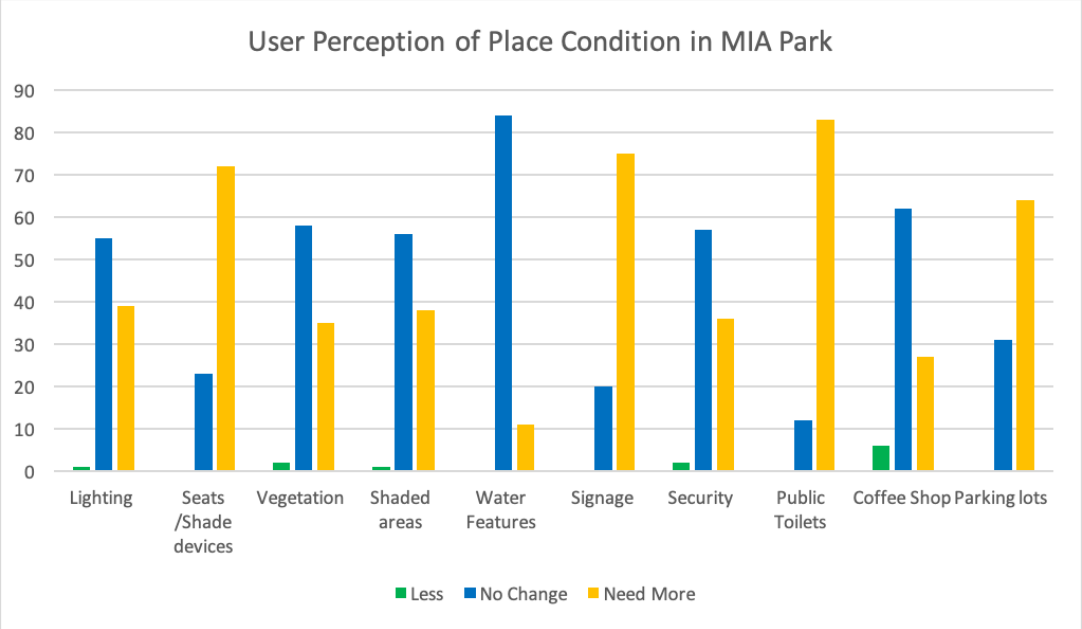


Figure 41. The user perception of MIA Park condition

4.2.2 POS non-physical characteristics assessment

4.2.2.1 User physical well-being: activities in MIA Park

Necessary (i.e. functional) activities were observed in the park: users were seen looking for a taxi and waiting for a bus or car—these users were mostly museum

and park staff. In addition, since the park enables access to the museum, one of the most essential reasons users visited was to enter the museum. However, the most common types of activity in MIA park were the social and optional types. As noted above, social (i.e. resultant) activities rely on the existence of users within POS. People came to gather to meet in appointed spaces to sit on the grass, talk, play and have a snack with drinks. Meanwhile, optional (i.e. recreational) activities are associated with sitting and walking. Optional activities usually occur if the time and place is suitable. Users were observed walking within the POS or sitting on the grass to enjoy the time and relax. Certain spots in this space seemed very attractive for adults and families such as the curved crescent and the kiosk, which both oversee the sea, enabling users to enjoy a view of Doha's skyline. (Figure 42).

Figure 42. The view of Doha's skyline from the kiosk

In this POS, cycling was impacted by the absence of the cycle lanes. Gathering, sitting and walking were the most common activities. Figure 43. illustrates the percentage of diversified activities in MIA park based on the two-day survey.

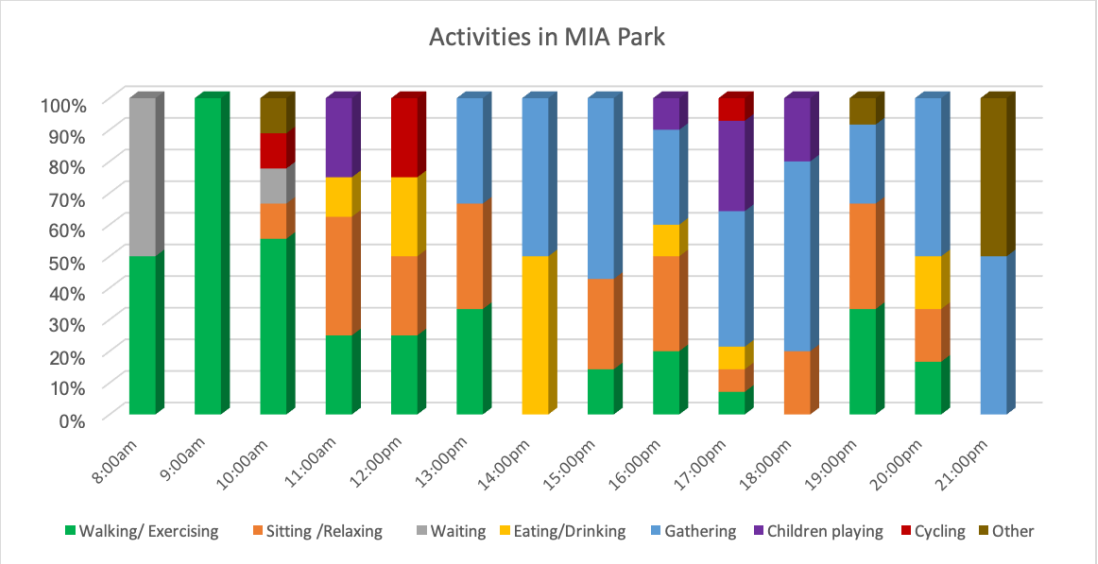


Figure 43. Activities in MIA Park (weekday & weekends)

A POS in itself is a necessary aim, enabling guests to engage in recreational, physical, social and cultural activities involving outdoor cafés, festivals, sports activities, and exhibitions (Gehl, 2012). Over the two days, it was observed that MIA Park was home to several such activities.

4.2.2.1.1 Type of user

Regarding the type of user, over the two days of site observations including both weekdays and weekends, it was observed that both men and women visit MIA Park. Women, who constituted approximately 60% of visitors, utilized the space more than men, who constituted the remaining 40% (Figure 44). However, it was noticed that men between (11am) and (12pm), men constituted 76% of the park population.

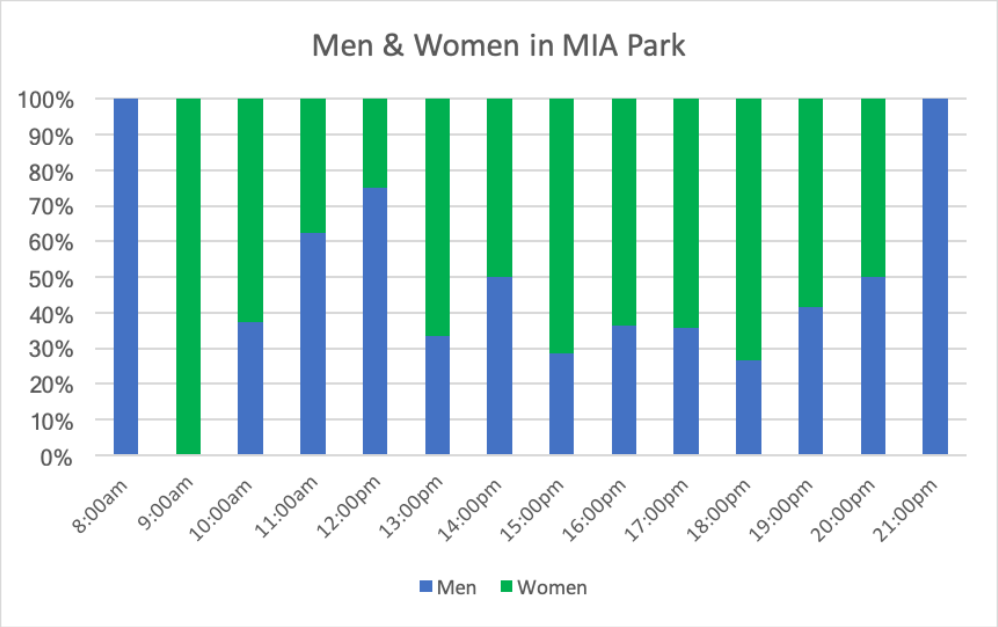


Figure 44. Average proportion for the women and men in MIA Park

4.2.2.1.2 level of use

MIA Park is considered crowded by users in the evening weekdays and throughout the weekend. It was least crowded during weekday mornings (Figure 45).

Figure 45. Users over afternoon on weekdays and weekend in MIA Park

Users of MIA Park usually spend a long time in the park when they come with friends and family over the weekends or in the evenings. Length of stay differs from one user to another. Time duration depends on several variables related to the environmental conditions such as climate variables (i.e. temperature). Ordinarily, when the weather is moderate, the park is used for longer hours; thus, activities can continue over the evening, allowing users to meet and gather. The POS of MIA Park is therefore a vibrant and rich environment occupied by many people and activities.

4.2.2.2 User psychological well-being: psychological adaptation

4.2.2.2.1 Day 1: questionnaire survey assessment (23-04-2019)—weekday

According to the survey, 100% of users in the early morning at (8am) managed to enjoy and bear the environmental conditions related to the weather, specifically humidity and air temperature in spite of high wind (Figure 46). From (9am to 11am), users were also able to endure the humidity level and temperature: 67% and 60% respectively desired no changes, while 80% of users preferred low wind velocity. Over the afternoon period between (12pm) and (3pm), it was found that the surveyed user was unable to tolerate the overall weather condition as they preferred low humidity, air temperature and wind velocity. Thus, it is evident that users were better able enjoy the park's environmental conditions in the morning because of the moderate weather situations. During the evening from (6pm to 9pm) 100% of users were able to tolerate the various physical changes (e.g. moderate temperature and humidity) because the large amount of green space and the park's proximity to the sea worked to soften the atmosphere. However, 50% noted that they preferred low wind velocity.

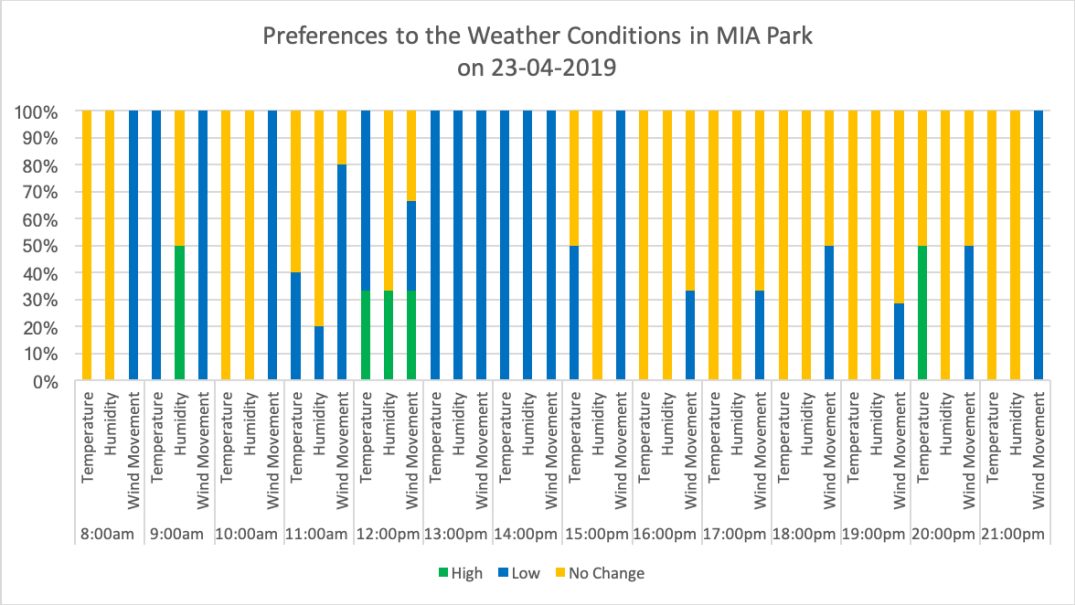


Figure 46. User's preferences to the weather conditions in MIA Park on 23-04-2019

Further, according to the survey, 60.87% of participants reported feeling comfortable after being exposed to the green spaces and 39.13% reported feeling relaxed. In general, 69.57% of users agreed that the park assists them in reducing stress and anxiety.

Regarding duration of stay, 24.44% of users were able to stay in the park for more than one hour. However, time of stay was impacted on user tolerance of the environmental conditions and the diversity of activities in the place.

On this day, a total of 46 visitors were surveyed. Remarkably, between (8am) and (2pm), few users entered the park. However, from (3pm to 7pm), a fast growth occurred in user numbers, with 22% of those surveyed stated that they had stayed there for more than 3 hours. Ultimately, MIA Park users were expected to stay for an hour in the morning period, less than fifteen minutes to half-hour in the afternoon, and more than two hours in the evening (Figure 47).

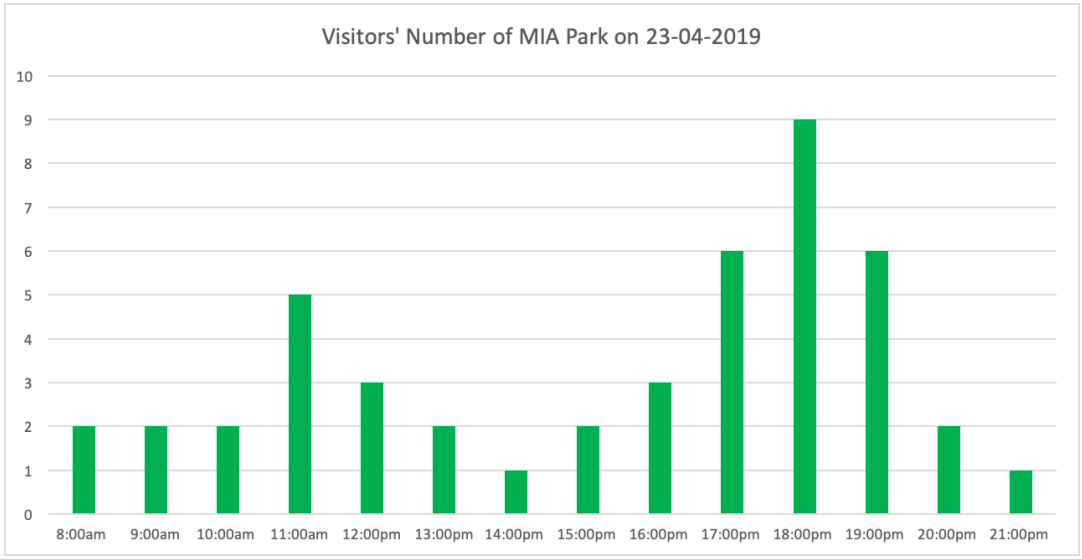


Figure 47. Visitors' number surveyed in the MIA Park on 23-04-2019

Furthermore, environmental stimulation was found to encourage people to visit MIA Park. These features are represented in the sea, the sound of the waves, and palm trees. Although at (3pm), 50% felt little uncomfortable because of high wind movement, the majority of users felt comfortable during the day's moderate weather conditions and thus these features had a primarily positive influence on user psychological comfort and well-being (Figure 48).

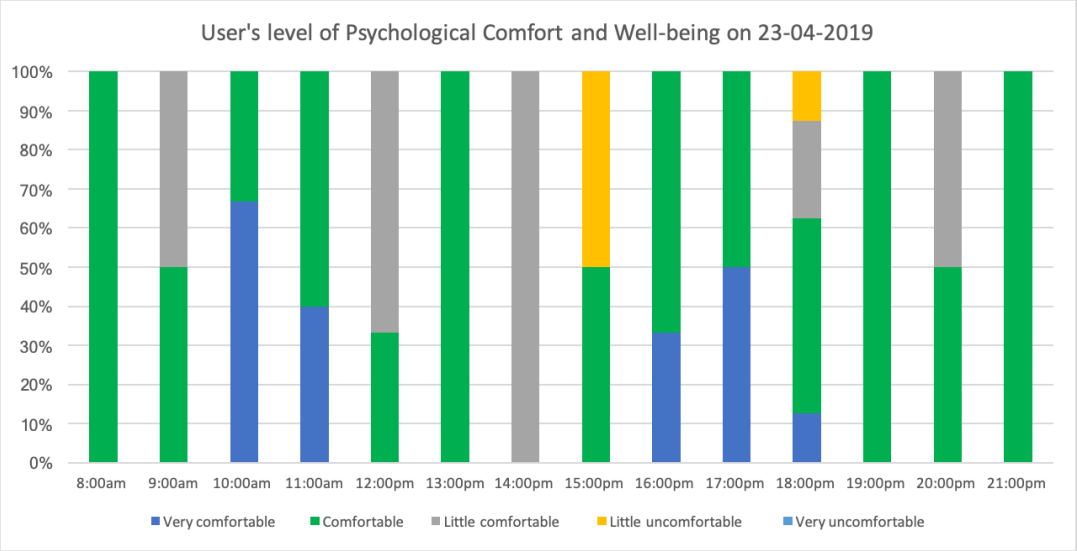


Figure 48. Level of psychological comfort and well-being in MIA Park on 23-04-2019

Between (8am and 12pm), it was noticed that the POS was occupied by families and individuals (Figure 49), especially employees of the museum who were passing through the park to access other museum facilities. The other users during this period were the park's maintenance workers. It was also noticed that the rest of the MIA park was utilized by few public users and that some spots were totally empty. In contrast, between (3pm and 9pm) the park was fundamentally used by groups (friends) and families, as shown in Figure 50.

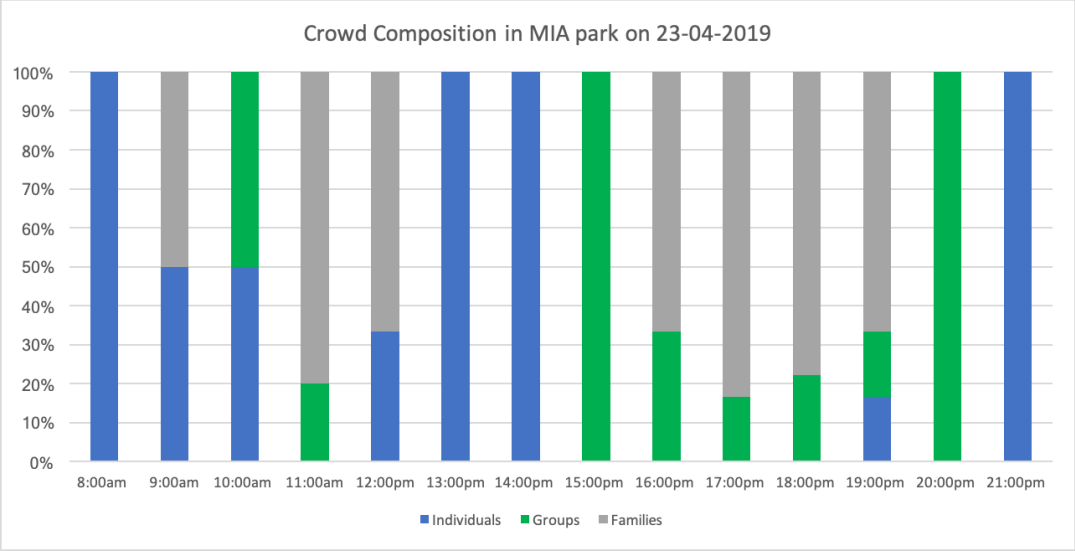


Figure 49. Crowd composition in MIA Park on 23-04-2019

Figure 50. Occupation the MIA Park by individuals and groups

According to the survey, users enjoyed and tended to tolerate the environmental conditions, spending long hours in the park. However, few did not plan to stay long in MIA Park because of they found its afternoon weather too hot.

4.2.2.2.2 Day 2: questionnaire survey assessment (26-04-2019)—weekend

As shown in Figure 51. during the morning from (10am to 11am), 67% of those surveyed reported that the humidity level and air temperature were high and preferred lower levels, with 60% desiring low wind velocity. In the afternoon, from (1pm to 3pm), the survey revealed that 100% of users desired low temperature and humidity in the surveyed moment but that they were satisfied with wind velocity. Meanwhile, between (4pm and 5pm), users were satisfied with the overall weather conditions: 57% and 100% of a user, respectively, did not desire any changes in temperature or humidity, and 71% of users preferred no change in wind velocity as well. During the evening, from (6pm to 9pm), users were able to endure the overall weather condition. Hence, the survey illustrated that during the evening period surveyed users were content with weather conditions since they were able to adapt physically.

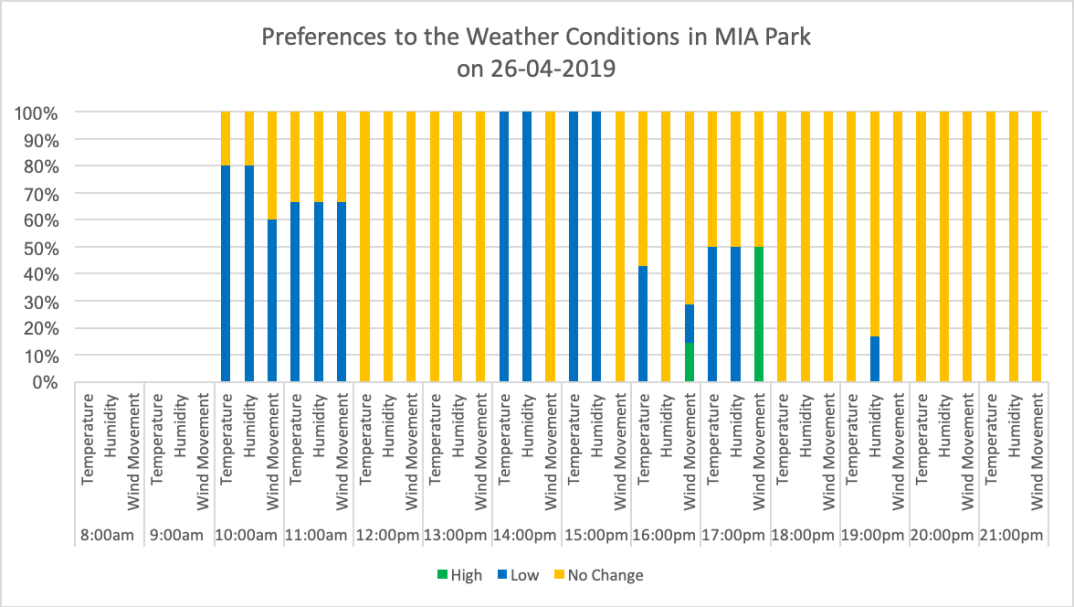


Figure 51. User's preferences to the weather conditions in MIA Park on 26-04-2019

In addition, it is important to mention that no users completed the survey between (8am and 9am), a gap is thus evident in the graph for this period.

Throughout the morning period, 25% of users desired to spend a long time in MIA Park. The survey showed that most of users who came planned to leave after more than three hours of arriving. On this day, 48 visitors were surveyed. After 1pm, it was observed that the number of users began to increase and, after 6pm, the number of users slowly began to decrease (Figure 52). Between (3pm and 9pm), 50% of users surveyed stated that they wanted to stay and spend a long time in the park.

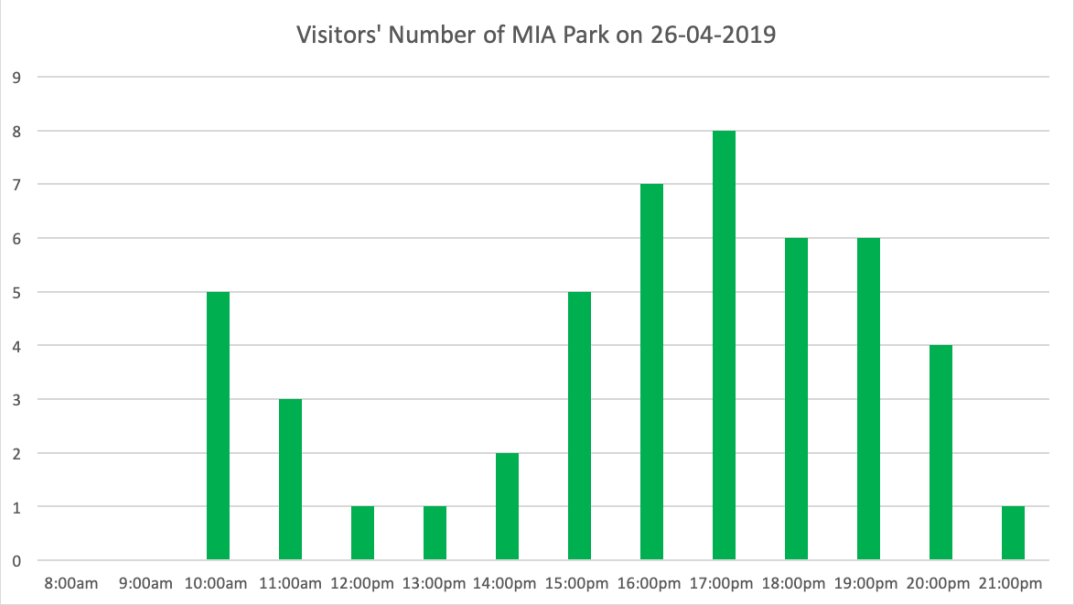


Figure 52. Visitors' number surveyed in the MIA Park on 26-04-2019

Moreover, users were expected to stay for an hour to two in the morning, less than an hour in the afternoon, and two hours to more than three hours in the evening. In addition, majority of users were felt comfortable in MIA Park on this day due to moderate weather conditions (Figure 53).

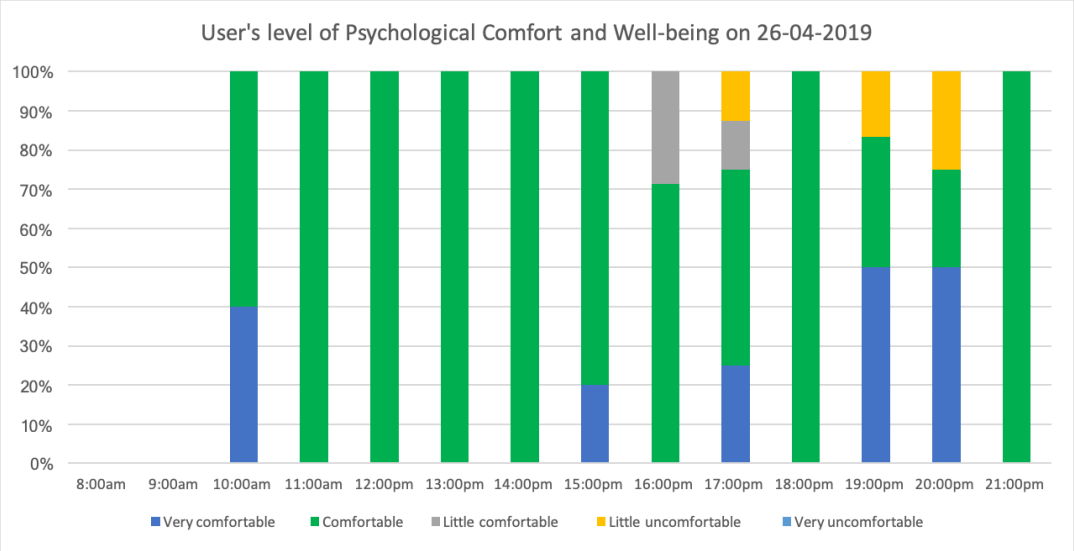


Figure 53. Level of psychological comfort and well-being in MIA Park on 26-04-2019

Ultimately, it was noticed that users comprised families, individuals and couples seen. Tourists were found at (9am, 11am and 5pm); they were passing the park to enter the museum (Figure 54).

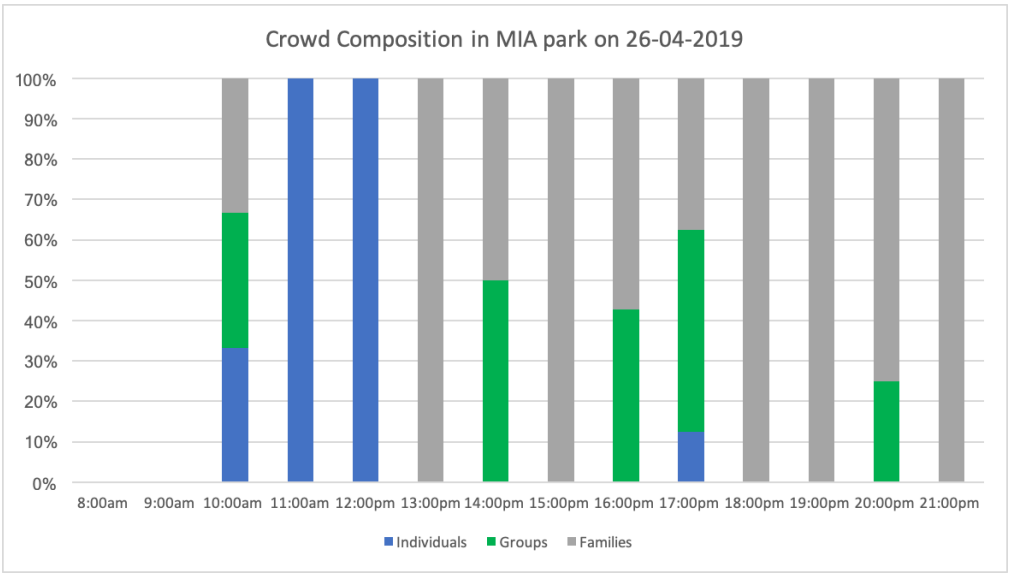


Figure 54. Crowd composition in MIA Park on 26-04-2019

4.2.3 Environmental condition assessment

4.2.3.1 Day 1: microclimate conditions in MIA Park (23-04-2019)

Looking to Figure 55, the hottest peak of this weekday was registered in the afternoon period (1pm and 2pm) at 28°C along with one of the lowest humidity levels of 32%, while the wind velocity was high at 41 km/h and 33 km/h, respectively.

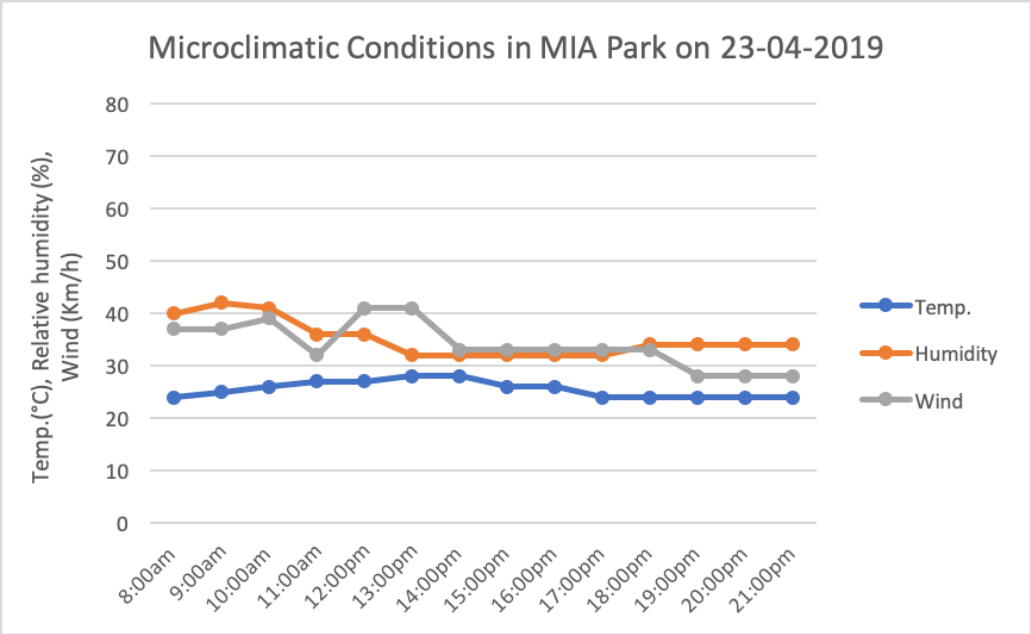


Figure 55. Microclimate conditions in MIA Park on 23-04-2019

According to these climate parameter readings, the sum temperature reached 23°C (slightly warm), as per the outdoor comfort calculator (Figure 56).

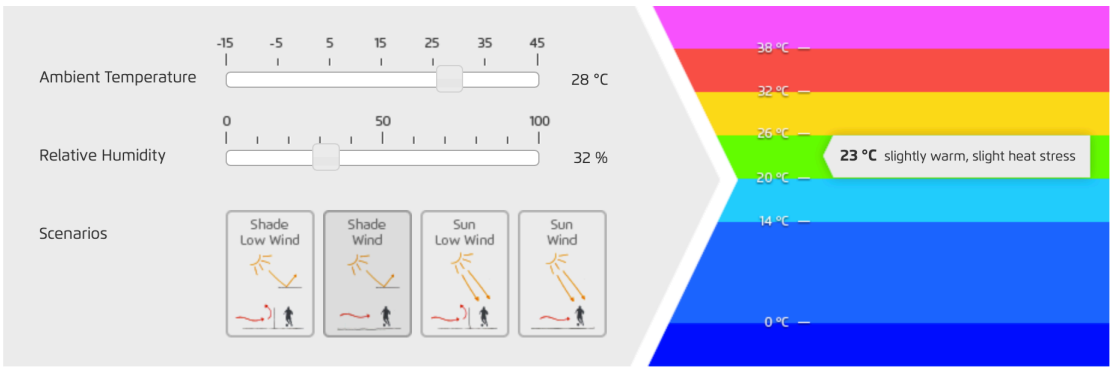


Figure 56. The outdoor comfort calculator (TranssolarKlimaEngineering, 2019)

Moreover, on this day the coolest peak was registered at (8am) at 24°C and again at (5pm) with the same temperature. At (8am), one of the highest humidity levels was registered at 40%, along with relatively high wind velocity at 37km/h. Based on these climate parameters, the sum temperature reached 25°C, as per the outdoor comfort calculator, illustrated in Figure 57.

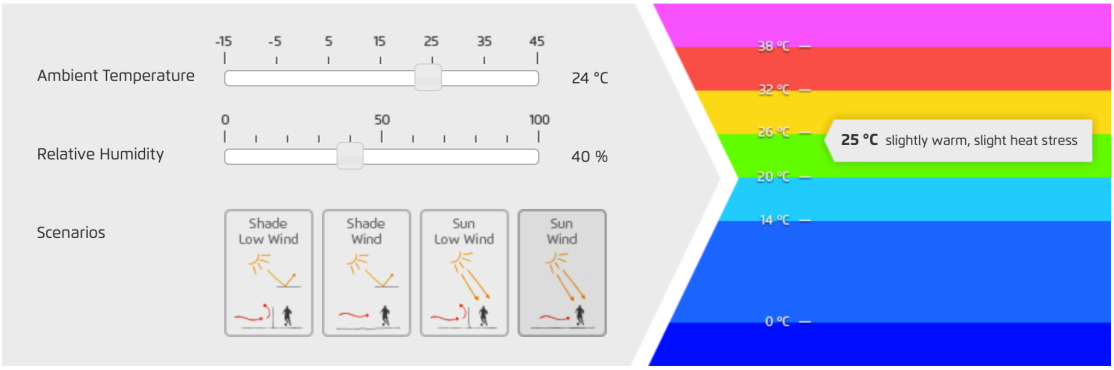


Figure 57. The outdoor comfort calculator

Meanwhile, the lowest humidity and wind were observed at (5pm) at 32% and 33 km/h, respectively. Hence, the sum temperature reached 19°C (Figure 58).

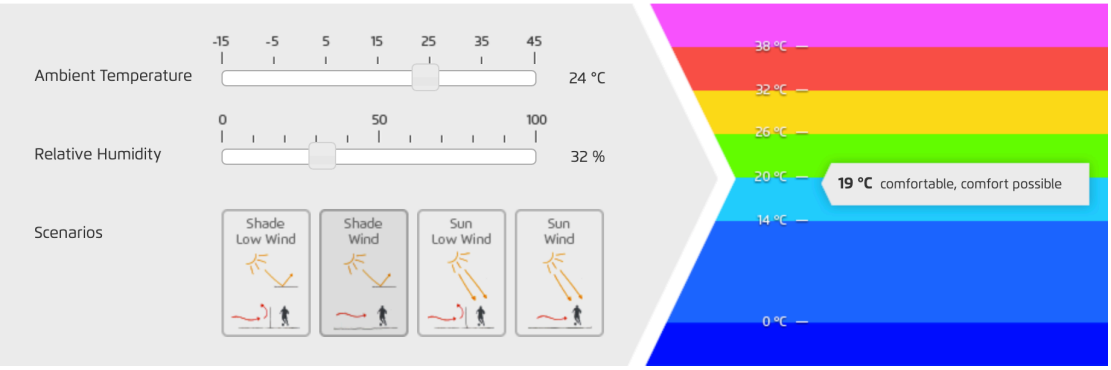


Figure 58. The outdoor comfort calculator

4.2.3.2 Day 1: noise level and air quality in MIA Park (23-04-2019)

During this weekday, the noise level was recorded between 50–60dB (moderate), with high sound registered in the morning at (10am) at 56dB and low sound recorded in the afternoon at (5pm) at 46dB. These findings were in accordance with the survey results: 84.44% of users reported feeling comfortable (Figure 59).

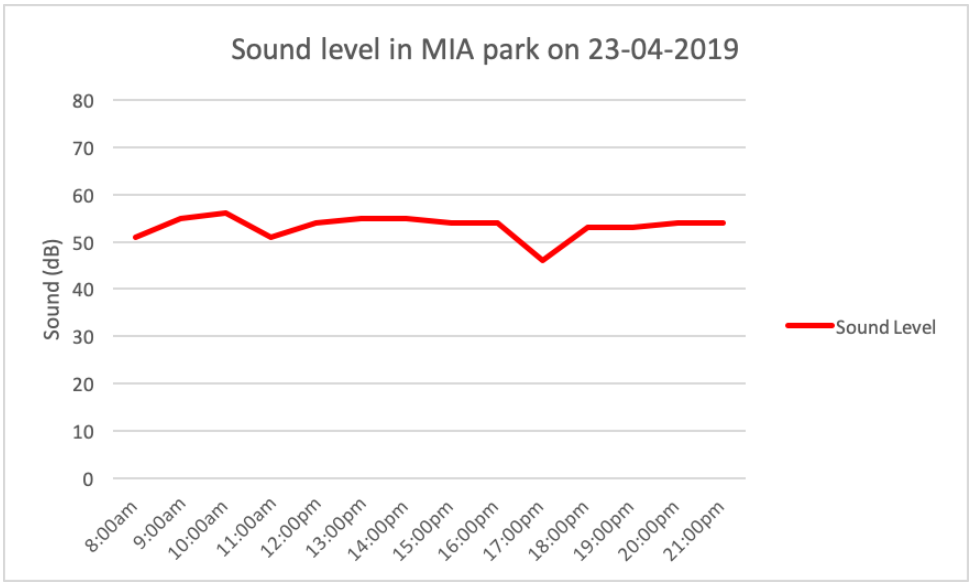


Figure 59. Sound level in MIA Park on 23-04-2019

Meanwhile, the day's air quality readings pointed out of variance range according to the AQI (Figure 60). During the morning period from (8am to 10am), the AQI values were between 51 and 100 (yellow), signifying that, while the air quality is 'moderate' and acceptable, there is a potential that some pollutants may exist that can cause health concerns. People who are unusually sensitive to air pollution may be influenced by these pollutants. Between (1pm and 4pm), AQI values were between 101–150 (orange), indicating 'unhealthy air for sensitive groups. In spite of fact that the general public is unlikely to be impacted at this AQI range, children, older adults and people with lung disease are at a greater risk of ozone exposure, whilst individuals who suffer heart and lung disease, older adults and children are at greater risk from the existence of particles within the air. Between (5pm and 8pm) values were between 151–200 (red), indicating that the air was 'unhealthy'. In such air conditions, user may start to experience some harmful health effects.

