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THE PATTERN OF URBAN VOIDS IN DOHA NEIGHBORHOODS AND THEIR IMPLICATIONS

BY

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ABSTRACT

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Title: THE PATTERN OF URBAN VOIDS IN DOHA NEIGHBORHOODS AND THEIR IMPLICATIONS

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The extensive expansion in terms of economy, policies, and society in Qatar demands an increase of equal extent/scale on the building and infrastructure to accommodate the growth that is happening and that is expected to happen. The expansion seeks to compete with the global economic superpowers and the regional demands for socio-economic and socio-political stability. However, growth and development brought some undesirable side effects.

One issue that rapid urban development brought with it is the existence of negative spaces within the city – underutilized voids that remain unused or occasionally misused between urban elements. A rapidly growing city as prosperous as Doha has many urban voids in its neighborhoods, even in its most populous and dynamic parts. As leftover spaces are perceived as a disadvantage to the economic health of the neighborhood they belong to since they devalue the image of the city, understanding their presence and persistence in critical areas like the Al Mirqab, West Bay, and The Pearl in Doha could be beneficial for any urban projects.

The study analyses the presence and persistence of urban voids in Al Mirqab, The West Bay, and The Pearl using a combination of qualitative and quantitative data analysis. A survey of literature on these neighborhoods, actual site visits, measurements, and visual examinations were employed to gather qualitative information about these neighborhoods. A combination of urban morphology analysis,

land use analysis, and building height analysis was conducted in all neighborhoods to identify patterns, designs, and structural/architectural repetitions indicative of how the urban voids developed and persisted within these neighborhoods.

Keywords: land, morphology, transportation urban, voids

DEDICATION

To my loved ones, my role models and source of inspiration,

my mother, Lubna, and my father, Mohammed.

To my companions on every journey,

my husband Mohammed, and my daughter Layan.

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CHAPTER 1: INTRODUCTION

The demand for useable spaces and the need to strategically utilize spaces in urban areas cause urban developers to look for the optimal way to structure and distribute critical elements in cities. Essentially, cities must be designed to connect people and provide the daily needs of people, ranging from access to necessary amenities and facilities to meet people's basic needs to connect socially (Zarate, 2005). Planning urban spaces encompasses activities to anticipate, represent, and regulate urban areas in response to social and economic forecasts affecting land use, regulation, and utilization of public infrastructures (Goldstein, 2001).

Migration and rapid urbanization introduced numerous problems in the urban setting, including, but not limited to, epidemics, climate change, environmental degradation, urban voids, and slums. (Kalnay & Kay, 2003; Roy, 2011). These concerns have become persistent recently as economic growth increased activities related to building economies, drawing many people into urbanized areas and occupying spaces in many different manners – frequently, without regard to the appropriate placement and utilization of urban spaces. These challenges transcend the individual and communal levels and thus require the intervention of bodies with considerable influence and authority – the State or the government (Aguedelo-Vera et al., 2011).

During the initial phases of modern urban planning, governments undertook most efforts for laying out urban spaces to meet the need of an industry-centric society (Ratcliffe & Stubbs, 1995; Li & Wu, 2012). Through the mandate of its people and significant economic stakeholders, the government-built infrastructures around key industries, serving the needs of the industries to facilitate economic growth and making centralized decisions to optimize economic growth through the spatial transformation

of urban spaces (Fairfield, 1993; Sanyal, 2007). Eventually, the crowding of major urban areas led to the development of suburbs as the Middle class moved away from cities and into the outskirts, resulting in a complex network of freeways and highways connecting the Middle class to the industrial complexes (Fairfield, 1993; Aguedelo-Vera et al., 2011). However, much of this approach changed when unfamiliar problems in urban spaces emerged, brought about by factors outside industrialization and urban sprawl.

Spatial transformations in urban settings have since sought communal experiences, creating new forms of interconnectedness and localization (Million et al., 2022). As the stakeholders in any spatial transformations have moved away from government entities to the public, the complexity of planning effectively and efficiently for urban expansion and sprawl has increased tremendously (Friedmann, 1987; Rydin, 2007). The reason for this is straightforward – planning for cities is no longer motivated by the industrial and scientific revolution, which were the earlier motivation for urban plans, but instead is an activity incorporating vertical development with functionality through infrastructure and zoning (Wilson, 1996; Alexander, 2022).

Urban planning activities are no longer solely dependent on construction and project management. Instead, urban planning became a combination of political mediation, enabling mutual comprehension between and among different social, economic, and cultural interests and incorporating the ideas brought about by such deliberations into a shared vision of the area's future to be developed (Pinson, 2002). McFarlane (2011) argued that urban planning is no longer a planning-related expert knowledge activity. Rather, it has become a mixture of activities requiring political knowledge, global- and local-knowledges, community-based learning, and understanding of the citizens involved.

1.1.1 Urban Expansion and Sprawl

Urban expansion and sprawl directly resulted from rapid migration due to excessive economic and industrial activities (Whyte, 1958). Various scholars define urban sprawl as a low-density land use pattern located on the city fringes (Ewing & Hamidi, 2015; Andong & Sajor, 2017), the continuous spread of urban constructions in outer, under-developed lands (Ewing et al., 2002) that are typically characterized by the low-density, discontinuous, and inefficient spread of land resources (Hamidi & Ewing, 2014).

The phenomenon known as urban sprawl is characterized generally with negative qualities, primarily when it increases dependence on automobile transport, economic segregation, traffic congestion, and environmental degradation become a persistent problem (John, 2006). This kind of expansion is typically characterized by haphazard housing development in the suburban regions, typically without the proper housing permit (in third world countries – developing and economically unstable countries), uncoordinated or improperly coordinated layouts, and mostly lacking the social infrastructure needed for the communities to flourish (Newman & Kenworthy, 1999).

There are various measurements of urban sprawl and expansion – it is measured using single or multiple indicators, depending on who evaluates it. Single indicator measurements typically check the relationship between land and population (or both). For example, land or population is measured against density (population, residential, and employment densities), spatial form (connectivity, fragmentation, or traffic accessibility), landscape pattern, growth elasticity, and growth rate (Sohb et al., 2012; Triantakonstantis & Stathakis, 2015; Liu et al., 2018). On the other hand, multi-index measurements check the relationship between land and population on multiple aspects.

For example, Galster et al. (2001) measure regional sprawl against continuity, aggregation, density, concentration, proximity, and nucleation. On the other hand, the four-factor index developed by Hamidi & Ewing (2014) measures urban sprawl against activity-centering, land use mix, street accessibility, and development density.

1.1.2 Urban Voids: Characteristics and Meaning

Expansion takes up space, and well-designed urban expansions optimize the use of the space to ensure that all integral parts of the urban sphere are considered – transportation, power lines, communal areas, and personal properties. However, urban expansions are often uncontrolled and unregulated as a direct response to the growing and typically urgent needs for the utilization of space (Mcdonnel, 2011; Huang et al., 2015).

In the simplest sense, urban voids are spaces in areas that serve no role whatsoever, are often abandoned, and whose existence has no clear, logical explanation (Akkerman & Cornfeld, 2010). Urban voids are abandoned or neglected spaces left on their own when the surrounding spaces have developed (Corsaro, 2010; Hetherington & Smith, 2013). Urban voids are typically dispersed throughout the urban areas and do not improve or increase the quality of life of surrounding communities. Because of their lack of a clearly defined purpose in the urban setting, many authorities on the subject characterize them as an antithesis of a balanced and well-planned urban development where the space loses all memories and meaning of their existence (Omar & Saeed, 2019; Zecca & Laing, 2020; Hashem et al., 2022), disturbing the fabric of urbanity, to some extent (Pluta, 2017).

Urban voids are viewed negatively due to the predominant perception of voids as failures. In a way, these voids in urban spaces are representations of the shortcomings

of political decisions and historical events that shaped how spaces in urban areas are utilized (Komninos, 2013). Trancik (1986) defines urban voids as lost spaces that have declined by losing their function or functionalities, causing problems to the environment and the immediate communities. The reason for this rests on the planning where decisions on how urban spaces are utilized are made in 2-dimensional urban planning sheets, where the relationship between buildings, spaces, and human interactions still needs to be thoroughly and exhaustively considered (Trancik, 1986).

This is true for modern cities that have gone through an exponential expansion rate in the last few decades, such as the city of Doha. Qatar and the rest of the Arabian Peninsula have seen economic developments at an exponential rate, along with the increase in migration to fill in the financial requirements of such development (Hugh & Roberts, 2006). This, in turn, accelerates city growth and sprawl and, consequently, the emergence of urban voids.

In recent years, a new perspective toward urban voids has emerged. Urban voids are considered revive-able if the following elements are met: form and vitality – the measure of urban voids' ability to attract pleasant and vibrant interactions from the surrounding communities; accessibility – the proximity of the urban voids to critical urban infrastructures like housing complexes, transport terminals (or subway systems), roads and highways, etc.; viability to design and visual preferences; economic/financial benefits; homogeneity and place identity; safety and security (Jackson, 2006; Hou, 2010; Columbia, 2014).

1.2 Statement of the Problem

As discussed in the previous paragraphs, not all urban voids are utterly devoid of meaning and further utilization. There have been cases where urban voids are well

integrated into the cityscape and identified as critical and essential locations – proving them optimal for key urban projects (Elrahman, 2016). Because urban voids are typically located in critical areas of the urban setting, repurposing these voids into something integral to the surrounding community and the overall infrastructural need of the city is possible (Akkerman & Cornfeld, 2010; Pluta, 2017). In this regard, it becomes imperative to examine the key elements that allow for revitalizing urban voids and how to apply this to the context of Doha's neighborhoods' significant urban voids in Al Mirqab, West Bay, and The Pearl.

1.3 Research Question and Objectives

To understand how to utilize urban voids found in Doha's neighborhoods, the study intends to examine these questions:

I. What are the physical characteristics, including morphology, movement, land use, and spatial configuration, of the neighborhoods under study? What do these characteristics signify from the perspective of urban voids?
II. What are the historical, social, and cultural factors that contribute to the existence of urban voids in Al Mirqab, West Bay, and The Pearl? How have these factors influenced the emergence of these voids, and how can they shape our understanding and approach to them?
III. Does the planning approach and design impact the emergence of urban voids? Specifically, whether the growth of a neighborhood, whether organic or structured, affects the presence of these voids.

These questions seek to provide a deeper insight into how the urban voids in Al Mirqab, West Bay, and The Pearl can be revitalized and integrated into the surrounding installations without them losing their meanings entirely and, thus, keeping the cultural relevance of these spaces. In particular, this study intends to provide more understanding of the following:

a. The historical, social, and cultural aspects of the urban voids in Al Mirqab, West Bay, and The Pearl and how they affect these spaces' decline into urban voids, and how the same aspects can help revitalize them.
b. The urban spatial network effect significantly improves the chance of success in revitalizing the urban voids in Al Mirqab, West Bay, and The Pearl.

1.4 Significance of the Study

The examination in this thesis will serve two functions: provide a thorough understanding of (1) the morphology, functionality, physical layout, topology, and spatial network and (2) how history, culture, and society can aid in the redevelopment, repurpose, and revitalization of urban voids. The results can then be used in the redevelopment, repurposing, and revitalizing of urban voids having close to or similar conditions to Al Mirqab, West Bay, and The Pearl in all parts of the world.

1.5 Limitations and Future Work

Since the study will be focused on three neighborhoods in Doha, and because of the unique historical, social, and cultural settings in Doha, the application of the study's outcome could be helpful on urban voids located in similar historical, social, or cultural environments. Another limitation of this study lies in the lack of public

information freely available to identify the ownership of urban voids, especially vacant lands, as either private or public property.

Nonetheless, the thorough analysis this thesis provides on human and non-human variables can be a good starting point for future research undertaken in different historical, social, or cultural settings. Moreover, future research, like the lines of inquiry of this research, can utilize the concepts, principles, and theories used in this study to expand the analysis from the scale of neighborhoods to wider scales like regions and cities.

1.6 Organization of the Thesis

This thesis is organized as follows: The first chapter will introduce the importance of urban planning and how urban expansion and sprawl are typically uncontrollable factors in urban growth, resulting in standard urban qualities that generate the creation of urban voids. The chapter then introduces the problem statement, research goals and objectives, and the scope and limitations of the study. Chapter 2 will review urban voids as a theoretical subject in the field, how they appear in many separate locations and timelines, and how this phenomenon becomes persistent and difficult to ignore in cities worldwide. This chapter will also discuss how other governments, cultures, and societies have attempted to solve the issues related to urban voids and evaluate the successes and failures of some case studies. Then this chapter discusses urban voids in the Middle East and Doha by examining research into case studies of urban voids in the region.

Chapter 3 will describe the research methodology of the thesis, a combination of descriptive (or qualitative) and quantitative analysis. The descriptive analysis employed in this research involves site visits, observational mapping, field observation,

and photography which are necessary to develop a deep, comprehensive understanding of the structural dynamics leading to the presence and persistence of voids in the identified areas. Another dimension of descriptive data came from literature reviews like books, journals, and publications relating to the neighborhoods under investigation. Quantitative analysis, on the other hand, uses actual measurements and data on urban spaces, structures, street design, human behaviors, and surrounding activities.

Chapter 4 will focus on the urban voids of Al Mirqab, The Pearl, and West Bay as evaluated through the lens of both (1) physical layout, topology, and spatial network and (2) how history, culture, and society transformed these urban voids into what they are today in 2023. After thoroughly analyzing each neighborhood, voids analysis and proposal are provided to summarize the findings and transform the information into something relevant.

Chapter 5 will conclude the thesis by summarizing the key findings in a discussion and then drawing inferences based on the data, finding a commonality among the three neighborhoods that could provide insights about how urban voids exist and persist to exist in these neighborhoods in Doha. It will also briefly discuss future avenues for research on the topics covered in the thesis.

In summary, this chapter emphasized the importance of addressing urban voids and outlined the study's research objectives, which were to identify the factors contributing to the emergence of urban voids, examine potential uses for urban voids, and explore methods for integrating urban voids into the surrounding urban fabric while maintaining their cultural value. The chapter also highlighted the significance of the study in promoting sustainable urban development and presented the structure of the subsequent chapters. The chapter also highlighted the three main research questions

regarding the selected case studies, Al Mirqab, West Bay, and The Pearl. The chapter concluded by briefly previewing each upcoming chapter in the thesis.

CHAPTER 2: REVIEW OF RELATED LITERATURE

This chapter seeks to provide an understanding of two main themes. The first is the applications of urban morphology, and the second is the concept of urban voids, both of which are achieved through a literature review. The review will focus on answering four foundational questions related to urban morphology and urban voids:

I. What is the study of urban morphology, and how does it contribute to the understanding of urban voids?
II. What are the definitions and classifications of urban voids, and how have these concepts been defined and categorized in the literature?
III. What factors contribute to the formation of urban voids, and what design approaches can be chosen accordingly to address them?
IV. What does the literature provide regarding urban voids in the context of Doha, and what are the current research gaps in this region?

The review will focus on a range of scholarly sources to provide an overview of the state of knowledge on urban morphology and urban voids, focusing on the context of Doha.

The literature revealed that the approach to tackling urban voids is split into two main directions. The first approach suggests that urban voids are spaces to be maintained as they are and should be protected from the profit-generating perspective within the urban setting (Lefebvre, 2004; Akkerman & Cornfield, 2010; Gehl, 2011). These views also perceive urban voids as spaces of freedom that allow people to conduct non-contextual activities such as performances, games, and social events or

simply use them as gathering spaces. This also, in their perspective, provides more efficient use of the space since multiple demographics are more likely to circulate within the space rather than serving a single social group. This perspective is slightly unrealistic because, in many cases, urban voids are empty spaces maintained free for the future to contain projects ahead.

A contrasting perspective views urban voids as spaces that need to be integrated within the urban fabric and should be redeveloped to adhere to the economic representation other urban elements provide within the city (Goode, 1992; Graham & Marvin, 2001; Roy, 2011). Not only are the spaces required to generate or deliver economic outcomes, but these leftover vacant spaces are also expected to blend and become one with their surrounding urban structure to maintain a specific urban image of the city. This second perspective is more business oriented. When approaching urban voids with a business perspective, in many scenarios, developers divorce spaces from the social outcomes and are unconscious of the historical or cultural values a space could hold.

Trancik's (1986) definition of urban voids as spaces that have lost their meanings is still valid in today's more modern view and understanding of the problem. Urban voids are both conceptual and physical constructs (Panayotopoulos-Tsiros, 2020). As a physical entity, urban voids are spaces where nothing useful happens, typically vacant, under-utilized, abandoned, or neglected (Rennie-Short, 2004). As a conceptual construct, urban voids are linked to an expectation that all spaces are expected to be used, and their non-use suspends their functions in time (Heynen et al., 2006). In general, urban voids are viewed not only as the failure of the urban society to optimize the use of space and terrain (Accordino & Johnson, 2000; Berger, 2006) but also as the interplay of the failures of numerous variables such as government, local

policymakers, historical events, and communities to optimizing urban spaces (Graham & Marvin, 2001; Edensor, 2005; Komninos, 2013; Foo et al., 2014). This makes the study of urban voids multidisciplinary and multidimensional since urban voids are no longer a geospatial problem but also a problem of the economic, political, and social characteristics of any geographical location in space (Lynch, 1990).

Although pre-war industrialization brought about a massive influx of people in urban areas, transforming cityscapes into an infrastructural jungle, it was only after post-World War 2 that urban planning became entirely relevant to urban development (Graham & Marvin, 2001). The focus of these transformations is as much renovation as it was optimization in anticipation of economic growth after the war (Murdoch, 2005).

The post-war reconstructions and renovations in major cities around the globe – Paris, London, Berlin, Amsterdam, and Hiroshima – allowed theories on urban planning to see actual applications. There were so many economic activities during the 1950s that linearly planning the distribution of urban spaces eventually collapsed as the meaning of cities became synonymous with economic growth and social advancement (Accordino & Johnson, 2000).

The focal point in these early applications of urban planning theories is the utilization and optimization of the urban space (Boyer, 1994 in GUST, 1999). Cities' rush to expand economic activities and growth typically means an imminent necessity to fill spaces as quickly as possible without disrupting the social fabric (Edensor, 2005; Hou, 2010). This unplanned expansion eventually led to the phenomenon that Trancik (1986) aptly called 'lost spaces,' later becoming urban voids.

Defining urban voids is challenging as there is no singular, accepted definition of an urban void. Trancik (1986) believes these lost spaces feel incomplete as they lack

the vibrance to integrate seamlessly with their surroundings. To Lynch (1990), urban spaces are spaces in urban settings defined by their functions, and urban voids are spaces in urbanized and industrialized areas that are neglected, useless, empty, and wasted. A study by Hetherington & Smith (2013) affirms this definition by arguing that urban voids are neglected or left behind when the surrounding spaces have been developed and utilized.

Perera (1994) defines urban voids as under-utilized, unutilized, or abandoned lands due to invalid or outdated uses. Others defined urban voids in a more metaphorical sense, like Akkerman & Cornfield (2010), whose definition of urban voids suggests a lack of construct within a defined space, a lack of definition in an otherwise well-defined urban area, having little to none of the logical explanation for their existence. De Sola-Morales (2013) argued that urban voids are places in urban settings that have no purpose or functions and whose identities are hidden, which agrees with how Omar & Saeed (2018), Zecca & Laing (2020), and Hashem et al. (2022) defined urban voids. Pluta (2017) characterized urban voids as incoherent spaces that are out of context with their surroundings, making them stand out and disrupting the urban fabric as they provide no coherence or measurable function in the overall urban design.

Modern urban designs are facing the challenges of creating urban spaces that unify collective frameworks of development – where aesthetic solutions of urban space are secondary to the utility and function intended for these spaces about how these spaces serve the greater good of the city and its occupants (Boyer, 1994 in GUST, 1999). As the understanding of the origins and persistence of urban voids has increased, so has the knowledge that urban planning is not a unidimensional approach but rather a multi-dimensional approach encompassing many different variables with dynamic interactions (Corsaro, 2010; Hetherington & Smith, 2013). Because of the school of

thought that values urban space based on its utilities or functions, anything in urban settings that do not provide utility or function is a failure.

Komninos (2013) has articulated that urban voids represent the failure of the urban system – from the government to local decision-makers, urban designers, to communities – to effectively use these neglected spaces. Massey (1994) expressed a similar view about the existence of urban voids where urban transformations that result in vacant spaces represent a broader problem of political and economic changes, particularly in the expressions of identity, power, and change. In major cities, the presence of urban voids represents the problems of socio-political and economic segregation due to the exponential increase of privatization of public properties (Gandy, 2002). In the case presented by Gamm (1999), the shift in capital investments and population growth in major urban areas in the States left the poor neighborhoods poorer and urban voids have significantly increased.

Despite the lack of a unitary definition of urban voids, the general agreement about urban voids can be narrowed down into two – urban voids as a construct have tangible and intangible dimensions (Gandy, 2002; Omar & Saeed, 2018; Hashem et al., 2022). Moreover, urban voids have always been classified in two divided views – useful or useless, public or private, growing or in decline, empty of filled, used or abandoned, problems or opportunities – and actions are taken about this phenomenon depends highly on the perception towards them, either positive or negative (Panayotopoulos-Tsiros, 2020).

2.1 Urban Morphology

A deeper understanding of the genesis and persistence of urban voids requires understanding related concepts – urban morphology. By understanding how urban

landscapes are formed – the philosophies behind them, the diverse cultural influences that help shape the formation of cities – and by gaining more profound knowledge on how territories cohere and integrate, we can conclude the possible explanations of the formation of urban voids.

Urban morphology is the scientific investigation of settlements' physical space and form (Elzeni et al., 2021). It analyzes the aspects of the urban fabric, particularly the dynamic in the relationship between and among various elements, with the idea that the analysis will provide a sufficient understanding of the spatial configurations across different disciplinary boundaries (Gehl, 2011; Batty, 2013). Urban settlements take shape according to the needs of societies, economies, technologies, and environments in the physical and relational aspects (Mandanipour, 2001). This study evaluates the effects of urban morphology, street layout, pedestrian, and vehicular accesses, and how these factors help create urban voids within cities and urbanized areas to optimize the physical characteristics of the urban space and form (Carmona et al., 2003; Bekkering, 2006).

Urban morphology is generally broken down into two dimensions – explanatory (or descriptive) and normative (or prescriptive). Explanatory morphology deals with how urban forms and functions are built and are related to one another, with the impact of any urban development and growth for the lives with the well-being of the people in mind (Samuels, 2008). On the other hand, normative morphology looks at the uniformity of the form and function of the infrastructures built within and around the city (Goode, 1992; Parolek et al., 2008).

Sadeghi & Li (2019) proposed three different schools of thought concerning urban morphology: the British, French, and Italian schools of thought, which were based on earlier research by Moudon (1997). This thesis adds to the point of view

expressed by Scheer (2007) on the American method of dealing with urban morphology.

2.1.1 The British School of Thought

The British School is characterized by thinkers like Dickinson (1934), Conzen (1958), and Whitehand (1977). The main contribution of Dickinson to the British school is to introduce the German perspective to the British audience – which is to say that urban landscapes need to be dynamic and, at the same time, conservative (Batty, 2013). Conzen (1958) took the idea further and introduced the building fabric, ground plan, and infrastructure utilization (Bekkering, 2006). Conzen (1958) argued that any urban space could be broken in the ground plan whereby the streets, sites, and blocks are laid out, followed by the building fabric or the 3-dimensional equivalent of the ground plan, and lastly, their utilization as seen from a wholistic view – all of which give rise to the spirit of the place (or '*genius loci*') (Larkham, 1998; Bekkering, 2006). Overall, Conzen (1958) changed the British view on urban morphology by considering (a) the characteristics and alteration of urban landscapes, (b) the involved institutions when urban landscapes are to undergo alteration, and (c) how these alterations are to be managed (Larkham, 1998).

Because of this new perspective in urban studies, the University of Birmingham's Urban Morphology Research Group (UMRG), led by Jeremy Whitehand, entirely detached from geography and placed into the realm of urban economy, where form and function are merged with the society, culture, and policies of the surrounding communities (Moudon, 1997; Maffei, & Whitehand, 2001).

2.1.2 The Italian School of Thought

The Italian School of thought examines the urban form as a human-made and temporal activity, leading to the idealization and structuration of everything related to the urbanscape, unlike the British School's emphasis on relations between structure and form and communities. The focus of this approach is to combine urban morphology and the typology of architecture through the typo-morphology method (Batty, 2013).

The Italian School of thought, particularly the Muratorian school, rejects modernist architecture and its historical implications, focusing on the built landscapes and their relation to open spaces (Batty, 2007; Kropf, 2009). Consequently, it considers the activity of the urban morphology through the interface of builders and inhabitants as the interaction, history, and communications between the inhabitants and the planners, designers, and builders help shape the cities as they are – the *storia operanti* ('operating history') (Moudon, 1997). It contradicts other schools' thoughts about urban history shaping future developments (Conzen, 2010; Grahame Shane, 2011). The Italians give too much weight to ordinary buildings – buildings that are built without architects – and their surrounding infrastructures as the primary defining force of the urban fabric where the inhabitants adapt to their forms and functions and not the other way around (Caniggia & Maffei, 1979).

