QATAR UNIVERSITY

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TOD'S ROLE IN ENHANCING URBAN QUALITY OF LIFE AND PRESERVING BUILT HERITAGE: THE CASE OF MSHEIREB DOWNTOWN DOHA

BY

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ABSTRACT

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Title: TODs' role in enhancing urban quality of life and preserving built heritage: The Case of Msheireb Downtown Doha

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The term 'Transit-Oriented Development' or TOD was firstly used by the American planner Peter Calthorpe in 1993. To address the urban sprawling caused by extensive car use and the disappearance of historical community centers, the strategy for TOD is based on planning land use on a regional scale integrated to public transport systems. TOD became part of the movement known broadly as 'new urbanism'. Lately, Doha faced rapid growth in social, economic, and built environmental aspects that shaped its current and future urban planning. TOD is seen as an efficient and energetic approach to resolve the existing challenges in urban planning of the city through a sustainable strategy in urban developmental planning. Msheireb Downtown, the heritage district of Doha, is the selected case study under investigation. The research study focuses on modeling a new pattern of sustainable traditional urban developmental planning, which supports integration of transportation planning, land use and cultural/identity heritage. The study intends to explore "new urbanism" theories, which are the basis for TOD, while investigating the role of TOD in enhancing urban quality of life by following a number of principles that address physical, social, economic, environmental and mobility concerns. The research study adopts a qualitative approach. Oral and visual data are collected via (i) interviews with urban planners and consultants from Msheireb

Properties, the Ministry of Municipality and Environment and Qatar Rail; (ii) walk-through studies; (iii) site visits and observations about the spatial form of buildings, streets and open spaces; (iv) on-site interviews; and (v) a survey conducted during the walk-through studies. The study aims at revealing the extent to which the TOD principles can be implemented in the selected study area, by exploring (i) its conditions [site analysis] and (ii) how the urban quality of life in the vernacular urbanism is achieved in modern times.

Key words: Sustainable urbanism, TOD, Msheireb [Downtown Doha], Urban quality of life, Built heritage.

DEDICATION

I dedicate this thesis to my parents; every bit of me is a little bit of you.

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"All work and no play makes Jack a dull boy." – a well-known saying. Thanks to all of my friends for ensuring that I never become the Jack.

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ABBREVIATIONS

ADA – ARRIYADH DEVELOPMENT AUTHORITY

GCC – GULF COOPERATION COUNCIL

GSAS – GLOBAL SUSTAINABILITY ASSESSMENT SYSTEM

MENA – MIDDLE EAST AND NORTH AFRICA

MME – MINISTRY OF MUNICIPALITY AND ENVIRONMENT

MOTC – MINISTRY OF TRANSPORT AND COMMUNICATION

MSDP – MUNICIPALITY OF SPATIAL DEVELOPMENT PLANS

PERS – PEDESTRIAN ENVIRONMENT REVIEW SYSTEM

PWA – PUBLIC WORKS AUTHORITY (ASHGHAL)

QNDF 2032 – QATAR NATIONAL DEVELOPMENT FRAMEWORK

QNMP – QATAR NATIONAL MASTER PLAN

QNV 2030 – QATAR NATIONAL VISION 2030

QPCMP – QATAR PEDESTRIAN CROSSING MAP

QPL – QATAR PLANNING LEGISLATION

QR – QATAR RAIL

SAFE – SAFE AND FRIENDLY ENVRIONMENT

SMCA – SPATIAL MULTIPLE CRITERIA ASSESSMENT

TOD – TRANSIT-ORIENTED DEVELOPMENT

CHAPTER 1: INTRODUCTION

The State of Qatar is one of the few countries in the world that has drastically improved in global rankings as well as in socioeconomic and human development indices within the span of only a few decades. The country's economic marvel began during the middle of the 20th Century and was almost entirely due to the wealth brought by the discovery of natural resources. The economic growth witnessed during this time led to massive urbanization that prompted half of the country's population to migrate to suburban areas around the capital city, Doha (Figure 1). However, the growth and development of urban centers in the country have been skewed in favor of major cities and towns, and particularly Doha. The resultant monocentric structural pattern created by urbanization has made Doha the political seat as well as the cultural, economic, and entertainment hub of the nation.