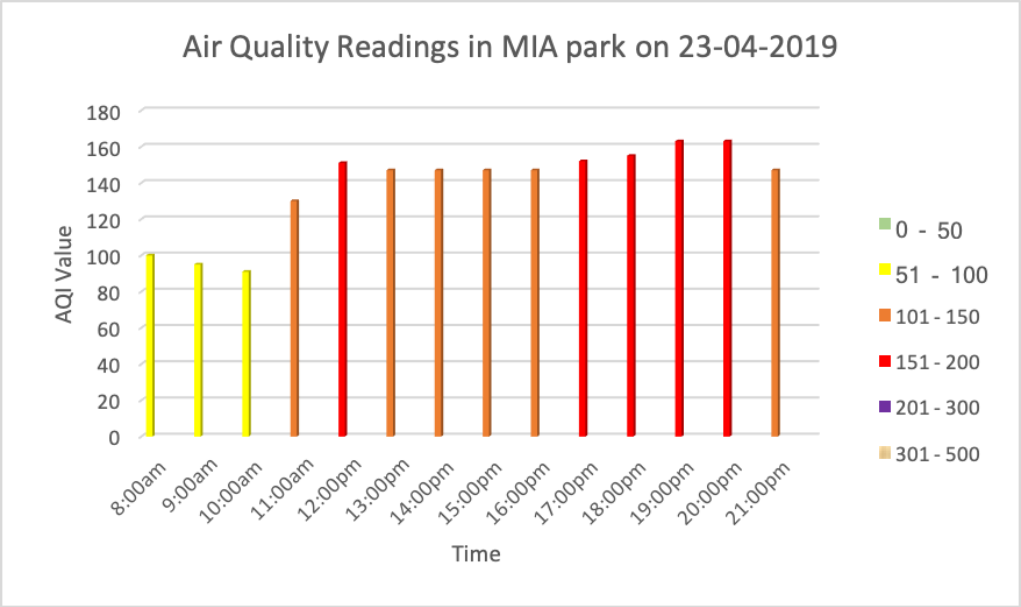


Figure 60. Air quality readings in MIA Park on 23-04-2019

4.2.3.3 Day 2: microclimate conditions in MIA Park (26-04-2019)

This weekend, the hottest peak was logged during the afternoon at (12pm) at 27°C. The humidity level was logged at 28%, and one of the highest wind velocities was observed at 28.8 km/h (Figure 61).

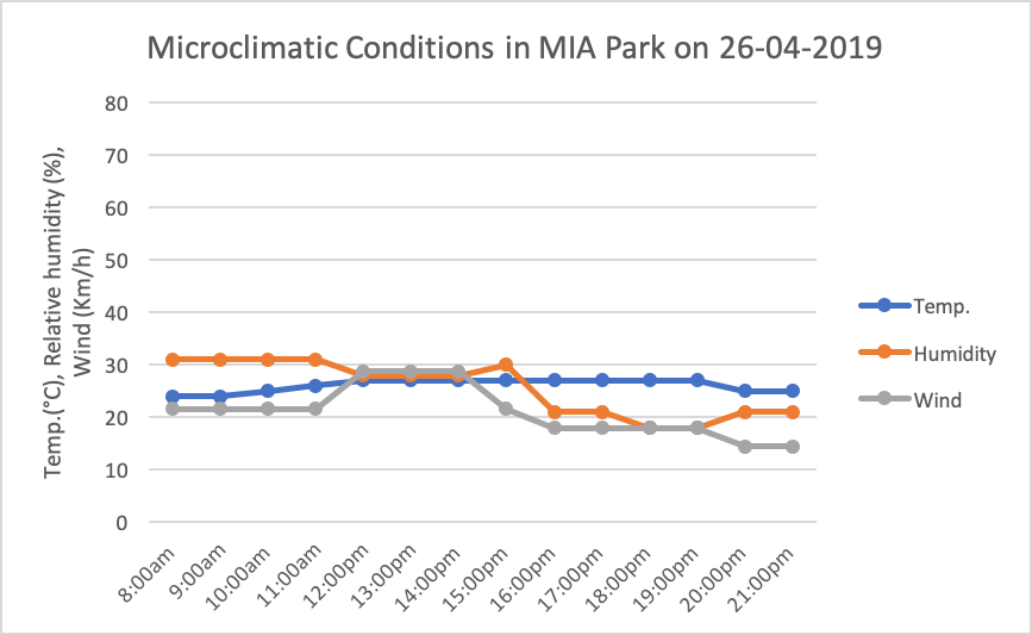


Figure 61. Microclimate conditions in MIA Park on 26-04-2019

Based on these climate parameter readings, the sum temperature reached 22°C, as per the outdoor comfort calculator, as illustrated in Figure 62.

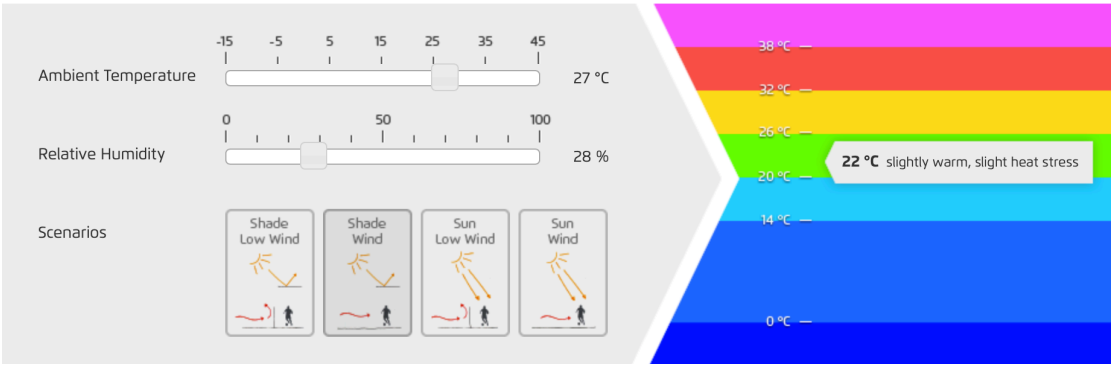


Figure 62. The outdoor comfort calculator

Alternatively, the coolest peak was recorded between (8am and 9am) at 24°C temperature while the humidity was found at one of the highest levels at 31% and wind velocity was recorded 21.6 km/h. Based on these climate parameter readings, the sum temperature reached 19°C (comfortable, comfort possible) (Figure 63).

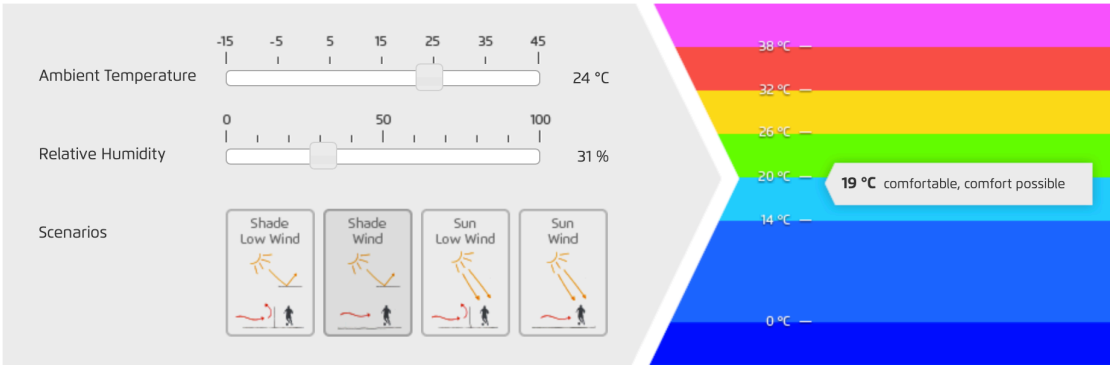


Figure 63. The outdoor comfort calculator

4.2.3.4 Day 2: noise level and air quality in MIA Park (26-04-2019)

The noise level readings of this day show that between (8am and 4pm), noise was between 30–40dB and from 5pm to 9pm between 50–60dB. The highest level of sound was logged in the morning period at (10am) at 53dB, while the lowest level of sound was logged in the afternoon period at (5pm) at 30dB (Figure 64). Generally, noise was moderate and soft, aligning with the survey results that 78.75% of users were comfortable with the day's noise.

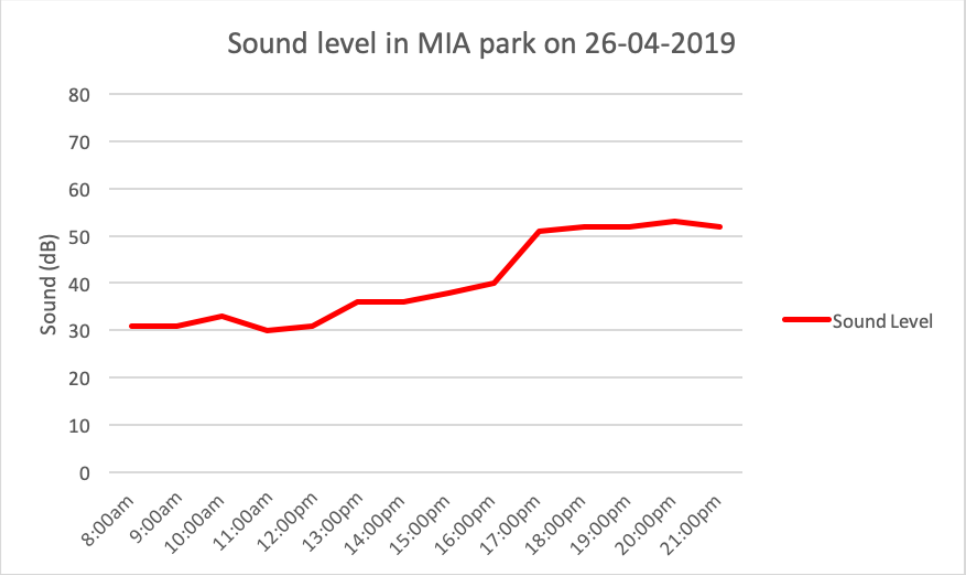


Figure 64. Sound level in MIA Park on 26-04-2019

Whereas, the air quality readings of this day were between 101- 150 (orange), signifying 'unhealthy air for sensitive groups (Figure 65).

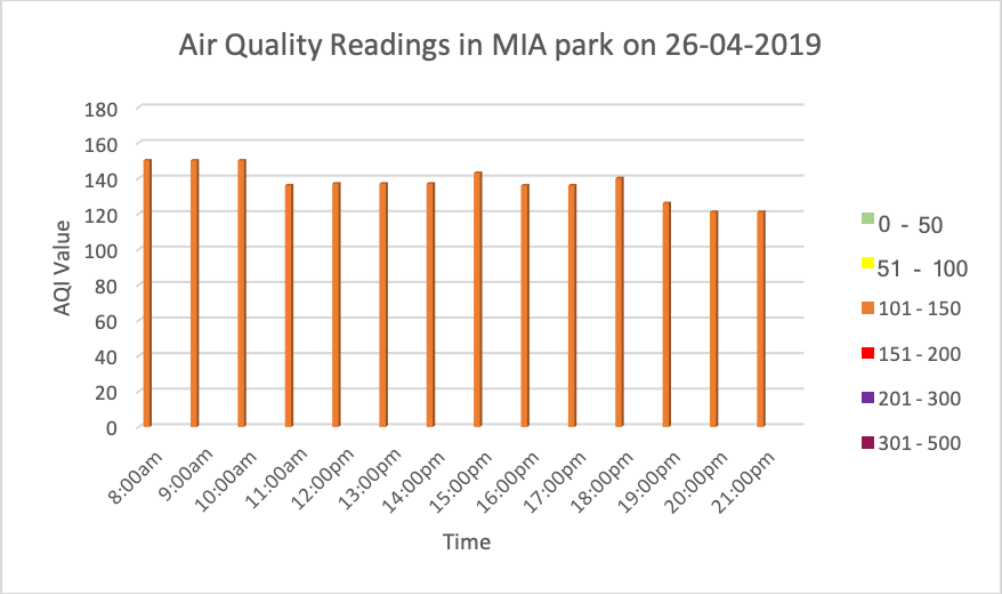


Figure 65. Air quality readings in MIA Park on 26-04-2019

4.2.4 Site observational of MIA Park

4.2.4.1 Day 1: site observation (23-04-2019)—10am, weekday

Because of the study's limitations, the researcher was only able to offer a geographical perception of the central focal point of the POS in two maps targeted for two periods: 1) one weekday morning at 10am and evening at 6pm and 2) one weekend morning at 10am and evening at 6pm.

Figure 66 shows the site plan of MIA Park, which overlooks the sea, museum and education building; this positionality makes the park attractive to many people. On the 23rd of April, 2019 at (10am), it was noticed that 35 people were gathering and occupying the park's main largest free space, where the museum and Al Riwaq exhibition center are located. On this recorded day, the weather condition was moderate and cloudy at 26°C, 41% humidity and a wind velocity of 39km/h. The sound level was moderate at 56 dB. The air quality was also moderate at 91.

Users were male and female and mainly landscapers and cleaners. While individuals spotted in the space, there were also groups and families with children observed at this hour of the weekday. Regarding types of activities, users conducted different activities in the space. Some were observed walking near the sea, others were sitting and relaxing under a tree and others were cycling. No users were found sitting on the grass, perhaps because of the sun. Moreover, no users were seen exercising, likely because most adult were at work during this time.

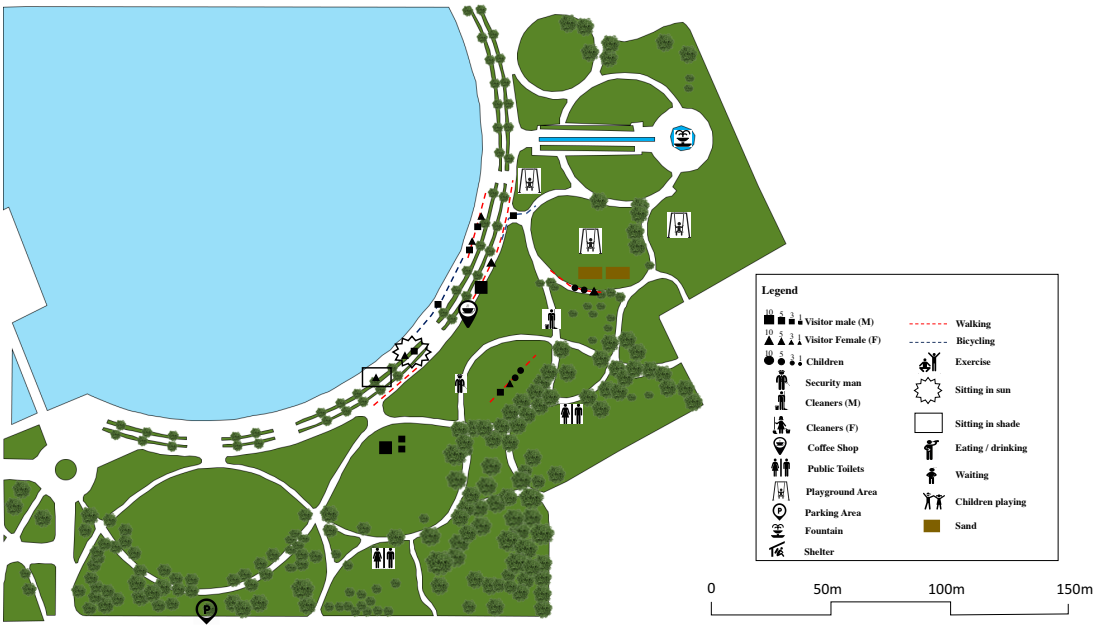


Figure 66. Observational map of MIA Park on 23-04-2019 at 10am

4.2.4.2 Day 1: site observation (23-04-2019)—6pm, weekday

As shown in Figure 67, on the 23 of April 2019 at (6pm), around 52 people were using MIA Park. The weather was cloudy, humidity was recorded at 30%, temperature at 27°C and wind velocity at 33 km/h. While it was observed that the

temperature was almost close to that recorded at 10am, humidity and the wind velocity had decreased. The sound level was moderate at 53dB. The air quality was at 155.

The majority of users were composed of males and females who often comprised families with children and adults of all ages. At this time, most users were observed walking on the grass. Moreover, a few people were exercising along the walkway located close to the waterfront. Cycling also was remarkably common due to the large space of the walkway, however, this situation may be uncomfortable users walking and exercising on the walkway. The users of space were scattered all around the central focal point. Some users were seen sitting in the grass and others on the pavement near the waterfront, probably relaxing. No users were sitting under the tree or in shaded spots. There were many children with their parents observed in the play area. The parents were sitting on benches watching their children.

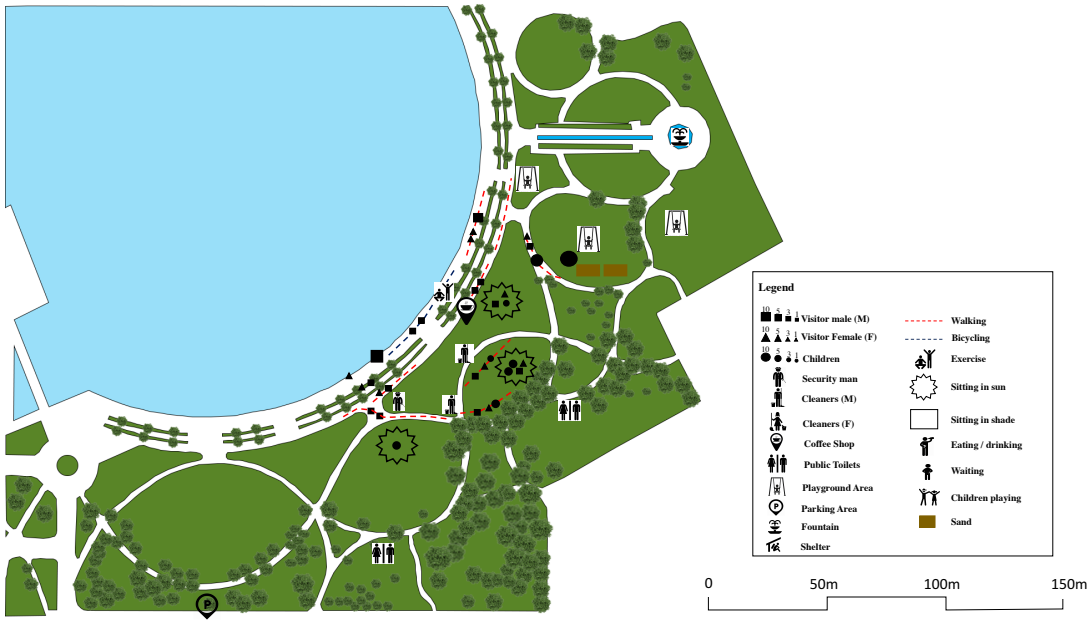


Figure 67. Observational map of MIA Park on 23-04-2019 at 6 pm

4.2.4.3 Day 2: site observation (26-04-2019)—10am, weekend

Figure 68 presents a site plan for MIA Park at (10am) on the 26th of April 2019. On this day, the temperature was at 25°C, humidity at 31% and wind velocity at 21.6 km/h. While, the sound level was 33dB, the air quality was found to be 150.

By looking to the map, it is evident that there were 37 users this weekend at 10am distributed in the space—in contrast, referring back to Figure 66, there were 35 users on a weekday at 10am. It was observed that users were a mix of males and females, families and children. The majority of users were walking and sitting on the grass under trees; however, it was noticed that no seats were provided under the trees. Although there were a few people walking along the walkway this morning, it was observed that the walkway was not shaded enough. This increases the possibility that people will be discouraged from practicing physical activities in the morning.

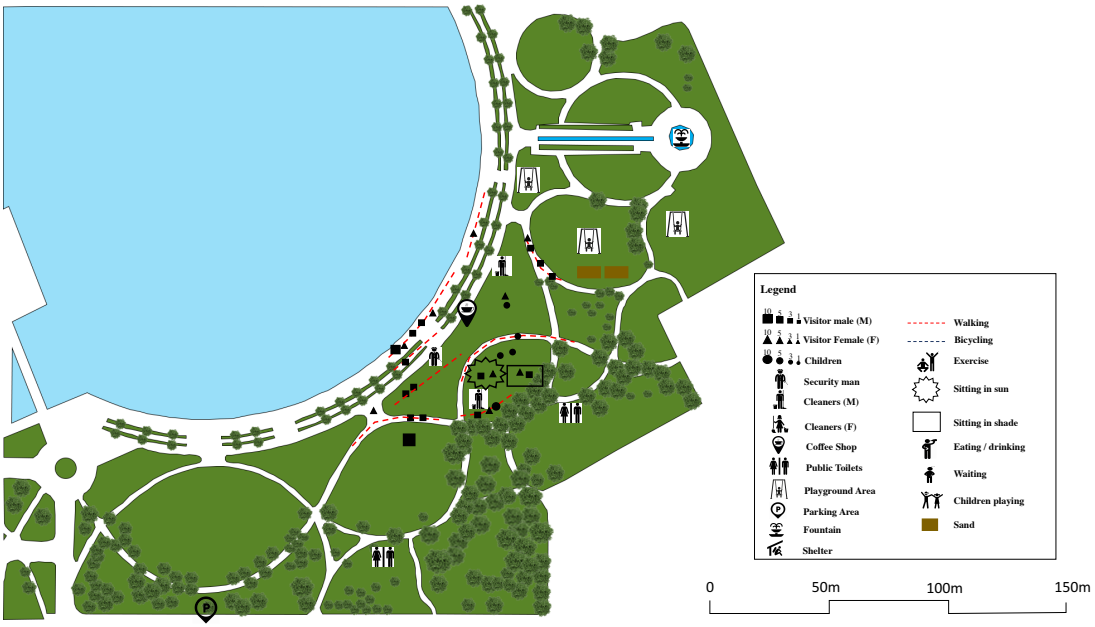


Figure 68. Observational map of MIA Park on 26-04-2019 at 10 pm

4.2.4.4 Day 2: site observation (26-04-2019)—6pm, weekend

The site observation plan of MIA park on the 26th of April, 2019 at (6pm) (Figure 69) revealed cloudy weather of 27°C, 18% humidity and wind velocity at 18 km/h. The sound level reached 52dB. Moreover, air quality was 140. On this weekend, a huge crowd of visitors appeared to use the POS between (10am to 6pm), during which time the number of users grew from 37 to approximately 200. None of the 200 users at (6pm) were sitting under the trees as the sun was about to set. Visitors were fundamentally sitting on the grass, or near the children's playground; no seats were provided and most of them brought their chairs. Others were sitting near the sea to enjoy the Doha sunset view and taking photos. Meanwhile, a few children were cycling along the walkway. Some couples were sitting away from the other, adjacent to the trees to have more privacy. Families were sitting on central area of MIA Park.

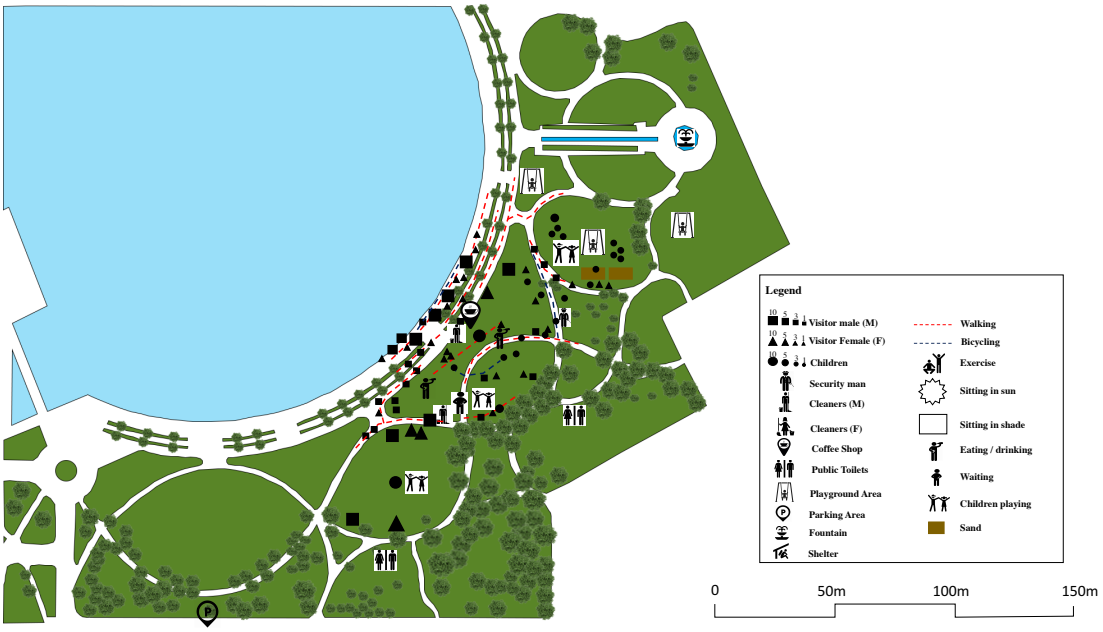


Figure 69. Observational map of MIA Park on 26-04-2019 at 6 pm

4.3 Oxygen Park

Oxygen Park is considered a newly developed parks in the Al Rayyan area, in Zone 52, and is located within the boundaries of education city, where it was implemented by the Qatar Foundation (QF). The POS of Oxygen Park opened in the 2016 and occupied 130,000 m2 with the aim of serving as an outdoor green oasis in education city that invited the students of the QF and the general public to refresh their bodies, minds and emotions by walking, engaging in sports and discovering the symbiotic relationships between plants, oxygen and healthy living. Key locations surrounding Oxygen Park include Hamad bin Khalifa University Student Center (HBKU), education city college and the male student housing (Figure 70).

Figure 70. The location map of Oxygen Park (author)

Oxygen Park is accessible to people of all ages. The park is connected by one main street, Huwar Street, and one secondary street, Al Huqoual Street, which street serves the users of the education city, mainly the students. Currently, the POS of Oxygen Park has no gates, barriers or fences; it can thus be accessed from everywhere.

Oxygen Park is divided into two featured zones. The first zone was allocated for sports and the second zone for recreation (Figure 71).

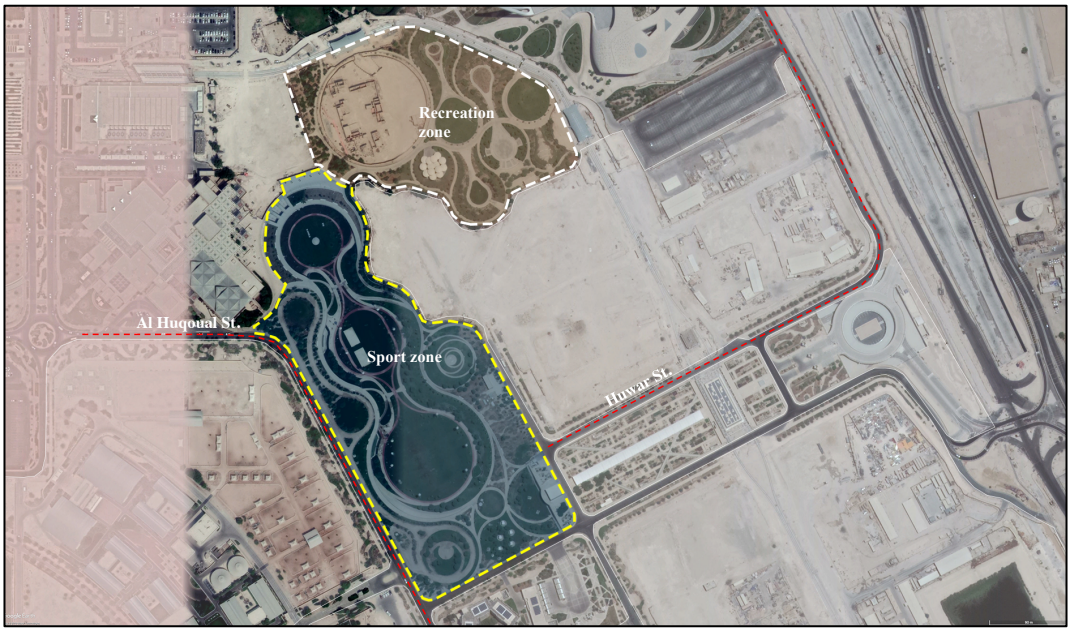


Figure 71. The zones map of Oxygen Park (author)

The sports zone is situated on the west side of the park. It comprises sports bowls made up of two-levels: upper and lower (Figure 72). The lower level contains three circular multi-use sports courts, which encompass the running path and volleyball pitches (Figure 72). A semi-covered pathway extends around the boundary of the sports pitches. The semi-covered pathway is a walkway with a cooling system

through subtle cooling units. This covered area contains seating and dim lighting and provides a shaded and comfortable place from the sun and thus serves as a place at which to relax. In the covered area, the carved wind passages manage wind flow and thus contribute to supplying fresh air. Over the edge of the pathway covering, there are cascading waterfalls. Moreover, amphitheater seating with grassy banks around the park provide space to gather, sit and see various other activities, while the upper level includes hills and an encircling walkway with a horse-riding track that overseeing the sports bowls. This zone also comprises a picnic and seating.

Figure 72. The two-levels with the running path and volleyball

The recreation zone is situated in the northeast of the park and includes a children's playground, individual gardens, heritage area and an amphitheater for multiple uses. The children's playground area is shaded and distinguished with undulating hills (Figure 73). There is concrete seating where parents can sit and watch their children as well as grassy banks all over the place, which are suitable for picnics. However, the children's playground area is far from the main area and located near the tram line.

Figure 73. The children's playground area in the Oxygen Park

Many Oxygen Park users are students of the QF who study at the adjacent universities. Users are of different nationalities, ages and genders. Many users visit the park to walk, exercise, sit and play on weekdays. While the same activities occur on weekends, this period sees more visitors. Users were observed as using the sports zone (middle circular) more than the recreation zone.

4.3.1 POS physical characteristics assessment

Oxygen Park, demonstrated some of the physical characteristics and elements, discussed in the literature review. The existing physical elements and related observations of Oxygen Park are as follows:

- Oxygen park has a variety of native plants, trees, shrubs and grass banks.
- In terms of water features, over the edge of the pathway covering there are cascading waterfalls, which offer a beautiful sight, sound and water spray that can be felt by users as they pass it (Figure 74).

Figure 74. The water features in Oxygen Park

- The lighting system is plentiful in different zones throughout the park (Figure 75). There is spotlighting, column lighting and 14 big lighting poles that provide better illumination at night. The park is also equipped with surveillance equipment such as CCTV and security personnel and emergency phones were observed throughout the space (Figure 75).

Figure 75. Lightings and emergency device in Oxygen Park

- The lower level involves seats in sun and in shade. The upper level also provides seats for all users (Figure 76). Further, there is amphitheater with grassy banks that provide space to gather, sit and see the sporting activities. Additionally, the park is equipped with trash and recycling bins.

Figure 76. The seats and the recycling bins in Oxygen Park

- The Oxygen park has a good signage system inside the park (Figure 77).

Figure 77. The signage in Oxygen Park

- There are no public toilets or prayer rooms in the park. Moreover, the park does not offer any cafés or kiosks. The whole park is facilitated only by the nearby QF facilities such as the HBK Student Center.
- The park has no car parking lots; however, there is little need for lots, as most of the QF facilities around the park have parking that users can use.
- The surface of the ground in Oxygen Park is of a mixture of artificial hills and flat land. It has light concrete pavement, soft walking mats (rubber) and sand trails (Figure 78).

Figure 78. The surface of the ground in the Oxygen Park

Furthermore, as shown in Figure 79 and according to the results of the survey with regards to the physical design elements studied, participants assigned different percentage to existing elements when questioned about their preferences for Oxygen Park. Considerably, the highest percentages of respondents desired public toilets (93.33%), coffee shops (60%), parking lots (54.67%) and signage (46.67%). The majority of users believe that public toilets, coffee shop and parking lots must be

added to accommodate all visitors, as the existing facilities belong to the education facilities with which visitors are unfamiliar. Other physical elements with which participants were satisfied include vegetation, seats and shaded areas, water features and lighting. The vegetation, water features and lighting were given the lowest percentages, categorized by participants as positive elements of Oxygen Park.

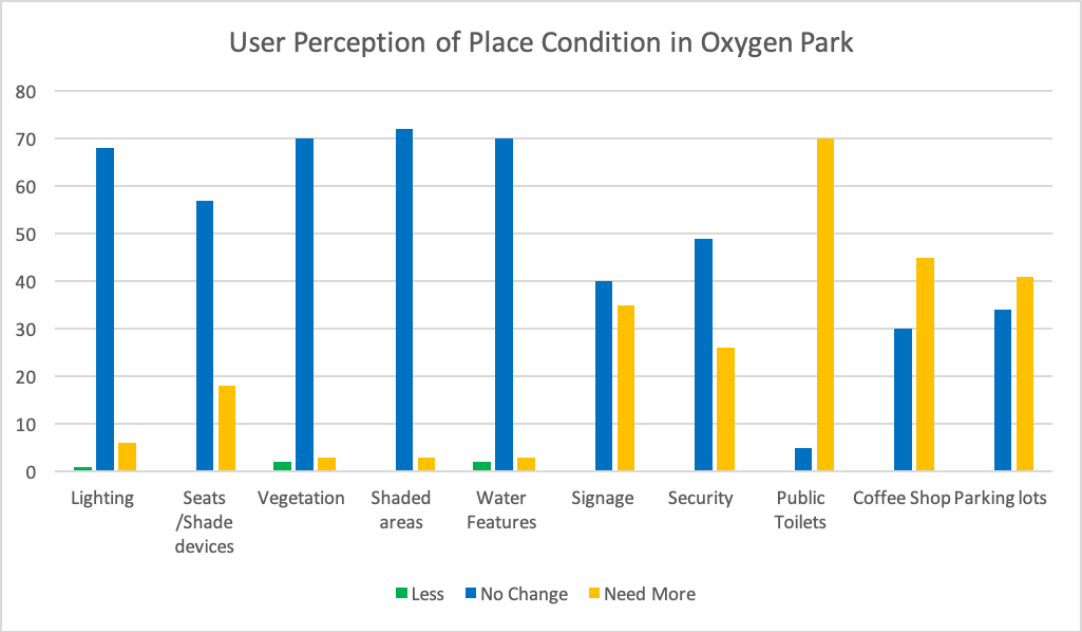


Figure 79. The user perception of Oxygen Park condition

4.3.2 POS non-physical characteristics assessment

4.3.2.1 User physical well-being: activities in Oxygen Park

In Oxygen Park, both social and optional activities were observed. Users were found sitting on the green hills enjoying their time and relaxing, or walking around the POS. There is a certain spot very attractive to adults and children: the circular multi-use sports courts, which is offer a running path and pitches (Figure 80).

Figure 80. The circular multi-use sports courts

In this POS, little cycling was observed; the most common activities included gathering, sitting and walking. Figure 81 illustrates the percentage of diversified activities in Oxygen Park based on the two-day survey.

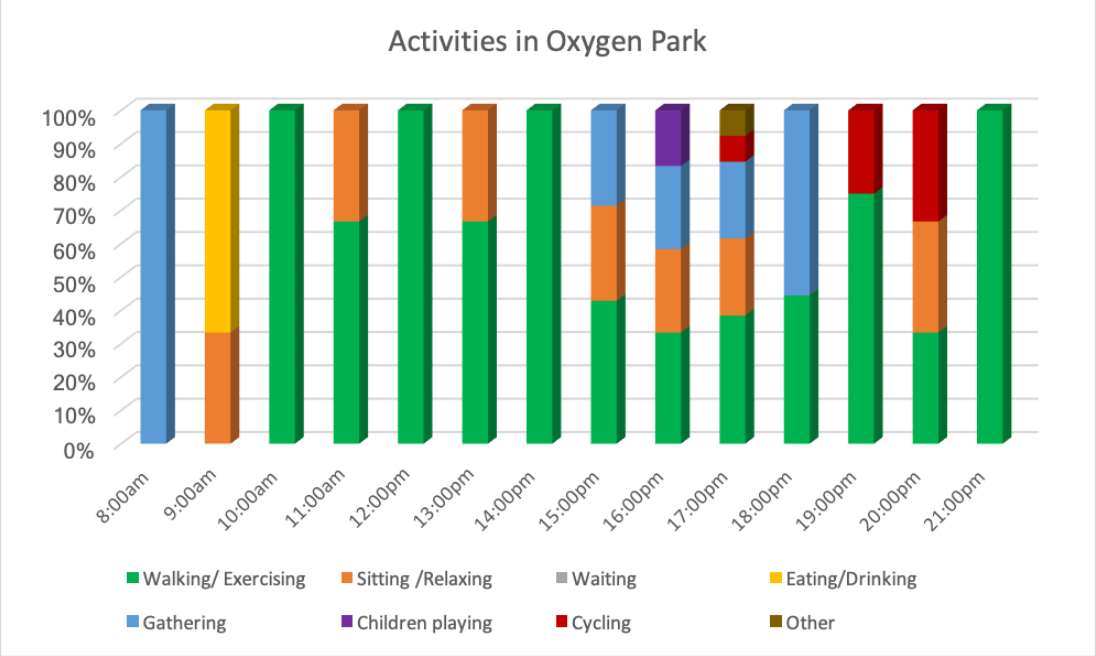


Figure 81. Activities in Oxygen Park (weekday & weekends)

A POS in itself is a necessary aim, enabling guests to engage in recreational, physical, social and cultural activities involving outdoor cafés, festivals, sports activities and exhibitions (Gehl, 2007). Over the two days, it was observed that Oxygen Park lacked outdoor cafés and exhibitions.