2.1.3 The French School of Thought

Although the French School arrived later to the urban morphology scene and was viewed initially as a continuation of both the British and the Italian Schools of thought, it eventually emerged as a distinct school of thought. Castex and Panerai (1982) discussed that typo-morphology views formations and transformations of urban settings as the alternative to the process-typological and historic-geographical

approaches. The French school dealt mainly with the organization of lots within cities, the fragmentation process of the urban block and buildings, the relationship between and among the built elements, the structure of lots and the public space, and how deformation processes in the urban landscape can be attributed to the other aspects (Batty, 2013; Elzeni et al., 2021). Two significant works are influencing the French School of thought – the *Analyse Urbaine,* which breaks down the urban fabric by extracting the fragments composing them, and the *Projet Urbain,* which looks at the urban fabric from an operational sense.

2.1.4 The American School of Thought

The work of Scheer on urban morphology offers multiple interesting insights into how the US approaches urban design and urban morphology. The planning methodology primarily adopted in US cities is the form-based codes (FBC), where codes supplant traditional land uses (Parolek et al., 2008). The European and British Schools centered on using space during urban expansion, forcing dwellers into congested, often unpleasantly designed neighborhoods if the forms meet functions (Duany et al., 2008; Polyzoides, 2008, in Parolek et al., 2008; Garnett, 2013). However, FBC focuses on developing land spaces according to the land's physical form as the development's organizing principle (Parolek et al., 2008; McFarlane, 2011). It is a methodology of urban development where the form of the buildings to be erected is evaluated primarily, and the function or utilization of the building is second (John, 2006). It was developed in response to the traditional zoning schemes that strongly emphasize the types of lands being used and developed, segregating different land use into various zoning districts (Goldstein, 2001).

FBCs are often called regulating plans since they promote compact development and mixed-use of available urban spaces, making cities more sustainable and harmonizing communities by allowing mixed-income communities to coexist in the same city sphere (Parolek et al., 2008). This approach addresses the challenges associated with inefficient lifestyles due to inadequate transportation options, the need for communities to access varying housing choices, and efficiency in public infrastructures (Graham & Marvin, 2001; John, 2006).

At this point, we already have a good understanding of the genesis of urban morphologies – whether by cautious design centered on the forms or functions of infrastructures, through the placement of infrastructures concerning the available spaces, or through how the needs of the inhabitants to participate in the economic activities of the cities are met, or through a more spontaneous response to the exponential increase in the influx of people to meet economic activities within the urban sphere. At this point, we must understand how morphologies take shape within regions to allow urban voids to appear.

2.2 Urban Voids: Typologies and Geographical Factors

Urban sprawl is a problematic phenomenon and a challenge for future town planners. As the population in major metropolitan areas increase, along with the population density due mainly to economic migrations. In principle, when a sprawl occurs, all available spaces are to be taken over before sprawl happens, as sprawl is an instantaneous reaction to the lack of readily available space within a given region or confine (Goldstein, 2001; Sohb et al., 2012). Ironically, urban districts with massive expansion and population growth have also seen significant numbers of voids or spatial vacuums where nothing of significance – whether economic, cultural, or social – occurs

(Murdoch, 2005; Ewing & Hamidi, 2015). In a modern society where everything is categorized according to its economic importance and the impact they make (directly or indirectly) on the future of the society, people, processes, and spaces that do not fall into any specific category are considered a failure. Such is the case of urban voids.

Urban voids are spaces with a loss of meaning as they become forgotten, underdeveloped, undeveloped, discarded, abandoned, misused, or completely neglected as the surroundings change according to the urban needs for space, utility, and form (Trancik, 1986; Triantakonstantis & Stathakis, 2015; Zecca & Laing, 2020). Their prevalence in any city or urban area has no definite patterns (Roy, 2011; Pluta, 2017); therefore, studies seeking to understand urban voids in these contexts are difficult to establish (Million et al., 2011; Huang et al., 2015). Strangely, urban voids exist even in densely populated urban settings (Edensor, 2007), making this phenomenon even more interesting to urban planners and policymakers.

2.2.1 Pluralistic Definitions of Urban Voids

As mentioned in the previous chapter, Trancik's (1986) definition of urban voids as lost spaces that have no positive contributions to their surroundings, while correct, has gradually become too broad and too generic to encapsulate the essence of what is an urban void entirely. Trancik (1986) based his remark on the observation that rapid urbanization activities, such as road construction and widening, force the isolation of pieces of useable lands and neighborhoods.

Over time, the urban void has become a blanket phrase for different terms that mean underused, unused, neglected, abandoned, and deteriorating spaces in urban areas (Akkerman & Cornfield, 2010). Some researchers have considered the term's neutrality, abstraction, and universality and have used these interchangeably similar terms that

mean the same (Rahmann & Jonas, 2011; Columb, 2012). Numerous researchers have pointed out the difficulties that arise in a unified definition of urban voids, including confusion, contradictions, and inconsistencies (Doron, 2000). The irrelevance of parameters that worked with one term but not on another (Pagano & Bowman, 2000) and the lack of any insightful analysis arose due to the lack of a singular meaning (Pearsall & Lucas, 2014). The reason for this challenge is apparent at this point. While the different terms used in defining urban voids are similar, the scales, attributes, relevant issues, causation, and urban contexts may differ (Eisinger & Seifert, 2012).

Table 1. Reclassifications of various terms of urban voids. Source: Hwang and Leee (2019).

RECLASSIFICATIONS	OTHER TERMS
Vacant	Vacant lot/land/building
Abandoned	Terrain vague/dead zone, wasteland or derelict space, terra incognita (abandoned unknown land), temporary obsolete abandoned derelict sites (TOADS)
Brownfields	Brownfields Drosscape (waste landscapes) Contaminated sites Opposite of greenfields Temporarily obsolete abandoned derelict sites (TOADS)
Urban void	Urban voids, underused or misused accidentally resulting space

RECLASSIFICATIONS	OTHER TERMS
Leftover spaces	Leftover/gap space, in-between spaces, indeterminate landscape, space left over after planning (SLOAP)

Among the various definitions given on urban voids, the work of Hwang & Lee (2019) stands out for its ability to narrow down a host of terms into five relevant ones (Table 1). They proposed five reclassifications of urban voids from about 12 different terms used to describe them, obtained from thirty-seven (37) studies on the definition and meaning of urban voids (Hwang & Lee, 2019). The standard terms used interchangeably in these studies include 1) vacant lot/land/building, 2) terrain vague/dead zone, 3) wasteland or derelict space, 4) terra incognita, 5) Drosscape, 6) temporary obsolete abandoned derelict sites (TOADS), 7) urban voids, 8) lost space, 9) leftover/gap space, 10) indeterminate landscape or ambivalent spaces, 11) space left over after planning (SLOAP), and 12) over-planned public space. The reclassifications then proposed are a) Vacant, b) Abandoned, c) Brownfields, d) Urban void, and e) Leftover spaces.

2.2.2 Voids and the Urban Fabric

While interest in urban planning and the more comprehensive approach to urban morphology intensified during the post-War years, urban voids were not considered a problem until Trancik's work in the late 1980s. There are two ways urban voids are a problem to the urban fabric. The first one involves the economic side effects of the urban voids, which inadvertently destroy the urban fabric; the second one involves the

lost meaning attributed to the urban void, which can be related to the neighborhood's culture, society, or history.

An earlier definition provided by Northam (1971) looked at the presence of vacant lands in urban areas that are typically small and irregular parcels of land that are in unusual settings (in flood hazards and steep slopes, for example) which could, in the future, be developed into something useful as long as the current limitations are removed or exacerbated. We need to clarify that this earlier definition of Northam (1971) about urban voids is critical in the prevalence of the perception of the economic values (or lack thereof) associated with the presence of unusable, abandoned, and neglected spaces.

It is no wonder that the views Accordino & Johnson (2000) expressed on the prevalence of urban voids depend entirely on their economics. In their definition, urban voids are seen as vacant and abandoned properties that cost neighboring properties value by lowering these properties' market equity simply by their existence (Accordino & Johnson, 2000). This typically projects its effects on the neighborhood, increasing the probability that properties in the area become abandoned or neglected, leading to another urban void, as data obtained by Accordino & Johnson (2000) heavily emphasizes a correlation between community life and urban voids.

De Sola-Morales (2013) held similar views. She described urban voids as undefined and inactive empty spaces with undeveloped (economic) potential, and Lynch (1990) defined urban voids as valueless material remaining after some undertaking of consumption or production of the land. Oswalt (2005) further advanced the idea by drawing parallels between urban voids and deindustrialization, peripheralization, suburbanization, and post-socialism. In the case of Spain, the real estate bubble between 1996 and 2008 saw the emergence of unfinished (or half-

finished) buildings and empty lots waiting for more favorable economic conditions to be sold, which never came, producing many areas without purpose or function in urban Spain (Bardhan et al., 2011). This cements the economic-centric definition and perception of urban voids indicated by Northam.

The problem of vacant urban spaces has become more apparent in the United States as industrialization has seen a significant decline along with the rapid movement of people from urban areas into the city periphery (Accordino & Johnson, 2000). The outmigration policies that incentivize the movement of the middle class to suburban developments and the housing policies that are highly favorable to new developments over developing existing but underutilized infrastructure and urban spaces all contribute to the increase in spaces that have seen underutilization (Roy, 2011).

To discourage further escalation about the presence of urban voids in the United States, policies were instituted that either (1) tighten the standards of property management and (2) maintain or increase the tax rate for outlawed properties. By tightening the standards of property management and maintenance, property owners are forced to maintain the property's condition to the urban standards, thus slowing down the trend of the increase in urban voids (Accordino & Johnson, 2000). Similarly, by enforcing taxes on properties left on their own and selling them in public auctions, owners must pay their real property taxes and are indirectly forced to maintain the well-being of their properties (Accordino & Johnson, 2000; Dunn, 1994).

Aruninta (2004) pointed out that the fundamental restructuring of the global economy caused an exponential growth in urban voids, coupled with unthoughtful policymaking, inefficient land management, and lack of coordination between and among decision-makers, all contribute to the creation of urban voids. Bowman &

Pagano (2000) argued that growing local economies, land reuse policies, shrinking cities, and in-migration policies helped mitigate the phenomena.

However, there is another aspect of the persistence of the urban voids that could not be explained entirely by economic models – the loss of meaning in these public spaces. According to Edensor (2007), urban voids represent what people seek in them, typically an experience more than the physical presence. Secchi (1984) argued that large urban voids have shown up in Europe because of (a) the growing disuse of 19th-century infrastructure that the urban setting no longer requires (slaughterhouses, railyards, barracks, etc.) and because of (b) the morphological approach to urban planning that focuses on individual architectural entities rather than on the relational dynamics between and among entities, leaving empty spaces, mainly if these spaces play no recognizable roles. It contradicts De Sola-Morales' (2013) argument that urban voids are *terrain vagues,* where urban voids have more to do with the presence of superimposed codes that often clash or destroy the identity of the place.

In the works of Stavrides (2014), urban voids are considered empty relative to something that is filled. That emptiness is a function of the relationship of the space relative to its history, culture, and processes. The school of thought promulgates the idea that a place's shape and form are linked to economic development and the evolution of the artistic, cultural, and social expressions of the space and time that the urban voids appear (Williamson, 2013). This is reinforced in Talocci's argument, where he pointed out that the formation of urban voids depends on the interplay of the internal and external forces that enact on them, between the dynamics of social and political powers, or communities, of cultural expressions, and of the prevalent school of thoughts of the time (Talocci, 2011).

To Doron (2000), urban voids do not necessarily mean dead areas. His research shows some activities happening in the urban voids of many different cities. However, these activities are non-conventional, implying that all plans on the available, underused, and unused city spaces are nothing but plans in complete suspension. At the same time, the rest of the details are being worked out by urban planners or private stakeholders (Doron, 2000). Similarly, Stavrides was quick to point out that identification of the urban voids implies the desire to improve the condition of the space by introducing new developments to utilize this space (Stavrides, 2014). These views towards urban voids remove the economic element of their existence and tend to romanticize their formation. As De Silvey & Edensor (2012) puts it, urban voids are lands that can serve as an escape for urban dwellers and as a refuge for wildlife.

2.2.3 Surface Parking as Urban Voids

In terms of environmental complications, according to Mohajerani et al. (2017), the use of asphalt in cities has been a significant evoker of an urban heat island effect (UHI) because of low albedo (a material's capacity to reflect solar radiation) of asphalt, which is typically equal to 0.05 (Pomerantz et al., 2003). This low ratio means that when the asphalt is exposed to solar radiation, it absorbs ninety-five percent (95%). This solar exposure, in return, increases the surface's temperature and the surrounding air. Additionally, the stored heat throughout the day is later released into the environment at nighttime, increasing the microclimate's temperatures. Moreover, exposed parking lots have a crucial role in the continuous pollution of harmful emissions like NOx (nitrogen oxides) and VOCs (volatile organic compounds) produced from various parts of a vehicle (body, engine, and fuel tank), which consequently reduces the air quality of the microclimate leading to long-term health

complications (Lo et al., 2003). For the reasons mentioned above, the open areas in an urban setting used as parking spaces, which are underutilized once the vehicles leave the space, are defined or categorized as urban voids.

2.2.4 Urban Voids as Opportunities

Trancik suggests that urban voids are the results of two-dimensional plans carried out in three-dimensional spaces without consideration of the relationship between and among the buildings and spaces outlined in the urban maps (Trancik, 1986). This idea is supported by Gehl (2011) when he used the example of road networks in urban areas that strongly emphasize individual buildings rather than public spaces. For instance, Erkilic & Ciravoglu (2018) pointed out the existence of flyovers and overbridges where, while they solve the transport efficiency issue, they leave unused spaces underneath them, adding no value to the city's growth. Lynch's idea about the usefulness of urban voids despite the neglect and abandonment was quickly picked up by scholars like Loukaitou-Sideris (1996), Doron (2000), and Stavrides (2014), among many more. Lynch argued that urban voids are suspended in time, waiting for things to happen, which could either be detrimental or open many opportunities (Lynch, 1996). Because urban voids are not isolated cases but are parts of the broader spectrum of the overarching context of the city, transforming them needs to be approached carefully. Otherwise, the outcome of the transformation would not be the expected one (Loukaitou-Sideris, 1996).

Cassegard (2010) argued that numerous opportunities are available for urban voids and the authorities need to pay more attention to these spaces. In most cases, they are unregulated, allowing users to shape the space according to their needs. As the urban voids are empty of any persona, nearby communities can repurpose them according to

their creativity and imaginative inventions (Overmeyer, 2002). Rahman & Jonas (2011) also argued that urban voids could mediate between the existing urban land and those that need to be developed, allowing them to be used as noncommercial spaces or spaces for temporary creative expression.

2.2.5 Urban Voids in Doha, Qatar

Urban voids are a phenomenon that can be observed in Doha on various scales, ranging from significant spaces, such as the old airport site, to the spaces between buildings. However, there is a lack of available literature on these leftover spaces in Qatar. One study conducted by ElGahani (2019) explored the subject of urban voids in the context of Doha, specifically in the neighborhood of Al Sadd. The study sought to assess the impact of these spaces on mixed-use neighborhoods and examined the factors that shaped their existence. It also proposed strategies to manage these spaces, focusing on three primary voids in Al Sadd and considering the surroundings' physical and non-physical aspects.

ElGahani (2019) concluded that urban voids hurt the sense of neighborhood in Al Sadd by influencing the area's image, security, and user behavior. The study also identified the primary factors that led to the appearance of these voids, including land subdivisions, irregular land shapes, ownership issues, and land-use regulations. However, it is essential to note that ElGahani's (2019) study only examined one neighborhood, leaving a research gap in comparing different neighborhoods and urban settings regarding urban voids. This limitation restricts the research outcomes to the selected case study or other areas with similarities.

To address this gap, future studies could explore the presence and impact of urban voids in other neighborhoods and urban settings in Doha. A comparative analysis

between different neighborhoods could provide a more holistic understanding of the phenomenon and its effects on urban environments. Such a study could also examine the potential benefits of urban voids and identify strategies to enhance their positive impact on urban spaces. In conclusion, while ElGahani's (2019) study provides valuable insights into the impact of urban voids in a mixed-use neighborhood in Doha. It also highlights the need for further research in this area. By exploring different urban settings and neighborhoods, future studies could provide a more comprehensive understanding of the phenomenon and its potential benefits for creating sustainable urban environments. This thesis addresses some of these research gaps, mainly by examining three neighborhoods in Doha and conducting a comparative analysis.

2.3 Chapter 2 Summary

This chapter provided a comprehensive literature review focusing on two main themes: urban morphology and urban voids. In the first section, the chapter introduced and defined the concept of urban morphology, which is the study of the form and structure of cities. The chapter then discussed the applications of urban morphology in understanding the emergence and persistence of urban voids in cities. This was followed by highlighting the schools of thought on urban morphology and the related approaches. Urban morphology has been a crucial concept for comprehending the emergence and persistence of urban voids, where the analysis of the physical space and form of settlements provides a better understanding of the spatial configurations of urban settings.

In the second part of the literature review, the chapter provided a review of the concept of urban voids. Scholars commonly described urban voids as leftover, underutilized, or unused spaces within the built environment. The various categories of

urban voids, including abandoned buildings, vacant lots, and derelict spaces, were briefly discussed. It was concluded from the related research that urban voids could be perceived from two main conceptions. One promotes preserving and maintaining them as areas of freedom, while the other proposes incorporating and revitalizing them to align with the economic representation of other urban elements.

Moreover, urban voids were also perceived as an urban failure since they reflect the shortcoming of decision-makers, historical events, and communities in optimizing urban spaces. On the other hand, the literature reflected that urban voids could have positive impacts, such as providing opportunities for public art and community engagement. Lastly, the second chapter presented studies on local urban voids in Qatar. A detailed analysis of the studies was provided, highlighting their key findings and research gaps. These research gaps were addressed in this thesis to provide a more comprehensive understanding of urban voids in Doha neighborhoods.

In conclusion, the literature showed that investigating urban voids is a multidisciplinary and multidimensional issue, requiring a geospatial approach and an economic, political, and social perspective. Defining urban voids can be a challenge. There have been various arguments and terms used to describe urban voids. Table 2 summarizes the most frequently used terms, along with their definitions and sources.

Table 2. Terms used in the literature review about urban voids. Source: Author.

TERM	DEFINITION	SOURCE
Vacant lot/land/building	A parcel of land, often in an urban area, that is currently unused	Hwang & Lee (2019)
Terrain vague/dead zone	An area that has been abandoned or neglected and is no longer being used	Rahmann & Jonas (2011); De Sola-Morales, Ignasi (1996); Kevin Lynch (1990)
Wasteland or derelict space	An area that has been left to deteriorate.	Akkerman & Cornfield (2010)
Urban voids	Underused, unused, neglected, abandoned, and deteriorating spaces in urban areas	Akkerman & Cornfield (2010)
Terra incognita	Abandoned unknown land	Bowman, A. O. M., & Pagano, M. (2004)
Drosscape	A landscape that is considered to be ugly or unattractive	Allen (1999)
Temporary Obsolete Abandoned Derelict Sites (TOADS)	An area that was once in use but has since been abandoned or neglected	Greenberg, Popper, & West (1990)

TERM	DEFINITION	SOURCE
Urban voids	Lost spaces that have no positive contributions to their surroundings	Trancik (1986)
Urban voids	An area within a city that is unused or has been abandoned	Trancik (1986)
Lost space	An area that has been lost or forgotten	Pearsall & Lucas (2014) Trancik, 1986; Triantakonstantis & Stathakis, 2015; Zecca & Laing, 2020
Leftover/gap space	An area that is left over after a development project has been completed	Pagano & Bowman (2000)
Indeterminate landscape or ambivalent spaces	An area that is difficult to define or categorize	Columb (2012)
Space left over after planning (SLOAP)	An area that is left over after a development project has been completed	Tseura Maruani & Irit Amit Cohen (2007)

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

This chapter will detail the research design of the study. A multi-layered approach will be used in qualitative and quantitative data collection methodologies to examine the current conditions of the street network in the identified neighborhoods comprising the built environment of these areas. The analysis will be divided into three case studies – one for each neighborhood identified. The analysis section contains a thorough contextual discussion on the Al Mirqab, West Bay, and The Pearl, focusing on each neighborhood's physical characteristics like morphology, movement, land use, and spatial configuration.

3.1 Research Approach

This thesis will approach the problem using the descriptive-analytical method to identify and find correlations between numerous factors affecting urban voids' formation, progression, and development. A thorough discussion on the definitions (or the lack thereof) of urban voids was provided in the previous chapters to introduce the readers to the core of what the thesis seeks to achieve. The description of the development of urban voids by relating it to urban morphology, the lack/absence/decline of meaning attributed to such spaces, and the opportunities for such places to future developments were provided. To gain a thoughtful analysis of the Al Mirqab, West Bay, and The Pearl neighborhoods, this study focused on analyzing their morphology and physical forms, land uses, and spatial compositions. By employing graphical representations that are highly accurate on specific parameters such as active and inactive frontages, ground-level land use, and street views of the

area, this thesis attempts to visualize the possible circumstances and the urban issues that eventually lead to the emergence of urban voids.

The method includes the use and generation of highly accurate graphical maps of the identified neighborhoods to develop a precise visualization of the plans and designs of these neighborhoods. These data are then translated into quantitative numerical data that would serve as essential variables in bridging physical parameters with socio-cultural and socio-economic parameters relevant to forming and developing urban voids in these neighborhoods.

Figure 1 illustrates the structure of the thesis, including the methodology and research approach, which also demonstrates the correlation between different sections. The study is initiated with a research problem addressing the urban voids pattern in Doha's neighborhoods. A literature review follows the research problem definition focusing on urban morphology and urban voids to understand their types, factors, and characteristics. The primary approach for the research method includes two sections, the data collection and the data analysis. The data is collected for three case studies (Al Mirqab, West Bay, and The Pearl). It includes site visits and other online sources such as Google Earth satellite images and governmental public resources. In the data analysis, the collected data is translated into two categories (tangible and intangible parameters), which include several sub-sections shown in Figure 1. The tangible properties compromise the neighborhoods' morphology, land use, and frontage activity. The intangible properties comprise the people's history, society, and behaviors within the identified neighborhoods. The data analysis also includes analyzing the urban voids from the same perspectives. The results of the data analysis on the three neighborhoods are cross-checked with the literature review and aligned with the identified research problems.

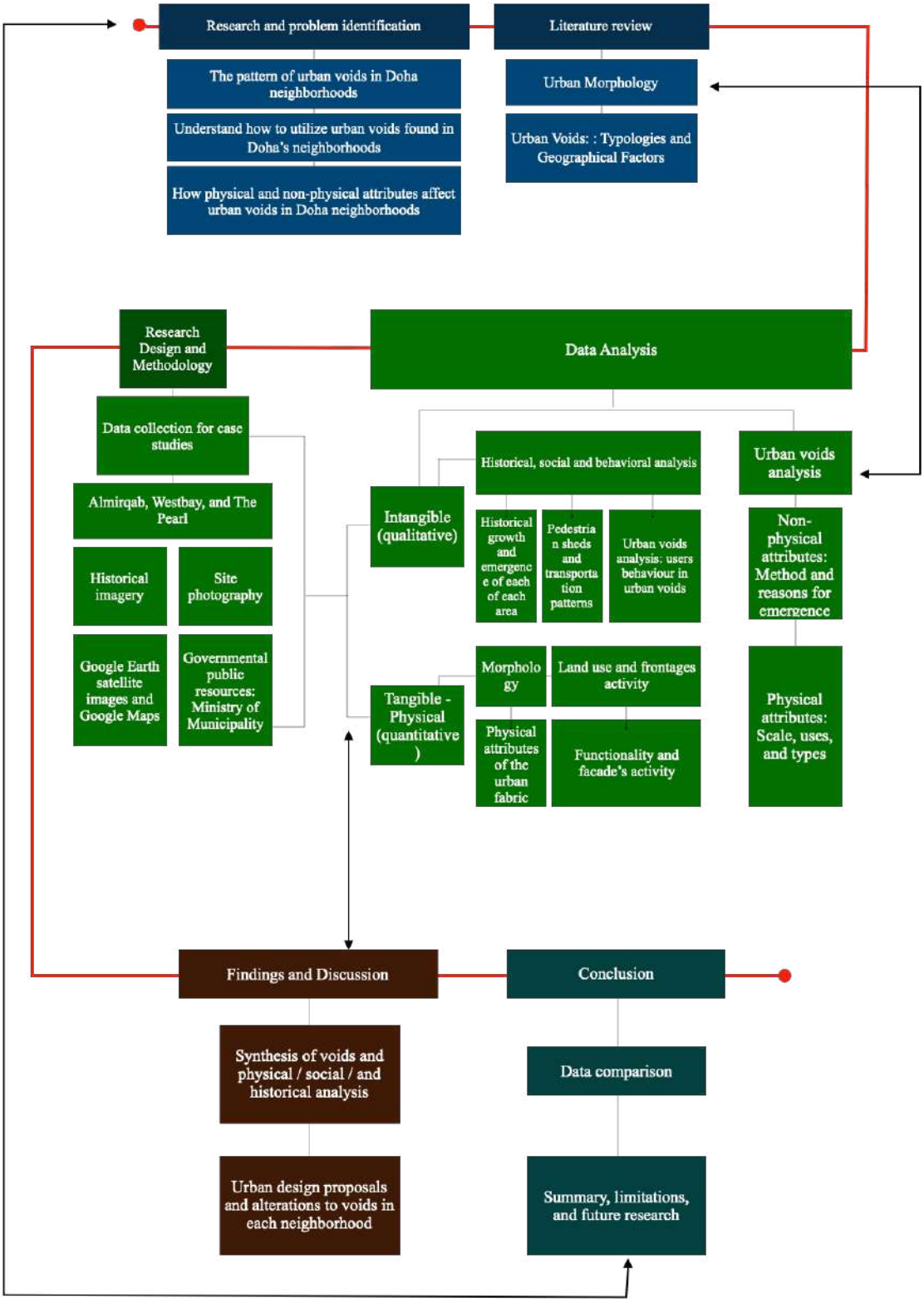

Figure 1. Diagram outlining the research methods and outline used in the thesis. Source: Author.