Figure 1. Map illustrating the context of Qatar (Source: MME)

This unprecedented urbanization has ushered in numerous urban problems, particularly those related to land issues, which have led to constant conflicts. Wiedmann et al. (2012) noted that a host of solutions to such problems—including the extensive expansion of urban centers nationwide—are being enacted to manage rural-to-urban migration and other relevant issues. These changes—which include the expansion of roads and other infrastructure networks to mitigate the strain on existing infrastructure—aim to transform Qatar into a divirsified economy by 2030. The prolonged infrastructure problems faced by the country have compounded the situation influencing the future design and development of roads and other amenities. Scholars and urban development experts suggest that large infrastructure projects, especially in transportation, may affect the quality and general development of future projects (Berke & Godschalk, 2006). Nonetheless, Ryan (1999) and others have noted that the alleged impact of large road construction projects on future developments will depend on their nature and characteristics.

Road projects initiated to address the prevailing transportation challenges of Qatar have affected traffic flow due to a high dependency on personal vehicle use, which places further pressure on the available public transportation infrastructure. Consequently, a perception of poor land planning and inefficient transport infrastructure have reduced the country's capacity and ability to meet commuters' travel needs. In this regard, the Doha Metro network system was designed to reduce the city's traffic load, offer an alternative public transport system, and subsequently enhance accessibility and mobility for community.

Overall, a sustainable growth strategy is required to tame the challenges posed by recent economic gains made by Qatar. Here, sustainable development is defined as social and economic development with no negative effects on the environment

(Lehmann, 2011). A good example of such social and economic development is transit-oriented development (TOD), which concentrates development within transportation corridors to promote ridership and temporal access. TOD promotes sustainable development in several ways. First, it provides alternative but equally efficient transportation options, which ultimately reduce the massive over-reliance on road transport. Second, it promotes efficient urban land use and planning to provide non-motorized traffic with unfettered access to any part of a city or town, thereby decreasing the frequency of automobile use to enhance health-related quality of life by reducing lifestyle diseases such as obesity (Sharifi, 2016). Likewise, the concentration of jobs and other activities around major transportation nodes provides economic opportunities for less-previliged residents and citizens, while giving people with disabilities greater access to goods and services. Third, creating a nucleus of economic and social activities along transport corridors facilitates better land use and planning as well as efficient urban design, which ultimately reduces air pollution.

Many scholars agree that the TOD model promotes the efficient planning of urban centers and the distribution of services. Calthorpe (1993) argued that TOD can be utilized in design to create attractive locations/destinations. However, the success of the model depends on the accessibility and attractiveness of the location. Thus, balance is required to achieve an efficient system that meets both the specific and broad goals of the community. Sustainable and resilient urban design is increasingly touted as the key to achieving social, economic, and environmental balance (Jacobs, 1961). While TOD has received significant attention in developed countries, Doha is considered new in adopting the model, despite having a persistent vehicular transport problem. Since walking and cycling are not taken into consideration in Doha, the overall urban transport environment is not user-friendly. Recent investment in the Doha Metro rail

system represents an attempt to address existing transport problems in the capital and other major urban centers. Notably, these investments are expected to attract the public to less congested neighborhoods. For instance, the Msheireb area in Downtown Doha—a world-class downtown regeneration project designed with a sustainable master plan—offers an insight into the expected implications of TOD since similar models are used. This study explores the built environment in old Doha to assess the extent to which implications of TOD are evident. Second, it examines the impact of TOD on quality of life and the preservation of built environment heritage in the studied area. Third, it explores the strategy used to implement TOD and examines the design and planning policy measures required. It also includes strategies to measure the degree of TOD-ness in the selected area.