4.3.2.1.1 Type of user

Regarding the type of user, over the two days of site observations including both weekdays and weekends, it was observed that women utilized the POS more than men, and constituted 65.33% of visitors (Figure 82). It is worth mentioning that at 12 pm, the percentage of men 75% surpassed that of women.

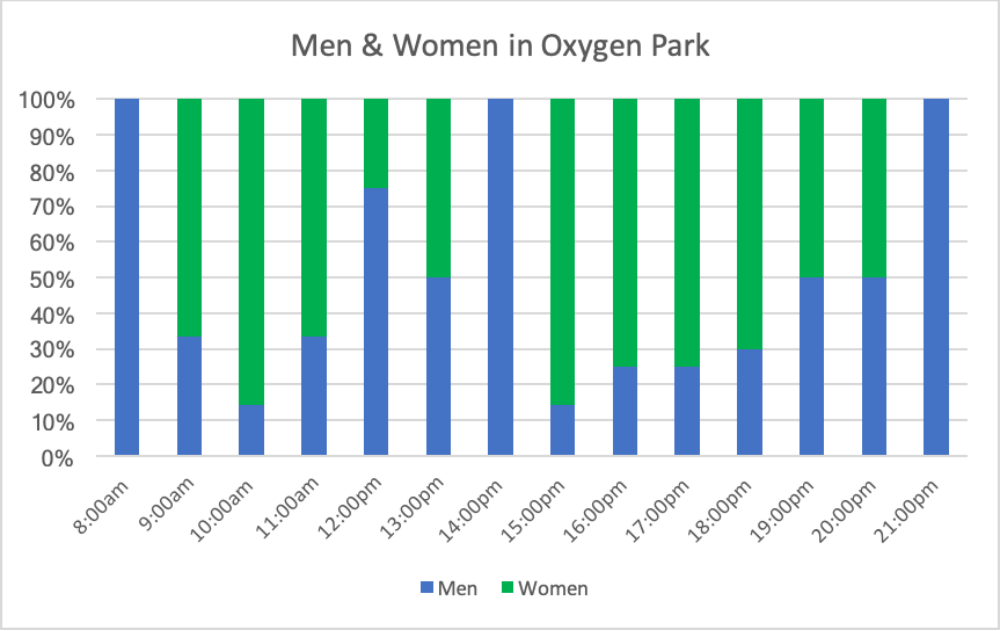


Figure 82. Average proportion for the women and men in Oxygen Park

4.3.2.1.2 Level of use

Regarding the level of use, the period of staying in space differed from user to user. It is mostly dependent on climatic variables, noise and other environmental factors. Usually, when the weather is moderate, users tend to use the park for longer times; consequently, activities persist into the evening, enabling different users to gather and enjoy the POS. Users of the park ordinarily spent a long time if they were with friends, with families visiting during the weekends and evenings. Hence, this POS was considered a lively environment occupied by many people and activities.

4.3.2.2 User psychological well-being: psychological adaptation

4.3.2.2.1 Day 1: questionnaire survey assessment (24-04-2019)—weekday

During the morning period from (8am to 11am), based on the survey results, 100% of users did not desire any change in the humidity level or wind velocity, and were able to endure the overall weather condition (Figure 83). However, 33% of users were not satisfied with air temperature at (9am), preferring a lower temperature. At (3pm), 100% of users surveyed preferred lower temperatures, 50% desired lower humidity and 100% were unsatisfied with wind velocity, wanting more air movement. Between (4pm and 5pm), the users began to endure weather conditions: 100% wanted no alteration in temperature and 72% did not desire any change in wind velocity. During the evening period, from (6pm to 8pm), users were able of enduring general weather condition with 100% of users satisfied with air temperature, humidity and wind velocity. This result suggest that users are able to endure the weather conditions over the morning and evening periods at Oxygen Park.

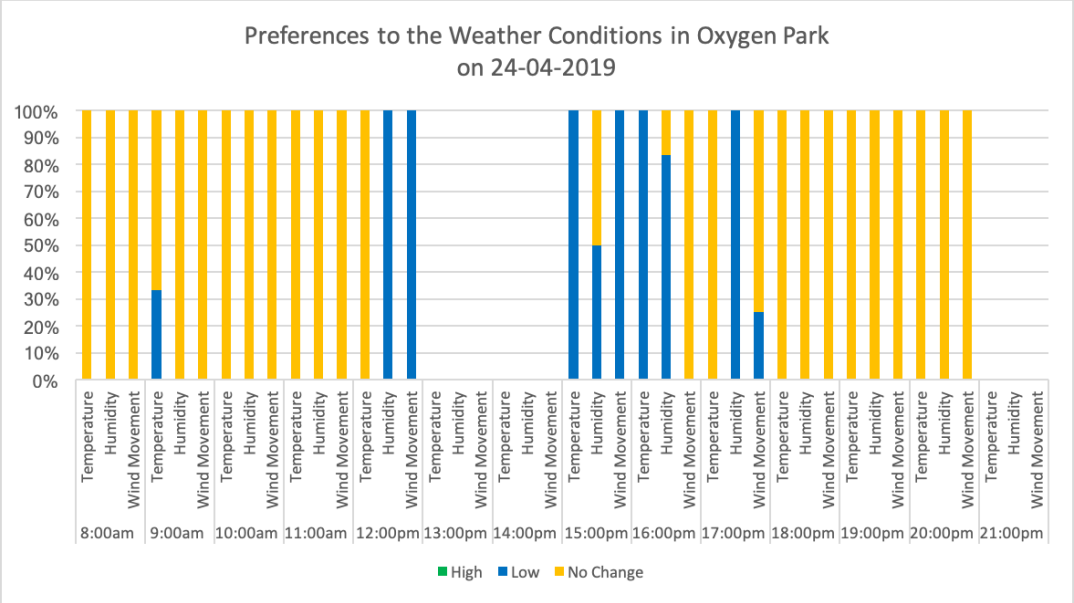


Figure 83. User's preferences to the weather conditions in Oxygen Park on 24-04-2019

It is important to note that at (1pm, 2pm and 9 pm), no users filled out the survey; this gap is evident in the graph.

Further, 79% of users reported feeling comfortable after exposure to the green spaces and 20% reported feeling relaxed. In general, 73% agreed that this place assists them in reducing stress and anxiety.

Regarding duration of stay, 23.53% of visitors were able to stay in the POS for over an hour and mentioned that they would visit again for a long stay. This could be due to the park design dealing well with the overall environmental conditions.

It is significant to note that, on this day, there was a total of 34 visitors surveyed. Between (3pm and 5pm), the number of users in Oxygen Park rapidly increased, and 16 persons were observed during this period. However, (5pm), as shown in Figure 84, saw the highest number of users with 8 people visiting at once.

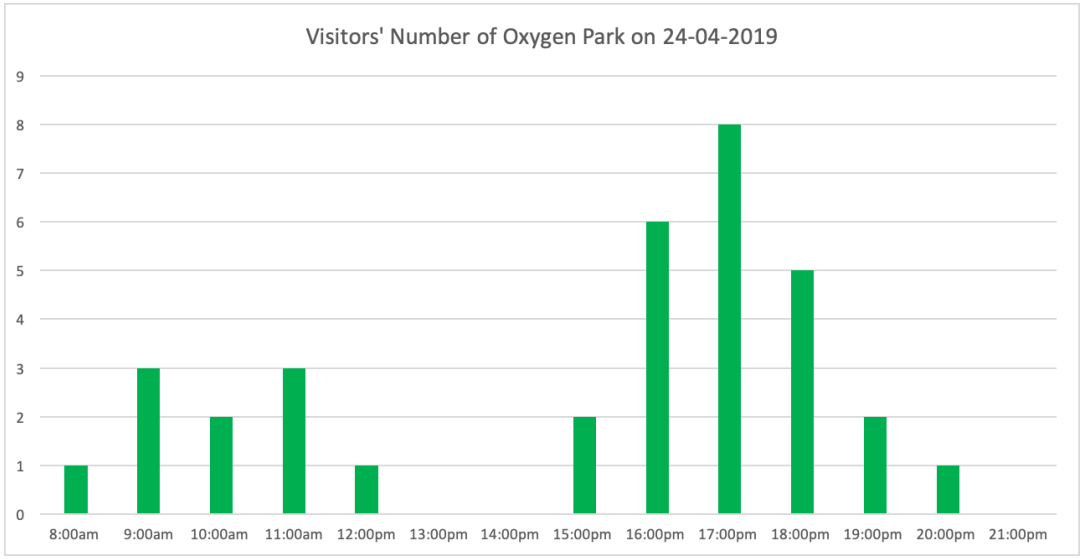


Figure 84. Visitors number surveyed in the Oxygen Park on 24-04-2019

Environmental stimulation is a unique feature that distinguishes this space. It encourages people to visit Oxygen Park and impacts the time of stay at which they choose to visit along with the level of their use. These features are evident in the beautiful landscape, the sound of the waterfall, the greenery and the seasonal flowers.

As Figure 85 clarifies, individuals and groups (couples, friends, etc.) used the park between (8am and 3pm); individuals, groups, and families frequented it between (4pm and 8pm) and families constituted the highest percentage of visitors after (6pm).

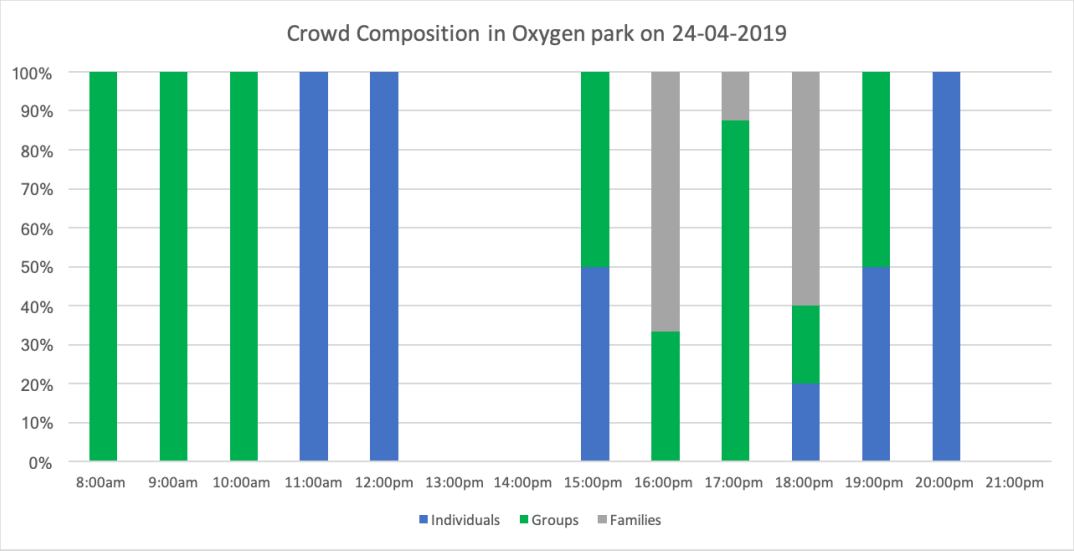


Figure 85. Crowd composition in Oxygen Park on 24-04-2019

4.3.2.2.2 Day 2: questionnaires survey assessment (27-04-2019)-Weekend

The survey clarified that, over the morning period from (10am to 12pm), users were unable to endure the weather conditions. 100% of those surveyed preferred low humidity and temperature, and 75% were not satisfied with wind velocity, wanting more air. Over the afternoon period, at (1pm and 3pm), all users preferred low air temperature with low humidity, with 75% not pleased with the wind velocity, against desiring more air in the space. As a result, it is argued that users were unable to bear the prevailing weather of the morning and afternoon. From (4 pm to 5pm), 50% desired lower temperatures and a similar percentage low humidity, with 50% of users again desiring more air. During the evening period, (6pm to 9pm), the results show that users desired no changes in to air temperature, humidity level and wind velocity and therefore that they were able to endure the predominant evening weather condition (Figure 86). It is significant to note that between (8am and 9am), no users filled the survey; this gap is evident on the graph.

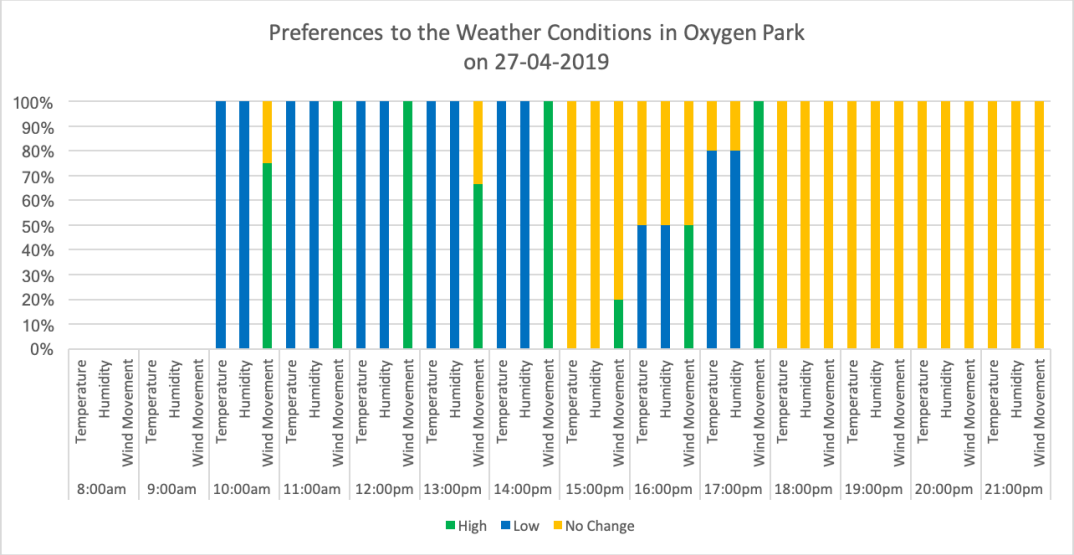


Figure 86. User's preferences to the weather conditions in Oxygen Park on 27-04-2019

On this day, 41 users in total were surveyed in the park. It was noticed that the number of users slowly began to increase after (2pm) and then began decreasing after (4pm) (Figure 87).

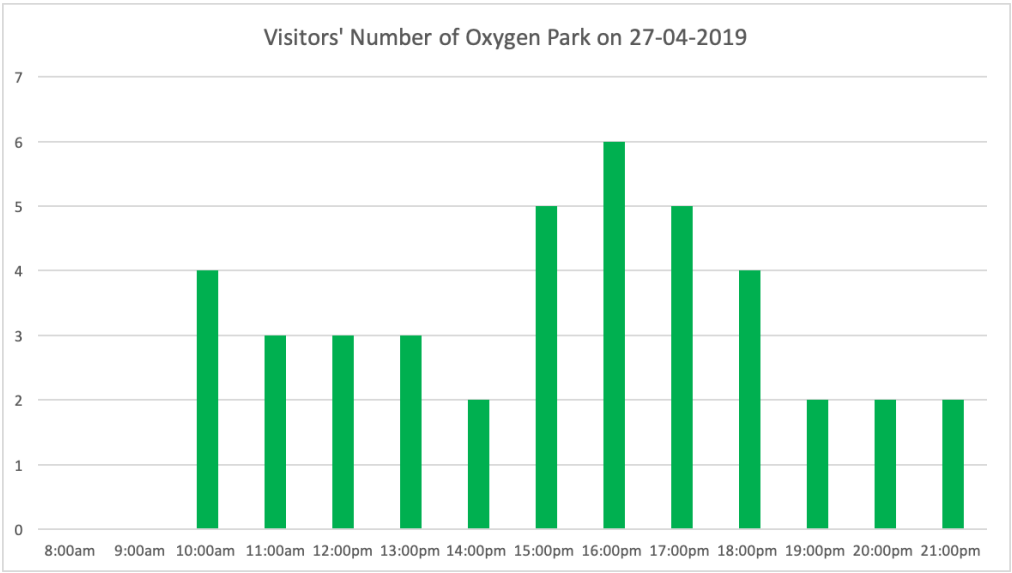


Figure 87. Visitors' number surveyed in the Oxygen Park on 27-04-2019

The majority of users felt comfortable in Oxygen Park on this day due to the moderate weather conditions (Figure 88). Thus, this has a positive influence on the level of psychological well-being.

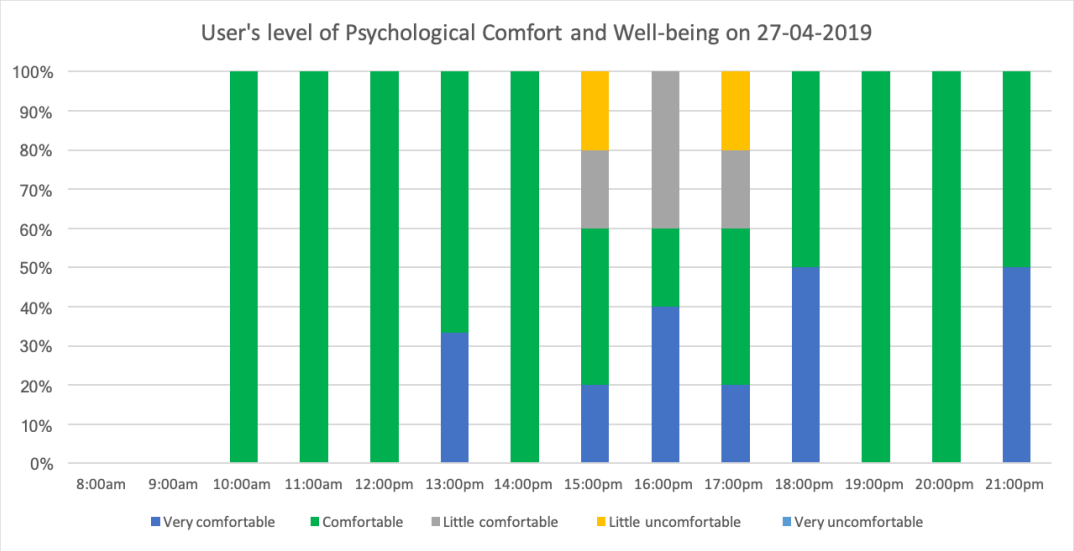


Figure 88. Level of the psychological comfort in Oxygen Park on 27-04-2019

The expected time of stay in the space for the users in the morning, afternoon, and evening periods were less than an hour, between fifteen minutes to an hour and more than two hours, respectively.

Moreover, during the time period between (10am and 12pm), it was noticed that the POS was occupied more by individuals, mostly park employees and QF students (Figure 89), however a few members of the general public were also observed in the space. In contrast, between (3pm and 9pm), the park was primarily used by individuals and groups, including a few families.

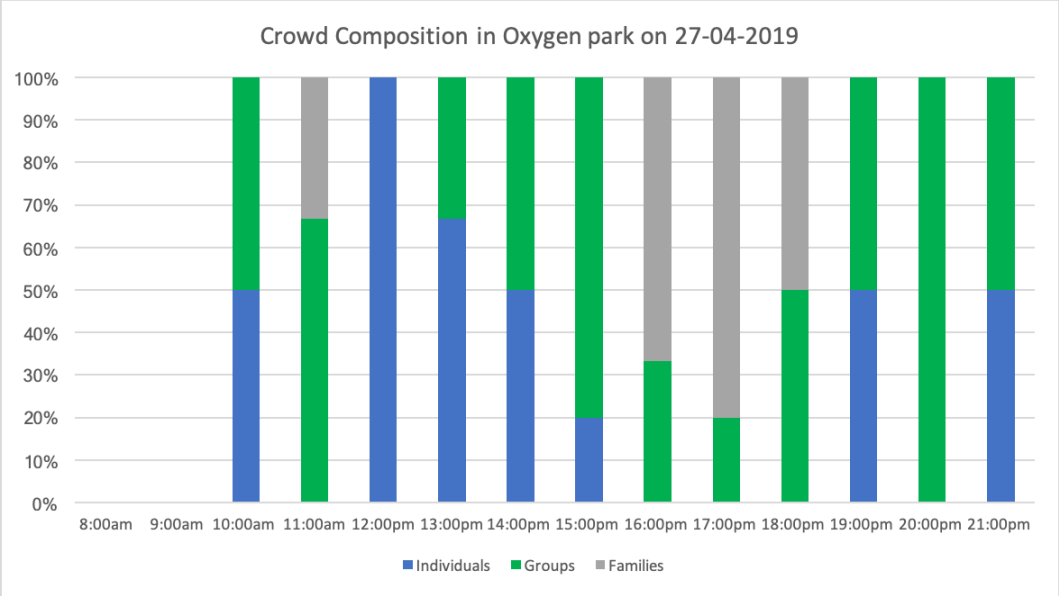


Figure 89. Crowd composition in Oxygen Park on 27-04-2019

4.3.3 Environmental conditions assessment

4.3.3.1 Day 1: microclimate condition in Oxygen Park (24-04-2019)

For this weekday, the hottest peak was recorded during the afternoon period at 3pm at 26°C, whereas, the humidity was found at one of its lowest levels at 25% and wind velocity was one of the highest recorded readings at 25.9 km/h (Figure 90).

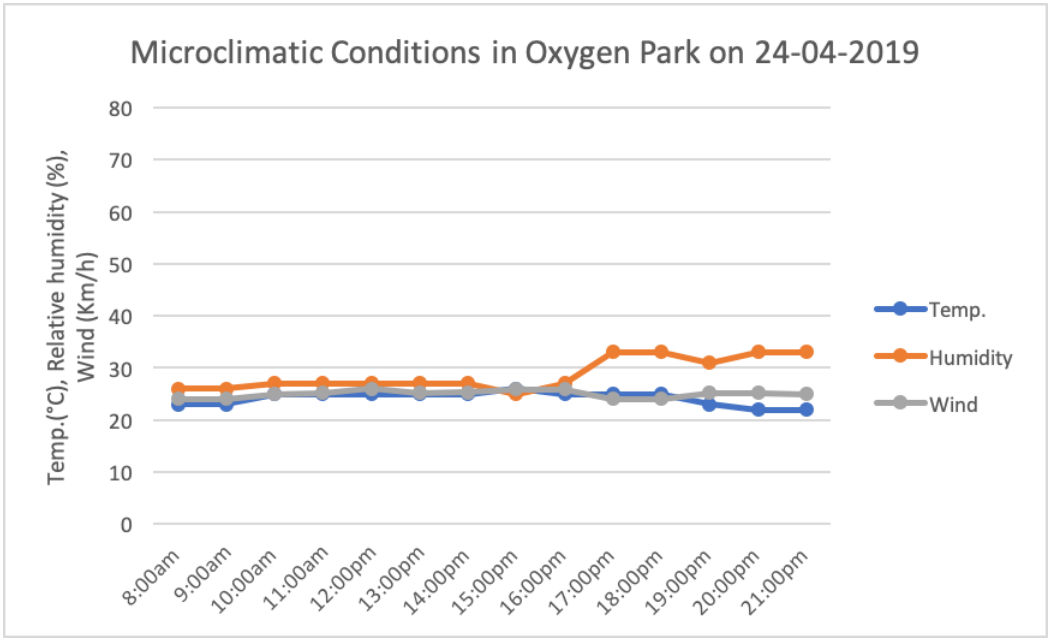


Figure 90. Microclimate conditions in Oxygen Park on 24-04-2019

Based on these climate parameters, the sum temperature reached 21°C (slightly warm, slight heat stress), as per the outdoor comfort calculator (Figure 91).

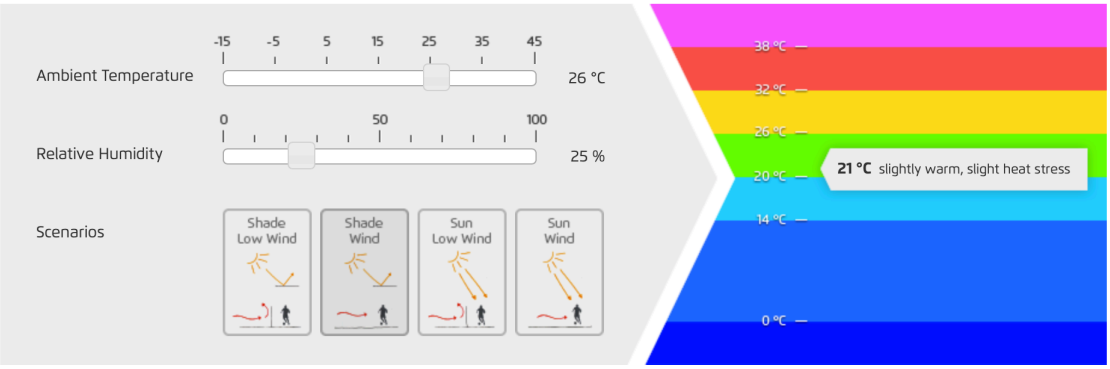


Figure 91. The outdoor comfort calculator

In other respect, the coolest peak was recorded during the evening period at 8pm at 22°C with one of the highest humidity levels at 33% and the highest wind velocity at 25.2km/h. Based on these climate parameter readings, the sum temperature reached 17°C (comfort, comfortable possible) as shown in Figure 92.

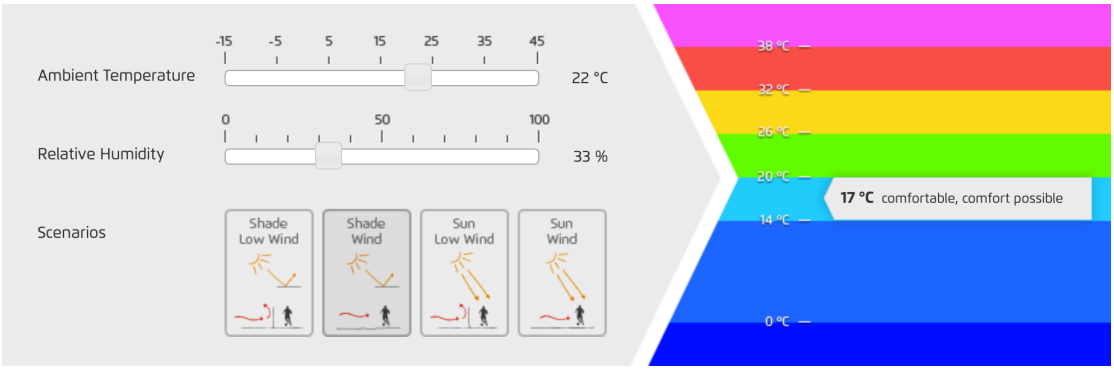


Figure 92. The outdoor comfort calculator

4.3.3.2 Day 1: noise level and air quality in Oxygen Park (24-04-2019)

The noise level readings of this day demonstrate that the highest sound level occurred between (5pm and 7pm) at 74dB (Figure 93). This may be due to renovations and thus construction in the park and the operating of the waterfall, which had been closed prior to this time. Comparatively, the sound was low at (2pm) at 35dB (soft). However, based on the survey result, 79.41% of users were comfortable with the noise level of this day.

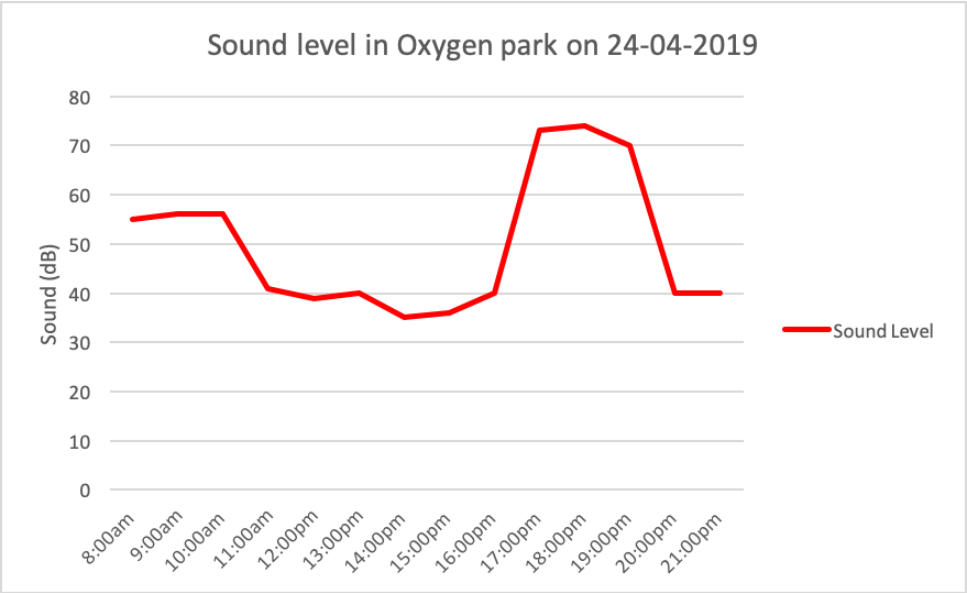


Figure 93. Sound level in Oxygen Park on 24-04-2019

The air quality readings of this day were in an AQI range between 51–100 (yellow), signifies that the air quality was 'moderate' and acceptable (Figure 94).

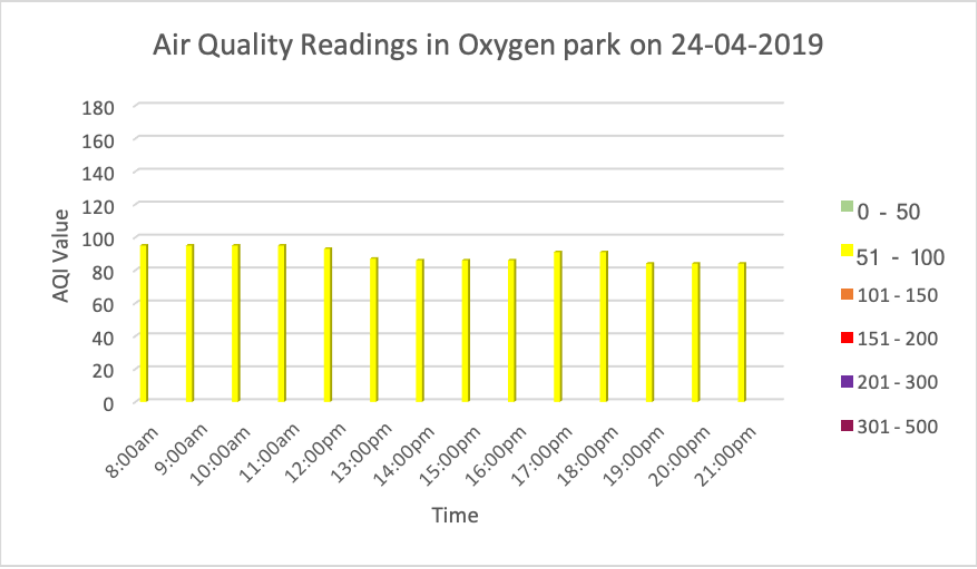


Figure 94. Air quality readings in Oxygen Park on 24-04-2019

4.3.3.3 Day 2: microclimate condition in Oxygen Park (27-04-2019)

The hottest peak of the day was logged in the afternoon period, between (1pm and 3pm), with 29°C, during which time low humidity was logged at 21% and moderate wind velocity was recorded at 21.6 km/h (Figure 95).

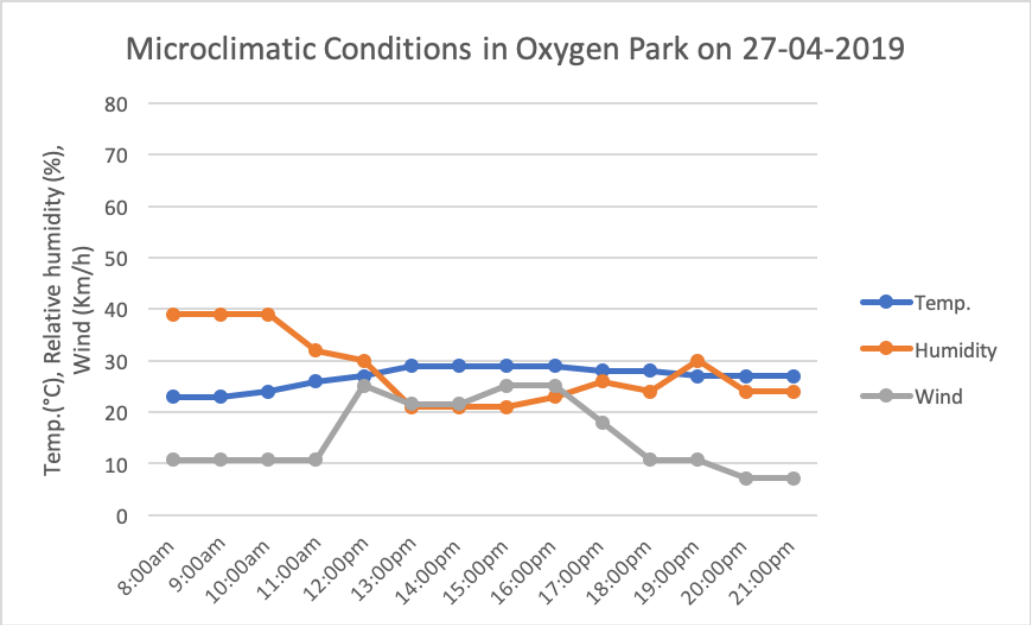


Figure 95. Microclimatic conditions in Oxygen Park on 27-04-2019

Based on these climate parameters, the sum temperature reached 23°C, as per the outdoor comfort calculator, as illustrated in Figure 96.

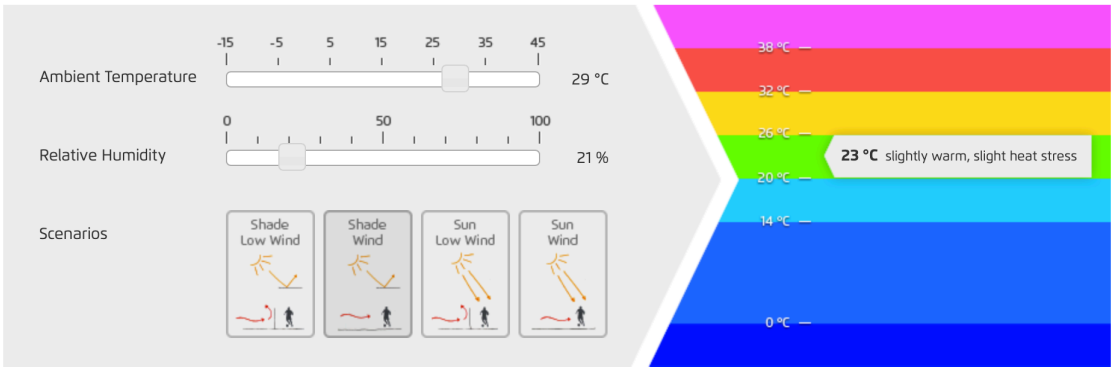


Figure 96. The outdoor comfort calculator

Further, the morning period between (8am and 9am) was the coolest peak, with the temperature reaching 23°C. This reading was logged with one of the highest humidity levels at 39% and the lowest wind velocity at 10.8km/h. Accordingly, the sum temperature reached 20°C (slightly warm, slight heat stress) (Figure 97).

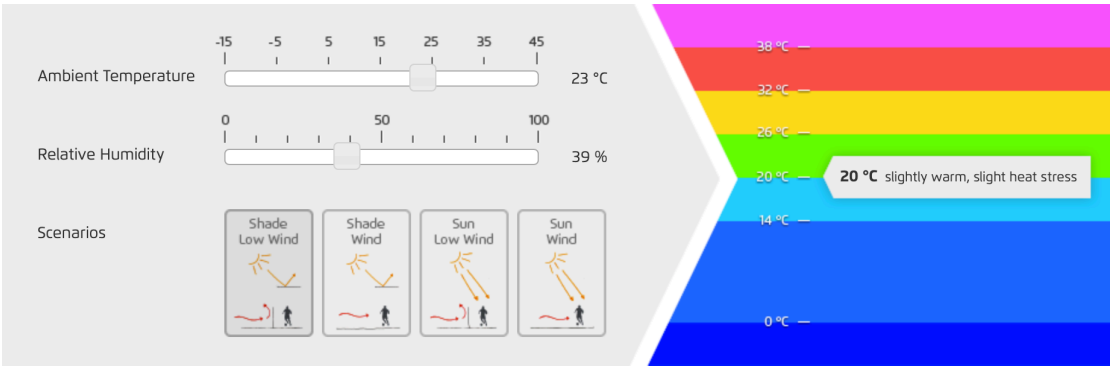


Figure 97. The outdoor comfort calculator

4.3.3.4 Day 2: noise level and air quality in Oxygen Park (27-04-2019)

As illustrated in Figure 98, the noise level readings of this day were between 30–40dB and 50–60dB. The high sound level was logged in the morning (9am) and

(10am) at 56dB, while the low sound level was logged at the afternoon at (12pm) at 37dB. Based on the survey, 97.73% of users were comfortable with the noise level.

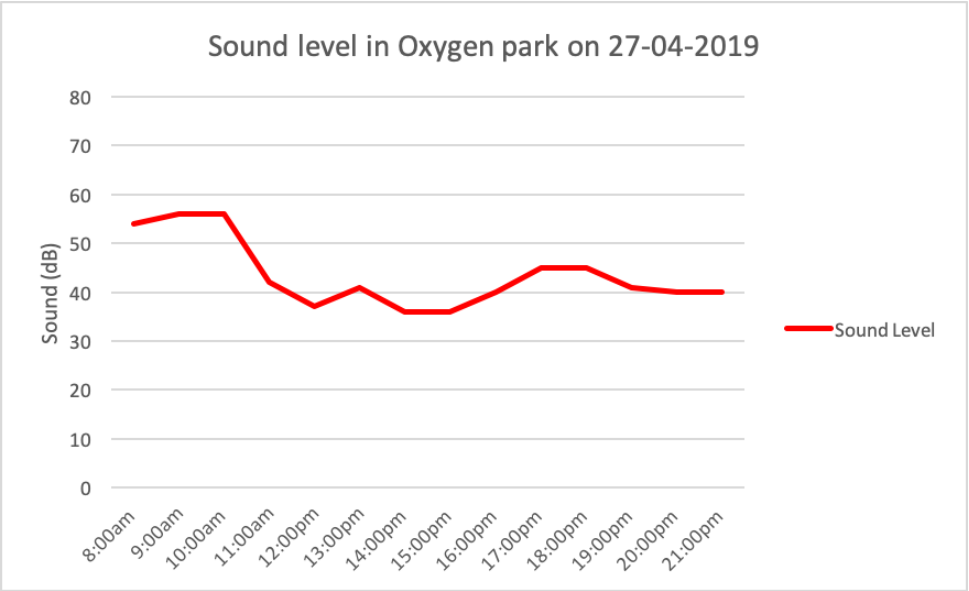


Figure 98. Sound level in Oxygen Park on 27-04-2019

Whereas, the air quality readings of this day were between 101–150, that is, 'unhealthy air for sensitive groups', as clarified in Figure 99.