After concluding the tangible and the intangible analysis, they are synthesized and related to the urban voids analysis to produce urban design proposals for the voids within the examined neighborhoods. The suggested recommendations are tied directly to each case study's attributes and analysis. Lastly, the thesis concludes by comparing the data analysis outcomes and the proposed solutions among the case studies, highlighting the limitations and the likely future research following this study.

3.2 Scope of the Study

The study focuses on three neighborhoods in Doha –Al Mirqab, West Bay, and The Pearl – as data collection and contexts from literature are used to evaluate the emergence and the persistence of urban voids. For each neighborhood, a contextual analysis is performed, which includes a historical evaluation of the neighborhood, an analysis of their urban development processes concerning their surrounding neighborhoods, and how the intended building use affects the overall design of the neighborhood and, consequently, how the neighborhood's function concerning other neighborhoods affect the choices made for building use and facilities. After discussing the morphology, movement, land use, and spatial layout for all three neighborhoods, a comparative analysis is provided. This comparative analysis identifies commonalities and attributes among the three neighborhoods.

3.3 Data Collection and Techniques

The study utilizes qualitative and quantitative analytical techniques in the thesis to allow for a broader understanding of the neighborhoods under study. Quantitative techniques commonly used in urban morphology are also employed in this thesis, including consistent site visits, observational mapping, field observations, and

photography. The quantitative measurements of the built environment within these three neighborhoods include urban spaces, urban structures, street design, surrounding activities, and human behaviors. Map images are accompanied by various focal points of analysis (street layouts, pedestrian sheds, frontage activity, etc.) and numerical measurements like street width, street segments, and block size using figure-ground representations. The results of these measurements are then used to form a comprehensive understanding of the complexities associated with the neighborhoods and the emergence of voids within them.

The qualitative data mainly comprises secondary data like news articles, journals and publications, and books relating to or mentioning the neighborhoods in recent years and historically. Apart from the data collection process using graphical maps, this thesis also provides essential background information on the historical urbanization process in these areas, allowing for the contextual development of arguments in cases where difficulties in the historical literature are present, obtaining information from various media outlets like *The Peninsula* and *Gulf Times.* Various online resources such as Google Maps and Google Earth supplement the arguments presented.

Each case study divides into three major sections. The initial part concerns the built environment's morphology, layout, and physical attributes without referencing regulatory zoning and functionalities. The second part analyzes the function of the built environment based on ground-level patterns and active/inactive frontages. Lastly, a review of other historical and social factors affecting the neighborhood's spatial morphology and physical attributes is provided to deliver a deeper, more meaningful understanding about the existence of the urban voids and how we might turn them into

opportunities. The remainder of the data collection involves field observations and site visits.

3.3.1 Site Visits

Site visits to the identified neighborhoods are the most direct way to get quantitative and qualitative information about the area under study. Site visits allow us to secure observations on the urban fabric and the street profiles, block sizes, and active/inactive frontages of the structures and buildings under consideration, in addition to users' movement patterns and the actual use of spaces. Multiple visits to the sites occurred between September 2022 and January 2023.

3.3.2 Plans and Maps

There are multiple sources for the maps of the city of Doha, Qatar, gathered from the Ministries and Municipalities of Doha, Qatar National Development Master Plan, and Google Maps. The maps and plans are later altered and modified according to the actual and realistic conditions of the areas by visiting the spaces and using Google Earth satellite images.

3.4 Chapter 3 Summary

In Chapter 3, the research design and methodology employed in the study were detailed. The chapter presented a multi-layered approach to conducting the analysis, primarily utilizing a descriptive-analytical method to establish correlations between various factors that influenced the formation of urban voids, including both physical and non-physical attributes.

Three neighborhoods in Doha, namely Al Mirqab, West Bay, and The Pearl, were selected as case studies. Chapter 3 also highlighted data collection and analysis techniques. Data collection will be primarily based on historical data, photographic documentation, and on-site data collection. Furthermore, conceptual and non-physical attributes, such as cultural, historical, and social parameters, are to be quantified to comprehensively understand the urban voids present in the selected case studies.

CHAPTER 4: DATA ANALYSIS AND DISCUSSION

Qatar has been known for its economic resilience amidst global and local political crises that affect neighboring economies. Qatar has maintained high per-capita rates and gross national products (Ingram & Al-Rowas, 2018). Most economic experts believe Qatar can sustain its competitiveness and financial performance in the MENA region in the mid- and long-term. Additionally, Qatar has rebranded Doha, the capital city, from a fishing-based settlement into a contemporary metropolis with high-rise towers and iconic architecture that projects a modern skyline (Figure 2).

Figure 2. Doha's skyline. Source: Author.

As one of the important countries for the Islamic faith, most of Qatar's social and infrastructural influences are borrowed directly from the works of earlier Islamic arts and crafts. Despite the push to accept globalization at the risk of losing their identities, Qatar's stance on preserving its national identity has remained among the most remarkable, despite Qatar's remarkable growth and developments. Globalization is a process of interaction and integration amongst people, companies, and governments worldwide. It includes increased international trade and the exchange of beliefs, culture, and ideas during the Information Age because of the rise of the Internet. It is primarily an economic process. Globalization involves capital, data, goods, labor, services, and

technology (Albrow & King, 1990; NRC, 1995). When the issue of effective and efficient land use comes into play, Qatar used some of the significant accomplishments of the Western architectural and structural experts to fully integrate their works into the country's cultural identity, thus creating unique infrastructures that remain unparalleled in the Arabic world. However, Qatar is not without a problem. Qatar's unique land distribution along the Gulf area causes current issues like urban fragmentation within the city, environmental impacts, and vehicular congestion due to ineffective public transportation alternatives. The Ministry of Municipality and Environment is working continuously to address the concerns of the Qatari people, particularly those that involve urban planning and design. However, it has still a long way to go to achieve the level of efficiency that equivalent government bureaus of first-world countries like Singapore possess. For one reason, the Ministry is yet to fully grasp the problems involving the presence and persistence of urban voids in Doha's neighborhoods.

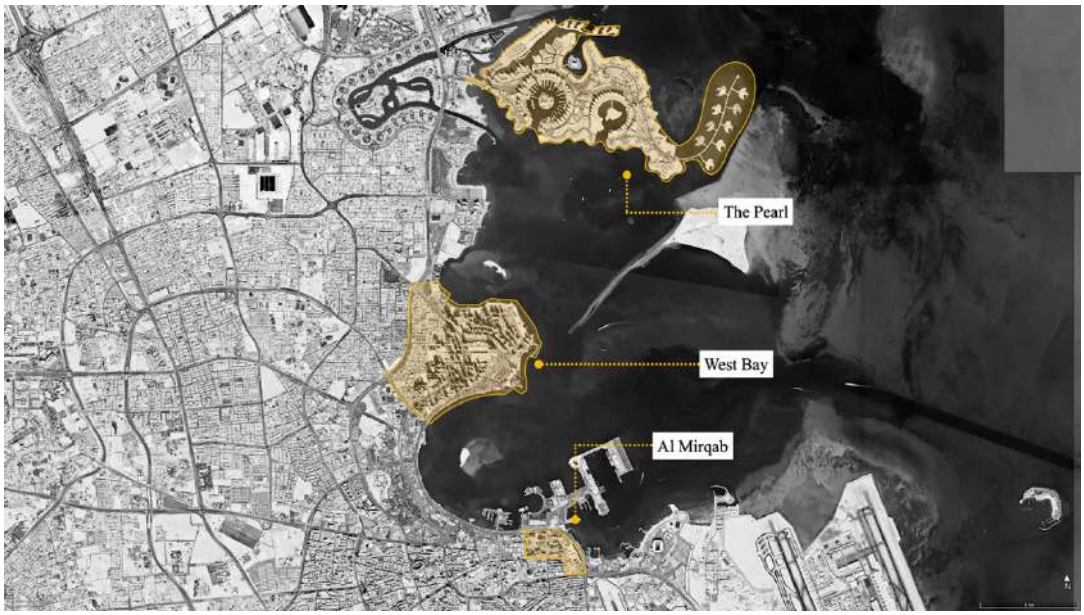

Figure 3. Satellite image of Doha with highlighted neighborhoods. Source: Google Earth, edited by the Author.

Considering Qatar's spatial and physical structures, looking at voids in three major areas with a high density of economic activities is interesting – the Al Mirqab, the West Bay, and The Pearl (Figure 3). Analysis obtained on the presence and persistence of urban voids in these areas will give us an idea of how to turn these vacant spaces into opportunities, given proper attention from the appropriate authorities.

Figure 4. Map of Qatar with Al Mirqab area highlighted. Source: Google Maps, edited by the author.

4.1 Case Study 1 - Al Mirqab

According to the Municipality of Qatar, this area is Zone 18 and combines two districts – Al Mirqab and Al Salata – consisting of 620,000 square meters (m^2) (Figure 4). The specific location of this Zone marks a transitioning spot between the south and north of Doha. The latter encountered rapid urbanization, including the business city center of Doha (The West Bay), which has concentrated high-rise private and public offices and numerous commercial uses. On the other hand, south Doha primarily

comprises low-rise buildings, residential zones, several mid-rise office buildings, and a few hotels. Because of its location, Zone 18 has witnessed modern urbanization and heritage preservation works. Some of these preservation works include the restoration of Shaikh Abdulla bin Ali's palace within the Qatar National Museum (QNM), which, contrastingly, is one of the most iconic modern buildings in Qatar, and the Middle East. Despite the historical preservation efforts, most recently built structures in the 2000s have contemporary designs composed of steel and glass. In comparison, earlier buildings constructed in the 1990s hold a few traditional characteristics, such as ornamental elements on facades and arches.

The area contains two districts – 1-Al Mirqab and 2-Alsaalata – split by Al Meena Street, which intersects with Al Corniche Street at the Northern edge and Museum Street (Al Mathaf Street) on the southern boundary (Figure 5). All the historically preserved buildings are in the Al Salata district (shown in orange in Figure 5). The largest of these is the palace of Shaikh Abdulla bin Jassim's palace located within the QNM, whereas the other two buildings are Alyousif Mosque and Bin Obaid Mosque. Although this area was inhabited since the beginning of the 1900s, it went through a phase of decay in the 1930s due to the movement of Shaikh Abdulla bin Jassim to the center of Doha and leaving behind the original palace. Nonetheless, it was populated again and held a dense settlement until 1975 (Qatar Museums, 2022), when urbanization began. Restoration works were implemented on the old palace converting it into Qatar National Museum.

Figure 5. Map of the Al Mirqab/Al Salata area highlighting historical buildings in orange, the main streets, and the two districts. Source: Author.

Since the beginning of the 2000s, Al Salata and Al Mirqab have been slowly transformed into medium-density residential areas. Between 2003 and 2008 (Figure 6), the site had an almost entirely vacant center with few buildings, such as mosques and houses. Later in 2010, more medium to high-rise buildings were constructed, including residential towers and hotels. Additionally, many developers transformed the initially built residential towers into offices; simultaneously, construction works began on the QNM site. This massive number of new transformations affected the area's morphology; buildings built earlier in the 2000s were at most five stories, considered high-rise back then, compared to the low-density residential units. However, since 2010, a new building typology emerged in the area consisting of 15-story buildings,

which became the dominant building height, making older structures relatively short. This enlarged scale of buildings and plots created an opaque facade around the area. While multiple newly constructed buildings emerged in 2010, the street network continued picking up the traces from 2003, with very few new secondary streets reaching building entrances.

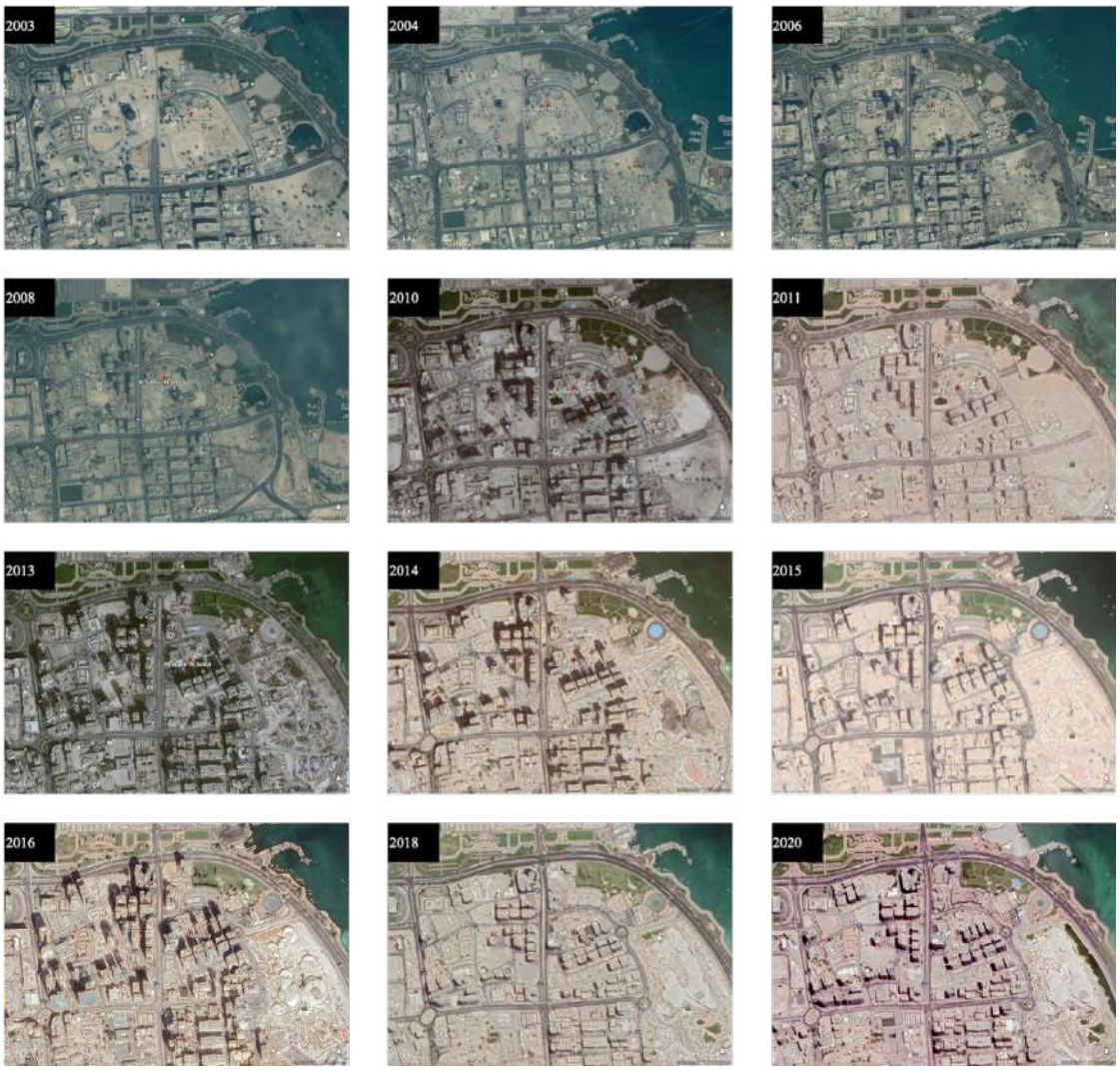

Figure 6. Satellite images of Al Mirqab/Al Salata from 2003 to 2020. Source: Google Earth.

Two reasons drove the intense transformation and increased construction between 2010 and 2016. Firstly, according to the Planning and Statistics Authority of Qatar (2022), there were 2.4 million people in 2016, an increase from 1.7 million in 2010, which indicates a forty-one-and-a-half percent (41.5%) growth rate during this period, increasing the demand for residential units and offices. Secondly, the construction site of the QNM makes up twenty-four (24%) of the total area, hence affecting the surrounding roads and built structures. In 2016, construction works in the area were at their peak, where some old structures were demolished and replaced with new ones, along with dividing plots to accommodate multiple towers. Between 2016 and 2019, Al Mirqab was static in construction until 2020, when a few new towers were built. Additionally, incremental maintenance works were implemented on the street network as part of the Beautification of Roads and Public Places in Qatar Project by the Ashghal Committee.

From a historical perspective, this area carries significance due to the establishment of the ruling palace of Qatar in 1906 (Qatar Museums, 2022). Shaikh Abdulla bin Jassim Al-Thani established his residential compound and used it as a residence and a center for ruling for approximately 20 years. He then moved the base of governance to the center of Doha in 1923 to today's location of the Amiri Diwan (Amiri Diwan, 2022); this shift influenced the city's expansion and the growth and later decline of the Al Mirqab area. From establishing the palace in 1906 until the beginning of the 1950s (Figure 7), Al Mirqab's growth was continuous, and the expansion of the settlement was moving towards the south (Al Wakra) and north (center of Doha). Additionally, urban growth was moving inward, away from the waterfront, mainly due to urban development fed by the discovery of oil and natural gas. In the following years, specifically between the 1960s and the 1970s, people moved closer to the center of

Doha, which caused abandonment and decline in Al Mirqab (Figure 7). In parallel, some old buildings were demolished to enable new development, except for a few mosques and Shaikh Abdulla bin Jassim's palace. Then, authorities in Qatar decided to restore the old palace and create the first QNM in the late 1970s. Considerable parts of today's Al Mirqab are reclaimed land off the shallow waters along the seashore (Figure 8), which shifted the QNM (the old palace) away from the waterfront.

Figure 7. Early images of Al Mirqab/Al Salata in 1934 (first left), 1590 (first right), 1952 (second left), the 1970s (second left), and 1960s (third left and third right). Source: catnaps.org.

In conclusion, early photographs show the dense settlement along the seashore and its direct connection to the waterfront (Figure 7). The later pictures display the expansion of the urban fabric north and south along the seashore, alongside the inward growth. Closer to the 1970s, the area witnessed a slight decline, followed by restoring the old palace to create the QNM.

4.1.1 Urban Growth and Historical Development

The shoreline of Qatar and around Al Mirqab was changing throughout the years. It was being shifted away due to land reclamation, one of the most common approaches to urban development in the gulf region. Al Mirqab area expanded its perimeter due to this process, which also shaped the Al Corniche Street layout and the Doha Port (Figure 8).

When comparing the early aerial images with today's satellite images, the conclusion is that the urban fabric of Qatar and Al Mirqab has changed radically over the years. In 1952 and prior, the city used to contain typical traditional Qatari neighborhoods. Al Mirqab's layout consisted of narrow streets, adjoining buildings, and compact, dense patterns. These settlements were developing along the seashore. The 1960s were a transitional phase for Doha when land reclamation began reshaping the coastline. The comparison shows that scale and density are the most affected urban parameters during this period. The main influential elements in transforming the urban fabric were the introduction of highway roads, wide streets, and land reclamation. These techniques resulted in a stretched city scale and less dense urban fabric.

Furthermore, new building regulations, such as setbacks, have created a magnified city scale. Consequently, urban voids emerged within Al Mirqab and several empty reclaimed lands around the area. Throughout the 2000s, the city scale continued

expanding; as a result, building plots and streets in Al Mirqab became considerably broader compared to 1952 and 1966 (Figure 8). Although the images in Figure 8 are set to the same scale, the 2022 satellite image gives the impression of an enlarged image of one neighborhood from 1952.

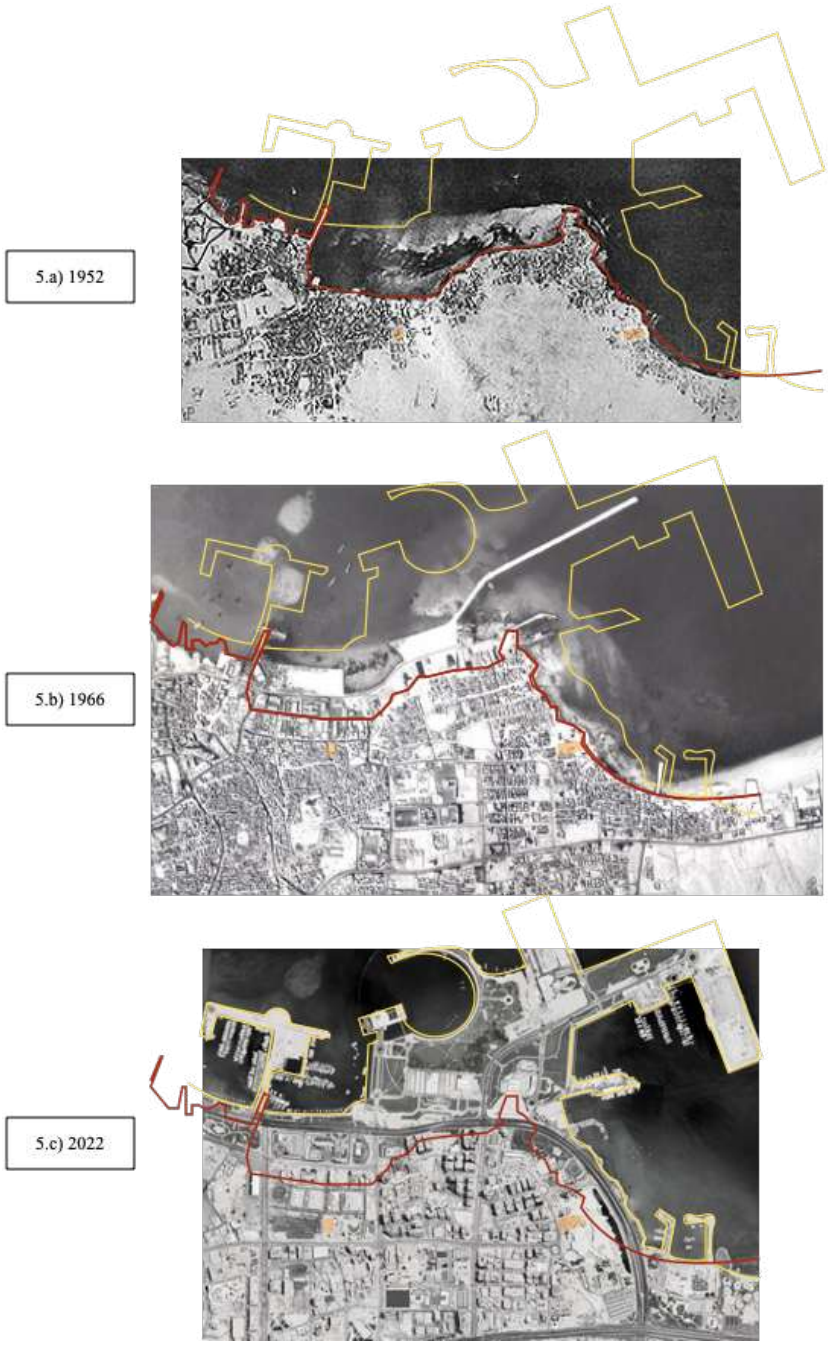

Figure 8. Shoreline comparison between a) 1952, b) 1966, and c) 2022. Source: Author modified of 1952 and 1966 from catnaps.org, 2022/Google Earth.

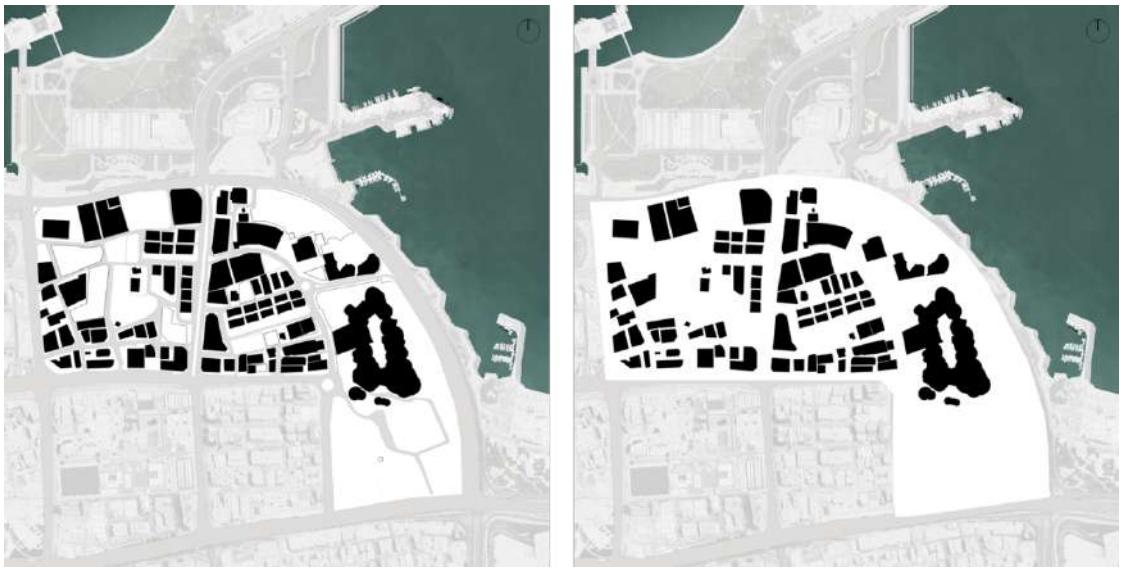

Figure 9. Figure-ground map with (left) streets and plots and (right) with white representing space and black representing buildings/blocks. Source: Author.