The Research Problem

Doha has recently experienced rapid socioeconomic growth that has given rise to unsystematic development, which has significant implications for urban planning (Figure 2). The resulting increase of population of the city and the growth of automobile ownership have led to unprecedented traffic congestion problems in the city that result in delays, major inconvenience, and high levels of air pollution. Consequently, Doha has sought to alleviate these pressures by investing in rail and bus transit systems. The city looks forward to leveraging these investments to become a center of opportunities for the increasing human population. Accordingly, these projects will improve urban planning and land use while enabling access to the city for suburban populations that are faced by congestion, noise, and socioeconomic factors. Thus, the inner city will once again become more accessible, pleasant, and affordable residential domain.

Figure 2. Urbanization in Doha, Qatar over time (Source: MDD Catalog)

As envisioned by Emir HH Sheikh Tamim bin Hamad Al Thani, Qatar has grown tremendously in terms of both social and economic development. In his ministerial speeches, he noted that transportation is one of the most important drivers of socioeconomic development in the country. Speaking on the Qatar Pedestrian Crossings Master Plan (QPCMP), he explained that the project incorporates concept designs for 50 crosswalk locations selected based on public needs and preferences. This plan also integrates 26 pedestrian overpasses and underpasses as well as 24 crosswalks

at key intersections and sites. The Minister further noted that the Pedestrian Crossings Manual was developed to ensure that the development of the project complies with Qatar's standards and guidelines as well as the Pedestrian Environment Review System (PERS). This manual provides a platform for designing pedestrian road safety facilities (i.e., crosswalks, over- and underpasses, and sidewalks) within a framework that aims to promote the safety of pedestrians and properties. The desire to solve Qatar's transportation challenges—specifically the limited transportation links—has prompted the Qatar National Development Framework 2032 (QNDF 2032) to launch a new strategic planning objective.

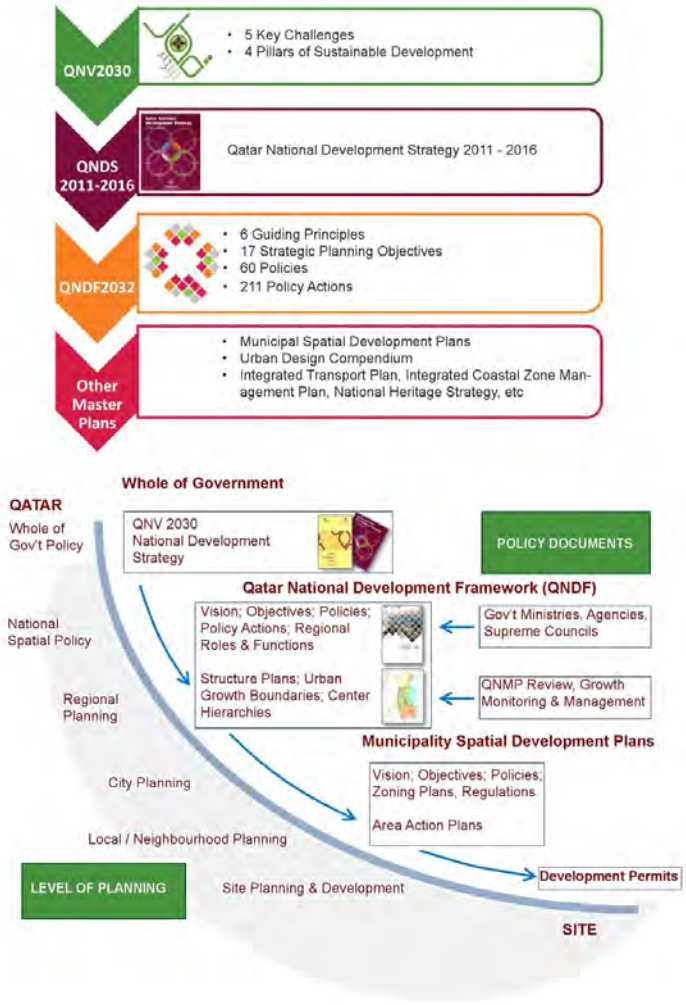

Figure 3. Diagram showing the QNV 2030 and QNDF 2032 (Source: QNDF booklet)