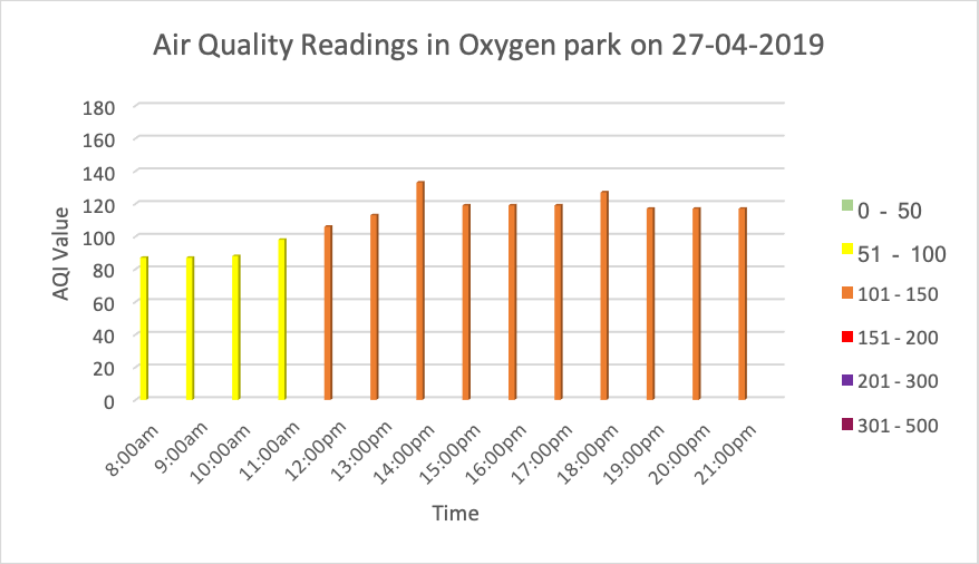


Figure 99. Air quality readings in Oxygen Park on 27-04-2019

4.3.4 Site observational of Oxygen Park

4.3.4.1 Day 1: site observation (24-04-2019)—10am, weekday

The site plan of the POS of Oxygen Park (Figure 100) includes a central circular multi-use sports court—this, including the observation for the upper level pathway—was used as the study space. On the 24th of April 2019, 12 people were seen using the space at (10am). Most of the observed users were using two main spots: the semi-covered walkway and the area near the waterfalls. Users appeared comfortable with regards the prevailing weather condition, where a temperature of 25°C, humidity of 27% and wind velocity of 25km/h were reached. Meanwhile, the sound level was high, due to factors such as regular maintenance work (i.e. landscaping) for which workers use machines with annoying sounds and the sound coming from the football pitch area under development. Adding to this, the air quality was moderate at 95.

The majority of users were male, and were primarily maintenance landscaping workers and cleaners. However, females were also observed, and were primarily QF students. Some of users were sitting under the waterfalls (a shaded area) and relaxing while others were walking under the covered area. No users were seen sitting on the amphitheater or in the sun. Significantly, the workers were working to maintain the trees and grass in the upper level. Security personnel were also spotted cycling in the space. It is worth mentioning that no children were noticed during this time.

Figure 100. Observational map of Oxygen Park on 24-04-2019 at 10am

4.3.4.2 Day 1: site observation (24-04-2019)—6pm, weekday

Based on the site observations and plan represented in Figure 101. On the 24 of April 2019 at (6pm), 26 people were observed using the POS of Oxygen Park,

multi-use sports circle. The weather was moderate: temperature was at 25°C, humidity was at 33% and the wind velocity was at 24 km/h. The sound level was 74 dB: during this hour, the waterfall was open, intensifying noise. The air quality was moderate at 91.

Users were male and female, groups and individuals. Some users were sitting in sun and others were walking in routes mainly around the edge and under the shaded/covered area while still others were running. Families and their children were seen walking and some parents were observed standing and watching their children playing in the sand trail. Moreover, there were a few children using bicycles.

Figure 101. Observational map of Oxygen Park on 24-04-2019 at 6pm

4.3.4.3 Day 2: site observation (27-04-2019)—10am, weekend

A description of the site plan of Oxygen Park on 27th of April 2019 at (10am) is shown in Figure 102. 10 of users were enjoying the moderate weather condition as a temperature reached 24°C, the humidity levels 39% and wind movement 10.8km/h. The sound level was 56 dB. The air quality was also moderate at 88.

Users were male and primarily workers. Some users were sitting and walking under the covered path facilitated by the waterfalls and vegetation, while others were sitting on the grass under a tree and another user was running on the upper level. It is important to mention that users seemed comforted by waterfall's beauty and refreshing spray of cold water.

Figure 102. Observational map of Oxygen Park on 27-04-2019 at 10am

4.3.4.4 Day 2: site observation (27-04-2019)—6 pm, weekend

On the 27th of April 2019 at (6pm), the Oxygen Park POS had a recorded air temperature of 28°C, humidity of 24% and wind velocity of 10.8km/h. The sound level was 45 dB. The air quality was 127. Approximately 70 people were observed on this evening (Figure 103), which may be attributed to the impact of the cooling unit. The circle shows a group of men and women, adults, families and children. using the volleyball pitches. There were approximately five children utilizing the sand trail. In addition, some users were walking on the running path along the upper level of this zone. Moreover, users were also moving around and sitting on the hills. The majority of users were walking along both covered and uncovered pathways and enjoying the atmosphere prior to sunset. It was observed that the majority of men were walking.

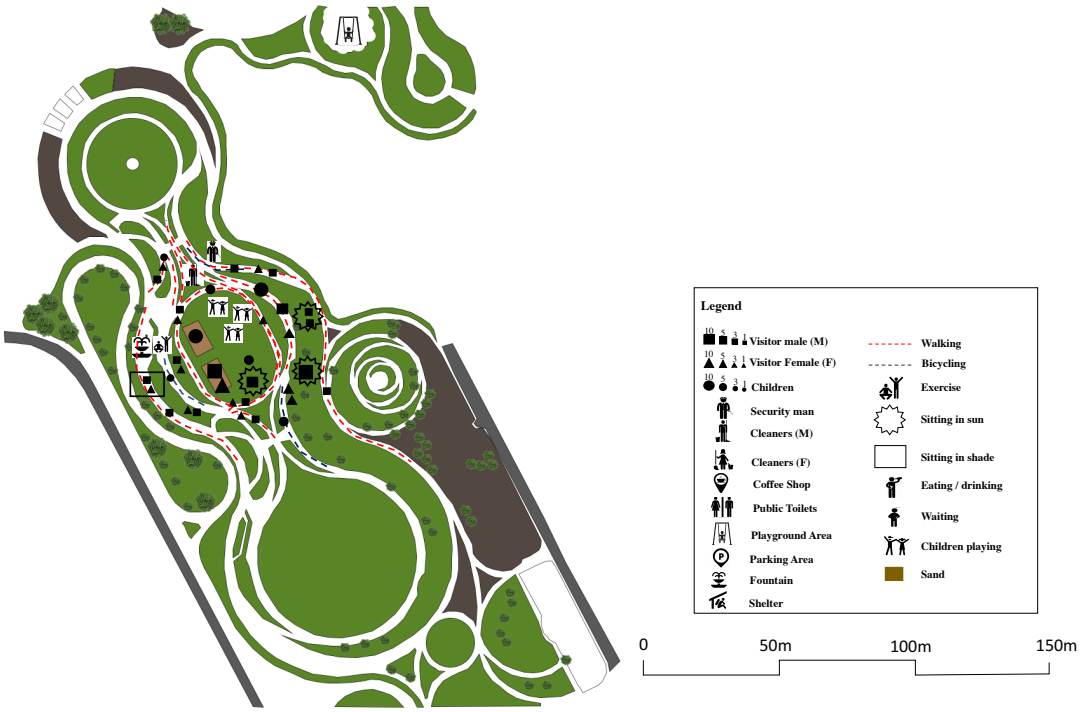


Figure 103. Observational map of Oxygen Park on 27-04-2019 at 6pm

4.4 POS of Msheireb Area: Barahat Msheireb and Sahat Wadi Msheireb

Msheireb Area is located in the center of the Doha, in Zone 3, where the old commercial hub and Doha's historic neighbourhoods are situated (Figure 104). The term ‘Msheireb’ takes its name from the Arabic word meaning ‘a place to drink water’, because people in the past used to take water from this area (Properties, 2011). Msheireb was represented a mixed-use neighbourhood populated by Qatari families and featured by Fereej that connects different types of spaces with single-story courtyard houses (Furlan, Petruccioli, & Jamaleddin, 2019). In 2010, the sustainable urban regeneration project began and the entire area of Msheireb was demolished, with the exception of four old houses located in the Heritage Quarter, which were restored and reopened for the public as museums to showcase the history of the Qatari people. The aim of this project was to revitalize the old commercial heart of the Msheireb area by encouraging an advanced and sustainable modern lifestyle inspired by traditional Qatari architecture that simultaneously preserves the historical area and the cultural heritage of Qatari society (Properties, 2011). The area of the development is around 35 hectares and the new development is divided into six phases by Msheireb Properties, as illustrated in Figure 105.

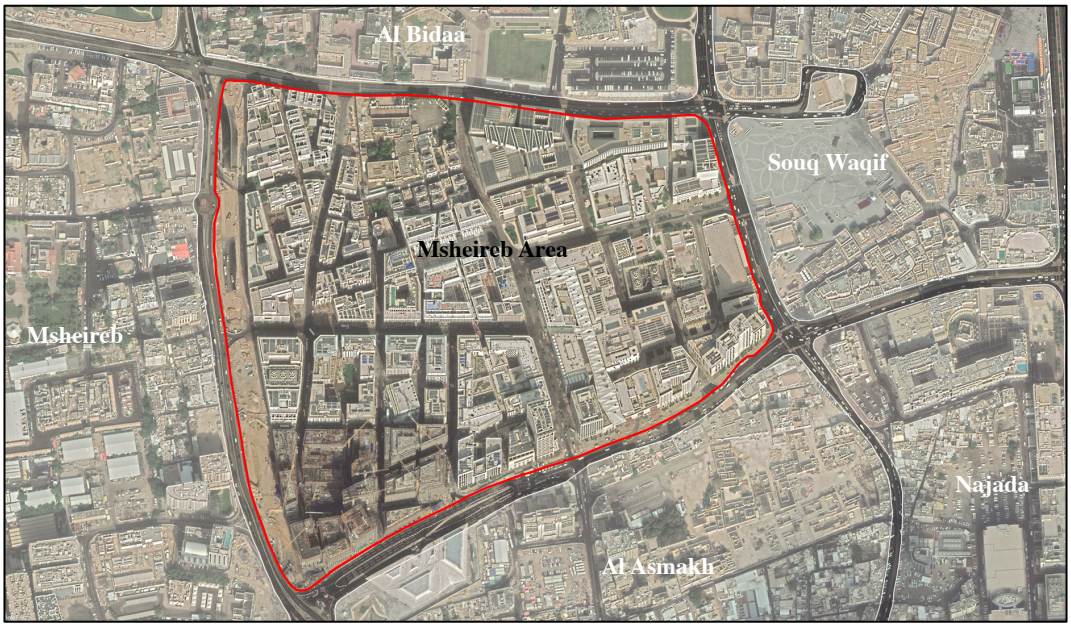


Figure 104. The location map of Msheireb Area (author)

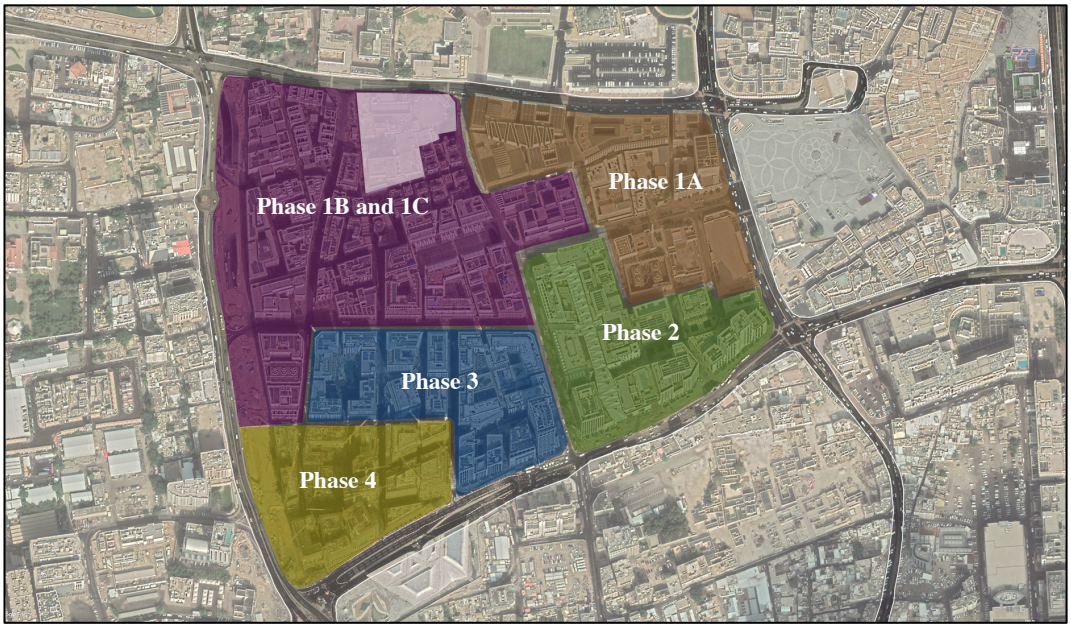


Figure 105.The phases of Msheireb project (author)

Presently, 95% of the first (A-B&C), second and third phases of construction have been completed. Some buildings are already opened for public use such as the acclaimed Msheireb museums, school, prayer ground and retail shops. Moreover, two hotels have recently opened: Al-Wadi Hotel and Mandarin Oriental (Figure 106).

Figure 106. Al-Wadi hotel and Mandarin Oriental hotel

Msheireb has strategic location as it surrounded by many significant destinations including Al Koot fort, Souq Waqif, the traditional Qatari Souq and Amiri Diwan. Msheireb is bordered by four main streets: (1) Jassim Bin Mohamed Street from the East, (2) Al Diwan Street from the West, (3) Al Rayyan Street from the North and (4) Wadi Msheireb Street from the South (Figure 107). Further, Abdulla bin Thani Street is located in the middle of area. These street networks play a role in connecting the area with surrounding destinations and thus make it easier for people to access the area from everywhere. Moreover, the heights of all buildings in the area range from 3 to 30 stories, providing pedestrians with shelter from the sun.

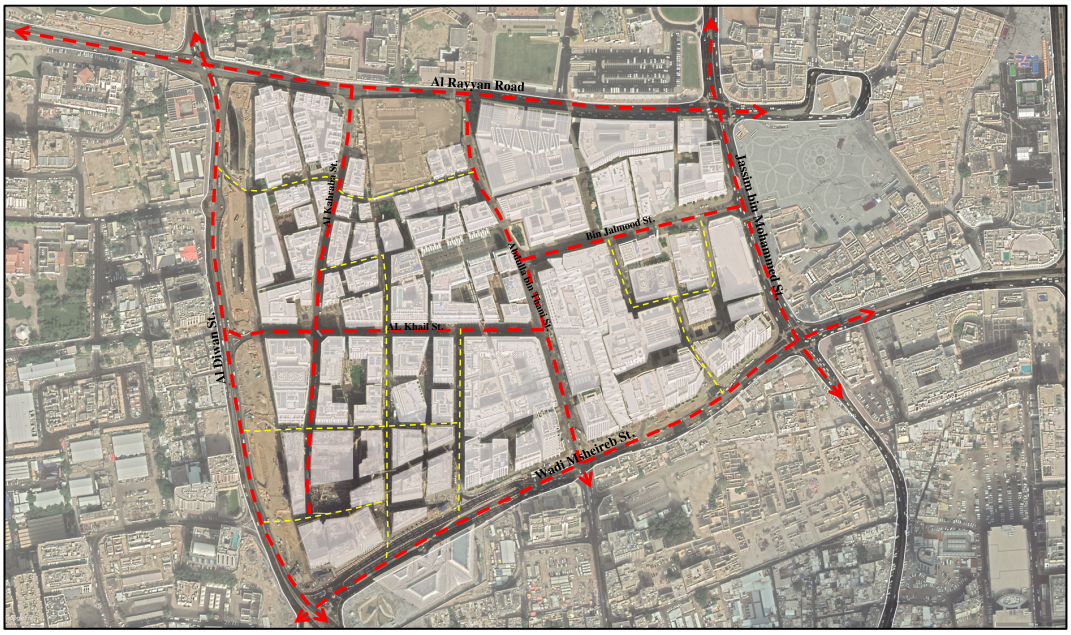


Figure 107. The streets networksof Msheireb Area (author)

Msheireb is made up of five distinct quarters (Figure 108); each quarter designed to be close to the others and provide a comfortable environment with shaded places in which to sit and along which to walk. More specifically, these quarters are:

(1) the Diwan Quarter, situated in the northeast corner of the area adjacent to Amiri Diwan and Souq Waiqf. This quarter made up of the new governmental buildings, such as Amiri Guard Building and the Qatar National Archive Building;

(2) the Heritage Quarter is located in the in the southeast corner of the area, adjacent to the Souq Waiqf and the Al Koot Fort. This quarter is the core historic area and contains the Msheireb Prayer Ground and the four old traditional houses that were restored and converted to the museums;

(3) the Mixed-use and Residential Quarter, located at the northern end of Al Kahraba Street. This quarter includes a school, a wide range of unique

apartments allocated in Fereej, cluster of services and shops, high level office buildings and community parks;

(4) the Business Gateway Quarter is situated in the southwest corner near to the retail quarter. This quarter includes office buildings spread over 193,000 m2 at Al Diwan Street and linked to the living area, schools, banks, mosques and the metro station of Sahat Al Nakheel and;

(5) the Retail Quarter is located in the west and extends through Sikkat Wadi Msherieb until it connects with the old retail area along Al-Kharaba Street. This quarter contains the largest POS square, Barahat Msheireb.

Figure 108. The five quarters of Msheireb Area (Properties, 2011)

With the aim of enhancing the liveability of the POS, the regenerated Msheireb Area contains different types of POS that have essentially existed in the past as well as properties considered by the urban design process as necessary outdoor spaces. This study evaluated these spaces with an eye for preserving its meaning and the character. The Msheireb POS have been categorized into the following: Courtyards; Fereej; Sikkat; Square and Plazas; Street Landscaping and Eid prayer ground. In this research study, two POS were selected for examination, namely; Barahat Msheireb (Square), and Sahat Wadi Msheireb (Plaza), as shown in Figure 109.

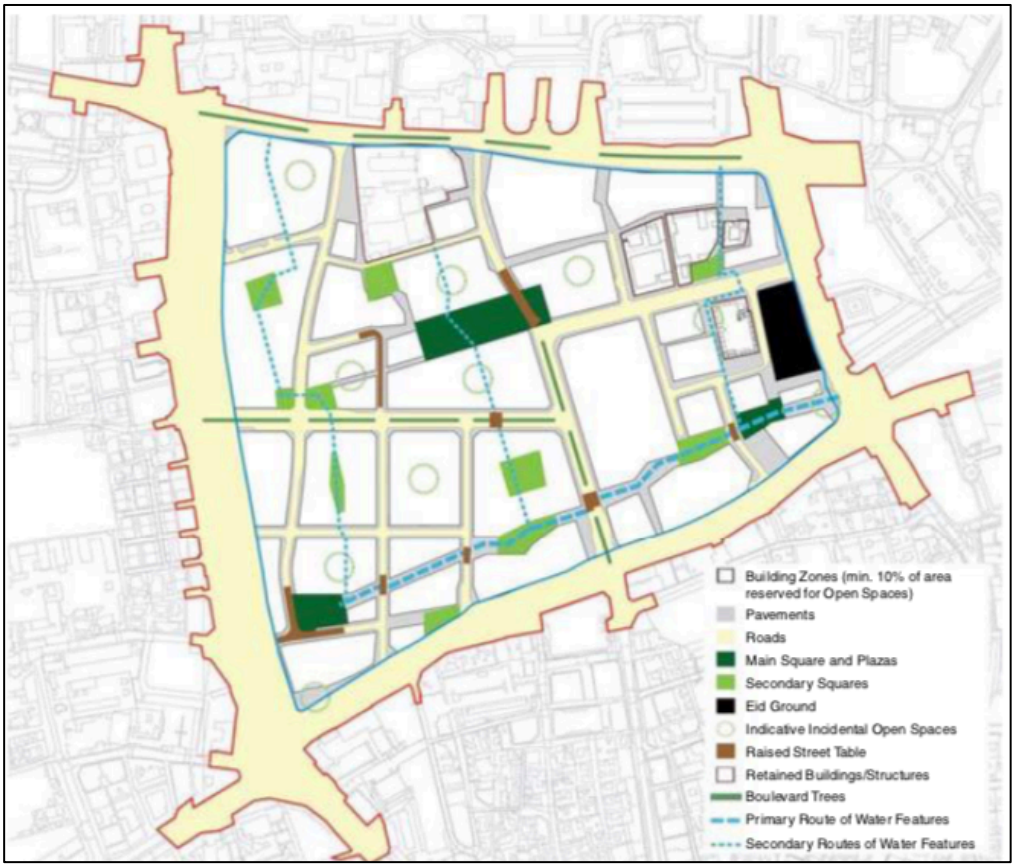


Figure 109. POS types of Msheireb Area (Furlan et al., 2019)

(1) Barahat Msheireb /Gathering Main Square (Figure 110)

Barahat is an old local name for the public open space that allowed people to meet and interact together. To preserve this terminology, Msheireb Properties named one of the biggest open-air squares in the area 'Barahat'. Barahat Msheireb is considered the main square and is located between the Mixed-use Quarter and the Retail Quarter, bordering Abdulla bin Thani Street on the East, where the street cuts Barahat in two parts. This location of Barahat is efficient because it is surrounded by different mixed uses, such as the Mandarin Oriental hotel, eleven food and beverage outlets and the cultural forum. The proximity of these uses enables activity and recreational use by all users.

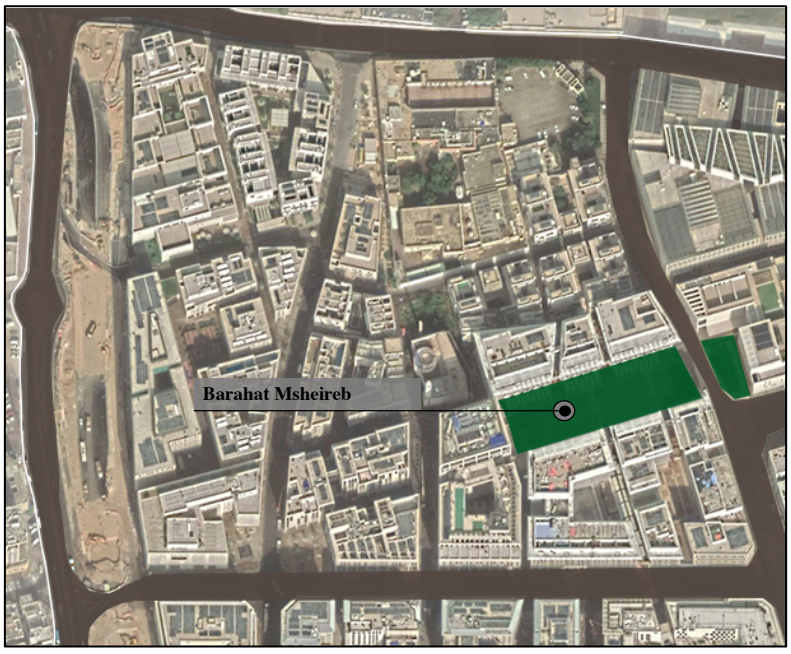


Figure 110. The location map of Barahat Msheireb

The design of Barahat is unique because of the different physical design elements that were available to create this year-round vibrant and healthy space all over the year in which to host live displays, exhibitions and community events. For this reason, Barahat was equipped to deal with the different environmental conditions that influence of the utilization of the place and user comfort, such as those climate variables highlighted by this thesis. In Barahat, the air temperature degree can be adjusted to be less 30°C, enabling users to comfortably have coffee and conduct other outdoor activities throughout the year. One of the significant elements is the presence of a large retractable roof, which distinguishes Barahat as a POS (Figure 111). This retractable roof can be used to protect users from the summer heat as well as from the cold temperatures of the winter season. Adding to the roof, there are also innovative cool pool systems scattered throughout the space. This system works to push chilled air up from the ground with the aim of keeping visitors comfortable during summer period so that they can enjoy outdoor activities and create a lively atmosphere. Thus, the Barahat is likely to be a vibrant and active space throughout the year.

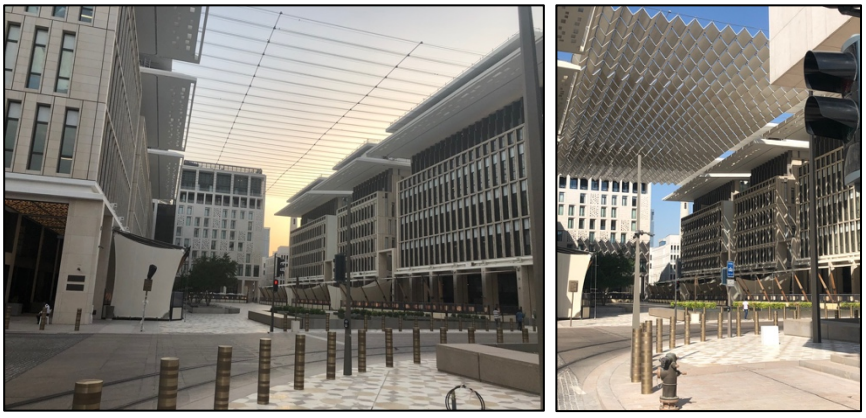


Figure 111. The retractable roof in Barahat Msheireb

However, because the Barahat is still not fully operation, the number of users is currently very low, although the users that do frequent it are of a variety of nationalities and origins. It is expected that once the surrounding shops are fully open, many more visitors will be attracted to the space.

(2) Sahat Wadi Msheireb - Plaza (Figure 112)

Sahat Wadi Msheireb is another POS located in the Retail Quarter and surrounded by medium-rise commercial, and retail buildings. The POS of Sahat Wadi Msheireb is well-connected and provides access to the surrounding areas by the Souq Waqif underground tunnel (which has both stairs and elevator). The space also can be accessed from Abdulla bin Thani Street, which connects the space with the main POS, Al Barahat, through Sikkat Wadi Msheireb. Abdulla bin Thani Street was designed to include a pedestrian path, drop-off area, bicycle lanes and racks and a bus stop to provide a safe and comfortable environment that enables people to walk and move freely between these spaces. Within Msheireb, streets and buildings are linked through 'Sikkats', zigzagged narrow alleyways that extend between buildings and feature high walls, linking the POS throughout the area and providing shaded and comfortable spaces for walking (Figure 113). This structure also encourages cool air movement to enhance the users comfort walking along these roads even over the summer seasons.

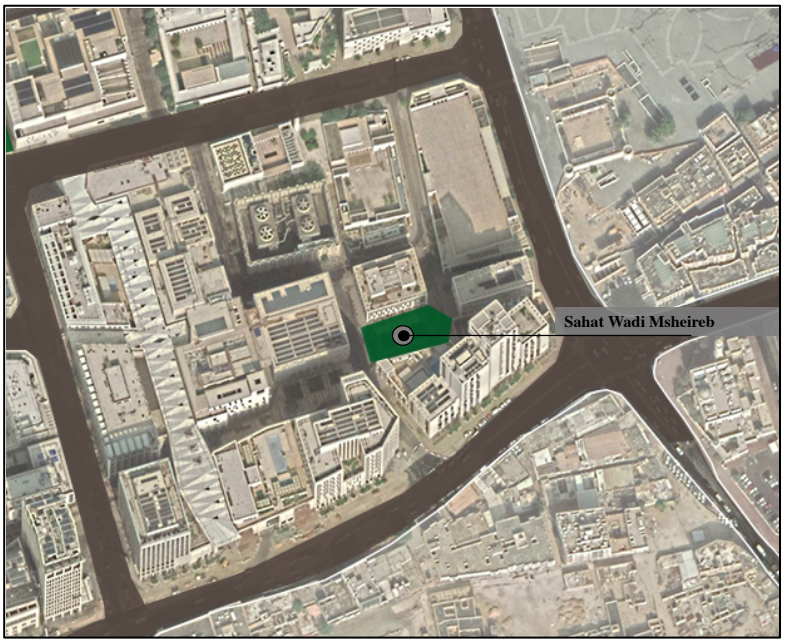


Figure 112. The location map of Sahat Wadi Msheireb

Figure 113. The concept of Sikkat

4.4.1 POS physical characteristics assessment

Similar to the other two POS, the Barahat and Sahat Wadi Msheireb demonstrate some of the physical characteristics and elements discussed in the literature review. These characteristics and elements were also reviewed during the interview with the

Design Manager of Msheireb Properties in addition, of course, to being visually observed. The existing physical elements and related observations are as follow:

- Various types of plants, attractive shrubs and flowers are scattered throughout Msheireb (Figure 114).
- Water features exist in various forms: water wall, water pool and fountains of all kinds (Figure 114).

Figure 114. Types of vegetation and water features in Msheireb POS

- Msheireb has adopted the concept of 'Light-Dark-Light' for its building facade lighting (Figure 115). This concept means that all decorative lighting for the main buildings concentrated on highlighting the building's entrances, the ground floor level and roofscape. Thus, it was observed that in both POS, the location of the lighting systems was very effective (Figure 116). Further, different types of lighting were present such as column lighting and spotlighting. In addition, security personnel and CCTV systems were observed throughout the area. The presence of lights and security officers create a sense of safety and comfort for the user.

Figure 115. Msheireb lighting master plan (Arup)

Figure 116. Lightings in Msheireb POS and security personals

- While there are only a few concrete seats in Barahat were users can sit and gather (Figure 117), these seats are shaded by the trees. No other seats are

provided and also no seats are provided in Sahat Wadi Msheireb; however, since Barahat and Sahat Wadi Msheireb include different types of restaurants scheduled to open soon, they will soon provide outdoor seats for visitors. On another note, it is worth mentioning that an Automatic Waste Collection System (AWCS) was implemented in the Msheireb Area. This system fits trash bins with underground vacuum technology. In both POS, the general bins and the recycling bins were installed with this technology to avoid the likelihood of litter and to raise awareness of recycling, as shown in Figure 117.

Figure 117. Concrete seats in Barahat and type of trash bins

- Msheireb has implemented a unique signage system (Figure 118). In both POS, the signage is clear and readable. However, it has been observed that some users have difficulties reaching the Barahat and Sahat Wadi Msheireb due to the limited directional signage.

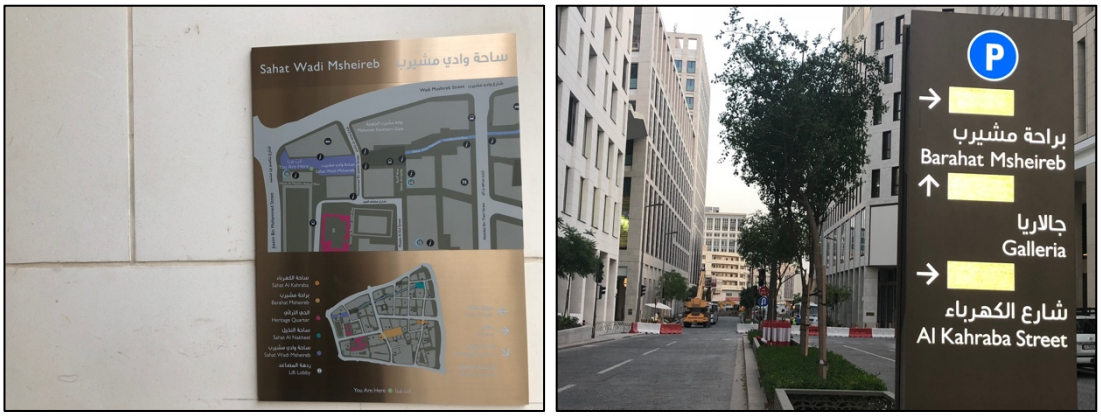


Figure 118. The signage in POS of Msheireb Area

- In both POS, there are no public toilets that specifically serve the spaces; however, because both POS are well-connected at the ground level with surrounding buildings with retail shops and mosques, users can use these amenities. In addition, there are mosque near Barahat and other near Sahat Wadi (Figure 119). Further, several shops are scheduled to open soon in both POS. In Sahat, a few shops have opened in the tunnel (Figure 120).

Figure 119. The mosque near to the Sahat Wadi and the tunnel

- Msheireb has parking lots both on the surface and underground. The underground parking lots covers the entire area of Msheireb, it is one of the world's largest car parks, with a capacity of 10,000 cars.
- The surface of the ground in Msheireb is flat and has a light-colored hard concrete flooring in some areas and dark flooring in others. Moreover, it uses sand in the Sikkat.

Turning now to the results of the user surveys on the physical design elements of Barahat and Sahat Wadi Msheireb, it is clear, as Figure 120 details, that users primarily desire public toilets (45.33%), seats (44.00%) and coffee shops (40.00%). The majority of users believe that more of these elements should be installed in the area. Meanwhile, participants were pleased with other current physical elements of the study, such as water features, vegetation, lighting and security personnel.

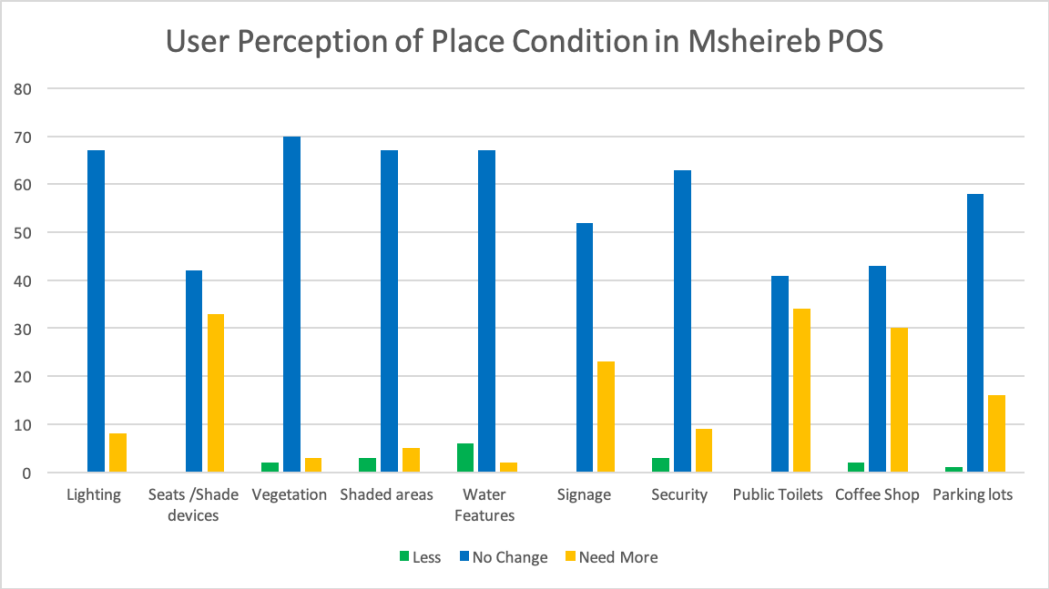


Figure 120. The user perception of Msheireb POS condition

4.4.2 POS non-physical characteristics assessment

4.4.2.1 User physical well-being: activities in Msheireb POS

In both Msheireb POS, a variety of social, necessary and optional activities were observed. Users were observed sitting on concrete seats under the trees to enjoy their time and relax and walking within the POS. The primary activities in both spaces were walking, sitting, eating and gathering. Figure 121 illustrates the percentages of diversified activities in Msheireb POS based on the two-day survey.

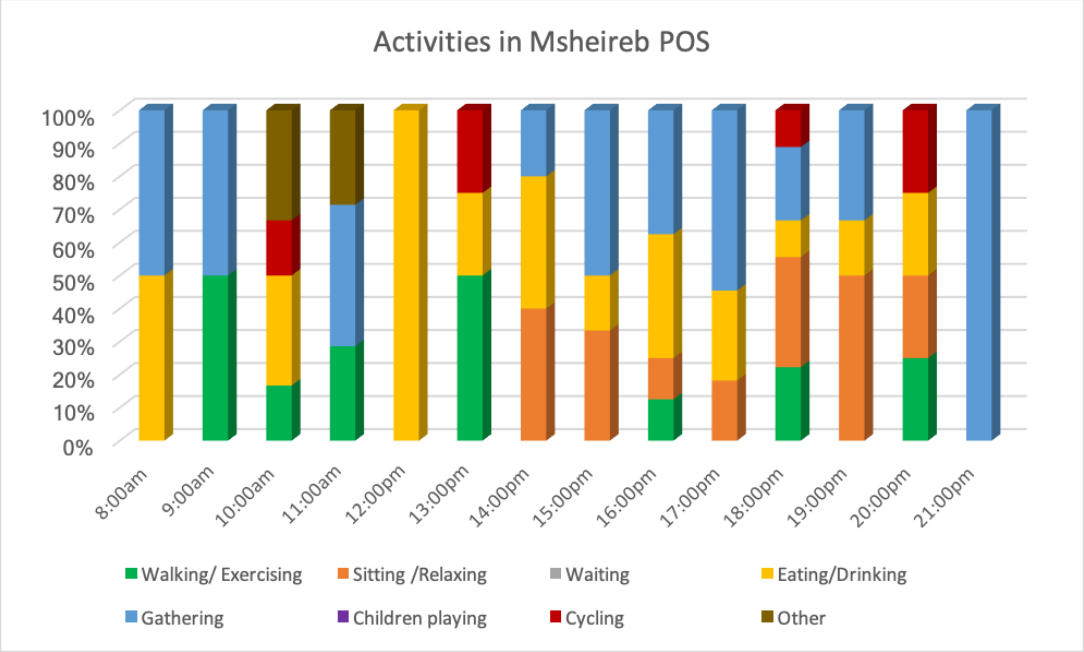


Figure 121. Activities in Msheireb POS (weekdays & weekends)

A POS in itself is a necessary aim, enabling guests to engage in recreational, social and cultural activities involving cafés and exhibitions (Gehl, 2007). Over the two days, it was observed that Barahat and Sahat Wadi lack outdoor exhibitions and cultural activities, perhaps due to the fact that the area is still under development.