4.1.2 Analysis of Urban Morphology

Figure 9 is the figure-ground map illustrating blocks with (left) and without (right) the street network and plots. The figure-ground map with the street network shows the sizable portion of space streets occupy. Streets occupy approximately twenty percent (20%) of the total land area. Most of those streets are tilted, irregular, and have shifting intersections instead of direct connections, causing each road segment to be relatively short. Al Meena Street is the only straightforward street longer than 500 m, which splits the area into two sub-districts. Because section B is smaller in surface area than section A, the streets' total area is 10,000 m^2 less than in section A.

Additionally, the footprint of building blocks in section B is more significant, which shrunk the streets into a relatively narrow network. In this Zone, the layout of the street network appears to be formed around existing plots instead of cutting through the land, creating an irregular grid. The general configuration of the street network is dividing the whole area into two sub-districts, which are then cut through from east to

west with irregular paths. In section A, the east-west connectivity is relatively successful, with three semi-straight streets connecting both ends.

However, in section B, the placement and size of the QNM and the Muthaf Park limit the direct connection and act as obstacles between both ends, leaving one semi-direct access route between Al Corniche Street and Al Meena Street through a roundabout. The link between the north and south ends is indirect throughout the sub-districts and only reachable across the central road (Al Meena Street). This north-south disconnection is mainly due to the size of blocks by Al Corniche Street, which, as mentioned above, creates an opaque façade on the area's perimeter.

The blocks in Al Mirqab vary in shape. Some blocks stretch into a linear rectangular form, and others take a square form. Some are irregular, generated either due to closely spaced smaller rectangular blocks or irregular due to their design, such as the QNM.

The density of these blocks is incredibly low compared to the original, old urban fabric. To compare, one of the old still-standing structures in Doha is Souq Waif, which the government maintained to continue functioning as it used to since the 1900s. According to Khan et al. (2021), the Souq's area is 190,000 m^2 and has 81 building blocks. In contrast, Al Mirqab's total area is 620,000 m^2 and contains 82 blocks. This difference indicates the low-density pattern and the enlarged scale of the newly developed areas of Qatar as a whole. This expanded scale of the urban fabric grew over time and became more car-centric rather than pedestrian-oriented.

Building blocks compose approximately thirty percent (30%) of Al Mirqab's total area, whereas streets compose twenty percent (20%), leaving fifty percent (50%) of the space empty. The average block size in Al Mirqab is 3,571 m^2; however, when removing the QNM's block from the calculation, the average area becomes 1,787 m^2

because the museum's block is 82.8 times larger than the average block size (148,086 m^2), it should be removed when measuring any average estimations with regards to the whole area. Additionally, Souq Waqif's average block area is 2317 m^2 (Khan et al., 2021), which is nearly thirty percent (29.65%) larger than the current average block size in Al Mirqab. The older settlements consisted of tightly connected structures, hence larger building blocks on an urban scale. However, today, the building blocks are situated more flexibly in a spacious manner with setback regulations. Moreover, due to the technology of high-rise towers, the building's footprint could be reduced and aligned vertically rather than horizontally, resulting in more 'free' space at the ground level.

In Figure 9-right, the figure-ground map without the street network shows vast empty spaces 'filling' the area, especially in section A. Contrastingly in section B, the empty spaces are marginal areas between less spread-out, smaller blocks, except for the vacant spaces in the location of the Almuthaf Park and the QNM site.

The building blocks along Al Corniche Street and on the periphery of each sub-district are more extensive than those in each section's central spaces. The largest block in Al Mirqab is the QNM, with 148,086 m^2. The area is massive mainly because of the vast size of the project and its wide-ranging border; however, the building footprint of the museum is only 41,705 m^2, which is still the most significant building footprint in Al Mirqab. On the other hand, Alyousif Mosque (Figure 18), with 245 m^2 located in section B, is the smallest structure in terms of building footprint and as an urban block.

Moreover, mosques are one of the area's most common functions; because Islam is the main religion in Qatar, according to the Ministry of Municipality, as a part of public utilities, all areas in Qatar should contain a sufficient supply of mosques reachable within a 3-5-minute walking distance. Therefore, regarding land use, more than seven percent (7.3%) of all building blocks are mosques.

Figure 10. The 150 m pedestrian sheds from the center of all mosques in Al Mirqab. Source: Author.

In Figure 10, a 150 m radius measures the pedestrian sheds to demonstrate a 3–5-minute walking distance (Khan, 2021) for all mosques in Al Mirqab. The center of Al Mirqab contains some overlapping pedestrian sheds; however, due to the street's layout, the central main road (Al Meena Street) acts as a partitioning element between the two sections, especially for pedestrians, mainly due to the high speed of vehicles and the relatively long distance between the opposite ends. Therefore, the increased supply in each section compensates for the limited accessibility.

Figure 11. 200m and 400m pedestrian sheds from the center of the Al Mathaf Park in Al Mirqab. Source: Author.

Regarding recreational spaces, the area contains one relatively large park on the northern edge of Al Mirqab along Al Corniche Street. When estimating percentages, the park compromises approximately ten-to-eleven percent (10-11%) of land uses; moreover, in terms of land area, the park takes up nearly four percent (~4%) of Al Mirqab's total area. Although the park is relatively large and composes a significant percentage of the total land use area, its location makes it inaccessible to most people in the Al Mirqab (Figure 11). The site of this recreational space might be

aesthetic from the drivers' perspective on Al Corniche Street but widely inaccessible to pedestrians and users within the Al Mirqab area.

To elaborate, the 200 m and 400 m (1/8 and 1/4 a mile) pedestrian sheds in Figure 10 show that the park is reachable by almost half of Al Mirqab's total area, primarily covering users from section B. Even with this, the actual on-street connectivity is limited due to two main factors: a tall parking building and a large restaurant obstructing the park at the south and east perimeters. Secondly, the perimeter on the north along Al Corniche Street has a fence (implemented for safety purposes, shown in Figure 12), which as a result, keeps the eastern edge the only access point to the park. This restricted access prevents the park from achieving its full potential and reduces its effectiveness as a public recreational space.

Figure 12. A view from Al Corniche Street towards the park in Al Mirqab, 2020. Source: Author.

4.1.3 Analysis of Land Use

The most dominant building typology in Al Mirqab and Al Salata is mid- and high-rise towers, with various functions such as offices, mixed uses, and hotels. According to the on-site data collection from 2020, the gross number of building blocks is 82. The entire area is split into sections A and B (Figure 14) for this analysis to facilitate a precise examination of each sub-area. In both sections, the two dominant functions are hotels and offices (governmental/public and private), mixed-use buildings containing retail portions on the ground floor, and offices or apartments on higher levels. In section A, the percentage between offices and hotels is almost equal (Figure 13), whereas, in section B, offices are the most spread-out function, making up forty-six percent (46%) of all uses. Other land uses, such as mosques and utility structures, are equally distributed among both sections, which include three mosques and one utility structure on each side. As for retail buildings, the majority are concentrated in section A.

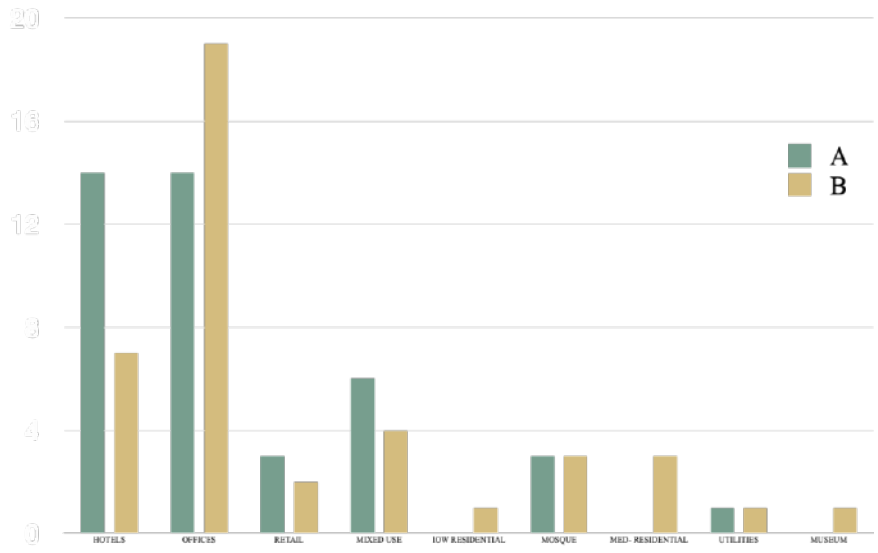

Figure 13. Land use chart of Al Mirqab. Source: Author.

However, retail buildings' percentage is low in terms of the overall area, forming only six percent (6%) of all building functions. One of the significant differences between the two sections is the absence of residential use in section A.

Figure 14. Land use map of Al Mirqab. Source: Author.

In contrast, section B contains seven residential units (1 low-density and six medium-density units). This difference enabled fewer hotels in section B compared to section A, where the number of hotels in A is double the number in section B. Moreover, section B contains the Qatar National Museum (QNM), which composes around fifty percent (~50%) of the sub-district's area. In terms of density, both areas

have an equal number of building blocks; however, because of the vast land allocated for the QNM in section B, the remaining area is smaller, which made sub-district B denser by seventeen percent (17%), excluding the QNM. According to the represented land uses in Figure 14, governmental functions are situated along Corniche Street, such as offices, parks, and the QNM. On the other hand, less figurative elements, such as retail units, are located at the furthest edges of the districts, closer to the adjacent residential Zones. Nonetheless, these retail functions are strategically situated on lively secondary streets rather than far internal roads, enabling reaching a larger catchment area of users within Al Mirqab and the surrounding districts.

Generally, land use's physical arrangement and distribution need a more precise zoning pattern. The land use pattern transformed over time; the area began as a center for ruling in the early 1900s; later, the area became highly residential and consisted of traditional housing. After years of abandonment due to the significant movement towards the center of Doha, the area began reshaping into a mixed-use zone. Rapid urbanization began appearing between the 1970s and 1980s. Since 2008 more office and hotel towers have been built, and more government buildings have been constructed.

One of the most observable patterns of functional arrangement in Al Mirqab is that most blocks along Al Corniche Street are governmental/public buildings, including offices and public facilities such as the Qatar National Museum and Al Salata Park (also known as The Museum Park). Overall, the further away from main streets such as Al Corniche Street and Al Meena Street, the more street-oriented functions become, where offices and hotels (containing most of their primary activity on floors above the ground level) are located on main streets. In contrast, secondary streets have retail stores and mixed-use apartment buildings. Unlike primary roads, secondary streets carry slower

traffic, enabling easier interaction with these retailers. Although retail blocks are located on secondary streets, they are considered exterior about the center of each sub-district, where their catchment area is expanded to the adjacent districts rather than being limited to Al Mirqab and Al Salata.

In section A, the perimeter contains most land uses. On the other hand, the smaller total area in section B is the main characterizing parameter influencing the functionality pattern, resulting in a concentration of most functions being at the center. This allocation leaves the parameter along Al Corniche Street entirely used for more extensive functions (three components: QNM, Al Salata Park, and a large restaurant). Furthermore, the southern edge of the section contains a few residential units and mixed-use apartment buildings.

In Al Mirqab, one of the predominant characteristics is the spread-out surface parking lots. This phenomenon is apparent in both sections but very observable in section A, precisely due to the vast empty lands in the center. In Figure 15, formal/official parking spaces bounded and accessed through gates are highlighted in yellow, whereas unused empty plots used as parking spaces (non-official parking) are highlighted in blue. All non-official parking spaces emerge near or adjacent to an existing official parking space. This pattern indicates an overflow of vehicles, hence, the need for more parking spaces in the area. It also indicates a high reliance on private transportation modes rather than public transportation. It is essential to consider the cultural aspect regarding the dependency on private transport to address the parking issue. Therefore, the optimal solution to reduce surface parking, with concern to the social context, would include implementing building regulations such as a minimum underground parking per tower or utilizing a shared parking building in addition to improving access to public transportation, specifically enhancing the pedestrian

connectivity to metro stations to facilitate their use throughout the year (during both the harsh and pleasant weather conditions).

Figure 15. Types of parking spaces in Al Mirqab. Source: Author.

Based on the Google Earth satellite images, these non-official parking spaces are only used as parking lots during work hours and remain empty on weekends and at night (Figure 16). Very few cars are parked during the weekend (Friday) and are mainly concentrated around residential units, whereas the sides adjacent to office towers

remain clear on weekends. In contrast, during working days of the week (Tuesday), the whole area is covered with vehicles within and around the empty land.

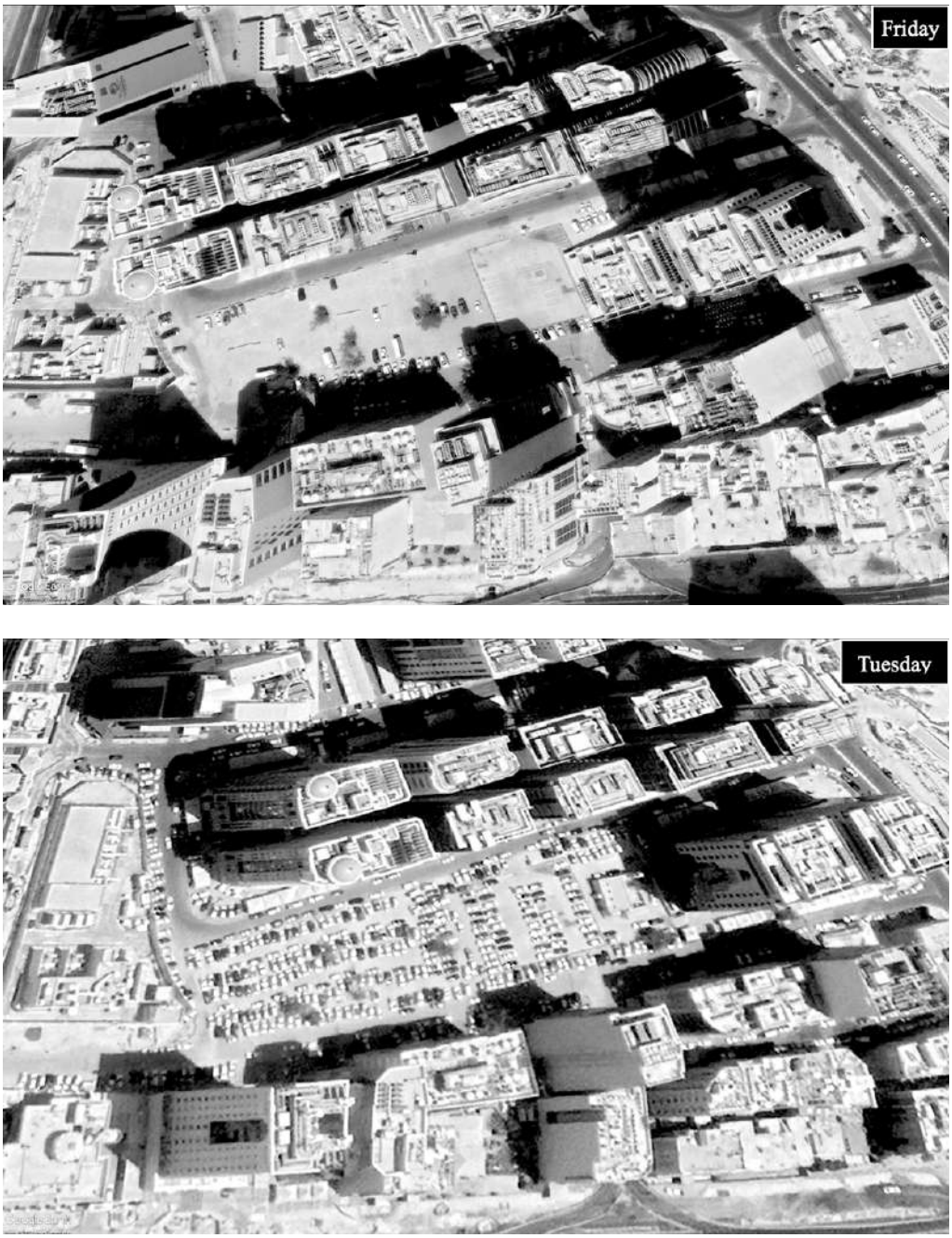

Figure 16. Satellite image of one of Al Mirqab's non-official parking spaces on a Friday (above). Satellite image of one of Al Mirqab's non-official parking spaces on a Tuesday (below). Source: Google Earth.

The land use analysis and functionality breakdown provide a deep insight into the major and minor activities in the area, reflecting the varieties and prevalent types of demographics occupying the space. Furthermore, the land use analysis demonstrates either a deficiency or over-supply of services and supporting components to assist the everyday functioning of the area. The supporting elements also depend on the type of users moving through and staying in the area. In Al Mirqab, the dominant function is offices (public and private). These users occupy the area from ~8:00 to 16:00 on weekdays. Many services required for users in this situation could include parking spaces, petrol stations, restaurants/cafes, recreational spaces, and mosques within walking distance. The second primary function is hotels; essential services for those users include entertaining and recreational functions (to serve people staying for leisure) or retail options. Those users would also benefit from restaurants or cafes within walking distance from and to their hotels.

4.1.4 Analysis of Building Height

Figure 17 shows that forty percent (40%) of all buildings in Al Mirqab are 13 levels or higher, and twenty-eight percent (28%) are between 9 to 12 floors. The remaining structures vary between 3-8 levels, where the least used height is 1-2 floors, found in mosques, low-density residential units, and retailers such as small grocery stores. Blocks that have a larger footprint tend to be shorter. For example, towers (13 floors and above) have a footprint between 500 m^2 and 1000 m^2. On the other hand, shorter structures –such as a two-story restaurant building and residential villas – have a building footprint between 2,000 m^2 and 10,000 m^2.

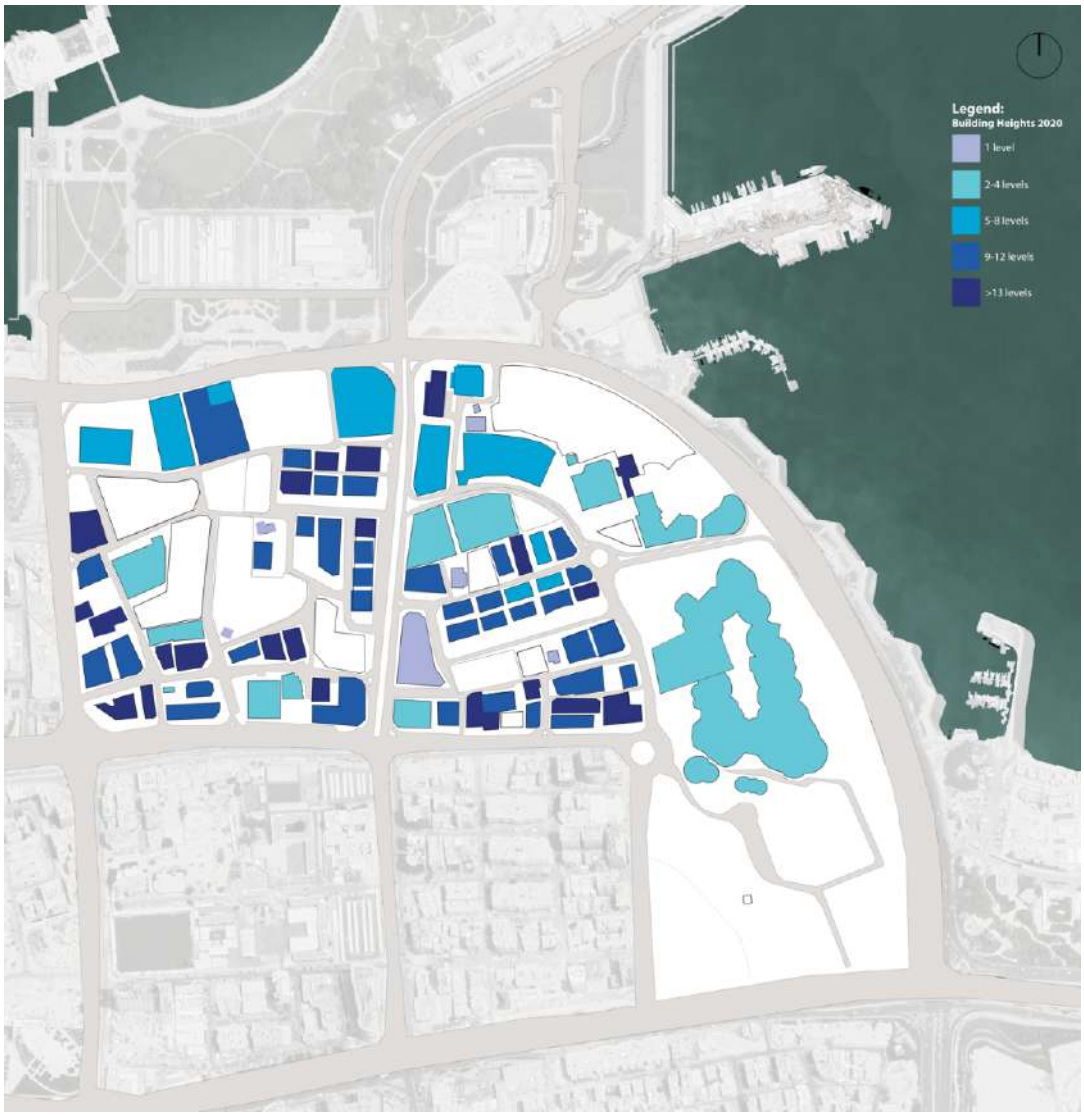

Figure 17. Building heights map in Al Mirqab, 2020. Source: Author.

The spread of mid- and high-rise buildings creates a scaled-up environment that overshadows smaller structures. Almost every major building plot contains at least one tower; eighty-five percent (85%) of plots in section A include towers and over sixty percent (+60%) of major plots in section B have towers. In section B, these towers line up close due to the higher building density, causing smaller structures to disappear visually. For instance, one of the old mosques (Alyousif Mosque in Figure 18) is surrounded by nine towers from all directions except the west, making it completely invisible from any point more than 40 meters (m) away.

Furthermore, these towers create an opaque facade around the area and continue this effect along both sides of Al Meena Street, which splits the area into two sections. As a result, the two sub-districts become visually inaccessible. This effect is only absent in one to two portions of the area's boundary, which contain a low-density residential villa allowing a slight glimpse of the inner context. However, although the towers create a visual obstacle, the spaces formed in between are shaded from exposure to harsh sunlight in the summer and provide a 'tunnel effect,' enabling the formation of a pleasant wind breeze.

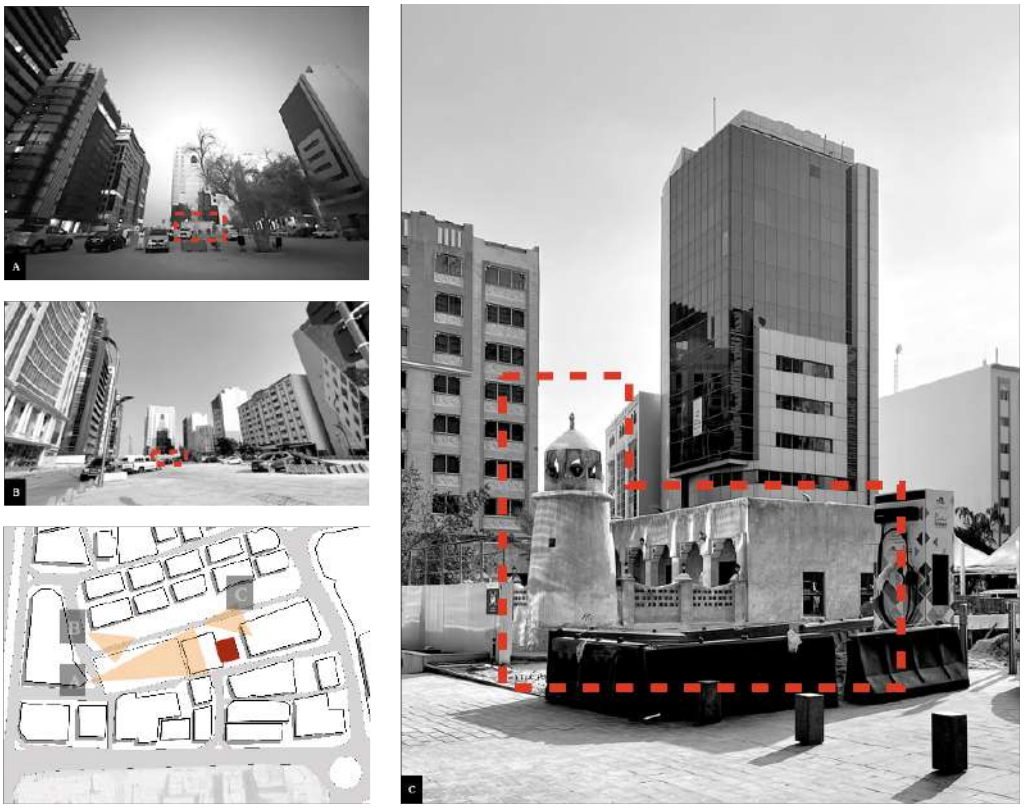

Figure 18. Alyousif Mosque from different perspectives, 2020. Source: Author.