The QNDF represents a new paradigm shift in urban planning for the state of Qatar, which is perceived as critical for advancing sustainable development and producing a high-quality urban lifestyle (Figure 3). Its main objectives are: (QNDF booklet)

- To promote a world-class Capital City Precinct within the Inner Doha area—composed of the West Bay, Downtown Doha, and Airport City business centers—with a vibrant, attractive, and sophisticated public realm where high-quality lifestyles can be achieved.
- To develop several high-quality, mixed-use, and mixed density centers with TOD facilities to achieve balanced growth and movement patterns.
- To establish a high-quality and integrated public transport network that promotes public transportation across the country.
- To prioritize radial routes as public transit corridors to reduce private motor vehicle usage and associated environmental costs while also promoting orbital routes to facilitate balanced growth.
- To integrate mega-projects and other large-scale development into the wider community to enhance their contribution to the sustainability of Qatar as a high-quality living space.
- To promote equitable access to community and social facilities as well as social amenities by co-locating people around key transit mixed-use centers.
- To develop a unique, high-quality public realm to ensure accessibility for all people to the country's urban areas.
- To adopt optimal density and building typologies that promote a variety of accommodation types, including adequate affordable housing for all residents.

The main objective of the project is to establish priorities for urban transport as follows: Mass public transport, non-motorized transport (i.e., bicycles and pedestrians),

intermediate public transport (i.e., buses and taxis), and personalized motor transport (i.e., motorcycles and cars). The changing face of Doha calls for a radical rethinking of its urbanism to make it more pedestrian-friendly. The concept of new urbanism—the brainchild of Calthorpe, Moule, Solomon, Plater-Zyberk, Duany, and Polyzoides—prioritizes repackaging the public space to make it more livable for citizens and residents. The concept of new urbanism encompasses a range of principles for designing spaces that support pedestrians and create an environment with mixed amenities, such as walkways, cafes, low-traffic areas, biking routes, and social gathering spots (Tight et al., 2004). The idea of pedestrian cities is based on the belief that urban centers reduce the use of motorized transport to give people the satisfaction of living in a sustainable community.

Barton and Grant's, 2010 theory, proposes that every development and transportation project should make a positive contribution to pedestrians' wellbeing to realize five measures: connectedness, convenience, comfort, sociability, and conspicuousness. Moreover, Whalley (1979) noted that most transport strategies and practices disregard or inadequately recognize walking as part of road usage. In other words, pedestrians' mobility needs are relegated to the periphery of the road management system, while priority is given to vehicles, which has led to the sustainability issues witnessed in major cities today. Relevant scholars and urban development experts agree that a sustainably built environment encourages walkability. Lifestyle changes and increased public consciousness of healthy living have prompted many people to reduce the use of vehicles in favor of walking whenever possible. While this current trend in human mobility behavior represents a positive change, it needs to be appreciated that walkability is a critical—but often missing—component of equitable and sustainable urbanism, particularly in the rapidly urbanizing Global

South.

Tactical urbanism emerged out of the new urbanism movement (Lydon, 2015), it provides a temporary adjustment that follows logical implementation strategy, which work, adjust and implement permanently with ample opportunity to develop pedestrian walking and resting facilities. Notably, this approach can be replicated in different and varied environments. However, since vehicular transport is the primary mode of travel in Qatar, other access modes to most parts of the country remain limited. Remedying this situation calls for inclusive planning and the efficient management of public transport infrastructure to improve the transit system. In addition to proper land use and the adoption of evolutionary policies, massive investment in transportation infrastructure has the potential to increase the possibility of sustainable urban development. While Doha's investment in its rail transit system is a commendable initiative, it alone cannot solve the prevailing challenges of urbanization. Global best practices recognize the integration of both efficient land management and transport planning as the main elements of sustainable development. While transit is a substantial component of urban development, its effectiveness only becomes apparent where the volume of ridership is high. The volume and frequency of ridership are influenced by various factors, such as zoning policies, land management, land distribution, and transport policy.