4.4.2.1.1 Type of user

Both Barahat and Sahat Wadi Msheireb proved attractive to adults and families. Over the two days of site observations it was been observed women 54.67% utilized the POS more than men 45.33% (Figure 122).

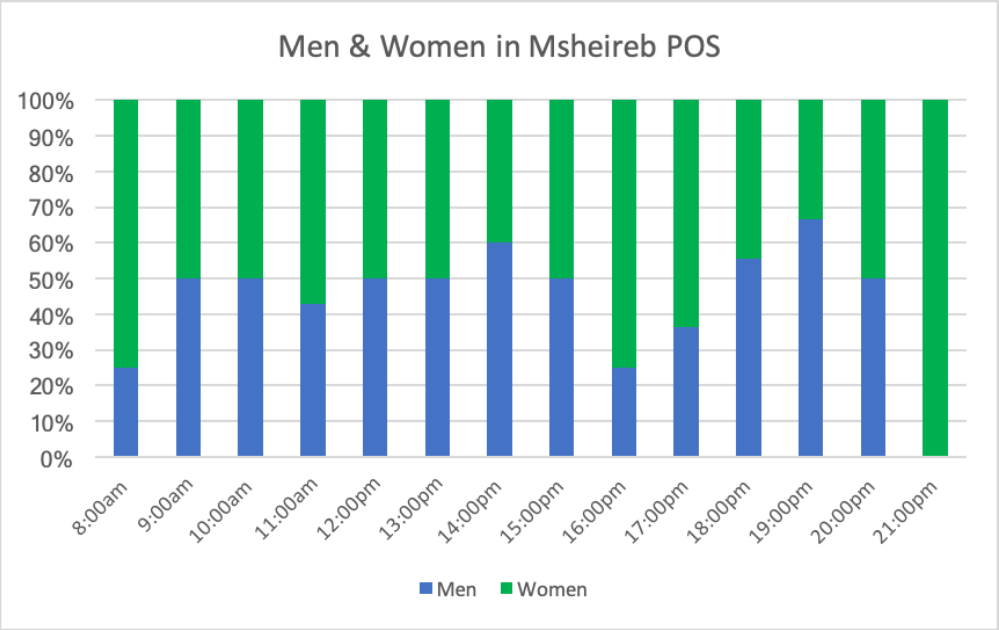


Figure 122. Average proportion for the women and men in Msheireb POS

4.4.2.1.2 level of use

In POS of Msheireb, surveys and observations revealed that users usually spent a long time in the POS when they came with groups and families, especially over the weekends and during the evenings. The fact that the area remained under development and most buildings and retail shops were not yet open may have influenced the length of time users spent at these outdoor spaces. Thus, POS of Msheireb area is expected to become an increasingly a vibrant environment that will be occupied by many people and activities once it is fully open.

4.4.2.2 User psychological well-being: psychological adaptation

4.4.2.2.1 Day 1: questionnaire survey assessment (28-04-2019)—weekday

Based on the survey and as shown in Figure 123, during the morning and afternoon period between (8am and 3pm), 100% of Msheireb users were unable to tolerate and enjoy the overall the weather condition which was characterized by light rain; they preferred low temperatures and humidity levels and higher wind velocity. From (4pm to 5pm), users began to accept the weather conditions: 75% preferred no change in temperature and the humidity level, and only 25% of users desired higher air movement. Consequently, it can be argued that users were unable to bear the hard weather conditions of the morning and afternoon. Over the evening period, from (6pm to 9pm), 100% of users were satisfied with the temperature, humidity level and wind velocity and they did not desire any changes in general weather conditions. It is worth noting that at (9pm) no users filled out the survey; a gap in thus evident in the graph.

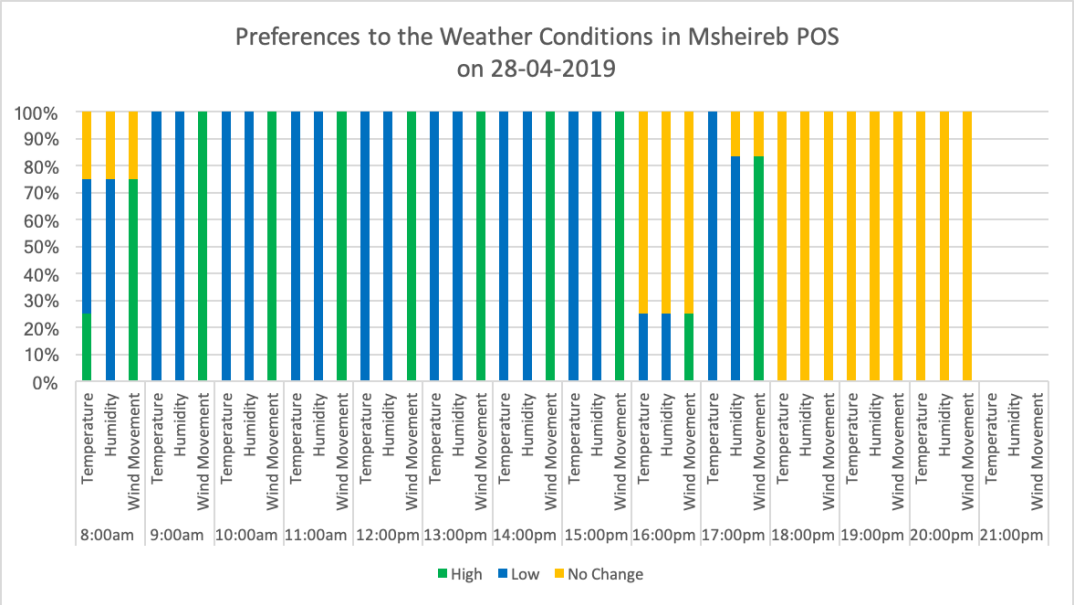


Figure 123. User's preferences to the weather conditions in Msheireb POS on 28-04-2019

With regards to the duration of stay, the survey results indicate that only 32.50% of visitors were able to stay in the POS for over an hour. The time of stay was impacted by several factors such as user tolerance of weather conditions, many retail shops not yet being open and the fact that the majority of visitors were visiting the area for the first time.

As illustrated in Figure 124, around 40 visitors were surveyed on this day. During the time period between (8am and 1pm), few visitors were found in either POS. However, between (2pm and 5pm), visitor volume quickly grew, reaching a total of 15 people with 33% of users planning to stay for more than an hour.

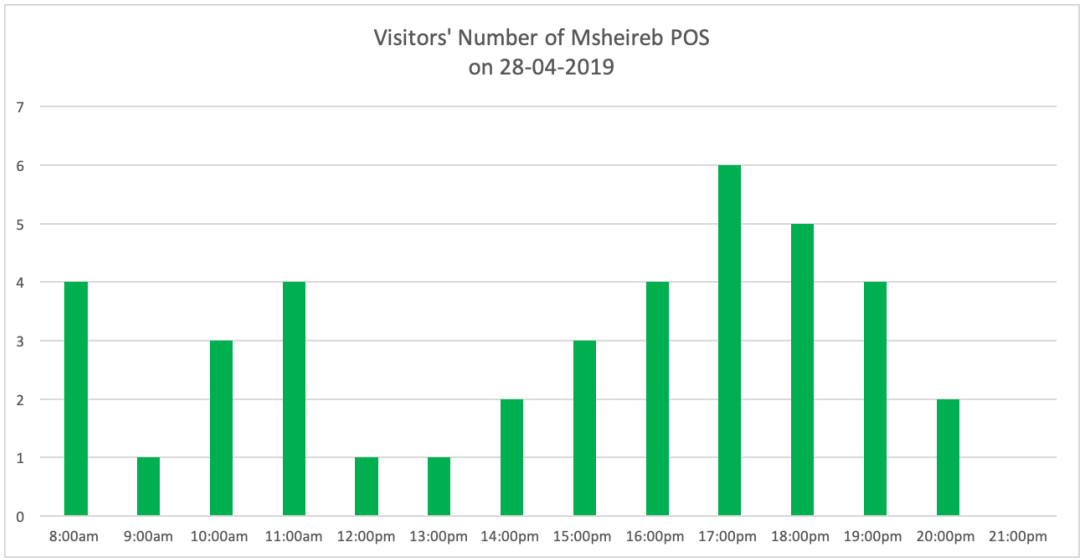


Figure 124. Visitors' number survyed in Msheireb POS on 28-04-2019

The environmental stimulations at these POS also encouraged people to visit and stay for a relatively long time. Such traits include water fountains, water ponds, the sound of the water and various plants and trees (Figure 125).

Figure 125. Environmental stimulation features in Msheireb POS

On a similar note, the majority of users felt comfortable throughout the day in both POS as a result of good air movement in the space. In particular, at (4pm), 75% of user reported feeling very comfortable. (Figure 126).

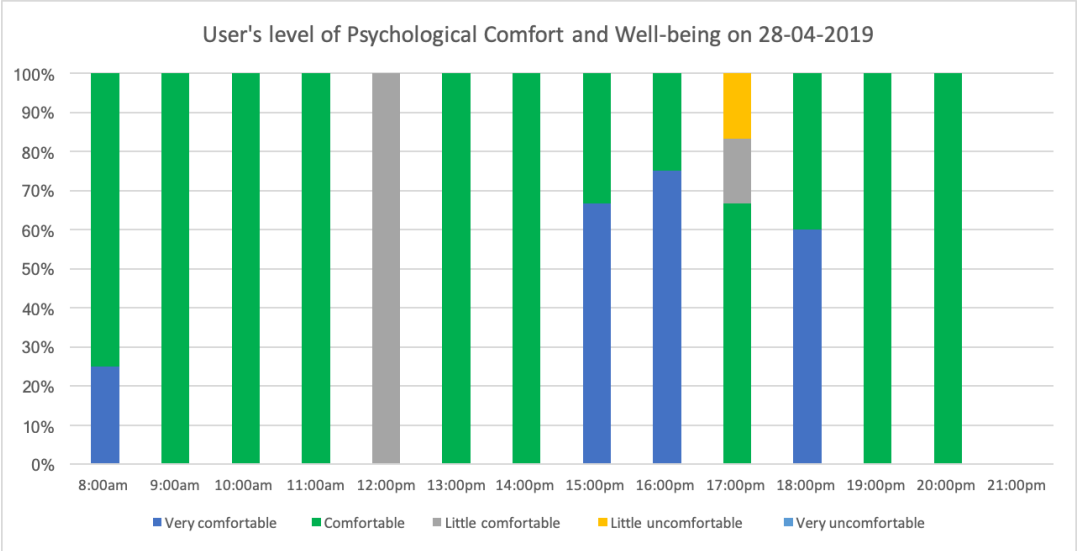


Figure 126. Level of psychological comfort and well-being in Msheireb POS on 28-04-2019

It was noticed that between (8am and 1pm) the POS were occupied by an increasing number of individuals and groups, most of whom had come from Souq Waqif through the tunnel to explore the area and mainly sought to visit Barahat Msheireb. Moreover, because the area is still under development, contractors and construction workers were scattered throughout the area. Between (4pm and 6pm), the POS of Msheireb were primarily used by groups (friends and couples) 20%, families 40% and individuals 40% (Figure 127). Additionally, between (7pm and 8pm), the spaces were occupied only by individuals and groups.

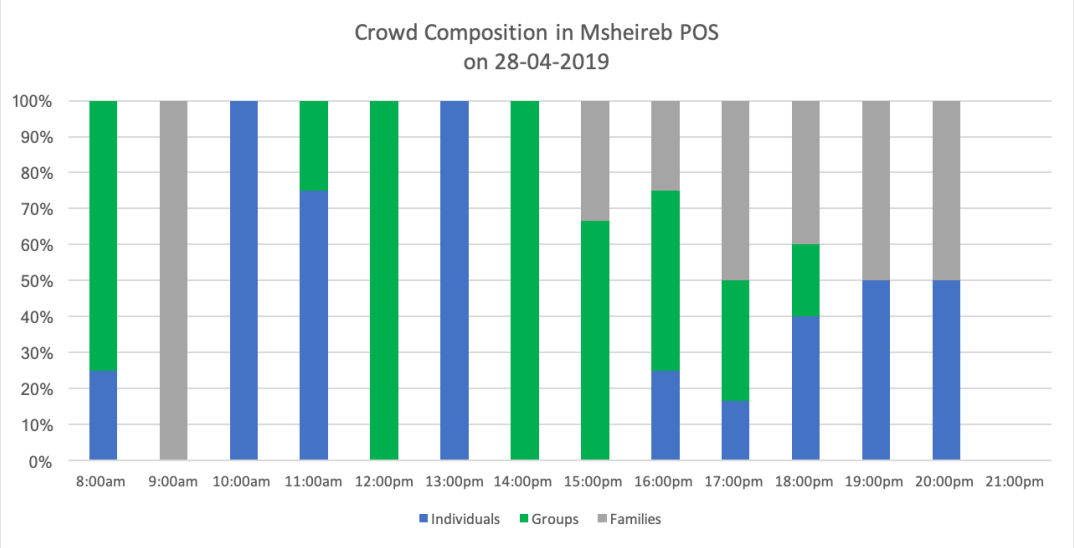


Figure 127. Crowd composition in Msheireb POS on 28-04-2019

4.4.2.2.2 Day 2: questionnaire survey assessment (04-05-2019)-Weekend

The survey results shown in Figure 128 demonstrate that in the morning period (beginning at 9am) and the afternoon period (beginning at 12pm), 100% of Msheireb users were accepted and enjoyed the overall weather condition. From (1pm to 5pm),

40% of users did not desire any change in the humidity level, 60% no change in air temperature and 80% no change in wind velocity. Over the evening period, from (6pm to 9pm), 25% desired lower humidity level, 100% were satisfied with the temperature and 25% desired more wind movement. However, based on the site observation, most users were able to endure the different circumstances of the environmental variables over the evening period because of the moderate climate in general.

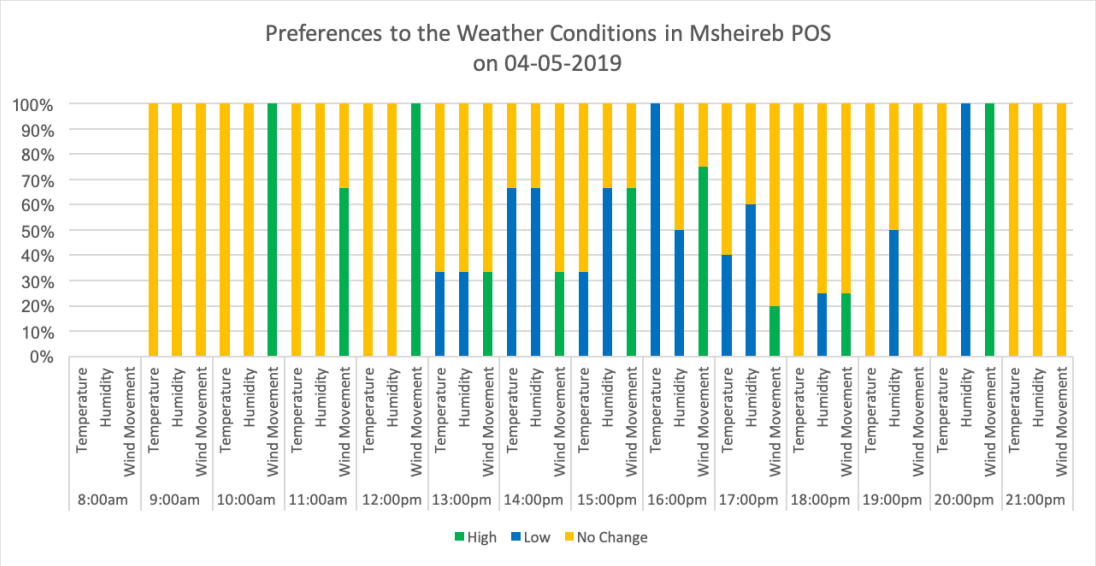


Figure 128. Users preferences to the weather conditions in Msheireb POS on 04-05-2019

As shown in Figure 129, approximately 44 visitors were surveyed on this day, perhaps because users were able to tolerate the overall environmental conditions. From (1pm to 5pm), approximately 18 people used the space. Generally, and according to observations, very few people used either POS on this day and any who did spend only a short time.

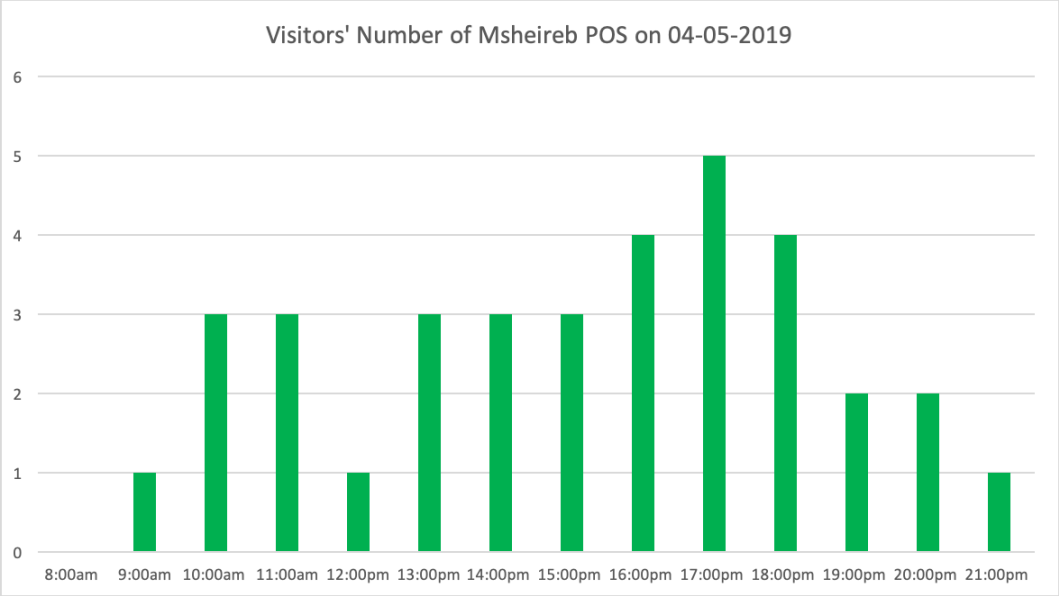


Figure 129. Visitors' number survyed in Msheireb POS on 04-05-2019

Exposure time depended on whether users were alone, in groups or with families. It was noticed that users stayed in the POS longer when they were with groups or families. Based on the survey, from (9 am to 12pm), individuals, families and small groups were found in the space. At (2pm), users were primarily individuals and groups. Meanwhile, from (4pm to 9pm), groups, individuals and families were observed (Figure 130).

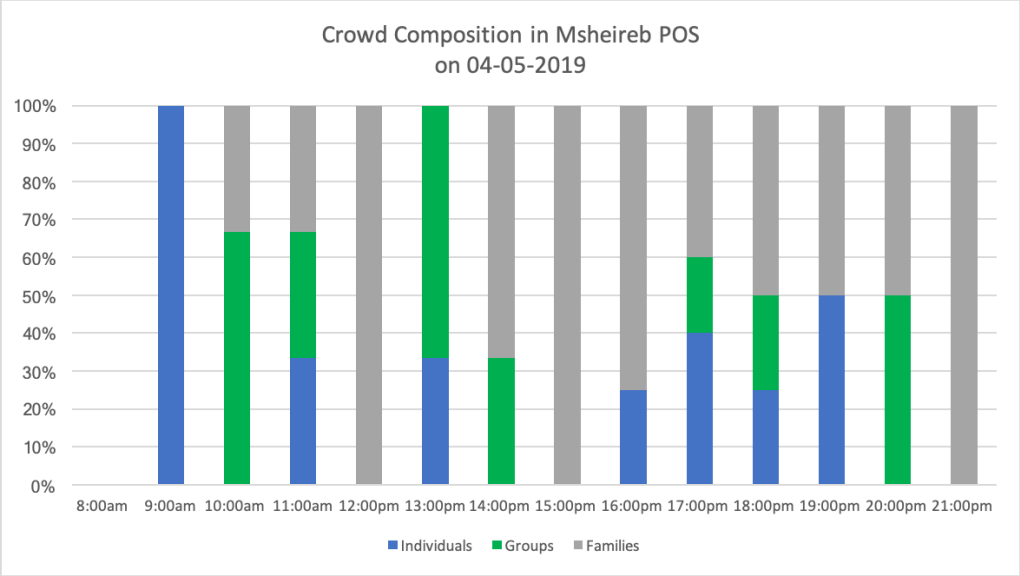


Figure 130. Crowd composition in Msheireb POS on 04-05-2019

4.4.3 Environmental conditions assessment

4.4.3.1 Day 1: microclimate conditions in Msheireb POS (28-04-2019)

On this weekday, the hottest peak was recorded during the afternoon period at (1pm) at 31°C with humidity recorded at the high level of 29% and moderate wind velocity at 14.4 km/h (Figure 131).

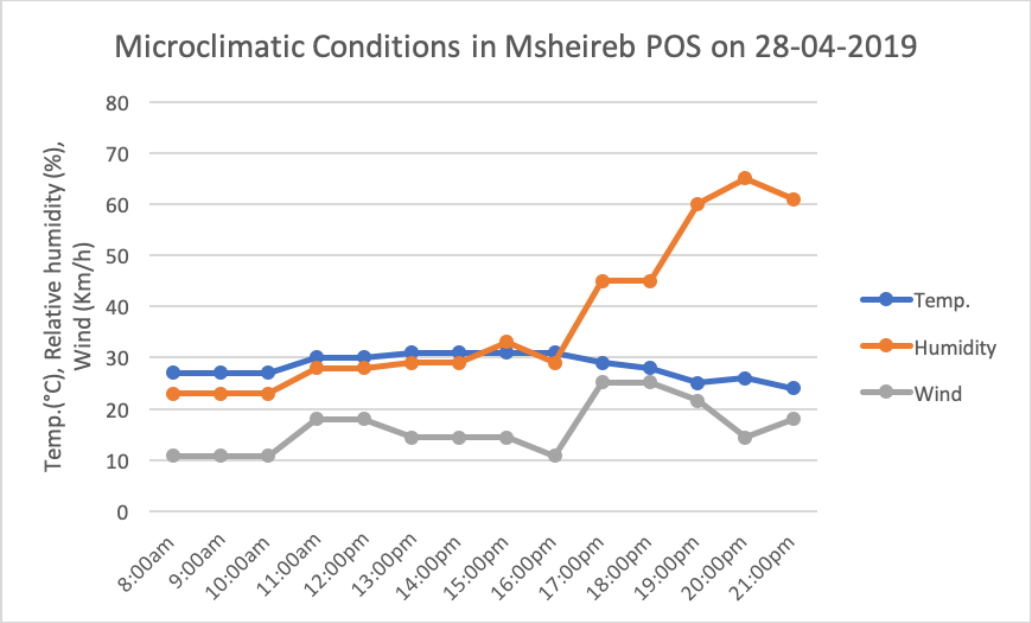


Figure 131. Microclimate conditions in Msheireb POS on 28-04-2019

Based on these climate parameters readings, the sum temperature reached 27°C, as per the outdoor comfort calculator (Figure 132).

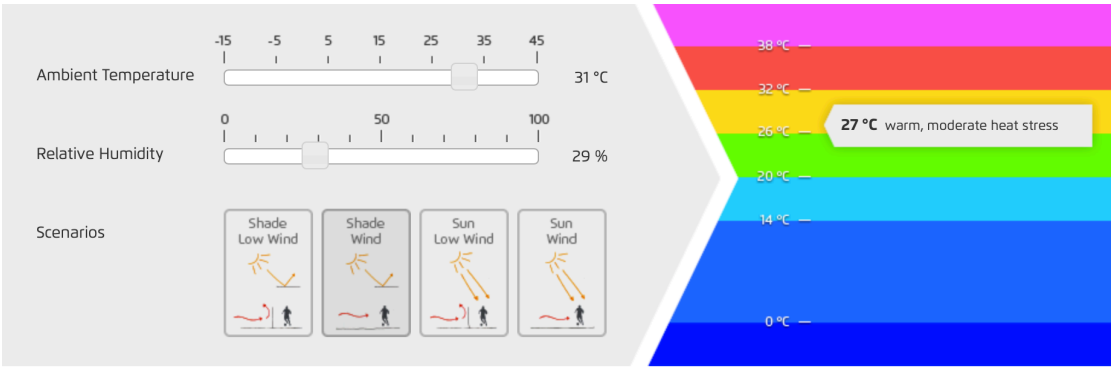


Figure 132.The outdoor comfort calculator (TranssolarKlimaEngineering, 2019)

Meanwhile, the coolest peak was recorded during the morning period at (7pm) at 25°C with one of the highest humidity levels recorded on this day at 60% and the highest wind velocity at 21.6km/h. Based on these climate parameters, the sum temperature reached 23°C (slightly warm, slight heat stress), as per the outdoor comfort calculator (Figure 133).

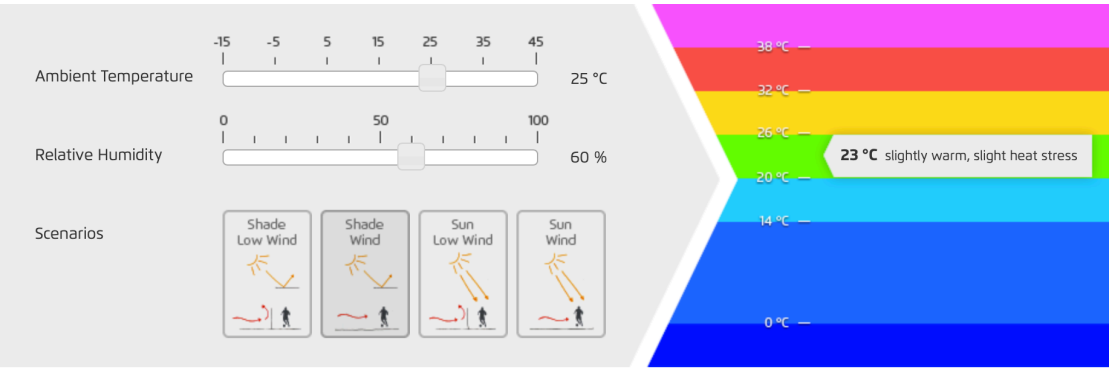


Figure 133. The outdoor comfort calculator

4.4.3.2 Day 1: noise level and air quality in Msheireb POS (28-04-2019)

The noise level of this day was between 30–40dB and 50–60dB. The highest sound level was in the evening period at (6pm) at 57dB and the lowest in the morning period between (8am and 9am) at 30dB (Figure 134). Both value levels can be classified as soft and moderate, and the survey revealed that 97.50% of users felt comfort with the noise level of this day.

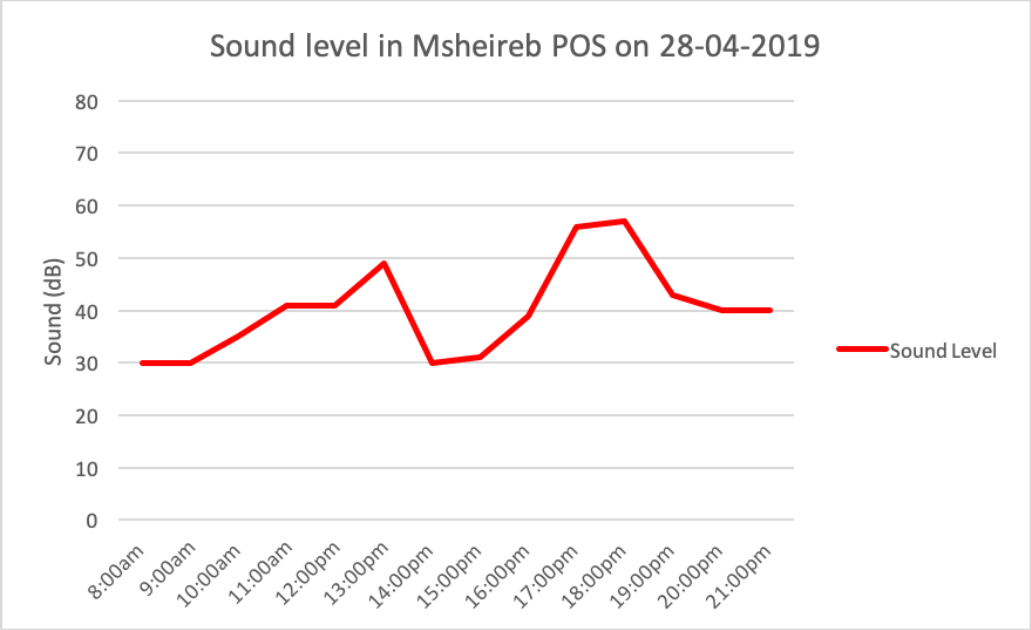


Figure 134. Sound level in Msheireb POS on 28-04-2019

While, the air quality readings of this day show that between (8am and 10am), the AQI values were between 151–200(red) range, signifying ‘unhealthy’ air quality. For the rest of the day, the AQI values were between 101–150 (orange), signifying ‘unhealthy air for sensitive groups’, as clarified in Figure 135.

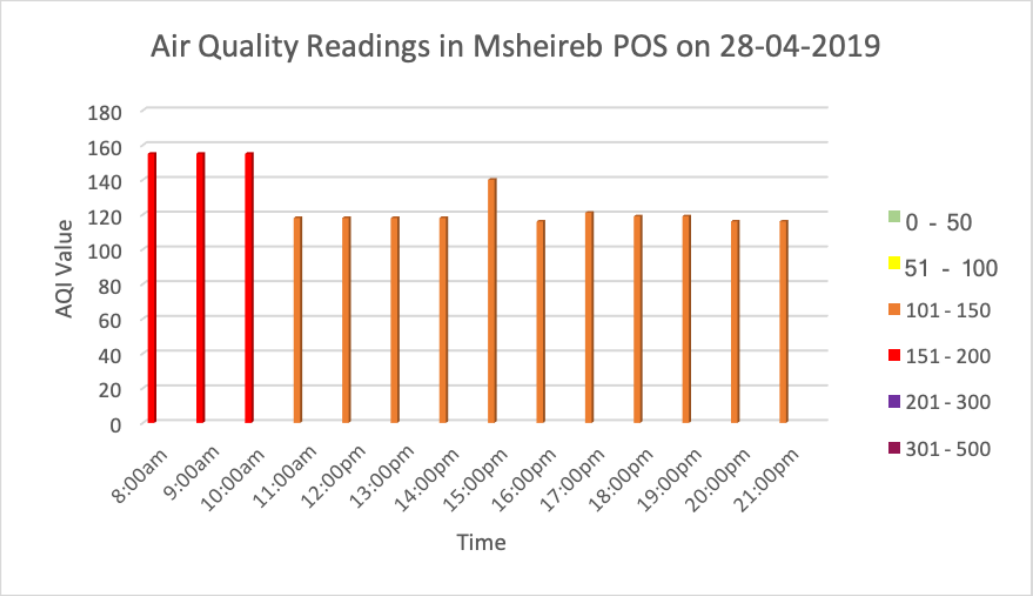


Figure 135. Air quality readings in Msheireb POS on 28-04-2019

4.4.3.3 Day 2: microclimate conditions in Msheireb POS (04-05-2019)

The hottest peak was logged during the afternoon at (3pm) at 34°C. The humidity was recorded at a low level at 26% and one of the highest wind velocities was observed at 14.4 km/h (Figure 136).

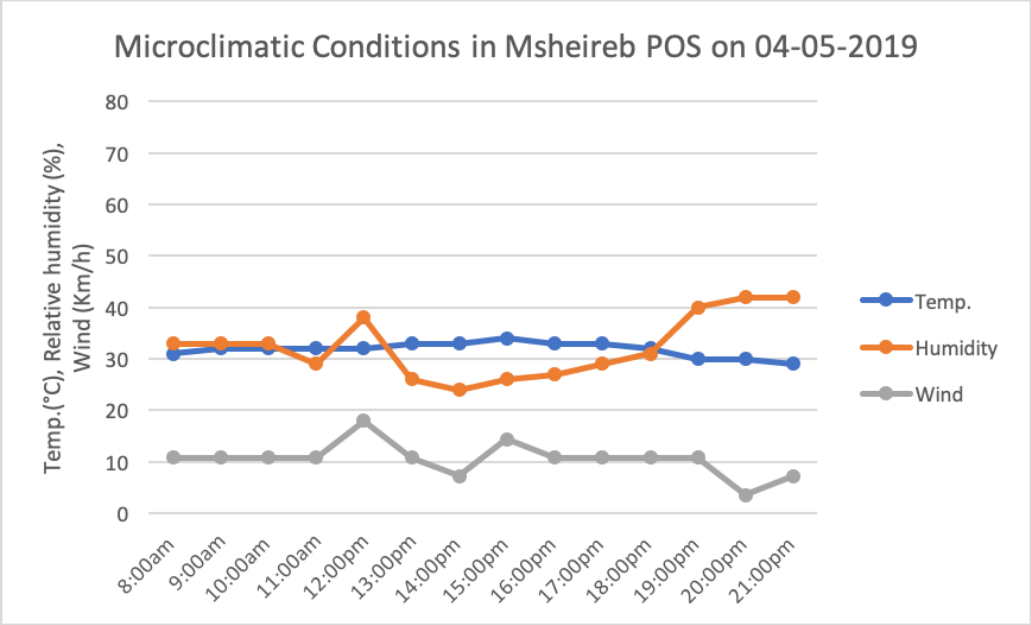


Figure 136. Microclimate conditions in Msheireb POS on 04-05-2019

Based on these climate parameters, the sum temperature reached 29°C, as per the outdoor comfort calculator (Figure 137).

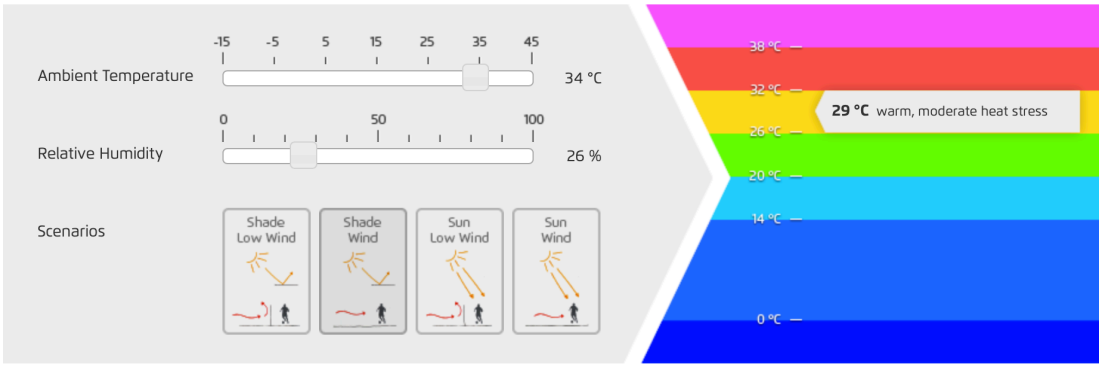


Figure 137. The outdoor comfort calculator

Alternatively, the coolest peak was recorded in the morning period at (9am) at 29°C during one of the highest humidity at 42% and one of the lowest wind velocities at 7.2km/h. Based on these climate parameters, the sum temperature reached 27° C (warm, moderate heat stress) (Figure 138).

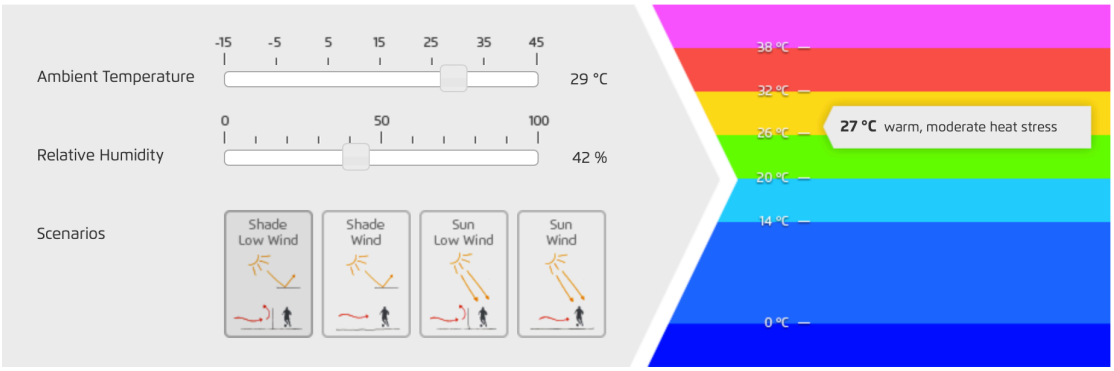


Figure 138. The outdoor comfort calculator

4.4.3.4 Day 2: noise level and air quality in Msheireb POS (04-05-2019)

As clarified in Figure 139, on this day, the noise level was between 30–40dB and 50–60dB. The highest sound level of this day was logged in the evening period at (7pm) at 49dB, while the lowest sound level was logged in the morning period between (9am and 10am) at 30dB. These findings align with the survey results which reveal that 94.12% of users felt comfort with the POS noise levels.