4.1.5 Voids Analysis and Proposal

Throughout the literature, scholars have classified urban voids according to various criteria and definitions, such as size, urban condition, presence, or absence of

the built structures (old, abandoned buildings considered urban voids). Others categorized urban voids according to the reasons for emerging (such as results of war, deconstruction of buildings, city decay, rapid city growth, etc...) (Sao et al., 2020).

For the most part, void spaces in Al Mirqab emerged due to the rapid urban growth of Doha, and specifically in Al Mirqab. A portion of these spaces appeared as unbuilt plots owned privately or by the government for future projects to expand. Other voids are used as surface parking spaces, which in the theoretical sense are urban voids, where their use implicitly ceases to exist once the vehicles are removed. Moreover, large unbuilt areas containing a function, such as a park, are considered 'space.' Especially when observing the district from the figure-ground perspective. As discussed earlier, the park in Al Mirqab is inadequately and inefficiently functioning as a public recreational area, making it a void space. In addition to these spaces, other voids in Al Mirqab are marginal areas produced by unorganized urban growth. This rapid urbanization has created accidental residual spaces between two or more buildings, along the length of street margins, and on street corners.

The spaces produced between buildings are either small unbuilt plots or the gap between the rear of two structures. Figure 19 (right) illustrates two primary scales of voids: the smaller range is between 400 m^2 - 3000 m^2, and the more extensive range is between 5000 m^2 - 15,000 m^2. In Al Mirqab, the most appropriate approach was to view voids from the size perspective. Because almost all these spaces have approximately the same surroundings, environmental circumstances, and urban conditions, the main differentiating element among these voids is their size and location. Additionally, these spaces remain identical at the primary level regarding their vacancy and 'voidness.'

In several instances, two voids would appear adjacent or opposite. In Figure 19 (left), the spaces are suggested to be merged into one massive void, providing more

surface area for generating a new project. Nonetheless, to sustain the street routes and the connections between each end, it is more appropriate to perceive these spaces as a network of spread-out voids rather than a small number of wider ones. To create a network, we address each void as a part of a whole rather than a single element on each site. With the network approach, the voids will better work by complementing each other for an urban synergy instead of conflicting with each other. This approach has a profound impact on the urban scale.

Furthermore, merging the voids and neglecting the existing street network would mean ignoring the current functions and structures. This procedure also means deconstructing and clearing any physical obstacles. Suppose this approach was applied, specifically in section A, it would result in a massive central block disrupting circulation rather than providing an opportunity for a mixed-use medium-density development. In a relatively old and small zone such as Al Mirqab, it is best to work around the existing circumstance and enhance the experience of its current users. Moreover, the issue with this technique is that it also limits the flow of people into these spaces because merging them will result in blocking streets at multiple intersections. Analyzing the space based on the figure-ground map alone is impractical, especially without the streets. Roads make up twenty percent (20%) of the total zone, which is, in theory, a vacant, empty area but is an indispensable component in the operation of any urban space, especially in car-dependent societies with car-centric urban designs.

Before proposing any design alterations or new functions, it is fundamental to understand the current pattern of use in these spaces. From observational visits to the site and through satellite images (Figure 16), it is evident that most of these spaces are occupied by vehicles wherever possible. Despite the size of any highlighted urban void located either in the center of a sub-district or on street corners and edges, those areas

are constantly used as parking spots. By comprehending this matter, people could utilize the voids in Al Mirqab more sufficiently.

The extent and complexity of alterations are defined based on the earlier analysis and related to the conclusions from the literature review. To prepare the area for new developments, we approach by organizing the surroundings of each void and addressing movement limitations when required.

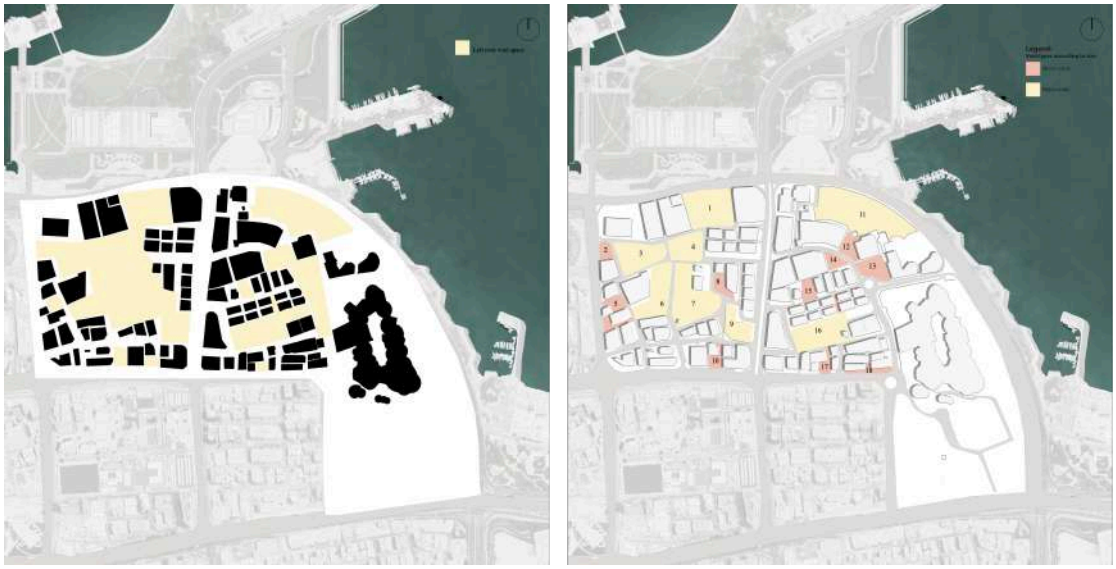

Figure 19. Urban voids merged in the figure-ground (left). Urban voids classified according to size (right). Source: Author.

Table 3. Void types according to scale in Al Mirqab. Source: Author.

VOID NUMBER AS LABELED IN FIGURE 19.	CURRENT CONDITION / USE	TYPE ACCORDING TO SCALE
1	Parking	Major

VOID NUMBER AS LABELED IN FIGURE 19.	CURRENT CONDITION / USE	TYPE ACCORDING TO SCALE
2	Vacant	Minor
3	Parking	Major
4	Parking	Major
5	Vacant	Minor
6	Parking	Major
7	Parking	Major
8	Construction	Minor
9	Parking	Major
10	Parking	Minor
11	Park	Major
12	Vacant	Minor
13	Parking	Minor
14	Parking	Minor
15	Parking	Minor
16	Parking	Major
17	Vacant	Minor
18	Vacant	Minor

The first step in addressing Al Mirqab would be enhancing circulation by providing a more regular street network. This portion of the enhancement is applied in section A, where there is an opportunity to create and add new street connections due to the vast empty space in the center. Section B, on the other hand, has a higher concentration of built structures and, therefore more challenging to interfere with.

Figure 20. (top) Original street layout with the (bottom) proposed road layout. Source: Author.

The improved circulation can be achieved by straightening unnecessarily tilted roads and creating more direct 4-way intersections in place of the shifted intersections. When the streets take a grid-like form, the accessibility chance increases, so vehicular and pedestrian movement becomes unproblematic (Dunn, 1994; Bekkering, 2006; Elzeni et al., 2021).

Section A's proposed urban fabric alterations incorporate new streets, four-way intersections, and road extensions (Figure 20, top). The new street network contains two primary roads; the first street (segment A) indicates a connection between the east and west peripheries of the area. A second direct road (segment B) connects section A's south and north ends. Nonetheless, the path only cuts throughout the area without reaching Al Corniche Street, this is due to the large building blocks along the northern parameter. Both primary segments are created by merging two or more originally disjointed and tilted street strands.

These segments (A and B) provided a 4-way intersection. More road segments were introduced to realign streets to create 4-way intersections and reduce dead-ended streets. The proposed street network also altered the size and form of four voids (3,4,7, and 9, shown in Figure 20 - top). The added streets also split some voids into 2-3 portions, providing a more regular (grid-form) area configuration. In section B, altering the street network is challenging for multiple reasons. Firstly, the curved shoreline is mirrored in the interior portions of the area, which limits intervention. Secondly, the ‘free space’ is less in section B due to the higher concentration of buildings. Lastly, although there are huge blocks along the perimeter, there are two streets which connect the central area to Al Corniche Street, making the sub-district more connected from and to all edges.

The new road layout slightly affects a few structures (such as a medium-rise hotel tower). This action could harm these building owners; however, it is more important to value the whole's benefit than one's benefit when addressing urban-scale developments.

In general, the alteration of voids in Al Mirqab is relatively incremental. The primary objective is to generate a better day-to-day experience for pedestrians passing through the area and those who work and live there. For example, minor voids, such as those found on street corners or between two buildings, can be improved through incremental design. A sufficient shading device and a simple seating area, along with vegetation, would enhance the space tremendously, especially from the perspective of pedestrians. On the other hand, significant voids can contain more expansive developmental projects.

Other than pedestrians' daily experience, another major problem within Al Mirqab is, as discussed above, the tremendous number of vehicles and on-street parking. To address this issue, we propose a two-tiered solution. The first step is to support reducing car dependency and integrating public transportation utilization. The existing Doha Metro stops' catchment area does not reach the users' concentration in Al Mirqab. This gap in the catchment area limits the usefulness of the Doha Metro. The existing stops highlighted in white in Figure 21 are challenging to walk from and to, especially in the harsh summer conditions. The pedestrian shed in Figure 21 is the standard radius shed of a quarter-mile (400 m), equivalent to a 5-to-7-minute walk. Employing void 13 (Figure 22) as a metro stop along the Gold Line can improve the utilization of the Doha Metro. This public transit extension would facilitate employees' access to their offices without using vehicles, reducing vehicular traffic and surface parking. The intentional infill of a function in the specified void (13) represents the

possibility of reconnecting a void into the existing functionality of the urban fabric. It also acts as a complementing element to the other vacant voids, acting as free spaces.

The second step is to utilize some voids (voids 3 and 15, in Figure 20 – bottom) as underground parking spaces and keep the ground level free of vehicles. These voids are the closest to the office towers in sections A and B. Void 15 is close to the office towers in section B, and void 3 is near offices in section A.

Figure 21. The 400 m pedestrian sheds from existing metro stations along the Gold Line (white) and 400 m pedestrian sheds from the proposed metro station (red). Source: Author.

The following proposal focuses on a major void: void 14 (Figure 20 – bottom). As discussed above, this void is under-utilized as a parking space during work hours (Figure 16) and remains vacant on weekends. At the northern edge, the space contains one of Qatar's oldest mosques, the Al Yousif Mosque (Figure 18). The appropriate concept in the proximity of the old structure is to maintain the void as an unbuilt space

containing a public square (Figure 23 – right). This approach will emphasize the historical element instead of being overlooked and provide a ‘free space’ for people near the mosque. The proposal includes adding soft shading structures that complement the old mosque's aesthetic and some vegetation, reducing the UHI effect (Hu et al., 2016).

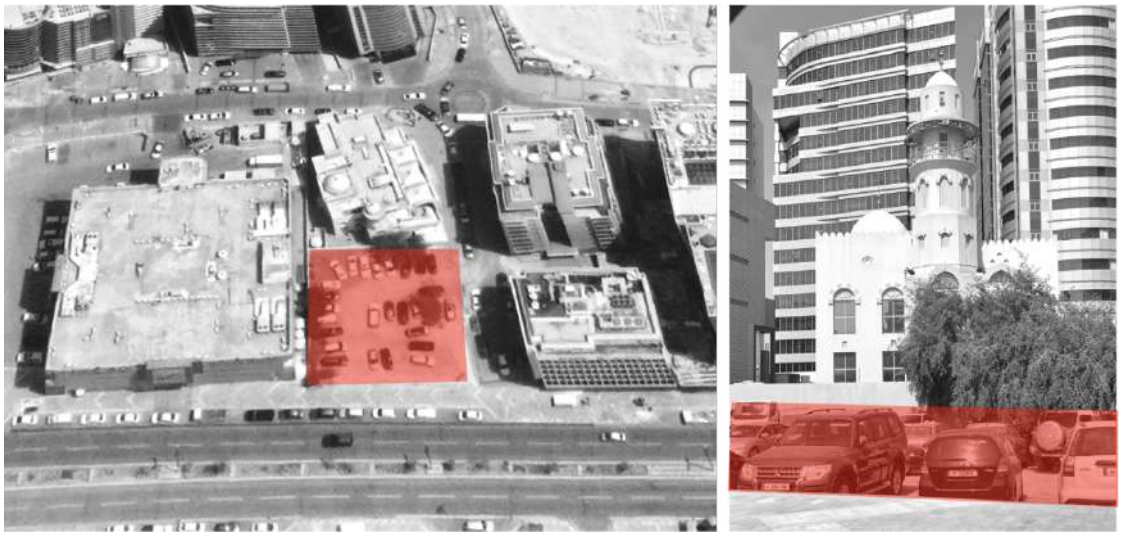

Figure 22. Satellite image of void 13 in Al Mirqab (left), image of void 13 in Al Mirqab (right). Source: Google Earth (left), Author (right).

Figure 23 (right) also shows a water feature resembling the old mosque courtyards containing ablution fountains. The water feature is also an attractive element, especially when children use the space. The alterations in this void will also serve people working in the surrounding offices a simple recreational space that can be used between work hours for a quick break. This void must remain a vacant and unbuilt space due to its high concentration of built structures. Besides the office towers, there are about 3-4 medium-density residential units. Those users can benefit from the space as a close-by public, recreational space for adults and children, resulting in different users and functions circulating throughout the day.

Furthermore, because void 15 will be used as an underground parking station, theoretically, the space within this void will no longer contain vehicles. However, an intentional design strategy can be implemented to prevent undesirable behaviors. For instance, a simple vegetation fence of bushes can limit cars from taking over the central space. At the same time, some on-street parallel parking spaces can be added around the void.

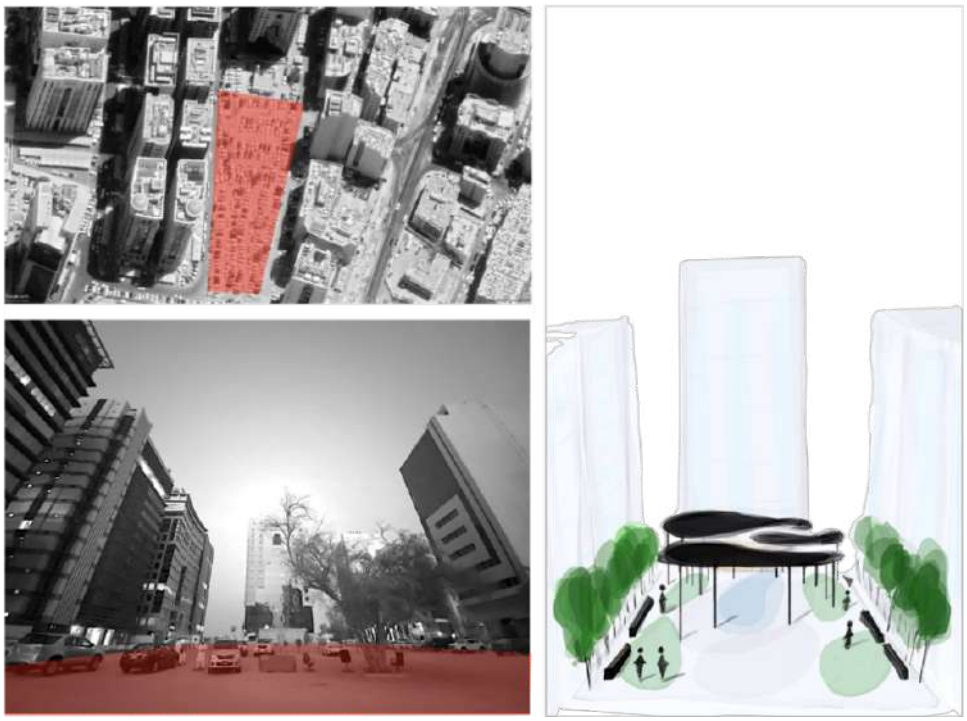

Figure 23. Satellite image highlighting void 14 (top left), an image of void 18 from a pedestrian's perspective (bottom left), and a sketch demonstrating the void 14 proposals (right). Source: Google Earth (left top), author (left bottom and right).

Regarding Al Mathaf Park (void 18), from the perspective of urban voids, it is better to utilize this area as a built space rather than maintaining its voidness. This location can utilize the waterfront as a view. The proposed alteration includes a mixed-use retail activity containing cafes and restaurants with terraces oriented towards the

sea view on the first floor and retail functions on the ground floor. This type of use will support the public square proposed in void 14 by contrasting its emptiness and complementing it from a functional perspective.

Al Mirqab is relatively one of the oldest zones in Qatar. It contains three still-standing historical buildings (two old mosques and Shaikh Abdulla bin Jassim's Palace located within the QNM). In addition to its historical significance, the area has one of the most iconic buildings in Qatar and the middle east, the Qatar National Museum by Jean Nouvel. However, because of rapid urbanization, the fast growth of the economy in Qatar, and the exponential development in real estate, the area transformed from a traditional dense neighborhood in the early 1900s to a towers-packed zone in the 2000s. This rapid urbanization process evoked an unorganized pattern in the urban fabric characterized by irregular blocks with wildly varying sizes, tilted and disjointed streets, shifted intersections, and multiple dead-ended routes.

Additionally, the urban fabric lacked a homogeneous allocation of buildings, resulting in multiple leftover spaces (voids). These spaces were often either occupied by vehicles or neglected. They appeared unsystematically as small spaces between buildings and as large, under-utilized areas (plots) in central space. These larger voids are constantly used as parking lots. This increased use of vehicles also indicated the high dependency on private transportation (vehicles) and the need for shared public parking among multiple office towers. The primary land uses in Al Mirqab are offices (governmental and private) and hotels. The users in offices are the type of demographics that stay in the area for long hours and throughout the week, making them the most constant type of users. For this reason, the alterations and proposals provided are for those users.

The alterations find opportunities in under-utilized urban spaces and implement place-making techniques to enhance the user's day-to-day experience by providing livable spaces that are an alternative to the harsh built urban environment. The proposals include incremental design alterations in smaller voids found between buildings and transport-related solutions to reduce the high dependency on vehicles, reducing surface parking in the larger voids.

In Al Mirqab, some voids required redeveloping and cohesion with the urban fabric to support the functionality and flow of people within the area. On the other hand, other voids are more suitable for recreational purposes. They are better maintained as vacant, empty spaces, which creates the potential for various functions and different people to activate the space according to their needs during a particular time.

4.2 Case Study 2 – West Bay

The West Bay area is located northeast of Doha city (Figure 24) and was extruded into the gulf waters through land reclamation. The area is surrounded by the coastline on the east and north sides, and major highways also border it from the west side. It is a relatively new zone in Qatar. It has become one of the most significant areas in the city since it has evolved physically and functionally as a Central Business District (CBD) to become the iconic skyline of Doha as a city and Qatar as a state (Figure 2). West Bay's total area is 5 square kilometers (km^2), divided into two regulatory zones (Figure 25). Zone 61 mainly contains offices, and Zone 63 comprises residential units and supporting utilities such as schools and mosques. The area has a total population of 11,584, which is split among the two zones: 7,562 in the residential zone (Zone 63) and 4,022 in the remaining spaces (Zone 61) (Planning and Statistics Authority, 2020).

Figure 24. Location of West Bay in Qatar. Source: Google Maps, edited by Author.

Figure 25. Zones and main streets in West Bay according to Qatar's regulations. Source: Author.

4.2.1 Urban Growth and Historical Development

In the mid of the 1950s and until the early 1970s, the West Bay Area did not exist in Qatar (Figure 26). In 1977, the land reclamation processes expanded the city's seashore into the Arabian/Persian Gulf. This approach to urban development was a standard method for countries in the Middle East and the GCC countries to expand land into the surrounding waters of the coast. The economic growth led by oil and gas production allowed such urban expansions. The government began developing West Bay to establish a new modern image of the State of Qatar in the late 1970s and early 1980s. This plan was also intended to highlight the wealth and advancement of the city.

Nonetheless, the beginning years after reclamation were relatively slow and only included a few road extensions along with residential units of single villas and residential compounds mainly for the foreigners working in the city. These residential units were built further from the seashore, which was then maintained free of any structures. The starting point to the ‘modern and futuristic’ image began with the Sheraton Hotel. The hotel's construction began in 1979, followed by accelerated urban development in the mid-1990s when the new Emir Shaikh Hamad bin Khalifa crafted an even stronger vision for the city's future. The Emir's vision was to situate Qatar along with high-influence countries of the world with its natural oil and gas assets in addition to the development of other sectors such as, but not limited to, education, healthcare, and economy.

The West Bay then took over the city's old perception of being a deserted land with tents or a fishing village. The city's new image installed in the West Bay included high-rise towers, mega construction projects, and iconic star—architect buildings (Figure 27). Initially, the area developed as a new extension of Doha towards its northern edges. However, in the later years, it became the center of Doha city, mainly

due to the type of buildings there, which are offices and governmental institutions, making it the central business district. Additionally, according to Doha's municipality zoning, the West Bay is indicated as the "Capital City Center," which validates the centric characteristic of West Bay.

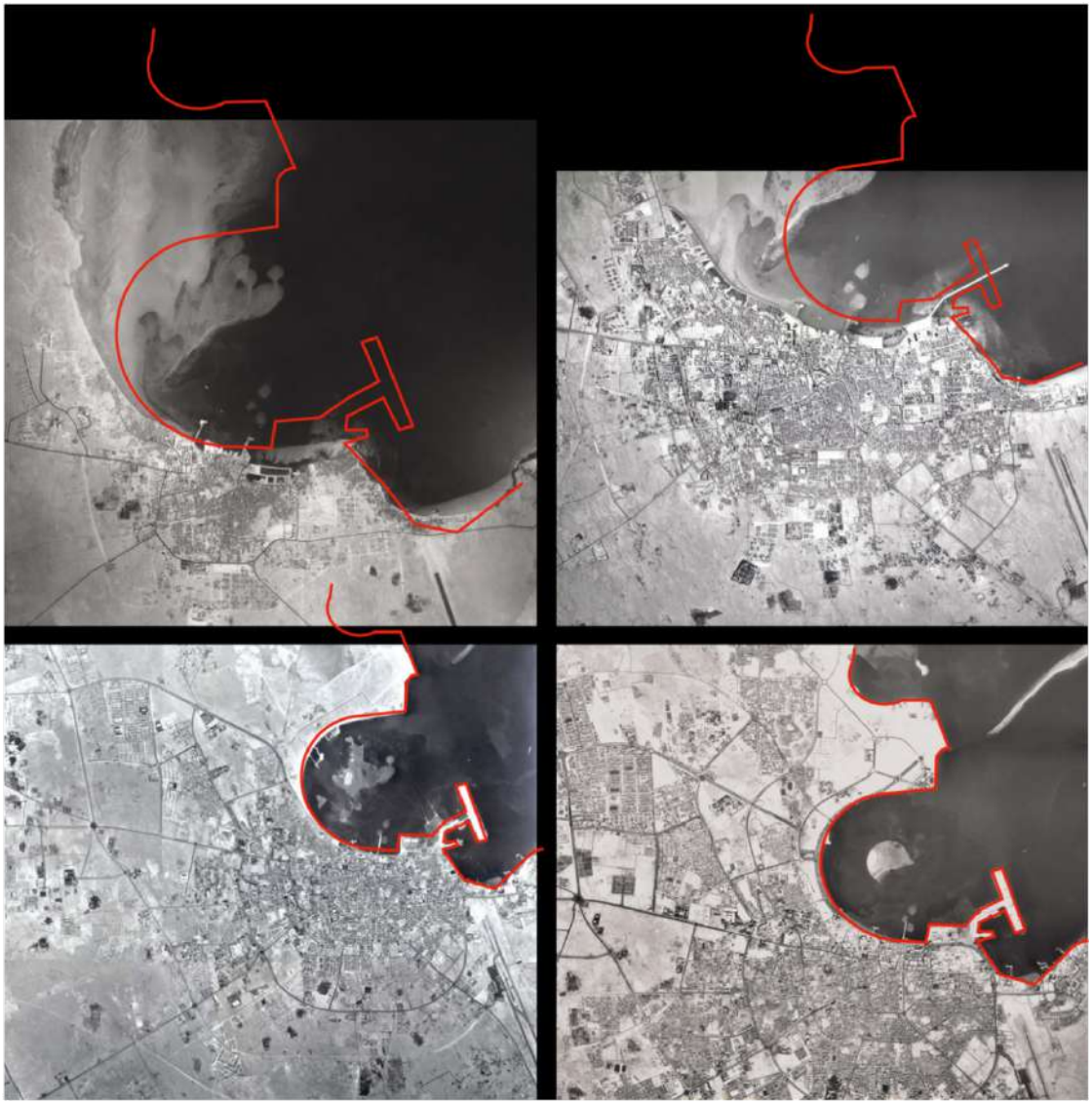

Figure 26. Historical satellite images showing West Bay formation (top left to right) 1956 and 1966, and (bottom left to right) 1977 and 1988). Source: Citiesfromsalt.com, edited by Author.

Figure 27. Image of West Bay today. Source: Author.