The discovery of extractable natural resources in Qatar has had a major positive influence on its infrastructure development. However, Rizzo (2014) argued that the uncontrolled development of urban centers in the country has diminished the quality of living standards. The stark contrast between the country's high level of economic growth and its living standards has prompted the Ministry of Municipality and Environment (MME) to formulate the comprehensive and revolutionary Qatar National

Development Framework (QNDF), which promotes sustainable and resilient urban development. While the QNDF was designed to address existing and emerging urban challenges, its ability to mitigate the serious challenges that hinder effective urban planning in Qatar remains at the formative stage. Hence, this study investigates the efficacy of transit system and the measures to facilitate the integration of land use and transportation system to realize sustainable urban development in Doha and improve the quality of urban life. Here, TOD is seen as an effective and robust approach to resolve current and emerging problems in urban planning by developing a sustainable strategy.

The Disciplinary Context

This study involves three broad disciplinary contexts: sustainable urbanism, TOD, and cultural heritage. Sustainable urbanism describes the application of robust principles in the design, planning, and management of urban centers (Sharifi, 2016) and is mostly concerned with the planning and smart designs that connect various sections of a city to promote walkability. Sustainable urbanism fosters two key aspects. First, it fosters livability by providing a range of healthy living options. Secondly, it fosters a sense of togetherness by promoting public engagement, integration, sustainable opportunities, pedestrian-friendly neighborhoods, and a user-friendly and sociable environment (Jacobs, 1961; Lehmann, 2011; Gehl, 2010). In urban planning, the concept of "sustainable development" must be pursued everyday in large and detailed decision-making at all levels of government and it should be clear that sustainable development is essential to pursuing the path to sustainability. Nonetheless, sustainable development—as described by Richer (2014)—is a process aimed at uniting a litany of previously independent socioeconomic and environmental policies rather than a tool for achieving premeditated urban development goals.

TOD—the second context employed in the present study—was first introduced by Peter Calthorpe, a US urban planning expert, in 1993 to address urban congestion caused by the massive motorization of human mobility and the degradation of historical community centers. The TOD strategy is predicated on efficient urban planning and land use that is integrated with public transportation facilities. TOD is used as a philosophical approach by movements such as "new urbanism". New urbanism was formed to find an efficient solution to challenges faced by prevalent urban design practices and proper interventions for enhancing people's quality of life. This movement focuses on integrating mixed-use development, creative street designs, pedestrian networks, and accessible urban facilities.

The new urbanism movement was induced by the need to devise a lasting solution to urban sprawl caused by the unsustainable growth of car ownership and an acute shortage of public transportation, which contributed to the disappearance of mixed-use development and traditional compact areas. As such, the main objective of the movement is to limit sprawl in urban areas by promoting traditional urbanism to evolve modern development and to create a livable urban environment. The third pillar--preserving cultural heritage—explores the role of transport infrastructure in supporting cultural heritage and the aesthetics of cities. The increased entrenchment of globalization in the last two decades has influenced the development and preservation of built cultural heritage. Examples of landmark areas in Doha include the Grand Mosque, the old National Qatar Museum, and Souq Waqif. Recent urban regeneration projects such as Msheireb took great care to balance modernization with the cultural heritage preservation of the built environment.