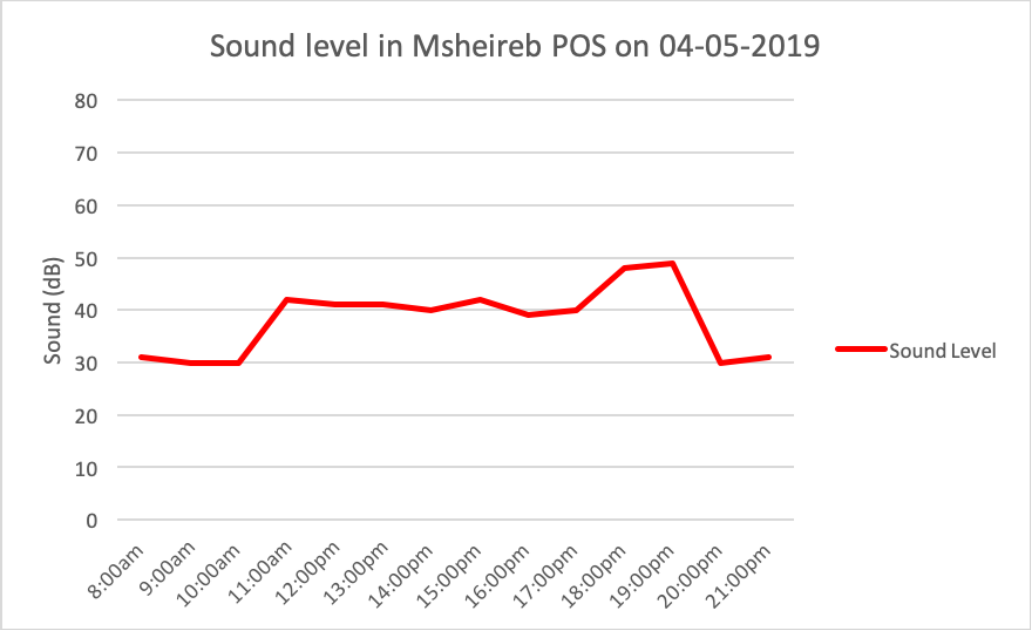


Figure 139. Sound level in Msheireb POS on 04-05-2019

Meanwhile, AQI ranged between 151–200 (red), clarified in Figure 140.

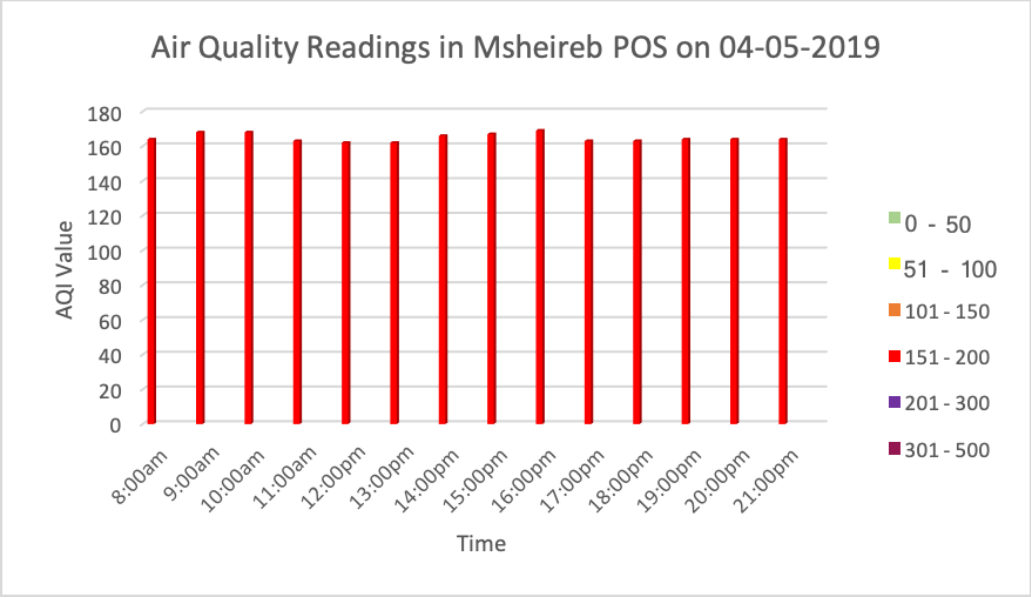


Figure 140. Air quality readings in Msheireb POS on 04-05-2019

4.4.5 Site observational of Msheireb POS

4.4.5.1 Day 1: site observation (28-04-2019)—10am, weekday

Figure 141 presents the Msheireb POS site plan (Barahat and Sahat Wadi Msheireb). On the 28th of April, 2016 at (10am), 5 people were observed in Barahat passing the central square of Msheireb and 12 people in Sahat Wadi Msheireb, mostly arriving from the pedestrian tunnel (underpass) that connects Souq Waqif with Msheireb. Generally, the weather condition was moderate on this day at 27°C air temperature, 32% humidity, and 10.8km/h wind velocity. The sound level was 35dB. The air quality readings reached 155.

Users were both male and female, and mostly employees and contractor workers. Individuals were observed but no groups or families or children were seen at this hour of the weekday. In Barahat, most users were observed walking and moving between the Msheireb museums and the hotel, while in Sahat Wadi Msheireb, some users were observed sitting outside the Al Wadi hotel and others walking between sikkats. No users were seen cycling or exercising, likely due to the fact that the area was still under development and most buildings were not yet open.

Figure 141. Observational map of Msheireb POS on 28-04-2019 at 10am

4.4.5.2 Day 1: site observation (28-04-2019)—6pm, weekday

The site observations and the plan of POS of the Msheireb POS (Barahat and Sahat Wadi Msheireb) are detailed in Figure 142. On the 28th of April 2019 at (6pm), around 20 people were experiencing the Barahat and 31 people Sahat Wadi Msheireb. On this day, at this time, the weather was cloudy with a logged air temperature of 28°C, humidity of 45% and wind velocity of 25.2 km/h. The sound level was 35dB and the air quality 119.

Both POS were occupied by adults of all ages and genders and families and children. The majority of users in Barahat were discovering the Barahat. No users were observed sitting, perhaps due to the fact that coffee shops in the Barahat were still not open to consumers. Meanwhile, in Sahat Wadi Msheireb, some users were seen sitting under trees and others walking with their children. Children were also seen playing near the fountain. Parents were standing and watching their children; no benches were available for them to sit and watch their child.

Figure 142. Observational map of Msheireb POS on 28-04-2019 at 6pm

4.4.5.3 Day 2: site observation (04-05-2019)—10am, weekend

On the 4th of May 2019 at (10pm) and based on the site plan illustrated in Figure 143, a total of 20 people was using both POS of Msheireb—7 people in Barahat and 13 in Sahat Wadi Msheireb. The weather was cloudy on this day at this time, and the temperature at 32°C, humidity at 33% and wind velocity at 10.8 km/h. On the other hand, the sound level was 30dB and the air quality 168.

The majority of users in both POS were composed of individuals and groups of different ages, genders and nationalities. A few contractor workers were also seen. At this time, in the Barahat, the majority of users were seen walking within the space. Meanwhile, in Sahat Wadi Msheireb, some users were seen walking and others sitting outdoor under the trees, probably relaxing and enjoying the sound of the water and the cloudy weather.

Figure 143. Observational map of Msheireb POS on 04-05-2019 at 10am

4.4.5.4 Day 2: site observation (04-05-2019)—6pm, weekend

Figure 144 depicts the site plan of the POS of the Msheireb on the 4th of May 2019 at (6pm). In Barahat, 30 users were observed using the space, whilst, in Sahat Wadi Msheireb, users were fewer than in the Barahat with around 5 users. The weather reading was registered at 32°C, humidity levels at 31% and wind velocity at 10.8km/h. Meanwhile, the sound level was 48dB and the air quality 163.

Users were male and female and were observed using the park as individuals, in groups and as families with children. Most users in the Barahat were walking through the space and sitting on the concrete seat beside the water pool under the trees enjoying the atmosphere. Moreover, a number of children were seen with a television crew filming a television scene. Meanwhile, Sahat Wadi Msheireb was a little quiet. Users were seen standing and taking a photo and others sitting under the trees.

Figure 144. Observational map of Msheireb POS on 04-05-2019 at 6pm

4.5 Conclusion

This chapter provided the core of this research study. The initial results of the POS (MIA Park, Oxygen Park and Msheireb POS) present a sense of the current conditions of the outdoor spaces in Doha and the level of comfort experienced by their users. In addition, these results enable a deeper understanding of psychological adaptation and the influence of environmental conditions—thus shedding light on how POS might best be modified to improve user comfort and well-being. This is addressed in the coming chapter, which takes up these research findings.

Chapter 5: Discussion of Research Findings and Interpretations

5.1 Introduction

The purpose of this study is to develop a set of design guidelines for sustainable POS to ensure that Doha POS promote comfort, health and well-being and, in turn, achieve SUD. Accordingly, this thesis has worked to assess the physical and non-physical characteristics of POS as elements and variables influencing socio-cultural, physical and psychological well-being. Essentially, it has focused on evaluating the different factors that influence user psychological adaptation and increase comfort, including microclimatic conditions, noise levels and air quality. In this respect, integrated quantitative and qualitative methods were used. Data were collected and analyzed for the three POS detailed above: MIA Park, Oxygen Park, and Msheireb (Barahat Msheireb and Sahat Wadi Msheireb) in Doha.

The study confirmed that the physical characteristics of a POS—including vegetation, water features, lightings and safety considerations (CCTV, security personal), urban furniture (seats in sun/in shade, shade devices, trash bins), signage, amenities and other facilities (public toilets, prayer room, coffee shop), parking lots, edges and floorscapes (materials, color, soft landscape, hard pavement)—significantly impact user experience and thus the research must address them clearly. The research study also affirmed the need to highlight the importance of non-physical characteristics that impact user psychological adaptation and comfort, namely: environmental stimulation, time of exposure, perceived control, the naturalness of the space and expectations and experience. This was done through studying the environmental conditions, namely: microclimate parameters (relative humidity level, air temperature and wind velocity (thermal comfort)), noise level and air quality (acoustic comfort and health).

The research adopted the below methods to record primary data:

- Questionnaires: users were surveyed on a weekday and over the weekend from 8am to 9pm. Responses were analyzed according to contexts. The analysis uncovered the ways in which POS might best be improved based on visitor perceptions, needs and preferences.
- Environmental measurements (data devices).
- Visual site observations.
- Observational mapping techniques.
- Interviews

Consequently, the results of study may prove useful for developing design considerations and design guidelines for the development of POS suitable for and able to dealing with different environmental conditions. This chapter will critically discuss and interpret the results based on the relevant literature highlighted in previous chapters.

5.2 Factors Influencing Human Comfort, Health and Well-Being

This study found that two principal factors influence human comfort, health and well-being, namely, (1) physical characteristics, (2) non-physical characteristics exemplified in psychological adaptation and environmental conditions (related to microclimate condition, noise level and air quality). Taking these findings to task, this work aims to investigate, define and assess these factors in the three selected POS.

5.2.1 Physical characteristics

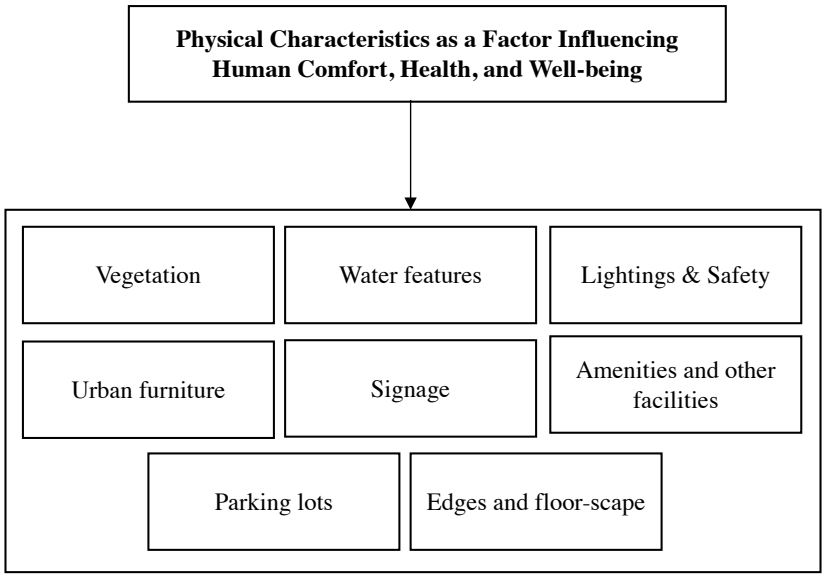


Figure 145. Physical factors influencing comfort, health and wellbeing

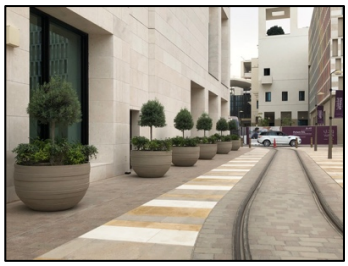
The physical characteristics of POS can alter user adaptation, perceptions and experience and thus optimizing them can enhance user comfort and, in turn, promotes health and well-being. While this would involve adjusting the physical characteristics listed above, such as vegetation and parking lots, it crucially also involves modifying design to deal effectively with microclimatic conditions (e.g. humidity, air temperature wind velocity), noise levels and air quality to foster the social-cultural well-being, physical well-being, and psychological well-being. Here, it is crucial to note that this study assesses these components with an eye for their sustainability.

In general, the researcher's observations, interviews and survey articulate the qualities of the physical elements of the three POS as follows:

(1) Vegetation

Dines et al., (2006); Frances et al., (1998) point out that socio-cultural well-being can be enhanced by vegetation and trees, which can foster social interaction, create social ties and facilitate multi-culturalism by gathering members of a society together in a shared place. Although MIA Park has different plants, shrubs and palm trees that attract many visitors from various nationalities and alter microclimatic conditions, the park's grass was very weak and needed regular maintenance. Such conditions may impact a family's selection of which parks to visit because they impact user comfort and health. Meanwhile, Oxygen Park has more condensed green areas than MIA Park. The various trees, grasses, flowers and shrubs in Oxygen Park encourage a large number of visitors to use the park for social and physical activities because these elements make users comfortable with the predominant climatic conditions. However, it was noticed that there was an open area near to children's playground, due to the absence of a barrier or fence. This may result in the space being unsafe for children and, moreover, may decrease comfort if a high wind scatters sand. Moreover, pollutants may be emitted from this area that have harmful health effects on human health (Abdullahi & Pradhan, 2017). Both POS of Msheireb had various types of plants and flowers and trees and vegetation were incorporated in every walking corridor.

Table 14. The summary of design comments – Vegetation

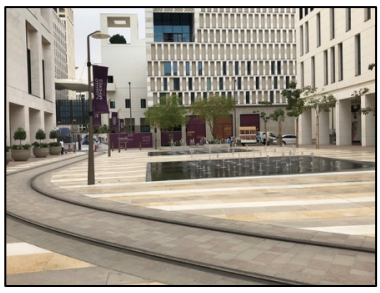
POS	Design Comments – Vegetation	
MIA Park	The grass area very weak and needed regular maintenance.	
Oxygen Park	The green areas should be increased in the children's playgrounds zone as barriers to offer safer space.	
Msheireb POS	The vegetation in the Msheireb POS well distributed in the spaces in which are reflected a nice visual landscaping.	

(2) Water Features

Water features provide a nice visual landscape, with (Setaih et al., 2013) mentioning that employing different POS water features (e.g. the fountains at MIA Park, the waterfall at Oxygen Park and the water ponds at Msheireb) can reduce heat with an evaporating cooling system. It is obvious that MIA Park's location, which extends along the waterfront assists in cooling with its cold sea breeze and open space. Consequently, climate significantly influences the POS variables correlated with

human comfort (Reiter & DeHerde, 2003). Moreover, MIA Park includes a number of fountains that greatly influence psychological well-being. In Oxygen Park, the waterfalls that cascade over the edge of the pathway covering offer a beautiful sight and a refreshing spray of cold water that users feel whenever they go through it. Meanwhile, both POS at Msheireb have water features including water ponds and fountains, enabling outdoor comfort and physical and psychological well-being.

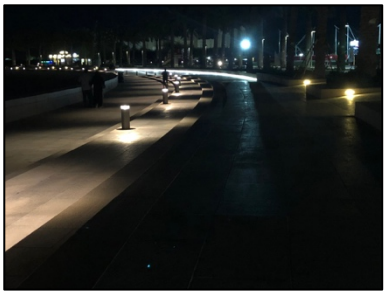
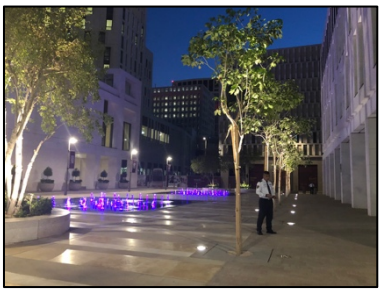
Table 15. The summary of design comments – Water Features

POS	Design Comments – Water Features	
MIA Park	Beside the waterfront, MIA park has number of fountains.	
Oxygen Park	The waterfalls that cascade over the edge of the pathway covering offer a beautiful sight and a refreshing spray of cold water.	
Msheireb POS	The water features (water ponds, waterfalls and fountains).	

(3) lightings and Safety Considerations

Gomes, (2012); JACOBS, (1995) point out that safety and comfort can be increased and guaranteed by the presence of elements such as artificial lighting oriented towards faces and surfaces, surveillance equipment (CCTV) and security personnel who can assuage any concerns that might affect human well-being in the place. In MIA Park, which has a large number of visitors, it was found that the current lighting system was not very effective in some spots, especially in the evening. This was confirmed by surveyed participants who stated that they wanted more lights in the space. Although security personnel were everywhere in the park, the lack of the sufficient illumination and CCTV may minimize accessibility, particularly for women and children, reduce the sense of safety and comfort and overload pressure on the facilities in some area while leaving other areas empty. In contrast, Oxygen Park has very good existing elements such as a lighting system, security personnel and CCTV. On the other hand, both Msheireb POS are home to different types of lightings, CCTV and security personnel, which increase comfort and well-being and, in turn, maximize user population and duration.

Table 16. The summary of design comments – lightings and Safety Considerations

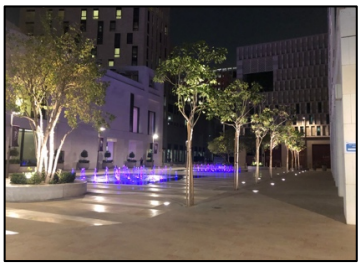
POS	Design Comments – lightings and Safety Considerations	
MIA Park	lighting in some spots is not very effective. Thus, lightings should be increased. Security personals everywhere in park. However; CCTV must to implement.	
Oxygen Park	lightings, security personals and CCTV existed elements in the space.	
Msheireb POS	Both POS reflected the presence of different types of lightings, CCTV and the security personals.	

(4) Urban Furniture

Furniture is an essential physical element that influences user comfort and well-being in POS. It includes seats, shade devices and trash bins. In spite of MIA Park being one of the most popular open spaces in Doha, most respondents underline the lack of seats in the park, which causes them to bring their own seats whenever they come to the park. Moreover, the seats that exist where children usually play are

not shaded. According to Whyte (1980), the absence of these elements precludes users from having a place to sit. Thus, MIA Park might be improved by offering a sufficient number of seats with shading devices. Further, although trash and recycling bins are available in MIA Park, some bins in bad conditions were found to affect the usage and image of the park. On a contrary note, in Oxygen Park, although respondents were satisfied with the seats provided and it was noticeable that the park offered seats in sun and in shade by using trees for cover, no seats were available in the children's playground where parents could sit and watch their children. Moreover, trash and recycle bins were prevalent throughout the park, discouraging litter and thus encouraging environmental responsibility. In the studied POS in Msheireb, only a few concrete seats were available in the Barahat; respondents advised that they wanted different seat types in addition to the small number of current concrete seats in the sun and shade. Based on this observation, the Sahat Wadi Msheireb may allow groups to sit together and selected the seats freely. Regarding the trash and recycle bins, it is worth mentioning that in Msheireb POS, AWCS was connected to the trash and recycling bins distributed throughout the area. The implementation of this system is expected to reduce several problems related to waste such as unwelcome smell, which is particularly prevalent issue in hot weather.

Table 17. The summary of design comments – Urban Furniture

POS	Design Comments – Urban Furniture	
MIA Park	Sufficient number of seats and shading devices should be added to all around the park. The existed colored chair should be shaded. The trash and recycle bins should be replaced.	
Oxygen Park	Seats should be added in the children zone to enables parents sit and watch their children. Trash and recycle bins available in the space.	
Msheireb POS	Few concrete seats available in Barahat. Seats should be added in Sahat Wadi. Trash and recycle bins available in the space.	

(5) Signage

MIA Park has a few unclear signs in poor condition. Participants agreed on point, reporting that improved signage was a priority for them as it is essential for wayfinding. Meanwhile, the surveys reveal that participants were satisfied with the signage at Oxygen Park. In agreement with this, site observations showed that Oxygen Park had good signage—far better than that of MIA Park—which increases the level

of user comfort. However, although the inside of the park has a good signage system, visitors mentioned that it was difficult to find the park. Therefore, signage from the main street giving directions to the park may be improved to help visitors find the park. For both POS in Msheireb, the signage system was clear and readable; however, designers would do well to ensure that the signs are constantly visible and not covered by trees. They may also consider adding directional signage.

Table 18. The summary of design comments – Signage

POS	Design Comments – Signage	
MIA Park	Signage is in poor condition.	
Oxygen Park	Signage is good inside the park. The Way-finding signage should be added from outside the park.	
Msheireb POS	Signage system is readable. Directional signage should be added from the surrounding areas.	

(6) Amenities and Other Facilities

In MIA Park, visitors complained about the lack of major facilities such as public toilets and mosques and reported that these elements were important to them. The existing toilets and mosque (porta cabin) cannot sufficiently accommodate the large number of visitors to the park, particularly on the weekends. Besides temporary food trucks, only one permanent kiosk is available in the park to provide users with food. However; the kiosk is very far from the main area and not affordable for all users. Meanwhile, in Oxygen Park, visitors emphasize that would like to see public toilets, prayer rooms and coffee shops. While visitors were largely satisfied with these facilities in Msheireb, some did still articulate a desire for more toilets and coffee shops, perhaps due to the fact that there many retail shops and facilities in Msheireb still not open and thus visitors may not be aware of these facilities.

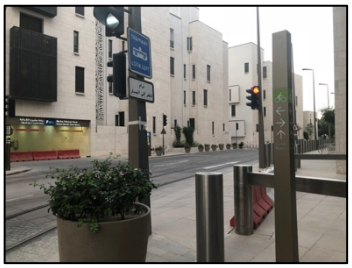
Table 19. The summary of design comments – Amenities and Other Facilities

POS	Design Comments – Amenities and Other Facilities	
MIA Park	Public toilets, and mosque should be increased. Affordable kiosk or shops should be provided in the park.	
Oxygen Park	Public toilets, prayer room and coffee shops should be added.	
Msheireb POS	Facilities; public toilets, mosque, and coffee shops expected to be enough once the all buildings open for public.	

(7) Parking lots

Although MIA Park has a capacity of 580 parking lots to serve both staff and visitors, according to the observations and surveyed results, it is not sufficient and there is a need for more; it was observed that parking was always full during the weekends. In Oxygen Park, it seems as there is no need for parking, as most of the QF facilities around the park offer it to the park's visitors. However, visitors articulated a desire for parking lots dedicated to the park. Last, both POS of Msheireb area have underground parking accessible to visitors to the outdoor space and the broader area.

Table 20. The summary of design comments – Parking Lots

POS	Design Comments – Parking Lots	
MIA Park	Parking is not sufficient and there is need for more.	
Oxygen Park	Parking of QF facilities can be used by users. Visitors preferred to have dedicated parking lots.	
Msheireb POS	Msheireb area has underground parking lots that serve all user to outdoor spaces.	

(8) Surfaces

Surface—including materials, colors, soft landscape and hard pavement—is another influential factor, impacting overall environmental conditions and, in particular, the climate. Light-colored—especially white—surfaces significantly ameliorate thermal comfort: using light-colored flooring can decrease the surrounding air temperature, as pointed out by (Synnefa, Dandou, Santamouris, Tombrou, & Soulakellis, 2008).

The ground surface of MIA Park is flat with three hills and characterized by light-colored and hard concrete walkways and walking routes. While the light color may reflect solar radiation and thus effectively minimize air temperature, heightening user comfort, the lack of rubber walking mats along the walkway may affect human health by discouraging physical activities. On a contrary note, Oxygen Park is characterized by a mixture of artificial hills and flat land. It has different light-colored ground surface materials that reduce air temperature and heighten comfort. Moreover, the rubber walking mat present along the walkway and running path near the concrete pavement stimulate walking and thus promote physical well-being. Furthermore, sand materials are available in which to play. Both Msheireb POS are flat and use light-colored hard concrete flooring and walking routes adjacent to concrete pavement.

Table 21. The summary of design comments – Surface

POS	Design Comments – Surface	
MIA Park	Ground surface is flat with three hills and characterized by light-colored and hard concrete walkways.	
Oxygen Park	Ground surface characterized by a mixture of artificial hills and flat land. It has different light-colored surface materials.	
Msheireb POS	Ground surface is flat and has a light colored hard concrete flooring in space and walking routes near to the concrete pavement.	

5.2.2 Non-physical characteristics

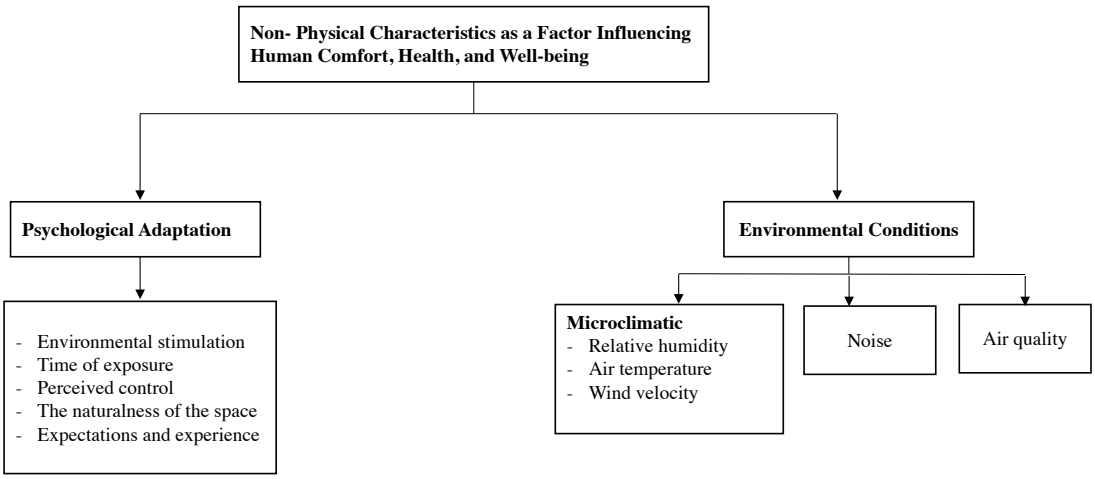


Figure 146. Non-Physical factors influencing comfort, health and well-being

5.2.2.1 Psychological adaptation as a factor influencing comfort, heath, and well-being

As stated by (T. Lin, 2009), the variances of POS user comfort and tolerance are affected by the user's mental and behavioral conditions. This argument is associated with user psychological adaptation, defined as an amendment action on the information perceived by the senses (Reiter & DeHerde, 2003). This idea is compatible with the relieving feeling of the intensity, especially in cases in which the user endures persistent exposures to analogous environmental stressors. Thinking with the literature, this study reveals the importance of user psychological adaptation in POS for well-being, especially psychological comfort. Thus, psychological adaptation in POS is a fundamental determinant of user comfort and well-being, which is reflected in turn in the impacts of using a POS.

Nikolopoulou & Steemers (2003), argue that the psychological adaptation factors that impact user feelings and perceptions of a place include: environmental

stimulation, time of exposure, perceived control, the naturalness of the space and expectations and experience. The findings of this study reveal that mutual relationships between the above-mentioned psychological adaptation factors for user comfort and well-being. In agreement with what has been addressed in the literature, it was noticed that in MIA Park, Oxygen Park and Msheireb POS, the majority of the people surveyed were able to endure high temperatures up to 27°C.

deDear & Brager (2001) establish a link between visitor adaptations to different external changes, behavioral changes and user perceptions of external conditions. Generally, this result is in agreement with the (Thorsson, Lindqvist, & Lindqvist, 2004) study, which illustrates that a visitor's behavior relies on external environment conditions including the climate and, moreover, is significantly affected by the expectations and experiences of the individual. For example, it was observed that, based on their experiences, POS visitors preferred to stay in the parks during—and thus appeared more comfortable in—high winds over high temperatures and humidity. This study also found that people decreased their physical activity and changing their position in the space to improve their comfort levels, that is, that users adapted to current environment condition. (Figure 147).

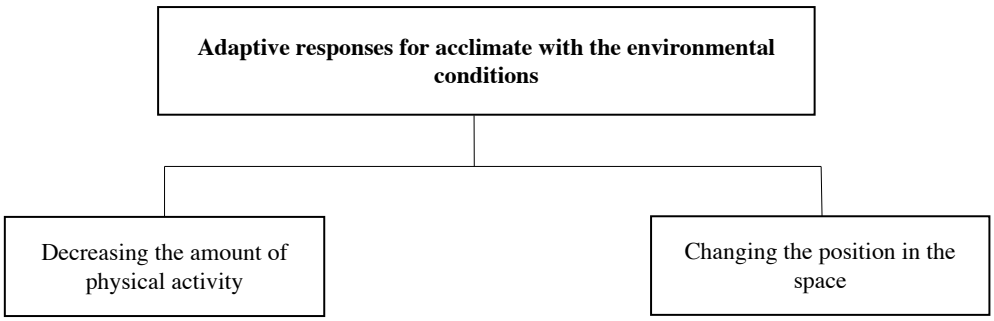


Figure 147. Adaptive responses of user to acclimate with the environmental conditions

Nikolopoulou & Steemers (2003) also, highlight that the perception of the environmental conditions—including thermal perception—is a determinant of how long the user will stay at the place. The literature demonstrates that exposure time in POS is an important instrument because it can amend user expectations related to comfort levels, which may differ from one user to another. People who visited MIA Park, Oxygen Park and the Msheireb POS in the afternoon or evening essentially anticipated lower temperatures and humidity than what they registered. Thus, people were unlikely to accept such climate conditions.

In accordance with analogous studies on user comfort, well-being and activity in POS, it was found that users tend to spend approximately 30 minutes on average in a park—longer if their perception of the environmental conditions was within their comfort zone (Nikolopoulou, Baker, & Steemers, 2001; Thorsson et al., 2004). In this study, the findings made clear that users who visited a POS and knew that they would spend only a short time could bearable the overall environmental conditions while, others spending an unknown amount time were inclined to adjust—and especially reduce—their physical activities in line with climate and other environment variables, such as, for example, by sitting under trees or in other shaded areas.

The research results of this study thus make clear that users are not totally selective of the POS environment conditions and are willing to adapt with the prevailing conditions to make themselves comfortable. This may be due to the fact that some people consider it necessary to be outdoors at least once a week to promote health and well-being with physical activities such as walking and running to keep fit and socialize. Therefore, individuals were found adaptive to environmental conditions, particularly those related to climate variables (i.e. heat, humidity and wind). Similarly, Nasir, Ahmad, & Ahmed (2012), prove that participants felt

comfortable and able to adapt to outdoor thermal conditions when they expressed their thermal sensation. Moreover, this same study found that user perceptions of the microclimate and other variables differed based on factors such as gender, age, race and activity level.

Environmental stimulation is another important factor that can influence user comfort, specifically the thermal degree of users. Authors such as (Reiter & DeHerde, 2003) argue that environmental stimulation encourages people to stay outdoors. During the site observation, it was noticed that a large number of visitors came to the POS to experience environmental stimulation—respondents confirmed this when asked about what they liked about the place. Similarly, the water features and the greenery in each POS studied were found to enhance the POS and generate psychological satisfaction by providing users with a chance to relax, relieve stress, feel comfortable and improve their well-being.

5.2.2.2 Environmental conditions

As made clear above, this study zoomed in on the following environmental conditions: microclimate and its impact on thermal comfort, noise level and its impact on acoustic comfort and air quality and its impact on human health (Figure 148). Microclimatic conditions refer to the atmospheric elements associated with variables such as humidity, temperature, wind and rain that vary across the climate of an area, as identified by (BojinSki & VerStraete, 2014; Erell et al., 2011). Meanwhile, noise refers to undesired sound that travels through the air and negatively impacts acoustic comfort and health. On another note, air quality refers whether the surrounding air is unpolluted and suitable for plant, animal and human health (WHO, 2000).

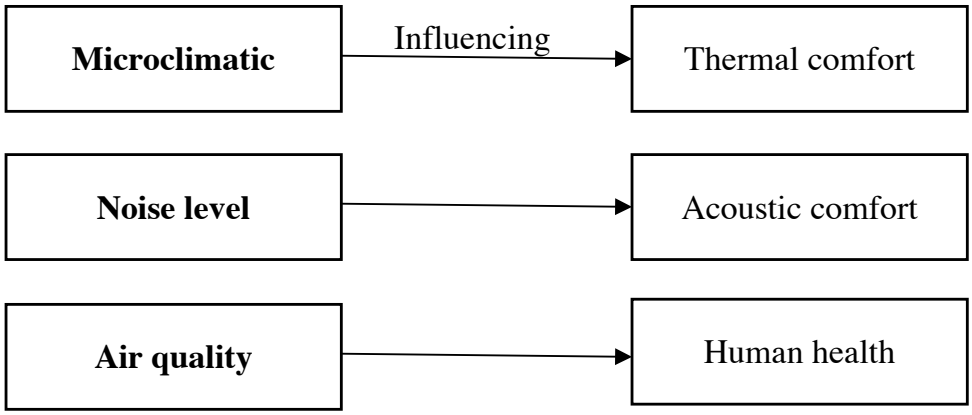


Figure 148. The relationship between environmental conditions and comfort, health and well-being

Many researchers suggest that microclimatic variables, noise and air quality impact the comfort, health and overall well-being conditions of users of outdoor spaces. For instance, (Staiger, Laschewski, & Grätz, 2012) declare that general comfort is a satisfied state of mind that results from a nurturing environment. On the other hand, (Nikolopoulou, 2011) argue that thermal comfort essentially depends on the level of individual activity while acoustic comfort depends on sound resources.

Turning more specifically to the study's measurements of microclimatic variables, the microclimatic readings of MIA Park, demonstrated an average temperature of average 25.79°C, an average humidity of 30.32% and an average air velocity of 27.54 km/h. Meanwhile, Oxygen Park's microclimate readings averaged 25.54°C, 28.39% and 20.21 km/h for temperature, humidity and wind velocity, respectively. Last, both Msheireb POS averaged 30.11°C, 34.79% and 13.37 km/h for temperature, humidity and wind velocity, respectively. The measurements of microclimatic variables, represented in relative humidity, air temperature and wind velocity were performed on weekdays and weekends in April and May of 2019, and were graphed hourly from 8am to 9pm for each selected location. The outdoor comfort

temperature was calculated using the online calculator mentioned above. As shown in Table 22, these figures were 24.43°C, 23.54°C and 27.79°C for MIA Park, Oxygen Park and Msheireb, respectively.

Table 22. Average of overall environmental conditions measurements

POS	**Average of Relative Humidity (%)**	**Average of Air Temp. (°C)**	**Average of Wind Velocity (km/h)**	**Average Outdoor Comfort Temp. (°C)**	**Average of Noise Level (dB)**	**Average of air Quality (AQI)**
MIA Park	30.32	25.79	27.54	24.43	46.82	137.68
Oxygen Park	28.39	25.54	20.21	23.54	46.57	99.96
Msheireb POS	34.79	30.11	13.37	27.79	39.142	146.11

As indicated by Moreno, Labaki, & Noguchi (2008) and illustrated by Figure 149, microclimatic circumstances, activity levels, vegetation and nature, sound levels and user psychological adaptability affect general human comfort, health and well-being to a great extent. In step, the study's findings clarify which variables led to dissimilarities in individual comfort levels in each part. Visual site observations conducted for the three surveyed locations over the morning and evening period on weekdays and weekends showed that, over the morning and evening hours, users were comfortable with the moderate overall weather condition and low level of noise, which enabled them to perform various social and physical activities. Meanwhile, during the afternoon period, from 1pm to 3pm, users mentioned that they were

uncomfortable with the prevailing conditions because of the high temperatures. This variance in user comfort levels is probably due to changes in numerous parameters such as psychological adaptation, humidity, amount of physical activities, perceptions and expectations.

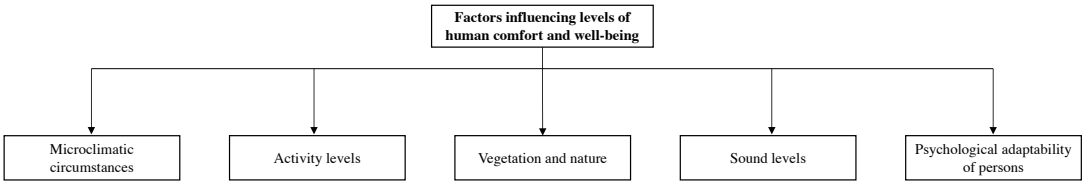


Figure 149. Factors influencing levels of human comfort (Moreno et al., 2008); author

According to Ragheb et al. (2016) a place design should motivate people to practice various activities. Zacharias, Stathopoulos, & Wu (2001) report a relationship between climate and the frequency of various activities types such as smoking, sitting and standing, more specifically noting a robust correlation between temperature and sitting. In line with this study, it was observed that most users were chiefly walking or sitting in shade. This was most evident on the weekend, when a large number of families were visiting MIA Park with their children and were playing and sitting (Figure 150). The findings of this study reveal that social and physical activities tended to decrease when the climate became unbearable or uncomfortable. (Nasir et al., 2012) argue that improving outdoor comfort increases the ability the bear POS environmental conditions, which ultimately stimulates the use of recreational areas in POS.

Figure 150. Families with children sitting under the trees in MIA Park

Chen & Ng (2012) suggest that microclimatic variables (e.g. solar radiation, air temperature), time and the features of the place itself impact user presence, more specifically accounting for user presence 12%, 7% 38% of the time, respectively. Meanwhile, Nikolopoulou & Steemers (2003) argue that satisfaction with environmental conditions depends on the place itself and on the personal variables of the users, which they suggest are in a mutually formative relationship. This relation was observed in MIA Park, considered a family-oriented place as well as a sports venue where a much greater number of children were observed than in Oxygen Park and Msheireb POS. Msheireb POS had similar number of visitors as Oxygen Park, in spite of the fact that the area is still new and people are largely not aware of it.

5.3 Conclusion

The findings presented in this chapter are important for enhancing and improving POS conditions. This chapter's analysis of the results of this study thus incite the next step: concluding and recommending additional design improvements for existing POS in line with users' perspectives and preferences.

Chapter 6: Research Conclusion and Recommendations

6.1 Conclusion

POS must be optimized for human comfort to secure health and well-being. This thesis reviewed three POS in Doha, Qatar—MIA Park, Oxygen Park and two POS in Msheireb—by unpacking three factors (physical characteristics, non-physical characteristics and environmental conditions) to deepen existing knowledge about best practices for POS to promote human comfort, health and well-being.