4.2.2 Analysis of Urban Morphology

The figure-ground representation in Figure 28 shows the varying shapes and sizes of building blocks in West Bay. However, there is a clear distinction and a gradual change in the urban density and compactness from the west to the east directions. The blocks on the western side are more condensed and formed in a cul-de-sac manner, whereas blocks towards the coastline are fragmented and loosely arranged. The west area is Zone 63, which is mainly a residential district. This residential neighborhood is a combination of the American cul-de-sac model and the enclosed residential

compounds. Each internal villa cluster is aligned in a hollow rectangular form, creating a relatively tight urban fabric.

Additionally, the exterior edges of the area are boarded with a continuous line of villas which act as a blocking element. Although this layout provides privacy, a highly valued principle for Qatari families, it limits pedestrian movements and circulation from and to their daily utilities such as mosques, grocery stores, and even to reach other neighbors' houses. All these seemingly nearby elements become unattainable except by using a vehicle. A study that measures pedestrian route directness (PRD) suggests that the ratio between linear and actual routes, where an acceptable PRD of a well-connected street network is 1.5 (Randall & Baetz, 2001).

When we apply this theory to the residential portions of West Bay, the ratio in many scenarios from a house to the nearest mosque, for example, exceeds 5.5. This high ratio confirms the discontinuity in the urban fabric. The challenge this network of blocks introduces is that the discontinuity is wider than the spaces within the neighborhood. However, the enclosed network also acts as an urban obstacle between districts, forcing drivers and pedestrians to take longer, indirect trips to reach their destinations. The segregated and loosely arranged blocks in Zone 61 are mainly towers built closer to the coastline to provide visibility toward the sea view. These tower blocks are distributed along main streets (Al Corniche St. and Omar Al Mukhtar St. in Figure 25); they are also found along the edges of and scattered within the northeast area of West Bay.

Figure 28. Figure-ground map, white represents space, and black shows blocks. Source: Author.

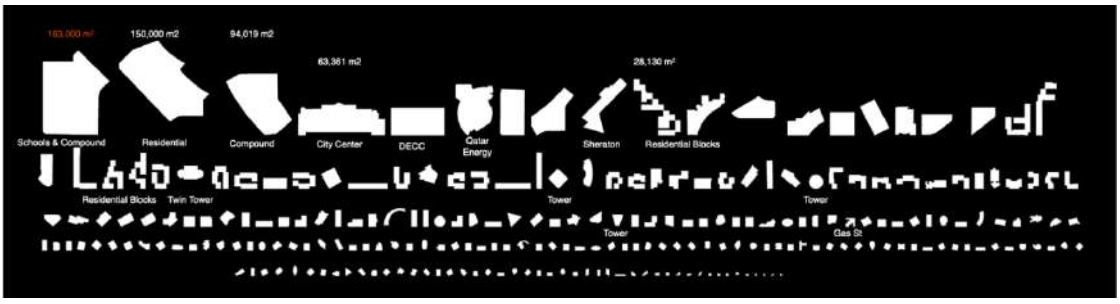

Figure 29. Block size ranking. Source: Author/Mohammad Najjar.

In terms of sizes, there are about six mega blocks with a surface area ranging from 65,000 m^2 to 160,000 m^2 (Figure 29). The two most significant mega blocks are a large school compound (163,000 m^2) and the Emir's residential compound (150,000 m^2). When considering these blocks in the average area calculations, the average block size is around 7,000 m^2; however, when excluding these mega blocks, the average block size is reduced to 4,500 m^2. With very tightly arranged blocks, it is more appropriate to consider them as one since they are impenetrable. Additionally, building compounds, such as the Qatar Energy block (Figure 29), are composed of 10 towers; however, because the internal space is gated and only accessible by permission, the whole space (even when hollow internally) acts as a single urban block within the urban scale. The same applies to residential compounds, which are empty from the middle but act as a movement barrier. The tower blocks and single residential blocks have approximately the same ground area (between 1,000 m^2 and 2,000 m^2), which explains why from the third from the top to the last row in Figure 29 has a significantly expanded graduality change in block size, unlike the difference between the first and second rows, which relatively have extreme variations.

Compared to the enormous blocks, the smallest ones are 0.002 times smaller, primarily composing mosque blocks (around 300 m^2) and the Metro station's ground entrances/lobbies (approximately 400 m^2). Two factors drive the small size of mosques in West Bay. First, the number of mosques per square area is relatively high, equal to around 2.7 mosques/km^2. The pedestrian shed representation (Figure 30) also confirms the high catchment area of these mosques, especially in the residential part of West Bay, where they are most needed.

Therefore, rather than building one or two mega mosques, it is more appropriate to distribute smaller ones within each sub-district. The second factor, which follows

along the primary land use in the residential area, is that smaller mosques are more fitting for the surrounding building scale when they are situated within the internal parts of the neighborhood.

The spatial layout of most towers is composed of a rectangular block at the ground level and covers an area between 1,000 m^2 to 2,000 m^2. Other urban elements, such as shopping malls, are also rectangular in their primary shape but contain extrusions to highlight entrances. Moreover, additional blocks are constructed of irregular forms for several reasons; one of the more dominant reasons is when multiple buildings compose a single block, such as the Qatar Energy block (Figure 29). The Sheraton Hotel's block is also a combination of numerous blocks, but its unusual form is also driven by the building's design (the triangular floor plan and the pyramid shape). Other structures take the form of the adjoining street, mainly occurring at curved street edges, which forces the block to mirror the street curve it is situated.

4.2.3 Analysis of Street Network Morphology and Circulation

There are three main functional types of physical characteristics for the street network in West Bay: arterials (major and minor), collectors (connecting local roads with arterials), and local streets (within the neighborhood and leading to buildings). The major arterials in West Bay are Omar Al Mukhtar Street and Al Corniche Street (Figure 25); these two major arterials are connected by two minor arterials, which creates the central zone in West Bay. The coastline surrounds the site from the east and north sides, and the seashore's outline is reflected on the two major arterials. The other significant edge around the area, which also acts as a secluding element, is Al Istiqlal Street, a highway along the western edge. The nature of the area being built on reclaimed land and the strongly bounding streets surrounding it makes it a somewhat isolated zone

from the rest of the city. This aspect is also found internally, especially for pedestrians, due to the high-speed vehicles on the major arterials, which are also very wide to cross.

Figure 30. 200 m, 400 m, and 800 m pedestrian sheds from the geometric center of West Bay. Source: Author.

Al Corniche Street creates a block between the waterfront and the remaining spaces in West Bay, whereas Omar Al Mukhtar Street splits Zone 63 and Zone 61. Collectors in West Bay are two-way roads that manage the flow of people into and out

of sub-districts, whereas local streets are one-way segments organizing the circulation within each sub-district. This approach is well-functioning in some portions, such as the north sub-district because the one-way path passes throughout the area.

This one-way local street network is inadequate in other areas. It needs to provide sufficient circulation throughout the area on the southern edge, and within the residential district, mainly because of the many dead-ended streets and the large loops around each block. This is consistent with the Pedestrian Route Directness theory mentioned previously (Randall & Baetz, 2001). These physical features overflow traffic back to the collectors and into major arterials, increasing vehicular traffic.

From the pedestrian's perspective, the street layout is harder to navigate, especially when moving from one district to another. However, within the central space of West Bay (between the City Center Mall and the Metro station), there happens to be a massive pedestrian movement, especially during office breaks and at the end of working hours, when people walk from their offices to the Metro station. A 200 m and 400 m pedestrian sheds are applied at the geometric center of the area (Figure 30) and at mosques (Figure 31) to evaluate the catchment area of each. The geometric center is shifted approximately 10 meters from the metro station's entrance. The closeness between the physical center and the metro station indicates the successful allocation of the metro stop, which benefits the West Bay's center to become a more vital space. The pedestrian shed shows that various commercial functions are within a 3-to-7-minute walk from the metro station.

Figure 31. 200 m and 400 m pedestrian sheds from mosques in West Bay. Source: Author.

Nonetheless, the office towers are slightly further away (800 m or a 10-minute walk); this distance is suitable when the weather is pleasant. However, summer's high heat and humidity limit people's comfort in walking longer than 5 minutes. Pedestrian sheds at mosques show that the residential area is completely covered with accessible mosques. As mentioned above, the high number of mosques could be driven by how the streets and block arrangement limit accessibility to nearby amenities. Figure 31

shows that most mosques are located within the residential zone, and only two are built within the office districts. This distribution is primarily because each office or residential tower contains prayer areas closer to users.

4.2.4 Analysis of Land Use

West Bay's land use is characterized by mono-use per sub-district. For instance, in Zone 63, the far west side is entirely allocated for low-density residential use only, in addition to the supporting elements such as schools, which are also clustered together (Figure 32), day-care nurseries, mosques, and other daily amenities like petrol stations and a grocery store. Gradually moving east from the residential sub-district, the area around the metro station (labeled with M in Figure 34) becomes relatively diverse in its functionality.

Figure 32. Schools cluster in one area in West Bay. Source: Google Earth, edited by Author.

Although the single-use pattern is persistent throughout the sub-districts, the central space in West Bay is an exception. Commercial activities such as shopping malls, cafes, and restaurants are in the central space, along with hotels, the Doha Exhibition & Convention Center (DECC), some office towers, and a large car showroom. Right below the central space, at the southern sub-district, the land use primarily includes private-sector office buildings. Less than ten percent (<10%) of these towers contain mixed services (offices on above-ground levels and cafes on the ground level). However, opposite the central space, on the exterior portions, the north sub-district includes a continuous strip of governmental and non-governmental office towers containing ministries and companies' headquarters (Figure 33).

In contrast, the internal areas of the north sub-district contain numerous hotels; sixty-six percent (66%) of the hotels in West Bay are in this area, and the principal reason behind this concentration is to take advantage of the water views. In addition to hotels, the northern area contains a high concentration of embassies with some medium-density residential units to support the diplomatic uses within the area. Right at the coastline, there are three hotels (blocks in red in Figure 34), four embassies (in pink in Figure 34), and lastly, at the edge is the Emir's Palace. Recently, the government began moving embassies to other locations to activate the beachfront as a public space. Currently, some portions are in use, while some old buildings are being renovated to contain new functions, such as restaurants and cafes.

After analyzing the land use pattern in West Bay, we can conclude the circulation of people, their concentrations, and demographics. To begin with, the single-use pattern creates contrasting demand hours, primarily where office towers are located. The West Bay becomes very crowded during work hours. Because there is a lack of other activities, many spaces become empty at night. The only space which continues

to be active throughout the day and week is the central space, where functionality is more diverse than in other sub-districts.

Moreover, where the schools are grouped in one location, the pickup and drop-off hours create massive vehicular traffic in the residential area. The single-use pattern, accompanied by the bounding street network, isolates West Bay from the rest of Doha. According to the Doha Municipality, significant portions of the West Bay need more variety, providing a lively space, despite its zoning designation as a Capital City Center. Although, before the FIFA 2022 World Cup, the government took action to incorporate incremental design changes to the streets of West Bay by adding cycling lanes, more vegetation, and wider pedestrian paths.

Figure 33. The continuous strip of office towers at the outer edge of the north sub-district in West Bay. Source: Author.

Figure 34. Land use map of West Bay. Source: Author.

These straightforward design alterations to streets addressed that during the World Cup, many visitors would walk and use public transit options such as the metro rather than private transportation. The street enhancements in West Bay created a comfortable environment for pedestrians; nonetheless, their circulation is relatively limited within the central space mainly due to the layout of the street network. Understanding land use in West Bay provided deep insight into the required

enhancements and the most appropriate proposals regarding urban voids. The area needs a reviving plan that brings more liveliness into the area after work hours and on weekends.

4.2.5 Frontage Activity Analysis

The analysis of frontages examines the interaction between indoor and outdoor environments. For instance, a visual interaction occurs between pedestrians and open, transparent storefronts, which helps increase the economic value by drawing more people inside. Similarly, restaurants and cafes with active frontages (either windows or outdoor sitting areas) create a pleasant and lively experience for pedestrians and people sitting. In both scenarios, the active frontages attract more people and activate the streets. In commercial and retail spaces, active frontages are the preferable approach. However, in residential areas, especially in a conservative society, where privacy is a highly valued principle, blank or inactive frontages are the desired approach. Almost all buildings are blank in West Bay (Figure 35), mainly because the primary method of commuting is through vehicles, where drivers' view is slightly raised above ground level and hence looking at upper stories of buildings. Because of the high application of reflective finishes and tinted glass on tower facades, it becomes challenging to find an active front while driving (Figure 36). In West Bay, active frontages are limited on the ground level and from the pedestrian's perspective, with only a few buildings with commercial uses or cafes at the ground floor, except in the central zone of the district.

This lack of active frontages is mainly driven by the need for mixed-use buildings, creating a dull pedestrian experience. West Bay would become livelier throughout the day if more frontages were activated. It would attract multiple user

groups, creating a continuous circulation of people and enhancing the economic value of retails and restaurants.

Figure 35. Active and inactive frontages in West Bay, green shows active frontage, and red shows inactive or blank frontages. Source: Author.

Activating the streets would also draw people from all sub-districts, especially if there was comfortable access through the street network or alternative transportation options. It is important to note that many spaces might be regarded as ‘active’ in the

theory simply because a door or a window exists with the social potential for interaction between the exterior and interior of the building but is relatively inactive/blank because these doors or entryways are guarded with security (such as at embassies or the Qatar Energy compound), or due to the type of glass used, which restricts the visual interaction.

Figure 36. The application of tinted glass and reflective materials in towers in West Bay. Source: Author.

As mentioned in previous sections, in West Bay, the walkability trend is increasing because of the street's enhancements and because many buildings are attempting to activate their frontages by expanding cafes and restaurants on the sidewalk. For instance, the City Center Mall owners built extended terraces and added

cafes and restaurants, everything in the mall was only accessible from the inside before this change. The new terraces attract many employees during their breaks to walk directly to the front side of the mall. Moreover, the Tornado Tower added an extension to its rear, a blank facade; the extension is now situated on a corner between major and minor arterials and acts as an attractive destination, especially for pedestrians.

The satellite image in Figure 37 can be used to understand the building height pattern in West Bay. By carefully observing the shadows of buildings, we can conclude that there is a distinction between building heights between the western and eastern sides. On the western side, the building height is at most three stories because the primary land use consists of low-density residential units.

Figure 37. Satellite image showing shadows of buildings in West Bay. Source: Google Earth.

On the east side, however, the primary function is governmental offices, headquarters, and hotels, typically in towers. Although high-rise buildings dominate the eastern side, the buildings at the coastline remain within three levels, mainly because they contain embassies built in the form of large villas. Although low-density residential villas compose seventy-nine percent (79%) of all buildings in West Bay, the dominant and more memorable perception of West Bay is high-rise towers, which only comprise eighteen percent (18%) of building types. This perception is what the media and the authorities in Qatar use to promote the futuristic and modern image of the city. The impression of these towers was possible through iconic and start-architect buildings, which typically create a strong impression. Doha's skyline comprises all the towers lined along Al Corniche Street.

Although the dominant feature on the eastern side is high-rise towers, the central space contains only a few medium-rise buildings (3% of all buildings). These include the City Center mall and the DECC. Both buildings have a large ground surface area, typically accompanied by a medium building height to maintain a comfortable ratio. Unlike towers with a considerably smaller footprint on the ground, they tend to be much taller than vast buildings. Right at the coastline parallel to Al Corniche Street, the waterfront is cleared of any buildings and is publicly accessible. However, on the southern side of West Bay, precisely at the west of Al Corniche Street, high-rise towers create a continuous strip that functions as a physical and visual barrier between the western side of West Bay and the waterfront.

The map in Figure 38 shows the pattern of building heights in West Bay, where the taller a building, the darker it is. This representation of building heights shows the transition between the east and west and how the central space contains medium-rise

buildings. It also shows the lineup of high-rise towers in the north and south sub-districts.

Figure 38. Building height representation in West Bay. Source: Author/Mohammed Najjar.

4.2.6 Voids Analysis and Proposal

The highlighted spaces in Figure 35 show all vacant and underdeveloped spaces in West Bay, also known as urban voids. The voids found in West Bay are, in general terms, plots that are yet to be developed by their owners. These voids often emerge due to the underutilization of specific spaces (such as empty land near embassies or surface parking lots) and the segregation between varying functions. The urban voids in West Bay also appear when public spaces are disconnected, and several plots and fragments of land need to be connected within the urban fabric. Because of the relatively low urban density in West Bay and the loose urban fabric (10% less dense compared to Al Mirqab), the nature of urban voids does not emerge as 'pocket; spaces or leftover portions of the land but are, instead, large, unused spaces found within central areas (Figure 40).

Before the World Cup, authorities addressed leftover spaces in West Bay, mainly by using vegetation, so these spaces seem to blend with the urban fabric, and the larger voids still stand out. Although this approach has reduced the dullness of previously underutilized corners, this touch-up technique should be considered a short-term solution in addressing voids, especially when there is an opportunity to create active street life in an attractive city area. Frontages, morphological analysis, and site observations highlighted how the area becomes a pedestrian attraction based on a land use strategy. The suggested proposal for urban voids in West Bay will include long-term solutions which will help revive the area and activate its spaces throughout various times of the day. Therefore, unlike Al Mirqab, which mainly required incremental alterations and more 'free' spaces, in West Bay, it is more appropriate to address a couple of major voids to create a long-term proposal that would enhance the liveliness of the area.

The selected voids for the design alterations are highlighted in orange in Figure 39. The primary concept is to create two connected centers, one at the current center close to the metro stop and the other right at the opposite sub-district on the western side. By redesigning the three highlighted voids, the area would extend its central space and hence its on-street activity.

Figure 39. Map showing all voids in West Bay. Source: Author.

The design alterations would also require a transport system that supports the main concept of two connected central spaces. The proposal connects the center of West Bay to the rest of Doha via a few street alterations. It is essential to consider that this proposal is a long-term correction – not limited to the current conditions of West Bay – but also its future potential as part of Qatar's most attractive locations.

Figure 40. Example of voids in West Bay. Source: Google Earth (above)/Author (below).

The initial design alterations address the movement issue and the disconnection between West Bay and the rest of the city by introducing minor arterials extending from the center to the highway adjacent to the western side, this road extension will include pedestrian, vehicular, and cycling lanes to provide access to several users (Figure 41). Given the size of the West Bay area, such an intervention will likely require some degree of vehicular access to be truly effective. The proposal suggests adding a local tram system that passes through this network along with the new streets. The suggested local tram moves throughout West Bay (red dashed line in Figure 41). This approach is currently used in Msheireb Downtown and is highly beneficial in connecting segregated spaces, especially during the harsh summer weather conditions. The tram line passes, stops by every sub-district, and connects the two centers, most importantly. People can use void three as an extension to the current metro area. The sides around the building in between (the DECC) currently provide a walkway between the two areas but could also be widened or closed entirely for pedestrians, especially where the rear of the City Center mall is. Currently, void three is one of the spaces vegetated and transformed into a park right before the World Cup.

However, due to the size and location of the space, it is more appropriate to utilize this void as a supportive space for the metro stop and the proposed tram line. Void three can be the central station where the tram stops/starts, and it could benefit from adding some commercial activities while maintaining some of the already planted vegetation. Moreover, because it is located right behind the DECC, it can be used as an extension to the arranged exhibitions for outdoor activities and for displaying sculptures and art. On the other hand, voids one and two could contain mixed-use buildings, consisting of medium-density residential units at upper levels and retails on the ground level. Square-like spaces are the suitable design approach for voids one and two.

Because of the proposed street network, void one would be split into three sections (1, 1.1, and 1.2). The central section is the one that would contain the main square because it is also connected to void two and, therefore, can include extensive temporary outdoor activities such as festivals, concerts, and exhibitions.

Figure 41. Proposed street network (in blue) and tram line (in red) in West Bay. Source: Author.

Moreover, spaces 1.1 and 1.2 would be more intimate and less crowded through design. Because these spaces are considered at the exterior edges of the current voids, they would be treated as entryways or exits, with shaded paths and relatively compact alleyways that create an opportunity for air circulation and a wind breeze. Although alterations do pass through the current residential area, future projects that work on a city scale must often remove some older elements and replace them with better solutions, especially after extensive experience with the existing models and comprehending how they do not work anymore.

With the changes in society and the more profound understanding of our environments, moving forward to a new practice in urban spaces demands long-term plans that require radical changes in our cities. Nonetheless, the current society in Qatar appreciates the outdoor experience and the enjoyment of moving on foot within cities rather than driving around. The 2020 Covid pandemic lead people to enjoy being in outdoor social spaces. Additionally, with the recent projects in Qatar that provide the outdoor experience, such as Msheireb Downtown, The Pearl, Al Hazm, and Katara, people became more drawn toward walking to their destinations and more attracted to outdoor spaces over closed malls, especially when the weather is pleasant.

4.3 Case Study 3 – The Pearl

At the beginning of the 21st century, authorities in Qatar started to implement extensive urban projects to generate a new image for Doha. The rebranding process included expanding the city along its coastline, with an annual expansion rate of about 9.2 km^2 over 70 years (Major et al., 2020). The goal of such expansion was for the Qatari government to alter the global perception of Qatar's blandness in both the urban setting and economy (Alraouf, 2018). To attract Indo-European Westerners, the

government created expansion programs that involved expansion towards the shallow coasts of the Gulf, creating urban attractions such as The Pearl-Qatar (Wiedmann et al., 2013) (Figure 42).

Figure 42. The location of The Pearl is in Qatar and Doha. Source: Google Maps, edited by Author.

Figure 43. November 2017 aerial view looking southwesterly at The Pearl-Qatar in Doha. Source: Wikipedia/Planet Labs, Inc.

The Pearl-Qatar (Figure 43) is settled in a 400-hectare artificial island located 350 m offshore in northeast Doha. The development cost about $15 billion when the Souq Waqif restoration project was first initiated in 2004 (Major et al., 2020). This new urban development project is the first of its kind in Qatar. It combines traditional Islamic and European architectural styles in urban development, offering contemporary lifestyles and conveniences for low-, mid-, and high-rise dwellers. Although many criticize the design approach of The Pearl, the project was targeted only to host the higher income Qatari, Arab, and Indo-European Westerners, allowing one hundred percent (100%) foreign ownership of land and property. The project included multiple residential and mixed-use districts containing hotels, retail, restaurants, and other utilities and services.

The Pearl-Qatar (The Pearl) was developed by United Development Company (UDC), which visualized the area as an unclasped string of pearls, with the Porto Arabia district, the Marsa Malaz district, and the Viva Bahriya districts as its three biggest pearls (Figure 44 and Figure 45). The Pearl is in Zone 66 at the edge of Metropolitan Doha, a historic site for pearl diving, hence, the name. The Pearl Qatar, despite 18 years of development, is still to see its completion (Ferwati et al., 2020). Nonetheless, there is little literature available on the land use of The Pearl as there is little data shared publicly by private developers. Most of the data on The Pearl is centered on the loss of cultural identity associated with the design of the district and its relation to rapid urbanization in the region without presenting deeper insights into the urban morphology of the area (Ibrahim, 2013; Ibrahim, 2016; Ferwati et al., 2020). Data from 2016 looked at the spatial utilization within The Pearl to identify possible correlations that developers and policymakers can use to improve the quality of spaces within the area (Muneerudeen et al., 2016). However, these data no longer hold credibility, given that

structural progress within The Pearl has changed significantly since 2016. A more recent study by Al-Amadi et al. (2021) is representative of the literature relevant to The Pearl-Qatar as it evaluates the design, planning, and land use mixture of the Porto Arabia district. In this study, the morphological and functional analysis is also reviewed from the perspective of urban voids to determine and understand their emergence in a contemporary urban setting.

Figure 44. Views of The Pearl's main districts (left to right): Porto Arabia, Qanat Quartier, Medina Centrale, and Viva Bahriya. Source: Al-Amadi et al., 2023.

4.3.1 Urban Morphology and Spatial Configuration of The Pearl

This section provides a morphological analysis of The Pearl, mapping the ground-level land uses, shed analysis, and frontage analysis of active/inactive residential and non-residential structures. Due to the expansive scale of The Pear, and the current continuous construction, the study will focus on the main arterial road in The Pearl, Pearl Boulevard, and its relationship with the key districts around its spatial layout - Porto Arabia, Qanat Quartier, and Medina Centrale (Figure 44). Officially, the island contains 12 districts. However, there are 15 physically split districts (Figure 45).

The Pearl–Qatar occupies 4 km^2 of land area with a 32 kilometers (km) coastline and is comprised of 12 districts (see table 1 below), the biggest of which are Porto

Arabia (16.0% of the total area), Pearl Boulevard (12.4% of the total area), Viva Bahriya (10.5% of the total area) and Qanat Quartier (7.5% of the gross area).

The urban residential plan for The Pearl – Qatar as of 2021 is approximately 19,000 residential dwelling units for 45,000 residents, of which 1,165 are apartments and townhomes in Qanat Quartier, 4,700 apartments in Porto Arabia, 1,780 dwelling units in Viva Bahriya, and 1,038 units in Medina Centrale comprising of villas and apartments above shops. This accounts for more than forty-five (45%) of the residential density in The Pearl. In principle, The Pearl would have a 47-dwelling unit per hectare residential density upon completion, which is the standard for medium-density residential land uses. In 2021, however, The Pearl had a ninety-three percent (93%) occupancy rate with a total residential population of 52,000 (The Peninsular, 2021).