This study has shed light on a cluster of parameters and assessed the interrelationships between them. It also affirms that a quantitative approach is not only related to physical characteristics and environmental condition variables, but also to non-physical characteristics such as user psychological adaptation, which clearly impacts user comfort and well-being. Data and information were collected from the three selected POS locations. Both quantitative and qualitative data were gathered through integrated methods, namely: questionnaires, on-site measurements (of climate, noise and air quality), on-site observations along with observational mapping and interviews. An analysis revealed that user comfort and well-being is influenced by different factors including many physical element—such as vegetation, water bodies, lightings and safety considerations (CCTV, security personal), urban furniture (seats in sun/in shade, shade devices, trash bins), signage, amenities and other facilities (public toilets, prayer room, coffee shop), parking lots, edges and floorscapes (materials, color, soft landscape, hard pavement)—as well as user psychological adaptation and environmental conditions.

The study reveals that users of MIA Park, Oxygen Park and Msherieb are more indulgent of the various environmental conditions. Users tolerated high levels of humidity, air temperature, wind velocity and sound. This may be because Qatar is

located within a region that, for most of the year, is characterized by a hot and humid climate. Hence, based on the user's experience, visitors of the space were found to adapt to the climate and other factors by staying in shaded or covered areas, reducing activity levels or changing their position, etc. (Figure 151). Comfort calculations revealed that there was no specific weather situation in which all people were always comfortable and thus comfort preferences differ. Such differences are answerable to individual preferences, purpose of visit, psychological adaptation parameters, time of day, cultural status and activity (Figure 152). Moreover, as Qatar is a multicultural community, there is a possibility that users' comfort was impacted by cultural diversity.

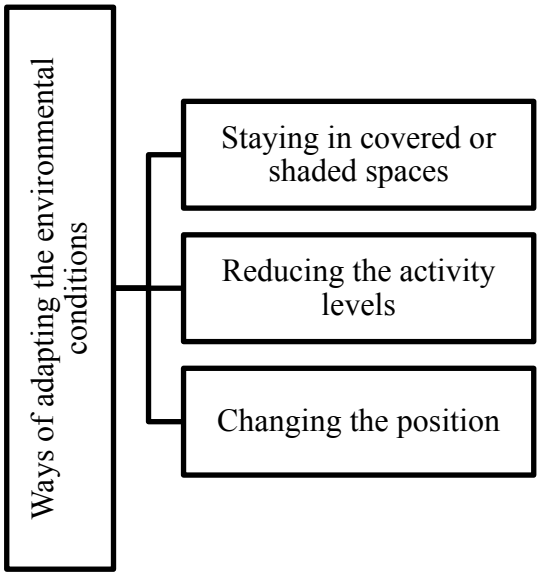


Figure 151.Ways of adapting with the environmental conditions

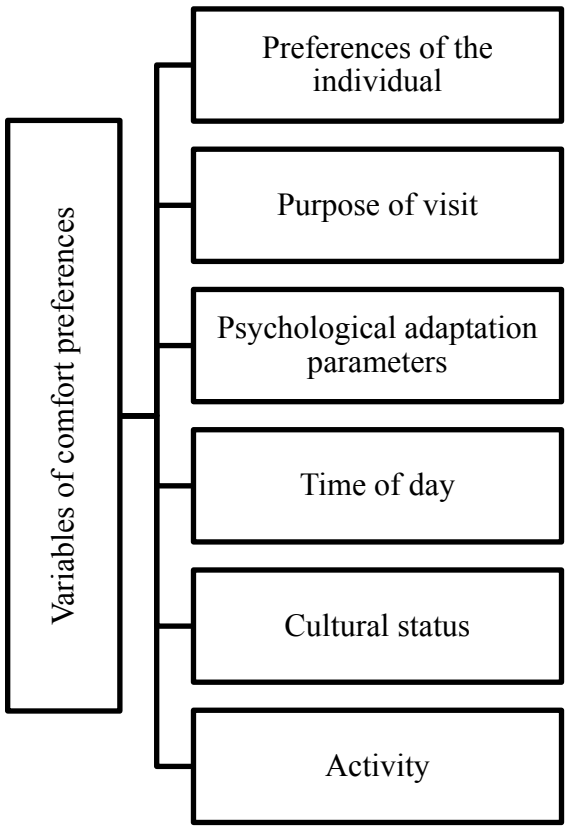


Figure 152. Variables of comfort preferences

Significantly, the existence of plants and trees played a major role in influencing user comfort, health and well-being. It was observed that vegetation and trees encourage people to gather and socialize. Individuals and groups from different nationalities were seen sitting on the grass. Moreover, people were found sitting under trees, using them as a canopy. However, although many participants were satisfied with the level of vegetation, the conditions of the trees and vegetation condition (especially the poor condition of the grass in MIA Park) frustrated levels of comfort, in particular, psychological well-being. The duration of time spent in POS also plays a role in the comfort levels of both individuals and groups. Crowd composition and intensity—impacted by the timing of the workday —also impact user comfort.

Non-physical characteristics—such as psychological adaptation parameters, namely: environmental stimulation, time of exposure, perceived control, the naturalness of the space and expectations and experience—considerably affect human comfort in POS. It was also found that crowd density and duration of stay impact the diversity of activities within the POS. An examination of the activities and influence of environmental conditions on user behavior in POS revealed that psychologically, personal perceptions, expectations, emotions, memory, attitudes and choice impact satisfaction with the encircling environment.

Many published studies address outdoor comfort and well-being, especially thermal comfort. However, few studies examine the relationship between physical characteristics, non-physical characteristics and environmental parameters to determine best practice for improving spaces and promoting human comfort, health and well-being together in the POS.

This thesis metabolizes these findings to lend insight to planners and urban designers: the next section articulates design guidelines to optimize user comfort and well-being by increasing physical activities, attracting more people, minimizing air pollution and minimizing noise affections. The importance of physical elements, psychological adaptation and environmental variables—including microclimate, noise and air pollution—in urban design was substantially assured by this thesis.

6.2 Recommendations and Design Guidelines

Responding to findings, a set of recommendations and design guidelines are offered below to enhance the redevelopment and improvement of these existing POS and thus promote human comfort, health and well-being (Figure 153).

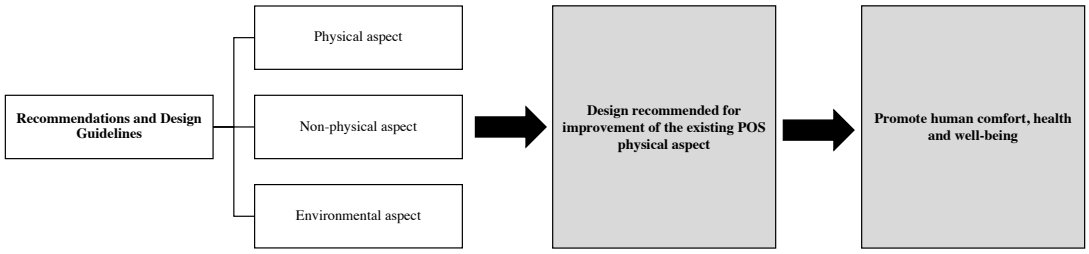


Figure 153. Recommendations and design guidelines structure

6.2.1 Design recommendations for the physical aspects

Perceived control can be affected by increasing the physical aspects within the place (Nikolopoulou & Steemers, 2003). This can be achieved by providing many sub-spaces in the same area. Urban designers and planners can do this by introducing transition spaces such as arcades. Implementing these will provide the user with options such as access to shade or sun, protection from harsh winds and exposure to breezes. The main area in MIA Park may be improved by dividing it into more subspaces, interspersed with adding arcades.

Controlling environmental conditions, especially the microclimate and noise, can foster the outdoor comfort and health. Employing hard landscaping elements—such as rubber, wood chip mulch, paving slabs and stone—and soft landscaping—plants and trees can reduce the heat—, increasing water features and utilizing cool

materials are efficient ways to avoid and reduce discomfort related to the weather conditions (Bougdah & Sharples, 2010; Cameron & Blanu, 2016). Hard and soft landscaping can minimize the amount of pollution and noise in the urban environment. A rubber material may provide MIA Park with soft flooring that encourages physical activities (Figure 154). Meanwhile, a collar of trees and plants can be implemented in the open area at Oxygen Park near the children's playground to act as a barrier (Figure 155). This will secure the space and, moreover, reduce the influence of the environmental condition.

Figure 154. Before and after views of MIA walkway

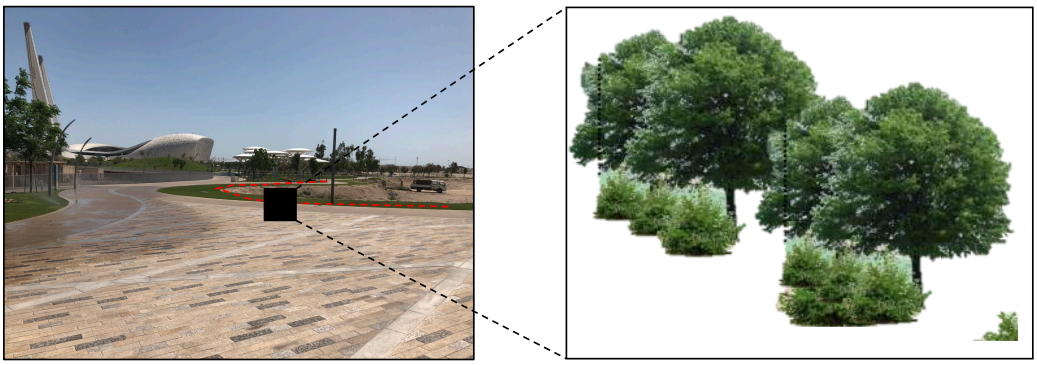


Figure 155. Before and after views of Oxygen Park and the suggested collar of trees

Recalling an earlier point, (Synnefa et al., 2008) points out that light-colored surfaces significantly ameliorate by decreasing ambient air temperature. Additionally, using reflective materials (i.e. high albedo materials) in urban environments can reflect solar radiation. Such practices can reduce the negative impacts of the environment, especially those related to thermal comfort.

Based on (Moonen, Defraeye, Dorer, Blocken, & Carmeliet, 2012), argue that water features such as ground-level water ponds are an effective mitigation measure. Ground-level water ponds within an outdoor space can offer a natural cooling mechanism to adjust and smooth surrounding temperatures by the evaporation process. Walkable fountains and evaporative cooling devices can also enhance comfort and well-being. In MIA Park, walkable fountains that align with the arcades may be developed to offer beautiful sights and sounds, while the spray of water may be felt by users whenever they pass (Figure 156).

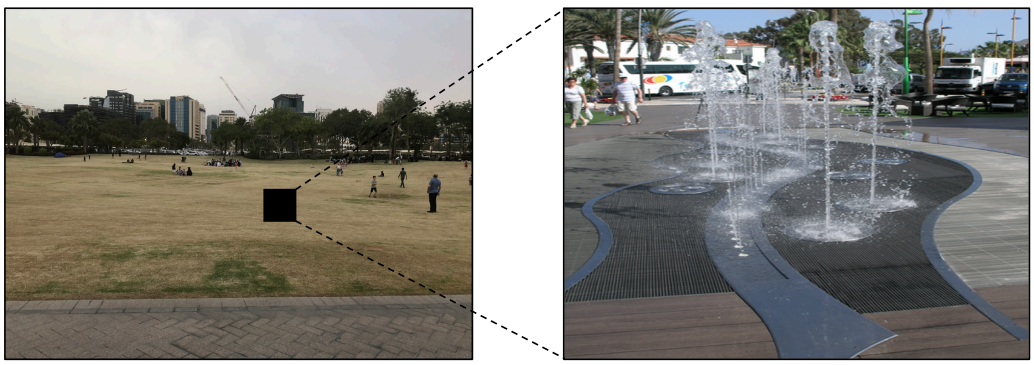


Figure 156. Before and after views of MIA Park and the suggested walkable fountains

The availability of urban furniture is yet another way to encourage the use of the space and thus fulfil user comfort. Further, arranging furniture in a way that

considers the influence of the wind velocity can maximize thermal comfort.(Edwards, 2014) emphasizes that patterns of landscaping, trees, and hedge plantings can affect wind direction. The urban geometry of buildings, technique-flow and height are other urban environmental aspects that can manage wind direction and velocity (Figure 157) (Ragheb et al., 2016).

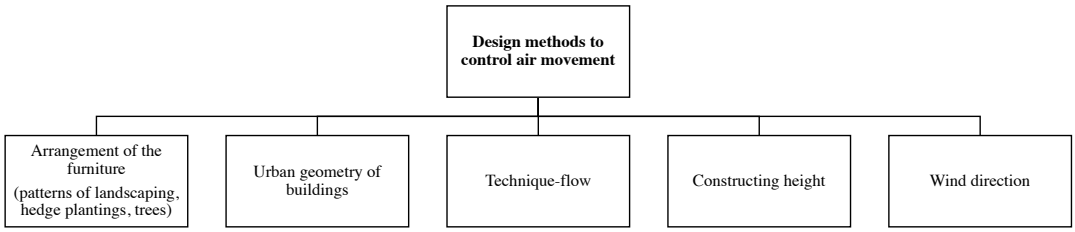


Figure 157. Design methods to control the wind directions

To attract more users to a POS and thus increase crowd intensity, good signage, lots of benches and appropriate facilities are necessary. It was observed that the majority of users that visit POS mainly sought to walk, gather, sit, practice fitness or engage in other physical activities. Establishing a space that can accommodate more social activities would serve a multitude of user needs and preferences. In MIA Park, benches may be added in the sun and in the shade (Figure 158), umbrellas may be installed in the existing colored chairs (Figure 159) and readable signs may be implemented (Figure 160).

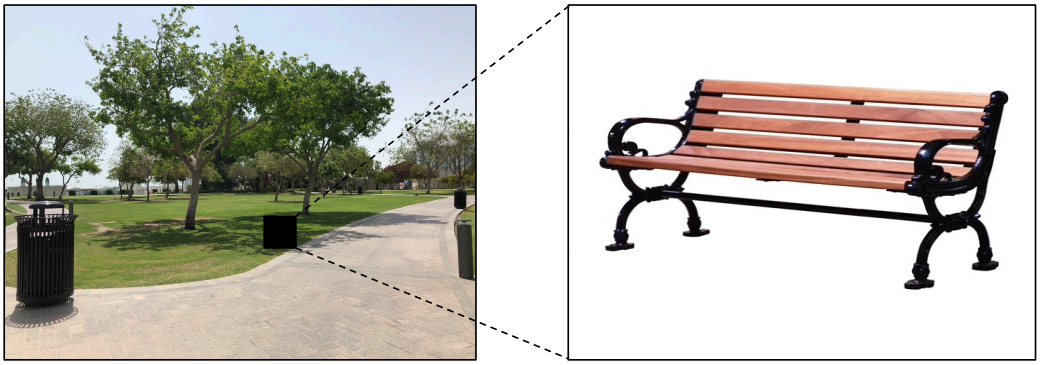


Figure 158. Before and after views of MIA Park and the suggested benches

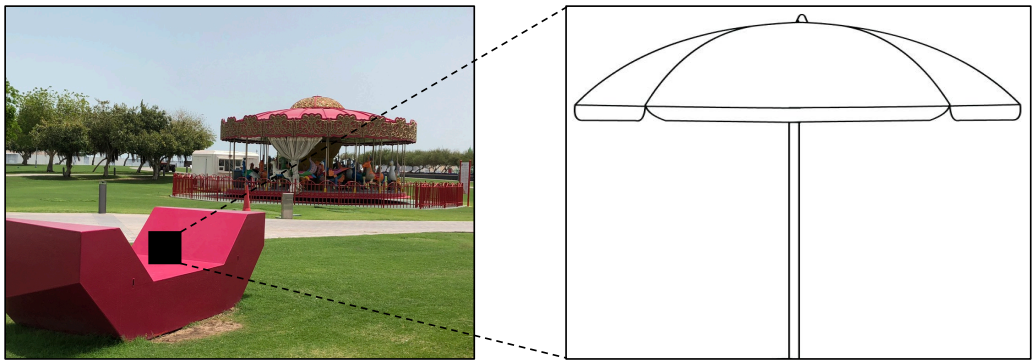


Figure 159. Before and after views of MIA Park and the suggested shade device

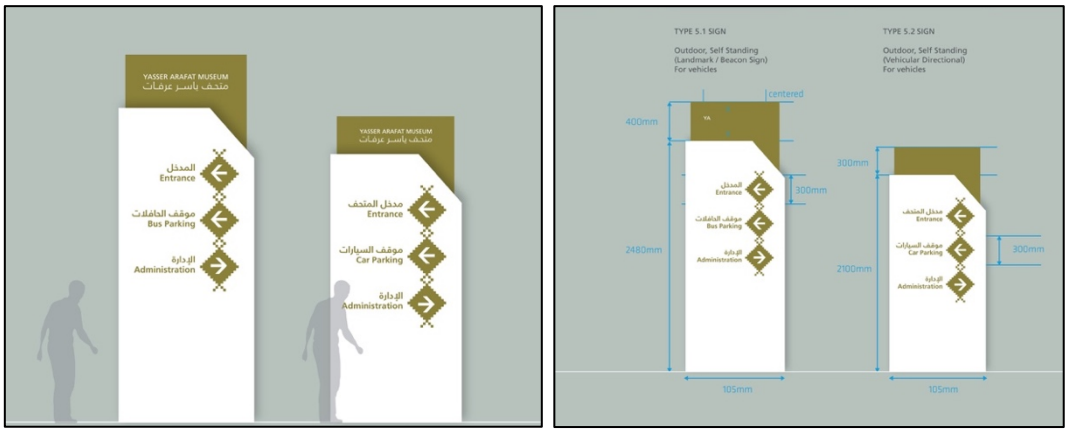


Figure 160. Signage and wayfinding design recommended (Design, 2014)

More benches can be also introduced in Oxygen Park, particularly in the children's playground area to provide a suitable place for the parents to sit while they observe their children playing (Figure 161). In addition, it is recommended that benches be added to Sahat Wadi Msheireb of a similar design of those distributed in the Msheireb Area (Figure 162).

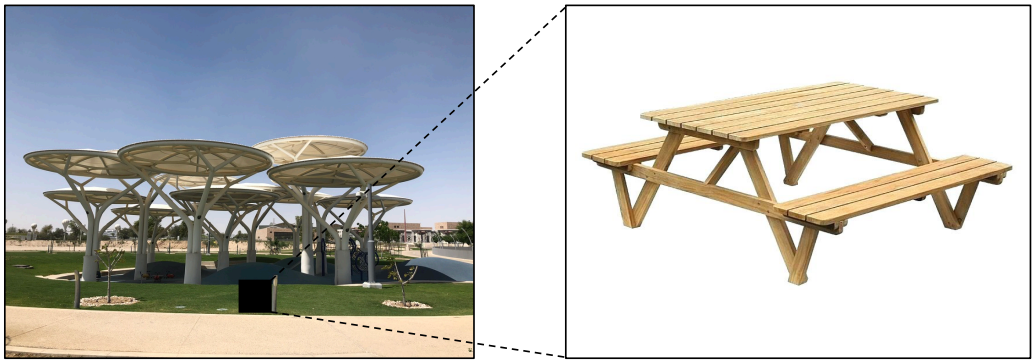


Figure 161. Before and after views of Oxygen Park and the suggested benches

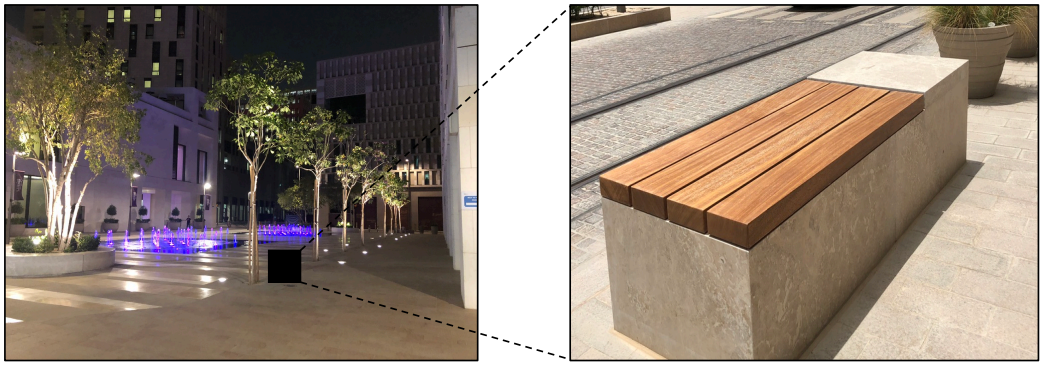


Figure 162. Before and after views of Sahat Wadi Msheireb and the suggested benches

6.2.2 Design recommendations for the non-physical aspects

Psychological adaptation parameters are valuable for urban designers and planners because they enrich design opportunities. These parameters are perceived control, naturalness and experience, which affected adaptation to the place. The naturalness of the place is an important parameter and can be considerably increased by adding trees and vegetation. (Ulrich, 1979) verifies that exposure to the natural greatly influences human psychological well-being. On a similar note, (Cameron & Blanu, 2016) indicate that vegetation type impacts space in various ways: they debate whether deciduous trees, characterized by dense leaves, may be used to retain heat, protect from solar radiation and reduce noise and atmospheric pollution. Exposure time is another personal variable. (Grahn & Stigsdotter, 2003) confirm that spending more time in green space resulted in feeling less stressed. In MIA Park, the current palm trees do not offer sufficient shade and can thus affect user comfort (Figure 163). Averting such conditions stimulate POS usage in different seasons. Furthermore, (Bougdah & Sharples, 2010) mention that plants can serve as shelters in POS.

Figure 163. Before and after views of MIA Park and the suggested deciduous trees

6.2.3 Design recommendations for the environmental aspects

(Edwards, 2014) suggests a set of design principles that should be considered to achieve sustainable outdoor spaces and foster user comfort. These principles include the establishment of place, incorporation of nature in urban plans, creation of social spaces and enhancement of microclimatic conditions.

The environmental conditions represented in the microclimate are affected by several parameters; sometimes, urban designers and planners are unable to control them, resulting in 'the weather prevailing, the place form, the place choice, any retained buildings, the encircling land, the created street network or constraints' (Bougdah & Sharples, 2010).

6.3 Design Guidelines for POS Spatial Quality

The data of POS that have been obtained (i.e. physical, environmental and behavioral data) supported the conclusions of this thesis and its development of design guidelines for Doha's POS by amending design aspects; the main aims being to enhance psychological adaption, minimize the effect of on-site climate variables (humidity, air temperature and wind) and increase the physical, psychological and social benefits. These guidelines can be summarized as follows:

- Different types of vegetation and trees should be introduced and maintained. This will reduce the effect of sun's heat provide shade; increase the physical, social and psychological benefits of the POS and clear the air from pollutants and emissions. Vegetation also increases the aesthetic value of the space and makes user experiences more memorable and enjoyable. Users become healthier and more comfortable because vegetation, shade and air quality encourage healthy outdoor exercise.

- Water features are beneficial and should be provided in all sorts of forms including waterfalls, water walls, ground-level water ponds and fountains of all kinds. Such features will create visual impacts and cool users—water features offer a beautiful sight and reduce the heat by evaporative cooling. In addition, users are pleased by the sound of water.
- Artificial lighting and other safety elements should be provided. Lighting should be oriented towards faces and surfaces and should be well distributed across the outdoor space. Safety elements such as surveillance cameras (CCTV) and security personnel must also be made available to dissuade any concerns for visitor well-being, increase accessibility for women and children and secure safety and comfort.
- Adequate urban furniture should be available throughout the space. This includes seats, shade devices, trash bins and bike racks. Seats and shade devices should be well-arranged to maximize user comfort. Trash bins should exist all around the space to avoid polluting the environment. A bike rack should be provided to encourage walking and cycling. The availability of such elements makes users more comfortable.
- An effective signage and wayfinding system should be developed. Signage should be sufficient, readable and well-distributed. In addition, designers would do well to install a map and put signs in places where tourists and new visitors may get lost. This would encourage the use of outdoor spaces by a wide range of users.
- Adequate amenities and other facilities should be provided and maintained to facilitate the use of POS. Here, amenities and facilities include the public toilets, mosques or prayer rooms and coffee shops or kiosks. Public

toilets should be available and well-distributed all over the space. Mosques or prayer rooms exist to prevent users from having to pray in the outdoor area. Coffee shops or small kiosks should be created to cater to visitors needs for snacks and drinks.

- Parking lots are a very significant part of POS infrastructure; they must should be sufficient and able to accommodate a great of number of visitors.
- Surfaces should design with colors and materials conducive to the environmental conditions to enhance user experience. Light-colored surfaces, high albedo materials, rubber, wood chip mulch and sufficient greenery should be employed to manage the microclimate, noise and pollutants in the interest of user comfort and health.
- A dedicated pathway for walking and cycling should be created. Allocating such paths and lanes is very important in making users feel comfortable walking, interacting and socializing in the pathways of a POS.

6.4 Limitations and Challenges of the Research

The limitations encountered during this study were mostly rooted in time limits and the lack of availability of accurate and comprehensive information and data. Little documentation, information and publications were available on the research subject, especially regarding MIA Park and Oxygen Park. The research also faced certain challenges with the questionnaires, because some participants were unfamiliar with the selected POS and thus their answers for the questions were random. Moreover, during the day, there were certain hours during which many users were not surveyed because of the volatile microclimatic conditions (i.e. high temperature and strong wind velocity) that discouraged people from spending time in the POS. Further,

interviewees were difficult to find and few were collaborative. On another note, some documents and data were confidential and not allowed to be publicly shared; this impacted the possibility of gathering more beneficial information to inform the main aim of this thesis.

Putting these thoughts aside for aside for a moment, it is also important to recall here that this research explored environmental conditions variables by determining the microclimate, noise and air quality. Due to a lack of specific instruments/devices for measuring air quality and concertation pollutants, only a mobile application was used to assess air quality. Other variables that influencing the quantitative sides of this research include personal mistakes and the outdoor comfort calculator.

6.5 Opportunities for Future Development Research

Studies revolving about comfort, health and wellbeing in POS are fundamental for sustainable urban development. While this thesis explores best practices for designing POS to promote comfort, health and well-being, this work may be developed—its scope broadened—by applying different methods and taking up different cases. It would be exciting if ample time were available to study user comfort in summer and winter seasons with wider sampling of POS to determine user adaptations to the environmental conditions. For example, it may be interesting to more deeply explore the POS in the Msheireb area (e.g. the regenerated historic district), in which different POS categories are incorporated into the urban fabric of the area (e.g. street landscaping, courtyards, plazas and square), paying high attention to the different environmental conditions in their design. These categories and related spatial elements are certainly worthy of further study into how they impact user

comfort (i.e. visual, thermal, acoustic and lighting). On another note, this thesis also explored the impact of vegetation on psychological well-being as well as the influence of seating placement and changes in social activities. Such lines of inquiry may also be generative for studies of maintained and redeveloped spaces in historic districts, especially in illuminating the relationship between social interaction and comfort in POS. To be sure, the guidelines this thesis presents serve as a framework for future work, their practical applicability encouraging more work in historic districts in Qatar. Along these lines, further assessments of specific POS should explore their impact on well-being by unpacking how they foster social interaction, physical activities and psychological comfort.

REFERENCES

Abdullahi, S., & Pradhan, B. (2017). Sustainable Urban Developement *Springer International Publishing*. doi:10.1007/978-3-319-54217-1_2

Ageing, A. G. D. o. H. a. (2009). *Health Spaces & places: a national guide to designing places for healthy living*. Retrieved from https://www.healthyplaces.org.au/userfiles/file/HS&P%20An%20overview.pdf.

Al-Shihri, F. S. (2013). Principle of Sustainable Development and their Application in Urban Planning in Saudi Arabia. *Journal of Engineering Sciences, 41*.

Apostol, I. (2007). *The Production of Public spaces: Design Dialectices and pedagagy.* (Doctor of Philosophy). University of Southern California, Retrieved from http://nethood.org/ileana/papers/2007_IleanaApostol_PoPS_finaldraft.pdf

Arbury, J. (2005). *From urban sprawl to compact city: An analysis of urban growth management in Auckland.* Auckland,

Arup. Lighting in the Urban Age. Meaningful design for cities, people & places. In.

ASHRAE. (2004). Thermal environmental conditions for human occupancy In *ASHRAE Standard 55*: American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

Assembly, U. N. G. (1987). *World commission on environment and development: Our common future*. Retrieved from Oslo, Norway:

Audiology, A. A. o. (2009). Level of noise in decibel In: American Academy of Audiology.

Barton, H., & Tsourou, C. (2000). *Health urban planning: A WHO guide to planning for people*. London/Copenhagen: World Health Organization Regional Office for Europe by Spon.

Bedimo, R., Mowen, A., & Cohen, D. (2005). The significance of parks to physical activity and public health: A conceptual model. *American Journal of Preventive Medicine, 28*(2), 159-168.

Bleicher, A., & Gross, M. (2010). Sustainability assessment and the revitalization of contaminated sites: Operationalizing sustainable development for local problems. . *International Journal of Sustain- able Development and World Ecology, 17*(1), 57–66.

BojinSki, S., & VerStraete, M. (2014). *THE CONCEPT OF ESSENTIAL CLIMATE VARIABLES IN SUPPORT OF CLIMATE RESEARCH, APPLICATIONS, AND POLICY* (Vol. 95): BULLETIN OF AMERICAN METEOROLOGICAL SOCIETY

Bosselmann, P. (1983). *Sun and light for downtown San Francisco*. Berkeley: University of California.

Bougdah, H., & Sharples, S. (2010). *Environment, Technology and Sustainability* USA and Canada: Taylor & Francis.

Bramley, G., & Kirk, K. (2005). Does planning make a difference to urban form? Recent evidence from Central Scotland. *Environment and Planning A, 37*(2), 355–378.

Brandenburg, & Arnberger. (2001) *The Influence of the Weather upon Recreation Activities. Proceedings of the 1st Int*. Workshop on Climate, Tourism and Recreation, Society of Biometeorology, Commission on Climate Tourism and Recreation.

Bruse, M. (2009). *Analyzing human outdoor thermal comfort and open space usage with the multi-agent system BOT world*. Paper presented at the The seventh International Conference on Urban Climate, Yokohama, Japan.

Burton, E. (2000). The compact city: Just or just compact? A preliminary analysis. *Urban Studies, 37*(11), 1969–2006.

Butterworth, I. (2000). *The relationship between the built environment and wellbeing: A literature review*. Melbourne, Australia: Prepared for the Victorian Health Promotion Foundation.

Cafuta, M. R. (2015). Open Space Evaluation Methodology and Three Dimensional Evaluation Model as a Base for Sustainable Development Tracking. *Sustainability, 7*.

Cameron, R. W., & Blanu, T. (2016). Green infrastructure and ecosystem services – is the devil in the detail? *Annals of Botany, 118*(3), 377–391.

Carmona, M. (2008). *Public space: the management dimension*. London: Routledge.

Carmona, M., Tiesdell, S., Heath, T., & Oc, T. (2010). *Public Places Urban Spaces-The Dimension of Urban Design*. New York, USA: Routledge.

Carr, S., Francis, M., Rivlin, L. G., & Stone, M. (1992). *Public Space*. Cambridge, UK: Cambridge University Press.

Casiccia, C. (2019). Rethinking noise in public spaces. *How noise pollution affects our health and wellbeing.* Retrieved from https://www.rockwoolgroup.com/our-thinking/blog/rethinking-noise-in-public-spaces/

Cecilia, A. (2016). Public Space and the New Urban Agenda. *The Journal of Public Space, 1*(1).

Chen, L., & Ng, E. (2012). Outdoor thermal comfort and outdoor activities: A review of research in the past decade. *Cities*, 118–125.

Chiu, R. L. (2008). Shanghai's rapid urbanization: How sustainable? Built Environment. *34*(4), 532–546.

Chiu, R. L. (2012). Urban sustainability and the urban forms of China's leading mega

cities: Beijing, Shanghai and Guangzhou. *Urban Policy and Research, 30*(4), 359–383.

Claessens, F. (2005). Mapping urban and social space: towards a socio-cultural. Understanding of the built environment. *Delft University of Technology*.

Clark, & Edholm. (1985). *Man and his thermal environment*. **London**: Edward Arnold.

Committee, P. a. H. (2011). *Public life in private hands: Managing London's public space*. Retrieved from London:

Dahl, T. (2010). *Climate and Architecture*. USA and Canada: Routledge.

deDear, R., & Brager, G. S. (2001). The adaptive model of thermal comfort and energy conservation in the built environment *International journal of biometeorology, 45*(2), 100 108.

Design, T. A. (2014). Bilingual Museum Signage System. Retrieved from http://www.atrissi.com/index.php?pageID=15

Dines, N., Cattell, V., Gesler, W., & Curtis, S. (2006). *Public spaces, social relations and well-being in East London*: Joseph Rowntree Foundation.

Durie, M. (1994). *Whai Ora: Mäori Health Development*: Auckland University Press.

Edwards, B. (2014). *Rough Guide to Sustainability*. London: RIBA.

Eliasson, I. E. (2000). The use of climate knowledge in urban planning. *Landscape and Urban Planning*.

EPA. (1999). Guideline for reporting of daily air quality – air quality index (AQI). In. Office of Air Quality Planning and Standards: Research Triangle Park, NC 27711.

Erell, E., David, P., & Williamson, T. (2011). *City weathers: meteorology and urban design*. Manchester: Manchester Architecture Research Centre (MARC) Centre for the History of Science Technology and Medicine (CHSTM).

Foster, S., & Giles-Corti, B. (2008). The built environment, neighborhood crime and constrained physical activity: An exploration of inconsistent findings. *Preventive Medicine, 47*(3), 241-251. doi:10.1016/j.ypmed.2008.03.017.

Frances, E., William, C., Coley, R., & Brunson, L. (1998). Fertile ground for community: Inner-city neighbourhood common spaces. *American J of Community Psychology, 26*(6), 823-851.

Francis, M. (2003). *Urban open space : designing for user needs*. Washington; London: Island Press: Landscape Architecture Foundation.

Fringuello, L. (2008). A "new" Architectural Style with a deep roots.

Furlan, R., Petruccioli, A., & Jamaleddin, M. (2019). The authenticity of place-making Space and character of the regenerated historic district in Msheireb, Downtown Doha (state of Qatar). *International Journal of Architectural Research, 13*(1), 151-168.

Gehl, J. (1996). *Life between buildings : using public space*. Copenhagen: Arkitektens Forelag.

Gehl, J. (2007). *Public spaces for a changing public life*. Oxon: Taylor & Francis.

Gehl, J. (2012). *Life Between Buildings Using Public Space* (Vol. 3). London: Island Pres.

Golany. (1996). *Urban design morphology and thermal performance*.

Gomes, P. (2012). FACTORS OF GOOD PUBLIC SPACE USE. *Humanities and Social Sciences*, 608-618.

GoogleMaps. (2019). Google. Retrieved from https://www.google.com/maps/@25.3142165,51.5456855,12745m/data=!3m1!1e3

Goonewardena, K., Kipfer, S., Milgrom, R., & Schmid, C. (2008). *Space, Difference,*

Everyday Life. New York and London: Routledge Taylor and Franic Group.

Grahn, P., & Stigsdotter, U. A. (2003). Landscape planning and stress. Urban Forestry and Urban Greening. *2*(1), 1-18.

Griffiths, I., Huber, J., & Baillie, A. (1987). *Integrating the environment*. Paper presented at the European conference on architecture, Netherlands.

Habitat, U. N. (2013). Public Spaces & Sustainable Urban Development Retrieved from https://www.unece.org/fileadmin/DAM/hlm/prgm/urbandevt/Public_Spaces_Geneva_2015/presentations/01_Saliez_Vital_Public_Spaces.pdf

Habitat, U. N. (2014). Public Space in the Global Agenda for Sustainable Urban Development. *The "Global Public Space Toolkit"*. Retrieved from www.unhabitat.org

Habitat, U. N. (2015). *Global Public Space Toolkit: From Global Principles to Local Policies and Practice*. Retrieved from Nairobi GPO Kenya: www.unhabitat.org

Health, R. P. (2010). *Healthy Open Spaces: A Sammary of the Impact of Open Spaces on Health and Wellbeing* Retrieved from

Healthy Spaces and Places. (2009). *Design Principle – Aesthetics*. Retrieved from https://www.healthyplaces.org.au/userfiles/file/Aesthetics%20June09.pdf

Hepcan, S., Kaplan, A., Özkan, B., Küçükerbau, E. V., M.Yigit, E., & S.Türel, H. (2006). Public space networks as a guide to sustainable urban development and social life: A case study of Mugla, Turkey. *International Journal of Sustainable Development & World Ecology, 13*, 1–15.

Ho, C. S., & Kean, F. W. (2007). *Planning for low carbon cities-the case of Iskandar development region, Malaysia. In Toward establishing sustainable planning and governance II*. Seoul, Korea: Sustainable Urban Development Institute.

Hoskins, R. (2008). *'Our faces in our places': Cultural landscapes – Mäori and the*

urban environment.Rethinking urban environments and health. Retrieved from New Zealand:

ICIMOS, A. (1999). *Burra Charter*. Retrieved from

JACOBS, A. B. (1995). *Great streets*. Cambridge: MA: The MIT Press.

Johansson, E. (2006). *Urban design and outdoor thermal comfort in warm climates.* (Housing development & management).

Kaplan, R. (1999). Public places and spaces *Journal of Environmental Psychology, 10*(3), 290-292.

Kingi, T., & Durie, M. (2000). *Hua oranga: A Mäori measure of mental health outcome*. Retrieved from New Zealand:

Kolcaba, K. (2003). *Comfort theory and practice: a vision for holistic health care and research*. Ottawa: Springer Publishing Company.

Konya, A. (1980). *Design primer for hot climates*. London: Architectural Press.

Kopfmüller, J., Brandl, V., Jörissen, J., Paetau, M., Banse, G., Coenen, R., & Grunwald, A. (2001). *Nachhaltige Entwicklung integrativ betrachtet: Konstitutive Elemente, Regeln, Indikatoren*. Berlin: Ed. Sigma.

Krueger, R., & Buckingham, S. (2012). Towards a 'consensual' urban politics? Creative planning, urban sustainability and regional development. . *International Journal of Urban and Regional Research, 36*(3), 486–503.