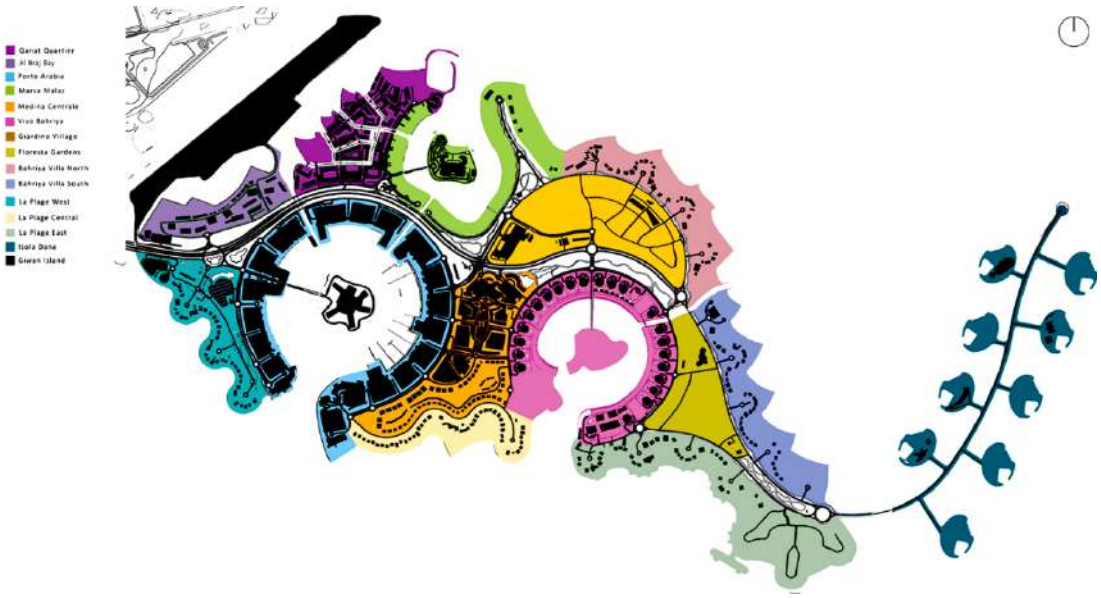

Figure 45. All official and non-official districts at The Pearl-Qatar. Source: Al-Amadi et al., 2023.

4.3.2 Street Morphology and Circulation

Pearl Boulevard is the primary and only access point of entry and exit into and out of The Pearl because the project's conceptual design is that of an 'unclasped string of pearls.' The Pearl Boulevard's right of way and associated frontages occupy more than twelve percent (12.4%) of the gross area (and have a total of 0.5 km^2, refer to Table 1). Pearl Boulevard comprises 22 road segments, with one end located at the Lusail Expressway and the other end 8 km away, terminating at the Isola Dana water villas. Five road segments connect Lusail Expressway to Medina Centrale, representing thirty-nine percent (39%) of the total length of the Boulevard. A 1.43 km segment comprised of five road segments connects Medina Centrale to Floresta Gardens, and 1.2 km comprises six road segments from Floresta Gardens to La Plage East. The last stretch of 2.25 km connects Pearl Boulevard to the restricted Isola Dana districts. One thing to notice is that the road segments become shorter the further west on the island.

Table 4. Total land area and district area (km^2), length (km) of coastline, and percentage of total land area by the district in The Pearl-Qatar. Source: Al-Amadi et al., 2023/QUCG-CENG-22/23-472.

The Pearl	4.0 km^2	
Coastline	32 km	
AREA BY DISTRICT (w/o water)	AREA (km^2)	PERCENTAGE (%)
Pearl Boulevard/Frontage Roads	0.50	12.4
Al Braj Bay	0.17	4.3
Qanat Quartier	0.30	7.5
Porto Arabia	0.64	16.0

AREA BY DISTRICT (w/o water)	AREA (km^2)	PERCENTAGE (%)
Marsa Malaz	0.21	5.3
Medina Centrale	0.20	5.0
Viva Bahriya	0.42	10.5
La Plage West	0.15	3.8
Other	1.41	35.3

Each district in The Pearl is attached to the Boulevard as if pearls on a string. The influence of the conceptual design can be analyzed from how the designers plan pedestrian access within the area. This is identified using pedestrian shed analysis shown in Figure 46. The 400m and 800m pedestrian shed at the first intersection of Pearl Boulevard, off the island, show a comfortable connection between the Lagoona Mall and the Legtaifiya Metro Station. However, the only possible access routes into The Pearl are through vehicles. In Figure 46, the 200m and 400m pedestrian sheds (west to east) are within Porto Arabia, Medina Centrale (also the geometric center of The Pearl), Giardino Village, and Viva Bahriya. Mostly, each of the districts' pedestrian sheds only highlights their central spaces.

Even so, although the pedestrian shed in Medina Central does not reach the ends of Viva Bahriya and Porto Arabia, the slight overlap between the pedestrian sheds shows the ease of reach between these three areas, especially when the weather is pleasant for walking. However, other districts, such as Qanat Quartier, are relatively isolated. Small areas near Abraj bay and Kempinski island are accessible to pedestrians but are outside the 400m radius of Qanat Quartier. Similarly, the pedestrian sheds of Porto Arabia and Viva Bahriya show promenades in the outskirts of the 400m radius

simply because of the walking grounds to the bays and marinas in the area. There are vehicular access roads in Giwan Island district, Viva Bahriya district, and Duck Lake that crosses Pearl Boulevard.

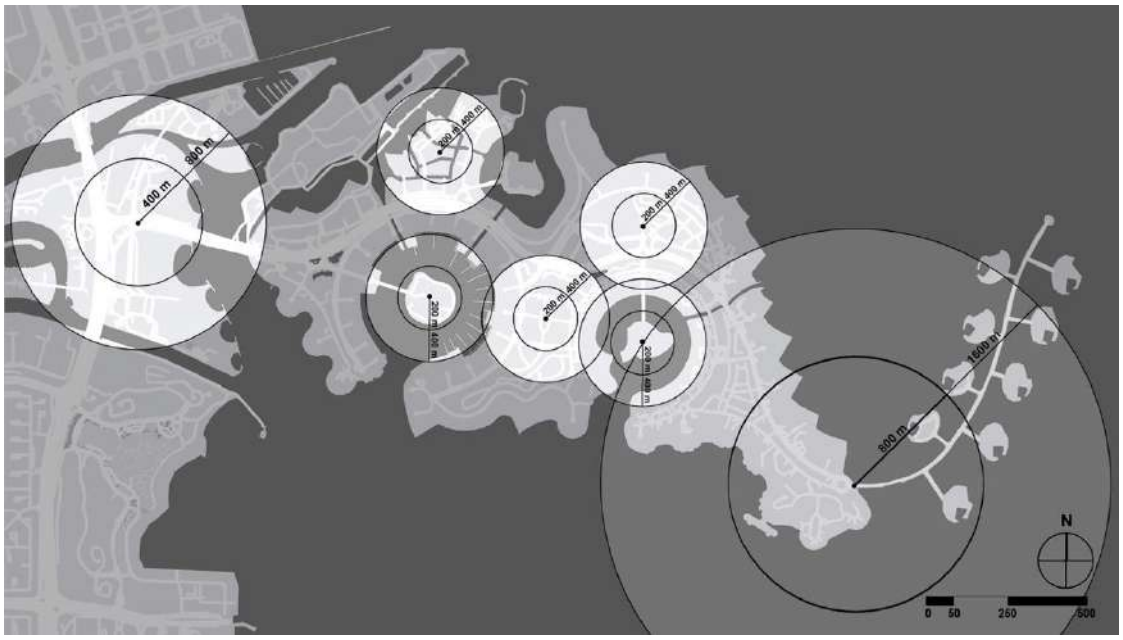

Figure 46. Pedestrian shed analysis of (left-to-right) first available street intersection on the mainland, the geometric center of Qanat Quartier, Porto Arabia, Medina Centrale, and the (under construction) Giardino Village, and entry point to restricted Isola Dana water villas district in The Pearl-Qatar. Source: Al-Amadi et al., 2023.

There is an access lane for pedestrians on the northern portions of Viva Bahriya and Medina Centrale within 500 m from Giardano village center, although with considerable caution as it crosses the high speed (80 km/hour) area of Pearl Boulevard. Medina Centrale is the most accessible district in The Pearl as it is considered the town center, with Porto Arabia and Viva Bahriya within 400 m of its geometric center. Looking at Isola Dana water villas, it is easy to identify by looking at the pedestrian shed that this district is highly isolated from the rest of The Pearl, as a shed of 800 m

and 1600 m are used to find the nearest access points. This is understandable in full consideration of the prominent residents in this district, like Father Emir Shaikh Hamad Al Thani.

Because of the scope of construction works happening in The Pearl, Al-Amadi et al. (2022) and this thesis studied only sixty percent (60%) of the available land when the remaining forty percent (40%) still needed to be under construction. The construction included individual lots for low-density residential units in the Marsa Malaz, ongoing construction activities of townhomes and mid-rise residential buildings in Medina Centrale and the Giardino Village, the construction of the resort island in Giwan Island, the marina island of Porto Arabia containing the St Regis Hotel, Isola Dana also contained five vacant water villas, in addition to some townhomes and towers in Abraj Bay, an island of apartment buildings in Qanat Quartier, and The Pearl Friday Mosque west of Porto Arabia.

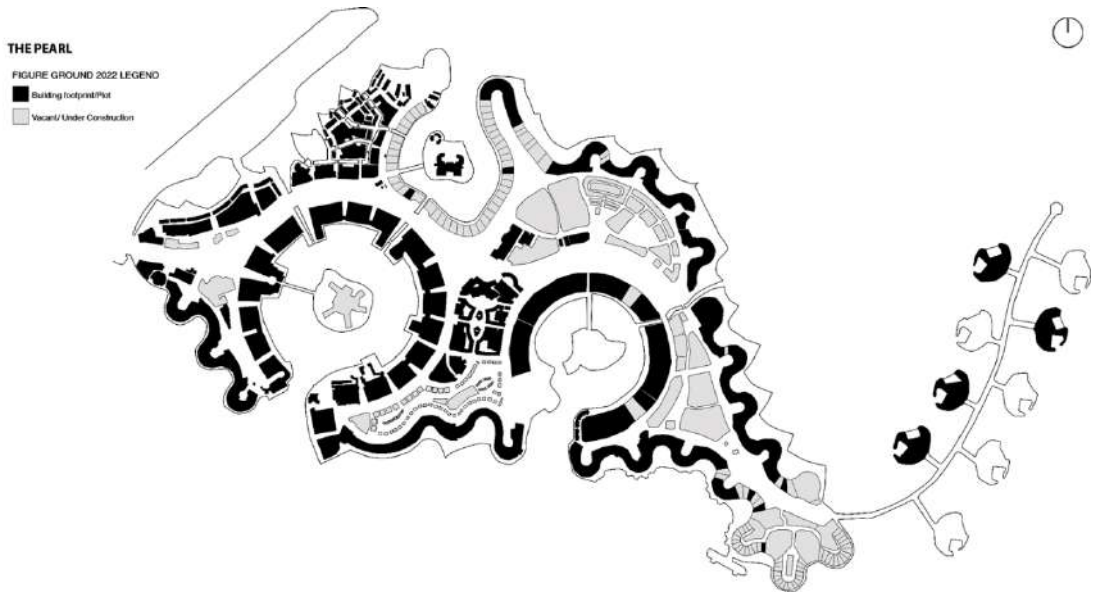

Figure 47. Figure-ground representation of The Pearl-Qatar-Qatar. Source: Author/QUCG-CENG-22/23-472.

Al-Amadi et al. (2022) observed that the structural development of The Pearl, regardless of the glamour that goes along with it, is like any typical urban development of the late 20th or early 21st century. In this case, strong emphasis is centralized on a single road (Pearl Boulevard) starting from the mainland and headed towards its most isolated locations. The only difference between The Pearl and the typical Western model of suburban sprawl is that the development of The Pearl does not accompany any dead-ends within its layout (Major, 2013; Major, 2018). The sense of balance is preserved in connecting the key areas of The Pearl, putting low-density residential units on one end and the mixed-use districts on another while connecting these two with pedestrian and vehicular access.

When conducting the morphological analysis of The Pearl, it is essential to remember that the island is a contemporary development. It does not contain any historical resources. That also means that the development process was and is still being excepted according to the timeline and phasing associated with the plan, unlike most of Doha, which expanded in a semi-organic method, where older and historical structures influence future projects and developments. This is especially found in Mshereib and Souq Waif, which underwent a massive restoration plan between 2004 and 2008 to maintain and highlight the historical characteristics of older settlements (Ferwati et al., 2020; Tannous, 2020; Major & Tannous, 2020).

The layout of The Pearl is formal with an organized geometric composition because the execution of The Pearl utilized a ‘string of pearls’ conception, along with radial geometry. This approach maximized the length of waterfronts, increasing the number of properties with sea views. In The Pearl, most urban blocks are rectangular, with many incorporating minor additions or subtractions from the building footprint to serve specific needs. For instance, in Porto Arabia, where cafes and restaurants are

located, the building footprint is extended towards the promenade to facilitate terraces and outdoor sitting areas. Contrastingly, there are chamfered corners for store entrances for the blocks in Medina Centrale, increasing the catchment area and attracting more people to shops. In low-density residential areas, the block pattern consists of continuous strips, especially for villas at waterfronts, which have walls on the street side, creating an elongated block between the street and the waterfront. This can be found in the Le Plage district. The urban block scale gradually reduces in size from west to east. Porto Arabia has the largest urban blocks at The Pearl. In Porto Arabia, we can find types of block sizes. The first is 11,000-20,000 m^2, and the second range between 21,000- 30,000 m^2. These have extensions on the ground floor and extend towards the promenade. Lastly, the largest block is 52,000 m^2, the St. Regis Hotel, recently completed at the center of the marina in Porto Arabia.

In many scenarios, the block layout of The Pearl performs as an urban barrier between districts. For example, a sizable mosque is under construction between Porto Arabia and the Le Plage districts. This large structure, wide streets, and extensive vegetation act as a barrier between the public spaces of Porto Arabia and the private villas along the waterfront.

We can observe from the figure-ground how a sizable portion of The Pearl is maintained for Pearl Boulevard and its associated frontage streets (12.4% of land area). It makes most districts pedestrian-friendly or even strictly pedestrian-only from within the district. However, the vast spaces between the districts due to Pearl Boulevard – especially north-south – makes movement challenging from district to district. This, in return, makes The Pearl very car-centric. Furthermore, with varying intensities, each district is purposely isolated from its neighboring districts.

Figure 48. Active and inactive frontages at The Pearl-Qatar. Source: Author/QUCG-CENG-22/23-472.

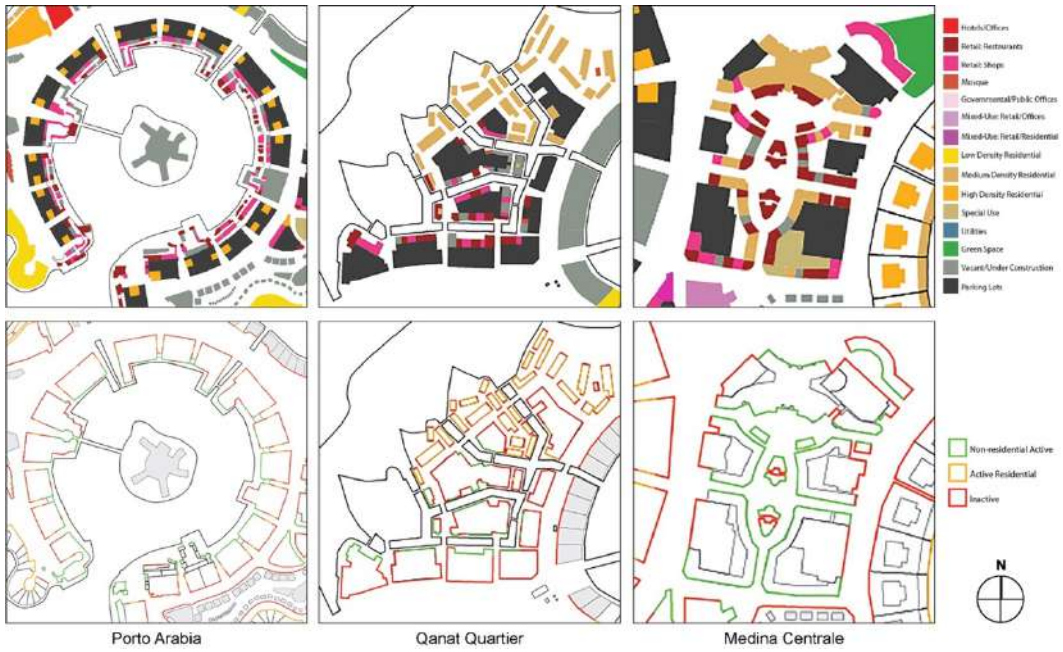

Figure 49. Close-up of (top) ground-level land uses and (bottom) non-residential and residential active and inactive frontages in the Porto Arabia, Qanat Quartier, and Medina Centrale mixed-use districts of The Pearl-Qatar in 2021. *NOTE: Not set to a common scale.* Source: Al-Amadi et al., 2023.

Although districts are physically proximate to each other, the inward orientation of buildings and the inactive frontages at the street side (Figure 48), like in Medina Centrale, the Qanat Quartier, and Porto Arabia, and prevents visual interaction with the inner activities, even when these districts contain commercial and retail activities available for the public.

4.3.3 Analysis of Frontage

The composition of active and inactive frontages in The Pearl shows the inward orientation of individual districts. This pattern is strongly apparent in Medina Centrale, the Qanat Quartier, Porto Arabia, and Viva Bahriya (Figure 49). Blank walls are used on building facades oriented at the surrounding streets of each district. This method provides another level of exclusivity and privacy in each district. This pattern is also present in Medina Centrale, where active frontages are inward facing; only some exterior facades have an active front (except for parking entrances). Although this technique, in a central space, might seem unpleasant and unwelcoming. This strategy emphasizes a lively space within the center of The Pearl, providing an attractive outdoor social environment.

Other districts, however, use the blank frontages technique to contain privacy and exclusivity in a space. Viva Bahriya is an exclusive residential area with high-rise towers and townhouses. All entrances from the exterior street are raised above ground level. In addition, the residential towers are tightly arranged, creating a visual barrier between the surroundings and the internal promenade. Moreover, non-resident pedestrians' access is controlled by security guards and specific day hours. This is accompanied by a long walk in a tight alleyway with high blank walls, resulting in an uninviting environment. Contrastingly, in Porto Arabia, a non-restrictive area with

mixed uses, the entrances toward the promenade are more expansive and allow vehicle drop-offs with multiple public underground parking spaces.

Additionally, one of the entrances is directly connected to Pearl Boulevard, making the space an attraction for visitors from outside The Pearl. Regardless of the blank frontages on Porto Arabia's street-facing facades, the wide entrances and the active frontages of cafes, restaurants, and shops, along with vehicles restriction into the promenade, provide a highly active and safe space for families with children and enjoy.

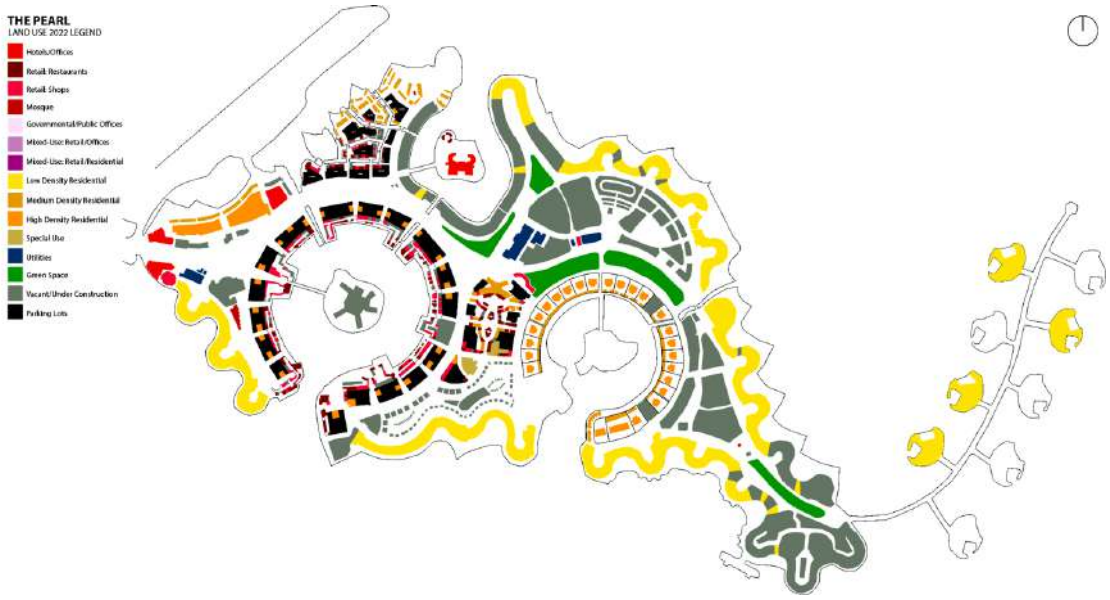

Figure 50. Land use map of The Pearl, 2021. Source: Author/QUCG-CENG-22/23-472.

4.3.4 Land Use Analysis

The Pearl is predominantly residential, with density varying from one district to another (Figure 50). Due to their waterfront vistas, high-density apartment towers such as Viva Bahriya and Porto Arabia line the coastal promenades. There are parking garages on the ground level and several floors (4-5 floors) in these residential towers. Low-density residential units are the core developments in many of the island's exterior boundaries (in yellow in Figure 50).

The remaining functions in The Pearl include hotels, restaurants, cafes, a gas station, and commercial and retail spaces, along with public utilities such as mosques, which are two mosques, one grand mosque still under construction situated between Porto Arabia and Le Plage West, and another smaller one at the eastern part of the island on Pearl Boulevard. However, significant spaces are yet to be developed or under construction. Because it is the largest area nearest Pearl Boulevard, Porto Arabia relies significantly on internal (pedestrian) and external (vehicular) traffic to operate. A detailed assessment of ground-level land uses, specifically on the boardwalk, demonstrates that public uses (53.4% of all activities) encompass more functions than private ones (Figure 49, top left).

Nearly twenty percent (19.7%) of these are food and beverage retailers. Almost twenty-seven (26.9%) are retail services. Finally, almost seven percent (6.8%) are commercial services, including banks, beauty salons, and gyms. More than eighteen percent (18.4%) of Porto Arabia's commercial retail spaces are unoccupied, most located on the southern ends of the promenade, further from the area's entrance and Medina Centrale. The urban block extends toward the promenade, extensively frequented by pedestrians during the evenings and the day in nice weather, are nearly entirely occupied by cafes and restaurants. The restaurants and cafes help enliven the promenade by providing outdoor seating on or immediately adjacent to the promenade.

The tallest buildings in The Pearl are found on the western edges on either side of the Boulevard and towards the North in Abraj Bay. As mentioned above, the layout of towers in Porto Arabia and Viva Bahirya prevents visual access to the internal parts of the promenades. This is also reflected in the building height trend (Figure 51), where taller buildings are used as an opaque facade around the districts.

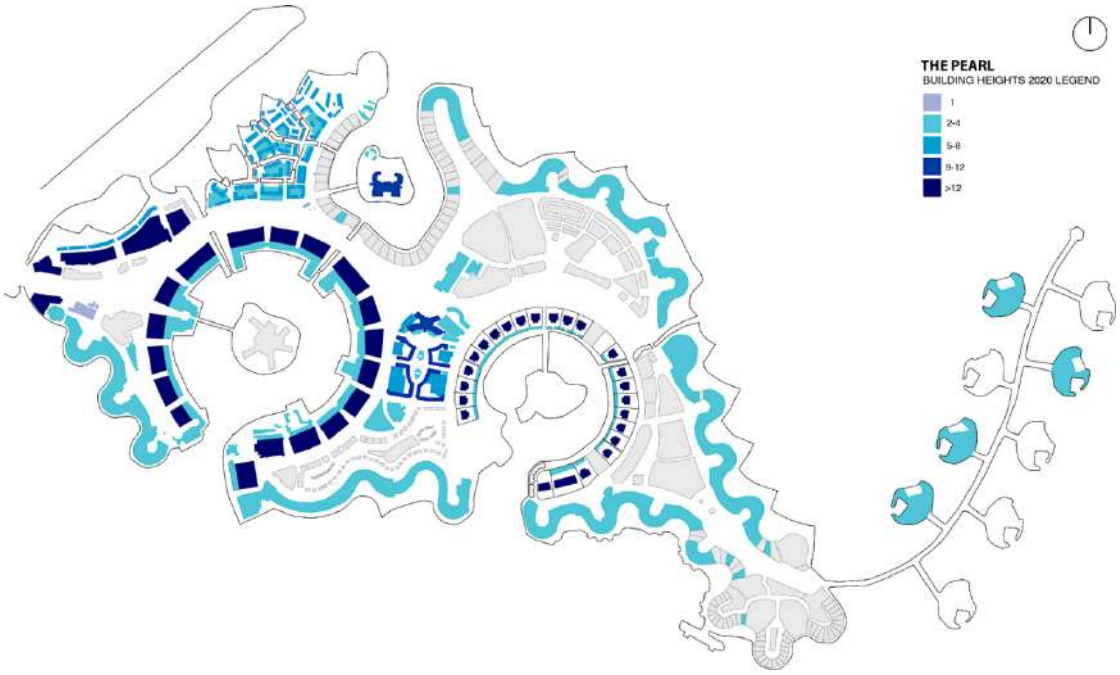

Figure 51. Building height map of The Pearl-Qatar in early 2020. Source: Author/QUCG-CENG-22/23-472.

The Pearl is of interest for urban planning and design, given the high spatial isolation from Metropolitan Doha and the State of Qatar (Al-Amadi et al., 2023). The only means of getting into and out of The Pearl is through Pearl Boulevard, which connects to a 9.2 km stretch of Lusail Expressway. It can be argued that The Pearl is the most isolated or segregated area in Metropolitan Doha, which is impressive given the relatively small land area of Metropolitan Doha. The most remarkable feature of this whole segregation is that this area is just within 30 minutes of the busiest areas of Doha – Souq Waqif, Msheireb Downtown, and Amiri Diwan. Nonetheless, The Pearl is relatively more integrated than Western Qatar's Dukhan or Zekreet Peninsulas (Major et al., 2020).

Figure 52. Examples of urban voids in The Pearl, with Category 1 in red, Category 2 in brown, and Category 3 in green (see Table 5). Source: Google Earth, edited by Author.

Table 5. Types of urban voids at The Pearl, with reference to Figure 52. Source: Author.

CATEGORY NO.	TYPES OF VOIDS IN THE PEARL
1	Very wide streets and urban elements used as segregating spaces between districts
2	Under construction or vacant land yet to be developed in future phases
3	Leftover spaces infilled with vegetation

4.3.5 Voids Analysis and Proposal

The voids in The Pearl certainly do not emerge as 'pocket spaces' between buildings but are either spaces designed to be empty or infilled with vegetation (Figure 52). These are the remaining spaces and areas between the districts as a segregation technique. The voids are also apparent as vacant land and plots awaiting the construction timeline and the future development phases of The Pearl. From the figure-ground perspective, it can be observed that vast spaces are empty and could be utilized instead. One specific example is the space diverging Pearl Boulevard Street into the districts, a roundabout (as shown in Figure 53 below). This roundabout is massive in its scale, covering approximately 12,500 m^2. Though possible, the roundabout is difficult for pedestrians to pass through or around. If done would be dangerous due to the high speed of vehicles. When the scale of the street network is too wide for its function, it becomes an obstacle between city elements. It represents the concern with underutilizing urban spaces, acting as urban voids.

Like West Bay, the proposal seeks to enhance the pedestrian experience and create a connection between districts. Contrastingly to the West Bay, this approach does not seek to connect the island to the mainland, mainly due to the project's purpose, which is to create an exclusive environment for its residents. In the context of The Pearl, the enhancement is better implemented as a large-scale project rather than addressing individual small spaces.

The proposal mainly focuses on one void (highlighted in red in Figure 53). This space has a total area of approximately 20,000 m^2. The proposal suggests that a portion of the roundabout be utilized as a station for a local tram that circulates among different districts in The Pearl (Figure 54). This solution can reduce vehicular traffic on Pearl Boulevard. Implementing a use or function near a mosque is common in Islamic cities.

The mosque was in the center of a public square, also the center of the traditional Islamic city.

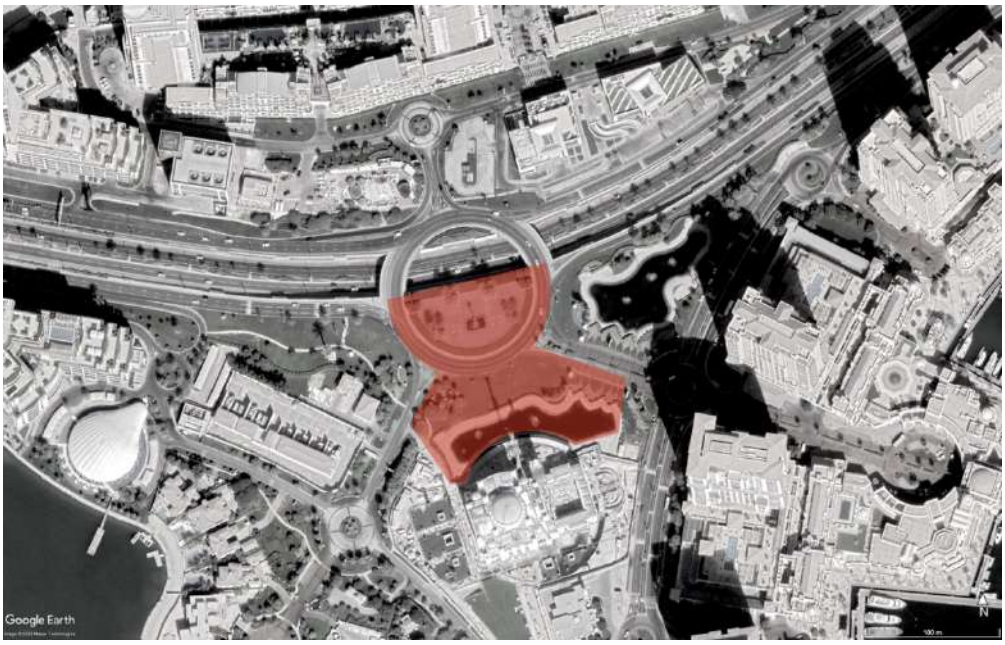

Figure 53. The roundabout urban void in The Pearl. Source: Google Earth, edited by Author.

Figure 54. Tram network proposal. Source: Google Earth, edited by Author.

Although other voids contain extensive vegetation as an infill solution and as a segregation technique, these spaces are suitable for adding sidewalks that connect internal districts, significantly when the width of the minor example of these areas exceeds 20 m. The proposed alteration in the void creates a more pedestrian-friendly street network, connects districts while maintaining exclusivity, and activates the mosque with a public area that supports its massive size and strong impression. Nevertheless, suppose The Pearl developers elected to connect the districts to the rest of the city. The tram network could be extended through Pearl Boulevard Street with the nearest metro stop, Legtafiya Metro Station (Figure 54).

4.4 Chapter 4 Summary

A brief introduction about the location of the selected case studies in the city of Doha began in Chapter 4. The introduction explained the urban and economic setting of the case studies. It provided a general view of the reasons that potentially led to the emergence of urban voids within the city. The introduction was followed by an analysis of each case study, relying primarily on the graphical representation of urban data. The case studies were laid out in chronological order from the oldest to emerge in Doha (Al Mirqab) to the one in between (West Bay) and, finally, to the most recent one (The Pearl). The layout of this chapter was structured into three main sections per case study. The first section included the analysis of tangible and intangible parameters. The tangible parameters incorporate physical components such as building height, block shapes and sizes, land use, and frontage activity (morphology).

On the other hand, the intangible parameters are behavioral, social, and historical factors referenced in the literature review, related to the case studies, and site visits supplemented by photographic documentation. The graphical representation of

information was then translated into quantitative values to provide more accurate conclusions. The second section includes the analysis of urban voids within each neighborhood by relying on the results of the first section, each case study's context, and the literature review in Chapter Two. The last section incorporated a synthesis of the data analysis found in both sections to provide appropriate urban design alterations that addressed the urban voids phenomena in each case study based on knowledge in the field and the urban context of each area. A discussion and comparison between the areas will be provided in the concluding chapter.

CHAPTER 5: CONCLUSION

This concluding chapter will highlight and summarize the earlier chapters in the thesis. Additionally, it will include a comparison of the results found in Chapter 4. The chapter will also relate the study results to the literature review, research questions, and objectives.

The first chapter of this study (Chapter 1: Introduction) provided an inclusive overview of urban planning and the emerging challenges linked to urban growth and sprawl. The chapter highlighted the need to address the phenomena of urban voids within cities, which are spaces that commonly emerge due to unregulated and uncontrolled urban growth or decline. Urban voids appear as leftover spaces that are typically neglected, resulting in challenges in the urban system. The introduction chapter also highlighted the thesis's research questions, objectives, outline, and structure.

The second chapter (Chapter 2: Literature Review) provided a review of the state of knowledge in the field, highlighting two main themes. The first theme focused on the study of urban morphology, while the second presented issues related to urban voids. In the first section of the literature review, we introduced the definitions and applications of urban morphology, emphasizing the importance of studying urban morphology for understanding the emergence and persistence of urban voids in cities. The following subsection on urban morphology briefly explained the schools of thought on urban morphology and the related approaches. In the second portion of the literature review, several subsections explored the concept of urban voids, their definitions, their impact on the urban fabric, and their types. The chapter explained how urban voids are perceived from various perspectives, derived mainly from two perceptions: economic

and social. We also highlighted how urban voids could be perceived as a failure in the urban system, reflecting the shortcomings of political and developmental decisions, the community, and the lack of historical events in these spaces. The chapter noted that urban voids could result from several factors, including economic, social, and political factors. In addition, the literature noted that urban voids can sometimes have positive impacts.

Lastly, the second chapter presented studies on local urban voids in Qatar. We concluded by highlighting the research gaps found in these studies, which were addressed in this thesis. It also emphasized some critical matters about urban voids that apply to the local case studies in Doha, Qatar. Chapter 2 of this thesis presents an extensive literature review of the study of urban morphology and urban voids.

In Chapter 3, the research design and methodology of the study were outlined and described. The chapter explained a multi-layered approach to conducting the analysis, primarily using a descriptive-analytical method to identify correlations between various factors affecting the formation of urban voids, including physical and non-physical attributes. It explained that the study would examine three neighborhoods in Doha as case studies: Al Mirqab, West Bay, and The Pearl. Chapter 3 concluded by explaining data collection and analysis techniques. The data collection was built primarily on historical data, photographic documentation, and on-site data collection. Additionally, conceptual, and non-physical attributes such as cultural, historical, and social parameters were to be quantified to help comprehensively understand the urban voids present in the selected case studies.

This study, as mentioned above, was executed in Doha, Qatar. The State of Qatar is on a peninsula with a gross land area of 11,571 km^2 in the Arabian Gulf. Because of its location in the Middle East, its seasons are characterized by humid

summers and pleasant winters. After the 1950s, the country transitioned from a cluster of coastal fishing villages in the 18th century. It became an oil-producing nation centered on Doha (Scholz, 1999). The country experienced tremendous urban growth due to exporting oil and gas, which altered the economy and citizens' lifestyles throughout the late 20th/early 21st century (Wiedmann, 2012). Doha's urban growth and population increased almost five times from 1970 to 1997 due to rapid economic expansion. The most recent census indicates that the present population exceeds 2.8 million individuals.

Two causes contributed to this population rise. First, life expectancy increased because of the improved healthcare, so births outpaced deaths. Second, many migrants repositioned to the country as construction laborers assigned to specific projects for a limited duration or permanent residents. Qataris comprise ten percent (10%) of the country's population today. (Authority for Planning and Statistics, 2022). A considerable proportion of ex-pats and immigrants (90%) influenced the city's planning efforts to accommodate societal variety from various backgrounds. Qatar's expansion agenda transitioned from the local/surrounding realm to a global one. Qatar's town planners began employing efforts to attract residents and workers. The planning technique supported situating Qatar within the global economic spectrum.

Initially, urbanization was approached slowly and subtly without a coordinated procedure. Llewelyn Davis, a British consultant, introduced Doha's initial planning and zoning maps in the 1970s. The proposals developed Doha's ring road structure, with each ring road defining a particular zoning type. Hence, this planning structure set the groundwork for Doha's suburban expansion (Wiedmann et al., 2012). The growing population and expansion of the oil sector provoked an accelerated pace of urban extension: roughly 130 hectares (in 1970) to more than 7,100 (in 1995) (Al-Buainain,

1999). Urbanization throughout the 1970s and the 1990s included land reclamation along the shoreline for new areas like the West Bay. It also included the construction of road infrastructures, residential districts, and mid- and high-rise buildings. The real estate industry flourished. Gross Domestic Product (GDP) grew, averaging nearly twenty-five percent (24.6%) early in the 21st century and increasing three times in just four years (Euromoney Institutional Investor, 2008). Several investment options emerged to decrease the nation's long-term reliance on fossil fuel exports, such as education, housing, and medical care.

Urban expansion in Qatar is influenced mainly by these new industries. These expansions focus on developing museums and high-rise towers, iconic buildings, industrial cities, and new districts, reclaiming more lands to create, such as Hamad International Airport, The Pearl, and the Hamad International Port. To prepare for the 2022 FIFA World Cup, Doha was undergoing additional development. After another stage of urban-intensive development and progression, this event confirmed Qatar's global brand and economic status.

Preparations for the World Cup included building eight new stadiums. It also comprised supplementary amenities catered for event attendees, such as hotels, residential complexes, temporary structures, and urban components such as transportation infrastructure (the Doha Metro and expanded highways), overpass bridges, and cycling/pedestrian paths for bikers and pedestrians. Doha was one of the most boring cities worldwide, according to a 2008 version of the Lonely Planet guidebook (Alraouf, 2018; 62). In response to this perspective, Qatar recognized the importance of establishing an image to increase its share of foreign businesses, customers, and visitors. It ties the economic worth of Doha as a city to its reflected global image. The country sought to change this unfavorable perception by spending

substantial revenues on Doha's infrastructure development and public-private partnerships for creating new districts (Wiedmann, 2012). A 'plain' urbanscape evolved due to rapid urbanization, globalization, and standardization. Qatar relied extensively on commissioning iconic, impressive architecture to rebrand its capital city – 'star architects' and their competing skyscrapers crowded West Bay. Another element was the development of new work and pleasure locations to serve the worldwide audience (Adam, 2009). From a macro perspective, the city extended its eastern boundary towards the shallow seashore to contain new districts with distinguishing characteristics to set them apart in Doha.

These areas include The Pearl, Lusail City, and West Bay along the coastline. The land reclamation process has been in use since the 1960s. It began around Souq Waqif and was used to extend the old Doha port. This phase was followed by reclaiming more land in the Northeast area in 1977 to build the West Bay Area; the application of land infill continued to appear in 2004 when the construction of The Pearl started. The examined areas in this study include Al Mirqab, West Bay, and The Pearl, all built on reclaimed land during various times and phases of urban development in Qatar.

5.1 Discussion and Comparison of Case Studies

The fourth chapter (Chapter 4: Data Analysis and Discussion), attempted to answer the research questions regarding urban voids in Doha neighborhoods. The three main research questions were:

I. What are the physical characteristics, including morphology, movement, land use, and spatial configuration, of the neighborhoods under study? And what do these characteristics signify from the perspective of urban voids?

II. What are the historical, social, and cultural factors that contribute to the existence of urban voids in Al Mirqab, West Bay, and The Pearl? How have these factors influenced the emergence of these voids, and how can they shape our understanding and approach to them?

III. Does the planning approach and design impact the emergence of urban voids? Specifically, whether the growth of a neighborhood, whether organic or structured, affects the presence of these voids.

Each case study presented different outcomes and results in response to the first two questions. The first case study, Al Mirqab, was one of the earliest settlements in Doha and one of the first areas to be expanded and developed through land reclamation in the 1960s. Although this area underwent modernization, three historical structures remain preserved, retaining historical value in the area. The discussion in Chapter 4 provided an in-depth analysis of the urban morphology and voids of Al Mirqab. The analysis concluded that the district was undergoing modernization, resulting in an urban fabric with unorganized and organic development that eventually led to the emergence of urban voids. The analysis showed that Al Mirqab also faced various urban issues, such as high use of surface parking and inaccessibility to public transport systems. These urban issues were presented and examined from the perspective of urban voids and addressed in the urban design proposals accordingly.

The analysis and discussion section about Al Mirqab answered the first two questions. Firstly, the emergence of urban voids was heavily related to urban morphology and, in particular, to the rapid urbanization process that reshaped the area's urban fabric. Secondly, concerning the historical and cultural value associated with the area, the design proposals and alterations presented, especially near historical

structures, focused on featuring these spaces and maintaining the surrounding urban void as a free space to reduce the crowding effect of more architectural elements in the urban space.

The second case study discussed in Chapter 4 was the area of West Bay, which was built on reclaimed land in 1977 (refer to Figure 26) to rebrand Doha and the State of Qatar as a modern city with a strong economy. The intention was to establish West Bay as a new Business District in Qatar. However, the morphological and land use analysis revealed more land use planning in the area, which resulted in contrasting demand hours and limited on-street activity. Additionally, the street network analysis showed a high number of dead-ended streets and loops around each block, particularly in the residential district, which led to an overflow of traffic back to major arterials, causing an increase in vehicular traffic.

Furthermore, the frontages activity analysis indicated that the residential zones lacked active frontages, which contributed to the dullness of the district. To tackle these challenges, a long-term solution was proposed to revitalize the area, connect the center of West Bay to the rest of Doha, and create a more vibrant and livelier urban environment, especially on the western side of the area. The proposal centered on creating two connected centers that extended the central space and enhanced on-street activity. It also focused on connecting the center of West Bay to the rest of Doha through a few street alterations and introducing a local tram system. The proposed design alterations would overcome the challenges posed by the land use planning and street network layout by introducing a more sustainable mixed-use pattern.

In response to the first research question, it was evident that the physical layout of West Bay, particularly the street network and block sizes, contributed to the emergence of large urban voids between the segregated land uses. Furthermore,

concerning the second question, the image and status that West Bay held had shaped the design approach and the proposal's direction by enhancing the activity and liveliness of the area. Rather than keeping the voids as free spaces, activating and blending them with the existing urban fabric was deemed more appropriate.

Figure 55. The Pearl-Qatar land reclamation process (top, left-to-right) 2004 and 2006 and (bottom, left-to-right) 2008 and 2022. Source: Google Earth.

The last case study discussed in Chapter 4 was The Pearl, an artificial island constructed on reclaimed land in 2004 (Figure 55), connected to the mainland through a single major street (Pearl Boulevard). Unlike the other case studies, The Pearl was an artificial island that was built according to a master plan, and its execution was carried out in phases. Like West Bay, The Pearl also attempted to create a new brand image for Doha. However, the rebranding translated Qatar's economic status into an attractive image for foreigners to live, work, and invest in Qatar. As intended by the United

Development Company (UDC) – The Pearl's developer – the island's master plan was based on the "string of pearls" concept utilizing radial geometry for individual districts. The island comprises 12 named districts primarily accessed via Pearl Boulevard. The analysis revealed that due to the significant space allocated for Pearl Boulevard and the street layout, the island's design is heavily car-centric. The street layout poses a significant urban problem, making it challenging to move from district to district, thus isolating the districts with varying intensities from their surroundings.

Moreover, the study of the frontage showed that most districts have an inward orientation, with blank walls on building facades oriented towards the surrounding streets. This approach provides privacy and exclusivity in each district. In response to the thesis' first and second questions, the voids found within The Pearl appear to be intentional. Firstly, due to the area's layout and geometric configuration, the voids appear as massive urban or road elements such as huge roundabouts and extensive road systems. Secondly, because The Pearl was designed to be an exclusive residential district that highly values the privacy and exclusivity of its residents, many urban voids are intentionally placed as leftover spaces filled with landscaping.

In summary, the culture of the space and the morphology together shaped the conscious presence of urban voids in this contemporary development. To address some of these challenges, the proposal suggested utilizing a portion of the roundabout at Pearl Boulevard as a station for a local tram that circulates among different districts in The Pearl. This solution can reduce vehicular traffic on Pearl Boulevard and create a more pedestrian-friendly street network, connecting districts while still maintaining residential exclusivity.

All case studies were along the coastline, and each has been significant to the development of Doha. Each case study contains distinct forms of urban voids for

several reasons. In general terms, the voids in Al Mirqab appeared due to the lack of planning and the unorganized urban pattern, creating small pocket voids and leftover spaces. Voids in West Bay emerged mainly due to the high segregation of uses, the land use planning, and the relatively loose urban fabric, leading to large urban voids. Lastly, voids in The Pearl appear due to the design strategy involving the disconnection between districts and a landscaping infill approach, which overflows large in-between-district spaces with vegetation, further emphasizing segregation and privacy, resulting in vastly underutilized space (urban voids).

Urban voids in their nature appear remarkably similar when excluded from their surroundings. Since they lack functionality and a clear purpose and are vacant, they can fit any urban context and appear similar. However, the treatment of each void should be linked to its context to deliver an appropriate proposal fit to the needs of users and the surrounding scale. For instance, if a void were found in a low-density residential area, it would not be appropriate to implement a high-rise building between the residential units. Therefore, in this study, we analyzed each context of the case studies from the physical, historical, and social perspectives to understand each zone's tangible and intangible attributes. The analysis results show that the land use, morphology, and the status or position within Doha of each zone, are the primary factors impacting the alterations approach. These elements provide a deep insight into the current uses of the voids and the missing features required in each zone.

In Al Mirqab, the area was very crowded with buildings and parked cars and hence needed more free spaces, in addition to the historical element, which has declined over the years. The voids in Al Mirqab require incremental alterations as well. On the other hand, the West Bay is very loosely arranged and has a monolithic land use pattern, which requires a long-term, large-scale intervention to put voids into use for reviving

and transforming the area from a space into a place. Lastly, The Pearl contains multiple districts, which are spaced away from each other (some more so than others), creating major in-between spaces that act as privacy and social barriers between districts. These voids appear as underutilized spaces requiring some social and functional purpose. Although the case studies vary in context and the emergence of voids, all areas required public transport solutions for different purposes. The public transit solution in Al Mirqab could be introducing a metro stop to reduce car dependency and ease of access for employees from the metro to their offices. In West Bay, the transit solution could be a local tram network, which acts as an extending element to the central space, connecting all sub-districts and reviving the space by enhancing walkability. Similarly, in The Pearl, the transit solution proposed to connect districts through a local tram network, which helps reduce vehicular traffic on Pearl Boulevard. This solution also enhances the pedestrian experience. It connects the island to the nearest metro station (Legtafiya Metro Station) without affecting the privacy or exclusivity of residents, which is maintained in the spatial layout via the active and inactive frontages technique of the master plan.

It is impossible to prevent the emergence of urban voids in our cities, particularly when the necessities of people change over time, and the growth of cities continues to have a semi-organic pattern. Many have viewed urban voids as a problem and a failure in the urban fabric. However, these spaces should be perceived as spaces for opportunities and spaces that can accommodate new social needs.

Despite the image of immense wealth and luxury, the urban areas in Doha still need to improve their efficiency, particularly for urban voids, as shown in Chapter 4 of the thesis. A closer inspection of the three major urban neighborhoods in Doha – The

Al-Mirqab, the West Bay, and The Pearl-Qatar – has shown us three important factors that determine the presence and persistence of urban voids:

1. Under-utilization of private and public spaces. As seen in the cases of Al Mirqab and West Bay, most voids in the neighborhoods are due to the need for more utilized space that limits the functionality of the available space. It invariably influences the perception of the overall quality of the neighborhood.
2. Doha is a car-dependent metropolitan region, meaning that all urban planning tends to focus on serving most commuters without regard to the efficiency of the available space. This can be seen prominently in the analysis of the highly commercialized neighborhoods of West Bay and The Pearl-Qatar, where pedestrian access to key infrastructures and locations requires more priority.
3. Old neighborhoods such as Al Mirqab need a proper layout and urban design strategies to ensure proper circulation, constricting some critical spaces in the neighborhood, which results in vast, empty, unused spaces. Since the initial constraints needed to be appropriately addressed, they became more complicated over time, further compounding the unaddressed issues.

The analysis provided in this thesis is critical in identifying these three key elements that are vital in how the urban plan of Doha was carried out, as it was able to identify the variables and elements that have immediate and indirect impacts on the presence, even the persistence, of urban voids.

With regards to the third research question in this thesis, which concerns the potential impact of the planning approach on the emergence of urban voids, it can be concluded from the comparisons and findings that the phenomenon of urban voids is persistent, regardless of how an urban setting grows. Specifically, this implies that the urban planning approach utilized in Al Mirqab, West Bay, and The Pearl, despite their differences, encountered the emergence of urban voids. These voids resulted for distinct reasons and exhibited different physical characteristics in each instance.

However, it is essential to recognize that urban voids can significantly impact the urban environment and the quality of life of its inhabitants. While eliminating the emergence of urban voids may be impossible, urban planners can reduce their negative effects and maximize their potential benefits. This can be accomplished by carefully implementing new design strategies and urban elements in these voids that cater to the city's and its users' needs.

For future research in a much broader context, the approach used in this thesis can be a helpful addition to qualitative and quantitative research studies. The research design in this thesis can also be utilized in similar contexts, even at a larger scale.

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APPENDIX 1

LIST OF PUBLICATIONS BY STUDENT

Al-Amadi, D., Major, M.D., Tannous, H.O. (2023). The Pearl-Qatar: A Study of its Morphology, Land Use, and Function. *Habitat International*, accepted and forthcoming.

Al-Amadi, D., Major, M.D., Atour, R.M., Al-Ansari, D.Y., Al-Maiki, N., Amleh, R.A.A., Mareeva, V., Mohammedsheriff, H. (2022). Form and Function in The Pearl-Qatar Artificial Island Development. *5th International Conference of Contemporary Affairs in Architecture and Urbanism (ICCAUA-2022) Conference Proceedings Book* (J.M.P. Madrigal, M. Nikoofam, Eds), 11-13 May 2022, Alanya HEP University, Alanya, Turkey: Municipality of Alanya, pp. 617–627, DOI: 10.38027/ICCAUA2022EN0100, E-ISBN: 978-605-71006-2-7, https://iccaua.com/page/2022-proceedings-full-papers,https://iccaua.com/PDFs/2022_Conference_fulL_book/SESSION_C_2022/ICCAUA2022EN0100_Alamadi_617-627.pdf.