Lanzafamea, R., Monfortea, P., Patanèa, G., & Stranoa, S. (2015). Trend analysis of Air Quality Index in Catania from 2010 to 2014. ATI 2015 - 70th Conference of the ATI Engineering Association. *Energy Procedia, 2015*(82), 708-715.

Larijani, A. H. (2016). Sustainable Urban Development, concepts, features, and indicators. *International Academic Journal of Science and Engineering,, 3*(6), 9-14.

Lefebvre, H. (2009). *State, Space, World*. London: University of Minnesota Press.

Lin, J., & Yang, A. (2006). Does the compact-city paradigm foster sustainability? An empirical study in Taiwan. *Environment and Planning B, 33*(3), 365-380.

Lin, T. (2009). Thermal perception, adaptation and attendance in a public square in hot and humid regions *Building and Environment*, 2017 – 2025.

Littig, B., & Grießler, E. (2005). Social sustainability: A catchword between political pragmatism and social theory. *International Journal of Sustainable Development, 8*(1-2), 65–79.

Lynch, K. (1972). *What Time Is This Place?* London: MT Press Camridge.

Madanipour, A. (1996). *Design of Urban Space*. London: Wiley.

Madanipour, A. (2003). *Public and Private Spaces of the City*. New York: Routledge.

Madden, K., & Schwartz, W. (2000). *How to turn a place around: a handbook for creating successful public spaces*. New York: Project for Public Spaces, 2000.

Mahmoudi, M. (2015). Determinants of livable streets in Malaysia: A study of physical attributes of two streets in Kuala Lumpur *URBAN DESIGN International*.

Makdii, U. (2011). *Influence of the Physical Characteristics of Urban Open Spaces on Residents Perception and Usage: A Case of 'Old Town' Mombasa.*

Marcus, C. C., & Francis, C. (1990). *People Places. Design Guidelines for Urban Open Space*. New York: Van Nostrand Reinhold.

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. (1972). *The limits to growth*. New York.

Mensch, J. (2007). *Public Space* (Vol. 40).

Mills. (1999). *Urban climatology and urban design*. Sydney, Australia.

Minken, H., Jonsson, D., Shepherd, S., Järvi, T., May, T., Page, M., . . . Vold, A. (2003). *Developing Sustainable Land Use and Transport Strategies: A Methodological*

Guidebook. Oslo: Institute of Transport Economics,.

Moonen, P., Defraeye, T., Dorer, V., Blocken, B., & Carmeliet, J. (2012). Urban Physics: Effect of the Micro-Climate on Comfort, Health and Energy Demand *Journal of Frontiers of Architectural Research*, 197-228.

Moreno, M., Labaki, L., & Noguchi, E. (2008). *Thermal Comfort Zone for Outdoor Areas in Subtropical Climate, in: Proceedings of the PLEA 2008*. Paper presented at the The 25th Conference on Passive and Low Energy Architecture, Dublin, Ireland

Morris, N. (2003). Health, well-being and open space. Literature review.

Murray, C. J. L., & Lopez, A. D. (1996). *The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020*. Retrieved from

Nasir, R. A., Ahmad, S. S., & Ahmed, A. Z. (2012). Psychological Adaptation of Outdoor Thermal Comfort in Shaded Green Spaces in Malaysia. *Procedia - Social and Behavioral Sciences*, 865 – 878.

Nikolopoulou, M. (2011). Urban Open Spaces and Adaptation to Climate Change. *Applied Urban Ecology*.

Nikolopoulou, M., Baker, & Steemers, K. (2001). Thermal comfort in outdoor urban spaces: understanding the human parameter. *Solar Energy*.

Nikolopoulou, M., & Lykoudis, S. (2006). Thermal comfort in outdoor urban spaces: Analysis across different European countries . . *Building and Environment, 41*(11), 1455-1470.

Nikolopoulou, M., & Steemers, K. (2003). Thermal comfort and psychological adaptation as a guide for designing urban spaces. *Energy and Buildings*, 95–101.

Nochian, A., Tahir, O., Maulan, S., & Rakhshanderoo, M. (2015). A COMPREHENSIVE PUBLIC OPEN SPACE CATEGORIZATION USING CLASSIFICATION SYSTEM FOR SUSTAINABLE DEVELOPMENT OF PUBLIC OPEN SPACES. *Universiti Putra Malaysia, Serdang, Malaysia, 8*(1).

Nurul, W. M. R. W. (2015). Compact urban form for sociability in urban neighbourhoods. *International Journal of Social Science and Humanity, 5*(10), 822.

Omasa, K., Saji, H., Youssefian, S., & (Eds.), N. K. (2002). *Air Pollution and Plant Biotechnology*. Tokyo: Springer.

Owen, N., Humpel, N., Leslie, E., Bauman, A., & Sallis, J. F. (2004). Understanding environmental influences on walking: review and research agenda. *American Journal of Preventive Medicine, 27*(1), 67-66.

Oxford. (2019). Retrieved from https://www.lexico.com/en/definition/well-being

Pintoa, S., Fumincellic, L., Mazzoc, A., Caldeirad, S., & Martins, J. (2017). Comfort, well-being and quality of life: Discussion of the differences and similarities among the concepts. *Porto Biomedical Journal, 2*(1), 6-12.

Porta, S. (2001). *Formal indicators: Quantifying the contribution of form to urban (social) sustainability*. Australia.

Properties, M. (2011). Msheireb DOWNTOWN DOHA. In *The New Center of Doha* Doha.

Qatar, G. (2008). *Qatar National Vision 2030*. Doha: General Secretariat for Development

Ragheb, A., El-Darwish, I., & Ahmed, S. (2016). Microclimate and human comfort considerations in planning. *International Journal of Sustainable Built Environment*, 156-167.

Reiter, S., & DeHerde, A. (2003). Qualitative and quantitative criteria for comfortable urban public spaces *ResearchGate*.

Salama, A., & Wiedman, F. (2013). *Demystifying Doha*. London, UK: Ashgate Publishing Limited.

Sauter, D., & Huettenmoser, M. (2008). Liveable streets and social inclusion *URBAN DESIGN International*.

Scotland, G. (2008). *Health Impact Assessment of greenspace: A Guide*. Retrieved from http://cloud.snappages.com/803c0945dd99f78b94cef59b278fec5244df7b24/HIA%20of%20greenspace%20a%20guide%20-%20GS%20HS%20SNH%20IOM%20Scotland%20-%202008.pdf

Setaih, K., Hamza, N., & Townshend, T. (2013). *ASSESSMENT OF OUTDOOR THERMAL COMFORT IN URBAN MICROCLIMATE IN HOT ARID AREAS.* Paper presented at the 13th Conference of International Building Performance Simulation Association, France.

Shi, A. (2001). *Population growth and global carbon dioxide emissions*. Paper presented at the IUSSP Conference Brazil/session-s09.

Silvius, A. J. G., & Schipper, R. (2010). *A Maturity Model for Integrating Sustainability in Projects and Project Management*. Paper presented at the IPMA World Congress.

Soja, E. (2000). *Postmetropolis: Studies of Cities and Regions*. Oxford UK, and Cambridge MA: Blackwell.

Soltanian, F. (2015). *Study of characteristics of urban public open spaces based on social interaction (Case study: Salavatabad's 3-kilometer route)*: Natural and Social Sciences.

Spaces, P. f. P. (2018). WHAT MAKES A SUCCESSFUL PLACE? Retrieved from

https://www.pps.org/article/grplacefeat

Staiger, H., Laschewski, G., & Grätz, A. (2012). The perceived temperature - a versatile index for the assessment of the human thermal environment. Part A: scientific basics . *International journal of biometeorology, 56*(1), 165-176.

Stanley, B., Barbara, S., Katrina, J., & Michael, S. (2012). ***Urban Open Spaces In Historical Perspective: A Transdispolinary Typology And Analysis*** Routledge Taylor & Francis Group.

Stiles, R. (2012). *Characteristics of Good Urban Spaces*: Institute.

Subeh, M. A., & Al-Rawashdeh, T. (2012). Urban sustainability,globalization and expansion organization in middle east. *Journal of Economics and Sustainable Development, 3*(14).

Synnefa, A., Dandou, A., Santamouris, M., Tombrou, M., & Soulakellis, N. (2008). Large Scale Albedo Changes Using Cool Materials to Mitigate Heat Island in Athens *Journal of Applied Meteorology and Climatology, 47*(11), 2846-2856.

Thorsson, S., Lindqvist, M., & Lindqvist, S. (2004). Thermal bioclimatic conditions and patterns of behaviour in an urban park in Goteborg *International journal of biometeorology, 48*, 149–156.

Tibbalds, F. (1992). *MAKING PEOPLE-FRIENDLY TOWNS Improving the public environment in towns and cities* London: Longman Group UK.

TranssolarKlimaEngineering. (2019). Outdoor Comfort Calculator. Retrieved from https://transsolar.com/blog/design-for-outdoor-comfort/assets/item_108_folder/index.html

Ulrich, R. (1979). Visual landscapes and psychological wellbeing. *Landscape Research, 4*(1).

UN. (2012). *Report on the United Nations Conference on Sustainable Development*.

Retrieved from New York:

Weidmann, F., Salama, A., & Theirstein, A. (2012). Urban Evolution Of The City Of Doha: An Investigation Into The Impact Of Economic Transformations On Urban Structures. *Metu Journal Of The Faculty Of Architecture, 29*(2), 35-61. doi:10.4305/metu.jfa.2012.2.2

Whitzman, C. (2008). The Handbook of Community Safety, Gender and Violence Prevention Practical Planning Tools. In. London.

WHO. (1948). WHO definition of health (online). Retrieved from https://www.who.int/governance/eb/who_constitution_en.pdf

WHO. (2000). *Air quality guidelines for Europe*. Retrieved from http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf

WHO. (2011). *Burden of disease from environmental noise, Quantification of healthy life years lost in Europe*. European Commission

WHO. (2018). Environmental Noise Guidelines, for the European Region. In. World Health Organization: Regoinal office for Europe.

Whyte, W. (1980). *Social life of small urban spaces*. Washington: Conservation Foundation.

Whyte, W. (1990). *City: Rediscovering the Center*. New York: Anchor Books.

Yang, F., Lau, S., & Qian, F. (2010). Urban design to lower summertime outdoor temperatures: An empirical study on high-rise housing in Shanghai. . *ELSEVIER; Building and Environment, 46*, 769-785.

Zacharias, J., Stathopoulos, T., & Wu, H. (2001). Microclimate and downtown open space activity. *Environment and Behavior, 33*, 296–315.

APPENDICES

Appendix A: Questionnaire Form

Questionnaire Survey Form

College of Engineering
Department of Architecture & Urban Planning

Master Thesis Focus on Urban Design

Thesis title: Rethinking Public Space through user's Health and Well-being: A Study of Improving Spatial Quality of Public Open Space in Doha

عنوان الرسالة: إعادة التفكير في الفضاء العام من خلال صحة المستخدم ورفاهه: دراسة لتحسين الجودة المكانية للمساحات المفتوحة العامة في الدوحة

This survey is part of my master thesis study about the " Improving the Spatial Quality of Public Open Space in Doha" (MIA Park, Oxygen park, and Msheireb area). The objective is to understand how the aspects of the public open spaces can be improved to promote health and wellbeing as well as the influence of the environmental condition on the level of physical and psychological comfort and well-being. The survey results will be analyzed the physical and environment elements and its relation with psychological comfort from user's perception and experience in order to evaluate, explore issues, and suggest solutions.

يعد هذا المسح جزءًا من دراستي لرسالة الماجستير حول "تحسين الجودة المكانية للمساحات المفتوحة العامة في الدوحة" (حديقة متحف الفن الإسلامي، وحديقة الأكسجين، ومشيرب). الهدف هو فهم كيف يمكن تحسين جوانب الأماكن المفتوحة العامة لتعزيز الصحة والرفاهية، وكذلك تأثير حالة البيئة على مستوى الراحة الجسدية والنفسية والرفاهية. سيتم تحليل نتائج المسح للعناصر المادية والبيئية وعلاقتها بالراحة النفسية من تصور المستخدم وتجربته من أجل تقييم واستكشاف المشكلات واقتراح الحلول.

Kindly be aware that your participation is voluntary and all the data collected through this survey will be remained confidential and anonymous. This data will be very helpful in understanding and developing set of guidelines for making a sustainable public open space in Doha to promote health and well-being and in turn achieve sustainable healthy environment. Time required to complete this survey is ten minutes. You can withdraw at any time or you can skip any question if you wish.

يرجى العلم بأن مشاركتك تطوعية وأن البيانات التي يتم جمعها من خلال هذا الاستطلاع ستبقى سرية ومجهولة. ستكون هذه البيانات مفيدة للغاية في فهم وتطوير مجموعة من الإرشادات لإنشاء مساحة عامة مستدامة في الدوحة لتعزيز الصحة والرفاه وبالتالي خلق بيئة صحية مستدامة. الوقت اللازم للاستكمال المسح هو عشر دقائق. يمكنك الانسحاب في أي وقت أو يمكنك تخطي أي سؤال إذا كنت ترغب في ذلك.

The study is approved by the Qatar University Institutional Review Board with the approval number QU-IRB 1120-EA/19; If you have any question related to ethical compliance of the study you may contact them at QU-IRB@qu.edu.qa

تمت الموافقة على الدراسة من قبل مجلس المراجعة المؤسسية لجامعة قطر برقم الموافق QU-IRB 1120-EA/19 إذا كان لديك أي سؤال يتعلق بالامتثال الأخلاقي للدراسة، فيمكنك الاتصال بهم على QU-IRB@qu.edu.qa

For additional information: Please contact Dr. Fodil Fadli. Email: f.fadli@qu.edu.qa - Office number: +974 4403 4351

للحصول على معلومات إضافية يرجى التواصل مع الدكتور/ فضيل فاضلي – رقم المكتب 4351 4403 974+

……**I have agreed to participate and fill this survey for education purpose.**

لقد وافقت على المشاركة وملء هذا الاستبيان لأغراض التعليم

Date/ Day **التاريخ/اليوم:** **Time:** **الوقت:**

Section 1: Introductory information **القسم 1: معلومات تمهيدية**

1. **Name (Optional):** **الاسم (اختياري):**
2. **Gender? الجنس**

( ) Male ذكر
( ) Female انثى

3. **Age? العمر**

( ) 18-25
( ) 26-35
( ) 36-45
( ) 46-55
( )More than 55

4. **Nationality? الجنسية**

( ) Qatari قطري
( ) Arab عربي
( ) Asian آسيوي
( ) European/American أوروبي/ أمريكي
( ) Other غير ذلك

5. **If you are an expatriate, years being stay in Doha?**
إذا لم تكن من المغتربين، فماهي عدد السنوات التي اقمت بها في الدوحة؟

( ) 1 - 2 year
( ) 3 - 6 years
( ) 7 - 10 years
( ) 11 - 14 years
( ) More than 14 years

6. **Are you? هل انت؟**

( ) Studying تدرس
( ) Working تعمل
( ) Retired متقاعد
( ) Other أخرى

7. **Education level? المستوى التعليمي**

( ) High school المدرسة الثانوية
( ) Diploma degree درجة الدبلوم

( ) Bachelor degree درجة البكالوريوس
( ) Master degree درجة الماجستير
( ) PhD درجة الدكتوراه

8. Frequently, models of transit used?
(Select all applicable)
في كثير من الأحيان، ماهي نماذج العبور المستخدمة؟
(حدد كل ما ينطبق)
( ) Car السيارة ( ) Walk المشي ( ) Bus الباص ( ) Bicycle الدراجة

9. Where do you live? (Area Name) ……..……أين تعيش؟ (اسم المنطقة)

Section 2: Current condition & types of activities القسم 2: الوضع الحالي و أنواع الأنشطة

10. Where do you spend your time in the weekend?
أين تقضي وقتك في عطلة نهاية الأسبوع؟
( ) Internal place مكان داخلي ( ) External place مكان خارجي ( ) Both الأثنان

11. Are you here?
هل أنت هنا؟
( ) Alone وحدك ( ) With friends مع الأصدقاء ( ) With family مع العائلة

12. When did you reach to this place?
متى وصلت إلى هذا المكان؟

( ) < 15min أقل من 15 دقيقة ( ) 15-30min بين 15 و30 دقيقة ( ) 1hr-1hr and half من ساعة إلى ساعة ونصف
( ) 2hrs-2hrs and half 2 ساعة - 2 ساعة ونصف ( ) 3hrs -3hrs and half 3ساعات -3 ساعات ونصف
( ) >3hrs and half أكثر من ثلاث ساعات ونصف

13. How long do you plan you will stay in this place?
كم من الوقت تخطط للبقاء في هذا المكان؟
( ) < 15min أقل من 15 دقيقة ( ) 15-30min بين 15 و30 دقيقة ( ) 1hr-1hr and half من ساعة إلى ساعة ونصف
( ) 2hrs-2hrs and half 2 ساعة - 2 ساعة ونصف ( ) 3hrs -3hrs and half 3ساعات -3 ساعات ونصف
( ) >3hrs and half أكثر من ثلاث ساعات ونصف

14. How often do you come to this place?
غالباً كم مرة أتيت إلى هذا المكان؟

( ) First time أول مرة ( ) Every day كل يوم ( ) Once or more a week مرة أو أكثر في الأسبوع
( ) Every month كل شهر ( ) Once or more in a month مرة أو أكثر في الشهر
( ) Few time in a year أوقات قليلة في السنة

15. At this moment, what type of activity you do in this place?
في هذه الأثناء، ماهي نوع الأنشطة التي تقوم بها في هذا المكان؟
( ) Walking/ exercising المشي/تمارين ( )Sitting /Relaxing الجلوس والاسترخاء ( ) Waiting الانتظار
( ) Eating/drinking الاكل/ الشراب ( )Gathering التجمع ( ) Children playing لعب الاطفال

( )Cycling ركوب الدراجة ( )Other غير ذلك

16. Why do you think you need to do this activity in this place?
(Select all applicable)
لماذا تعتقد أنك تحتاج القيام بهذا النشاط في هذا المكان؟
(حدد كل ما ينطبق)

( ) Reducing stress تخفيف الضغط ( ) Fitnessاللياقه البدنيه ( ) Weight lossفقدان الوزن
( ) Reducing risk of Diabetesالحد من مخاطر مرض السكري ( ) Enjoying time قضاء وقت ممتع

17. Considering the current condition, how would you like this place to be in terms:
بالنظر الى الوضع الحالي، كيف تريد أن يكون هذا المكان من حيث

Items	less أ قل	No change لا تغيير	Need More تحتاج اكثر
A- Lightingاضاءة			
B- Seats and shade devices مقاعد و تضليل			
C- Vegetationتشجير ونباتات			
D- Shaded areasمناطق مضللة			
E- Water featuresسمات مائية			
F- Signage'sلافتات			
G- Securityأمن			
H- Public toilets حمامات عامة			
I- Coffee shopمقهى			
J- Parking lotsمواقف سيارات			

Section 3: Place perceptions القسم 3: تصورات المكان

18. What is the main purpose from your visit?
ما هو الغرض الرئيسي من زيارتك؟

( ) Walking/ exercisingالمشي / ممارسة ( ) Sitting/relaxingالجلوس/ الاسترخاء
( ) Eating/drinkingالأكل / الشرب ( )Gathering التجمع ( ) Children playing لعب الأطفال
( ) Otherغيرذلك

19. Why do you prefer to come to this place?
لماذا تفضل أن تأتي إلى هذا المكان؟
(حدد كل ما ينطبق)

( ) Accessible/ easily to reach يمكن الوصول إليها / سهولة الوصول إليها
( ) Allowing all people meet and see friendsالسماح لجميع الناس بمقابلة الأصدقاء
( ) Diversity of activities تنوع الأنشطة
( ) Safe place مكان آمن
( ) Availability places to sit (in shade /in the sun)توفر أماكن للجلوس (في الظل / في الشمس)
( ) Beautiful and clean placeمكان جميل ونظيف
( ) Low level of noiseانخفاض مستوى الضوضاء

20. What do you like about this place?
(select all that applicable)
ماذا أحببت في هذا المكان؟
(حدد كل ما ينطبق)
( ) Bicycle lanes ممرات الدراجات ( ) Pedestrian routs مسارات المشاة ( ) walkway الممشى
( ) Signage system نظام اللافتات ( ) lightings الإضاءة ( ) Furniture الأثاث
( ) Public toilets الحمامات عامة ( ) Parkingمواقف ( ) Security/CCTV نظام الأمان
( ) Water feature السمات المائية ( ) Vegetation النباتات ( ) Floorings الأرضيات
( ) Children playground العاب الأطفال ( ) Othersغيرذلك

21. What do you think the design elements this place missed?
(Select all applicable)
ماذا تعتقد ماهي عناصر التصميم التي ليست موجودة في هذا المكان؟
(حدد كل ما ينطبق)
( ) Bicycle lanes ممرات الدراجات ( ) Pedestrian routs مسارات المشاة ( ) Signage systemنظام اللافتات
( ) lightings الإضاءة ( ) Furniture الأثاث ( ) Public toilets الحمامات عامة
( ) Parkingمواقف ( ) Security/CCTV نظام الأمان ( ) Water feature السمات المائية
( ) Vegetation النباتات ( ) Floorings الأرضيات ( ) Children playground العاب الأطفال
( ) Othersغيرذلك

22. What is your perception and experience regarding this place?
ما هو تصورك وتجربتك فيما يتعلق بهذا المكان؟
( ) Interesting ممتع ( ) Boring ممل ( ) Attractive جذاب

23. From your perception, what is a good public open space?
من وجهة نظرك، ما هي المساحة المفتوحة العامة الجيدة؟
……

Section 4: User perception and comfort and well-being القسم 4: تصورات المستخدم و الراحة النفسية والرفاهية

24. How do you feel after exposure to the green spaces?
كيف تشعر بعد التعرض للمساحات الخضراء؟
( ) Relax استرخاء ( ) Stress ضغط ( )Anxietyقلق ( ) Comfort مرتاح ( )Depressed مكتئب

25. At this moment, how do you prefer the weather situation in regards:
في هذه اللحظة، كيف تفضل حالة الطقس فيما يتعلق

	Parameters	More	Less	No change
2.1	**Air temperature درجة الحرارة**			
2.2	**Humidityالرطوبة**			
2.3	**Wind الرياح**			

26. A. If the weather gets colder, what's you will do?
إذا أصبح الطقس أكثر برودة، فماذا ستفعل؟

( ) Leave place مغادرة المكان ( ) Change the position تغيير التوجه والمكان
( ) Stay at the same place البقاء في نفس المكان

B. If the weather gets hot, what's you will do?
إذا أصبح الجو حارًا ، فماذا ستفعل؟

( ) Leave place مغادرة المكان ( ) Change the position تغيير التوجه والمكان
( ) Stay at the same place البقاء في نفس المكان

27. Do you think the weather condition can affect your visit time?
هل تعتقد أن حالة الطقس يمكن أن تؤثر على وقت الزيارة؟

( ) Greatly affect تؤثر بشكل كبير ( ) Affect تؤثر ( ) Do not affect لا تؤثر ( ) Do not affect
( ) significantly لاتؤثر بشكل كبير

28. Do you feel comfort in regards to the current noise level?
هل تشعر بالراحة فيما يتعلق بمستوى الضوضاء الحالي؟

( ) Yes نعم ( ) No لا

29. How do you think the air quality this moment?
كيف تعتقد تلوث الهواء هذه اللحظة؟

( ) Very polluted ملوثة جداً ( )Polluted ملوثة ( ) little polluted ملوثة قليلاً ( ) Unpolluted غير ملوثة
( )Don't know لا أعرف

30. In general, how do you rate the present level psychological comfort and well-being?
بشكل عام، كيف تقيم المستوى الحالي للراحة النفسية والرفاهية؟

( ) Very comfortable مريح جداً ( ) Comfortable مريح ( ) Little comfortable مريح قليلاً
( ) Little uncomfortable غير مريح قليلاً ( ) Very uncomfortable غير مريح للغاية

31. What do you think are the main issues prevent from feeling comfort and well-being in this place?
ما هي برأيك أهم القضايا التي تمنعك من الشعور بالراحة والرفاهية في هذا المكان؟

( ) Lack of accessibility and connectivity عدم إمكانية الوصول والاتصال
( ) Human behavior السلوك البشري ( ) Lack of activities قلة الأنشطة
( ) Lack of amenities عدم وجود وسائل الراحة ( ) Lack of safety انعدام الأمن
( ) Weather condition حالة الطقس ( ) Noise الضوضاء
( ) Air pollution تلوث الهواء ( ) Other غير ذلك

Section 5: General satisfaction **القسم 5: الرضا العام**

	Scale from: 1. Strongly agree, 2. Agree, 3. Neutral 4. Disagree, 5. Strongly disagree). **مقياس من: 1. أوافق بشدة 2. أوافق 3. محايد 4. لا أوافق 5. لا أوافق بشدة**	**1**	**2**	**3**	**4**	**5**
1	Do you think this place is suitable for all family member هل تعتقد أن هذا المكان مناسب لجميع أفراد الأسرة					
2	Do you think this place provide sense of comfortable and safety هل تعتقد أن هذا المكان يوفر الشعور بالراحة والأمان					
3	Does the existing trees & vegetation sufficient for reducing the environment effects هل الأشجار والنباتات الموجودة كافية للحد من الآثار البيئية					
5	Do you think this place help in reducing stress, anxiety and enhancing relaxation هل تعتقد أن هذا المكان يساعد في الحد من التوتر والقلق وتعزيز الاسترخاء					
5	Do you think this place promote society health, comfort and well-being in general هل تعتقد أن هذا المكان يعزز صحة المجتمع وراحته ورفاهه بشكل عام					

❖ Please if you have any further recommendation please share it?
من فضلك إذا كان لديك أي توصية أخرى، يرجى مشاركتها؟

THANK YOU FOR YOUR PARTICIPATION AND TIME
شكراً على مشاركتك ووقتك

Appendix B: Field Observation Checklist

Field Observation Checklist

Checklist obtained to investigate the type of user's and type of activities within the selected study space.

Date/Day: Location: Time: 10 am 6 pm
Temperature: Humidity: Wind velocity:

1	Type of user's		Visitor Male
			Visitor Female
			Children
			Disabled person
2	A mount number of people		Alone
			In group (with family& children-friend)
3	Type of activities		Walking/ exercising
			Sitting (sitting place: under shade- in sun- by seaside) other……
			Relaxing
			Biking
			Eating/Drinking
			Gathering
			Children playing
4	User feeling observed		Relax
			Sad
			Pleased
			Stress
5	Weather conditions		Dusty
			Sunny
			Rainy
			Cloudy
6	Noise level		High
			Medium
			Low

Appendix C: Interview Form

Date: Sep 01, 2019

Semi-structured Interview Form

The aim of the semi-structured interview is to investigate the design aspects in Doha's for the public open spaces and whether the current design elements of Public Open Spaces such as the parks and plaza consider the impact on society health and well-being and in line with achieving the sustainable development aspects. This is to aid in developing guidelines that can lead for improvement public open spaces in Doha to promote comfort, health and well-being.

الهدف من المقابلة شبه المنظمة هو استكشاف جوانب التصميم في الدوحة للأماكن المفتوحة العامة وما إذا كانت عناصر التصميم الحالية للمساحات المفتوحة العامة مثل الحدائق والمساحات العامة تراعي التأثير على صحة المجتمع ورفاهه وتمشيا مع تحقيق جوانب التنمية المستدامة. سيساعد ذلك في تطوير مبادئ توجيهية يمكن أن تؤدي إلى تحسين الأماكن المفتوحة العامة في الدوحة لتعزيز الراحة والصحة والرفاه.

The information provided is a significant source for the study and will be remained confidential and anonymous. For educational purposes only, this information provided will be used. The discussion topics mentioned below will be addressed only, if you feel you want to add more things that support the topic during the interview you are free to add it. You can withdraw at any time or you can skip any question if you wish. The interview time requested is approximately 15 minutes and will be audio- recorded. In case you don't wish to recording the voice, the interviewer will write the answers during the interview and would appreciate if you share the summary of interview content or any documents related. Finally, if the content clear and understandable, please sign below to confirm that you agree to participate. If you have any questions before signing the consent form or you want to know about the findings and results please find below the contact information.

المعلومات المقدمة هي مصدر مهم للدراسة وستظل سرية ومجهولة المصدر. لأغراض تعليمية فقط، سيتم استخدام هذه المعلومات المقدمة. سيتم تناول موضوعات المناقشة المذكورة أدناه فقط، إذا كنت تشعر أنك تريد إضافة المزيد من الأشياء التي تدعم الموضوع أثناء المقابلة يمكنك إضافته. كما يمكنك الانسحاب في أي وقت أو يمكنك تخطي أي سؤال إذا كنت ترغب في ذلك. مدة المقابلة المطلوبة حوالي 15 دقيقة وسوف تكون مسجلة. في حالة عدم رغبتك في تسجيل الصوت، سيقوم القائم بإجراء المقابلة بكتابة الإجابات أثناء المقابلة وسنكون ممتنين إذا كنت تشارك ملخص محتوى المقابلة أو أي مستندات ذات صلة. أخيراً، إذا كان المحتوى واضحًا ومفهوماً، فيرجى التوقيع أدناه لتأكيد على المشاركة. إذا كان لديك أي أسئلة قبل التوقيع على نموذج الموافقة أو كنت ترغب في معرفة النتائج، فتجدون معلومات الاتصال أدناه.

Note: the study is approved by the Qatar University Institutional Review Board with the approval number QU-IRB 1120-EA/19; If you have any question related to ethical compliance of the study you may contact them at QU-IRB@qu.edu.qa.

ملاحظة: تمت الموافقة على هذه الدراسة من قبل مجلس المراجعة المؤسسية لجامعة قطر برقم الموافقة QU-IRB 1120-EA/19
إذا كان لديك أي سؤال يتعلق بالامتثال الأخلاقي للدراسة، فيمكنك الاتصال بهم على QU-IRB@qu.edu.qa.

Regards and Thanks,

Eman Saleh AL Fadala - 200558264@qu.edu.qa

Dr. Fodil Fadli- Thesis supervisor - f.fadli@qu.edu.qa: Office number: +974 4403 4351

Participant signature: **Date:**

The below topics were included in the interview, but not limited: تم تضمين المواضيع أدناه في المقابلة، ولكن ليس على سبيل الحصر:	
1	Design considerations in Msheireb (accessibility and connectivity; sociability; activities; and user's comfort). اعتبارات التصميم في مساحات مشيرب (إمكانية الوصول والاتصال، التواصل الاجتماعي ، الأنشطة ، وراحة المستخدم)
2	Physical elements in Msheireb design (Barahat Msheireb – Sahat Wadi Msheireb) العناصر المادية في تصميم مشيرب (براحة مشيرب – ساحة وادي مشيرب).
3	Guidelines used in current designing. المبادئ التوجيهية المستخدمة في التصميم الحالي
4	Elements required to be added/improved.العناصر المطلوبة لإضافتها / تحسينها

Investigator signature: **Date:**

Appendix D: QU- IRB Approval

جامعة قطر
QATAR UNIVERSITY

Qatar University Institutional Review Board
QU-IRB

September 1st, 2019

Dr. Fodil Fadli
Master's Student Supervisor
College of Engineering, Qatar University
Tel.: +974 4403-4351
Email: f.fadli@qu.edu.qa

Dear Dr. Fodil Fadli,

Sub.: Research Ethics Expedited Approval/ Master's Student Project
Ref.: Student, Eman Saleh AL Fadala / Email 200558264@student.qu.edu.qa
Project Title: "Rethinking Public Space through user's Health and Well-being: A Study of Improving Spatial Quality of Public Open Space in Doha"

We would like to inform you that your application along with the supporting documents provided for the above Master's Student project, has been reviewed by the QU-IRB, and having met all the requirements, has been granted research ethics **Expedited Approval** based on the following category(ies) listed in the Policies, Regulations and Guidelines provided by MOPH for Research Involving Human Subjects.

1) present no more than minimal risk to human subject, and
2) involve only procedures listed in the following category.
Category 7: Research on individual or group characteristics or behavior (including but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies

Your approval is for one year effective from September 1st 2019 till August 31st 2020.

Documents Reviewed: Appendix (Questionnaire Form) -3rd sub, First Submission-QU-IRB Check list Blank, Msheireb letter – interview, QF–email response, QM letter–QM, QU letter-QM, QU letter-Msheireb, QU Letter-QF, QU-IRB Application Human Subject V3-Bilingual-Feb 2019-3rdsub, QU-IRB Review Research Proposal, Semi-Structure interview form (MIA Park) Semi-structure interview form (Oxygen Park), Semi-structure interview form (Msheireb), responses to IRB queries and updated documents.

Please note that this approval is for a study that investigates ways for improving the spatial quality of public space in Qatar (in particular MIA Park, Oxygen Park and Msheireb area). It will involve a questionnaire survey among visitors and interviews among key employees of the three identified public places above. This approval is subject to prior permission from relevant authorities in those public places.

Also note that expedited approvals are valid for a period of **one year** and renewal should be sought one month prior to the expiry date to ensure timely processing and continuity. Moreover, any changes/modifications to the original submitted protocol should be reported to the committee to seek approval prior to continuation.

Your Research Ethics Expedited Approval No. is: **QU-IRB 1120-EA/19**. Kindly state this number in all your future correspondence to us pertaining to this project. In addition, please submit a closure report to the QU-IRB upon completion of the project.

Best wishes,
Dr. Ahmed Awaisu
Chairperson, QU IRB

جامعة قطر
QATAR UNIVERSITY
Institutional Review Board
(IRB)
Office Of Academic Research

Appendix E: QU- Letters

جامعة قطر
QATAR UNIVERSITY

QATAR UNIVERSITY
COLLEGE OF ENGINEERING

DEPARTMENT OF ARCHITECTURE AND URBAN PLANNING

20/01/2019

O/1002 AUP/14/STU/TRIPS/19

إلى من يهمه الأمر في

هيئة متاحف قطر

تحية طيبة وبعد،

يهدف قسم العمارة والتخطيط العمراني بكلية الهندسة في جامعة قطر الى تشجيع الطلبة على إجراء البحوث والدراسات والتواصل مع مختلف المؤسسات والشركات والمجتمعات في البلاد وخارجها.

يقوم طلبة ماجستير التخطيط العمراني والتصميم بقسم العمارة والتخطيط العمراني بكلية الهندسة، بعمل البحوث والدراسات على العديد من المشاريع المختلفة وجمع المعلومات من الشركات المعمارية المتميزة والمؤسسات الحكومية في الدولة وخارجها. وكجزء من العمل على رسالة الماجستير MUPD 760-Thesis Focuses on Urban Design تحت اشراف الدكتور فضيل فاضلي، سيطلب منهم الحصول على المعلومات اللازمة لمواصلة دراستهم.

يرجى التكرم باتخاذ ما يلزم لتسهيل عملية توفير هذه البيانات والمعلومات المطلوبة الازمة لطالبات القسم لإكمال دراستهم على أكمل وجه.

اسم الطالبة:

1- ايمان صالح الفضالة، رقم قيد: 200558264.

مع جزيل الشكر وتفضلوا بقبول فائق الاحترام والتقدير

قسم العمارة والتخطيط العمراني
كلية الهندسة - جامعة قطر
Department of Architecture & Urban Planning
College of Engineering, Qatar University

د. فضيل فاضلي
رئيس قسم العمارة والتخطيط العمراني

Department of Architecture and Urban Planning, College of Engineering, Qatar University
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Phones: 974 4403 4340 Fax: 974 4403 4341 E-mail : architecture-urban@qu.edu.qa

جامعة قطر
QATAR UNIVERSITY

QATAR UNIVERSITY
COLLEGE OF ENGINEERING

DEPARTMENT OF ARCHITECTURE AND URBAN PLANNING

28/03/2019

O/1031 AUP/14/STU/TRIPS/19

To whom it may concern at

Qatar Foundation

Greetings

Dear Sir/Madam,

The Department of Architecture and Urban Planning at Qatar University aims at encouraging its students to conduct research studies and communicate with different organizations, companies, and societies in the country.

Master students are conducting research studies that are related to Thesis Focuses on Urban Design course, under supervision of Dr. Fodil Fadli. This requires gathering information from outstanding Architectural Firms and Government Agencies. As part of their research, they will have to acquire drawings, maps, taking photos and other necessary materials to pursue their studies.

I would be grateful if you could kindly facilitate the process of having these data to our students.

The names of the students are:

1- Eman Saleh Al-Fadala– QUID: 200558264.

Thanking you in advance for your cooperation.

Sincerely,

28.3.2019

قسم العمارة والتخطيط العمراني
كلية الهندسة - جامعة قطر
Department of Architecture & Urban Planning
College of Engineering, Qatar University

Dr. Fodil Fadli
Head, Department of Architecture and Urban Planning

Department of Architecture and Urban Planning, College of Engineering, Qatar University
Females Campus, Room # C 0219 P.O Box 2713 Doha, State of Qatar
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QATAR UNIVERSITY
COLLEGE OF ENGINEERING

DEPARTMENT OF ARCHITECTURE AND URBAN PLANNING

20/01/2019

O/1004 AUP/14/STU/TRIPS/19

إلى من يهمه الأمر في

مشيرب العقارية

تحية طيبة وبعد،

يهدف قسم العمارة والتخطيط العمراني بكلية الهندسة في جامعة قطر إلى تشجيع الطلبة على إجراء البحوث والدراسات والتواصل مع مختلف المؤسسات والشركات والمجتمعات في البلاد وخارجها.

يقوم طلبة ماجستير التخطيط العمراني والتصميم بقسم العمارة والتخطيط العمراني بكلية الهندسة، بعمل البحوث والدراسات على العديد من المشاريع المختلفة وجمع المعلومات من الشركات المعمارية المتميزة والمؤسسات الحكومية في الدولة وخارجها. وكجزء من العمل على رسالة الماجستير **MUPD 760-Thesis Focuses on Urban Design** تحت اشراف الدكتور فضيل فاضلي، سيطلب منهم الحصول على المعلومات اللازمة لمواصلة دراستهم.

يرجى التكرم باتخاذ ما يلزم لتسهيل عملية توفير هذه البيانات والمعلومات المطلوبة الازمة لطالبات القسم لإكمال دراستهم على أكمل وجه.

اسم الطالبة:

1- ايمان صالح الفضالة، رقم قيد: **200558264.**

مع جزيل الشكر وتفضلوا بقبول فائق الاحترام والتقدير

قسم العمارة والتخطيط العمراني
كلية الهندسة - جامعة قطر
Department of Architecture & Urban Planning
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