This study aims to explore these principles in the case of Msheireb in Downtown Doha and its surroundings. It is restricted in its disciplinary context because it deals

with problems relating to the public transportation system in Doha to strengthen and facilitate transport within and between the selected land use areas to enhance integration, with a focus on leisure. Mass transit interventions into urban areas, such as the metro transit system, attenuate the density of land use and the volume of property or infrastructure development. Hence, the anticipated Doha Metro network is expected to significantly impact the quality and extent of urban development in Qatar. Specifically, the Doha Metro network is expected to shift the focus to efficient land distribution and use, which should ultimately lead to the diversification of economic activities. The Doha Metro system could influence the development of the city, attenuate sprawl, and reduce vehicular over-dependence. This system is divided into yellow, green, and red lines and dotted with elevated and underground stations. Stations are located in densely populated areas to increase access to important resources.

Using the Doha Metro to implement TOD aims to reduce the distance traveled between resource points, thereby increasing the proximity of desirable destinations and reducing the demand for motorized travel. Based on observations made by Shaaban and Khalil (2012), the introduction of the Doha Metro will boost land supply. Accordingly, the system was planned to support a new pattern of development around the Metro stations through integrated, compact mixed land-use activities, environmentally-friendly land-use policies with pedestrian and cycling facilities, and vibrant urban economic centers. Moreover, the Metro could help in tapping into the nerve center of the country's economic nodes and strengthen its unique position as a significant corridor of international transport and a major destination for urban development. This can be achieved by assimilating different concepts of urban development to address sprawl and motor vehicle dependency. From a succinctly positive framework and perspective, the Metro seeks to connect all four corners of the country in a user-friendly

manner via interchanges and links.

Additionally, issues related to traffic occur because the station areas have wide streets, cul-de-sacs, irregular grid patterns, and dead ends, which encourages increased vehicular usage and thus reduces the public safe and adequate walking space, community gathering places, cycling lanes, and connectivity. Generally, the improper design of stations creates connectivity challenges between different sections of the city, especially in areas that are heavily developed (Hamra & Attallah, 2012). The usefulness of the anticipated transit station development spread throughout the Doha gold line will only be achieved if the supportive urban planning strategy is sustainable, scalable, and robust. In this case, TOD became the tool of choice due to its focus on the integration of mixed-use development projects (combined office, commercial, and residential projects) and public transit in close proximity to major transit stops, which provides multimodal transportation opportunities without downgrading the economic pattern and ecology of the area (Cervero, 1998). Notably, TOD has support among many scholars eliminated wide spread; for example, Ewing and Cervero (2010) noted that the adaptation of TOD into existing Metro stations expands the accessibility and overall reach of a city without necessarily interfering with its land-use policies. However, implementing a TOD project in and around a Metro station involves different challenges.

Feasibility studies on the appropriateness and effectiveness of TOD-type development espouse the concept of the 5D principles (i.e., distance, diversity, destination, density, and design), thought this may not be sufficient to support rich, vibrant, and conducive living conditions in Metro areas (Dittmar & Poticha, 2004; Ewing & Cervero, 2010; Vale, 2014). Nonetheless, customizing TOD-type development to the unique characteristics of existing Metro stations provides a platform

for future adaptation to achieve better planning, sustainable designs, and operational efficiency (Kamruzzaman et al., 2014). Thus, the relationship between land management and the development of transportation facilities along the Metro line requires close study, and the knowledge gained from such studies can be used judiciously to address existing and emerging issues. In this regard, the current study attempts to assess and categorize Msheireb Metro Stations based on several indicators to provide recommendations on land management and transport strategies to encourage TOD-ness in Metro station design.

The Focus of the Research

The current study explores and analyses the impact of the transit system on the vibrancy, livability, and accessibility of neighborhoods and streets in Doha. The accessibility and livability of neighborhoods in Doha are heavily influenced by urban planning and design as well as the availability of transportation systems. Thus, in recognition of this factor, the present study uses TOD to assess the state and condition of the public transit system in one of Doha's neighborhoods. Today's neighborhoods face several obstacles, including the sprawling nature of urban development with limited connectivity, serious traffic congestion, limited pedestrian facilities, and lack of mixed-use amenities. Consequently, remedying the situation of Doha's neighborhoods requires a fundamental reconceptualization of the entire fabric of urbanization in the city alongside the mobilization of extensive resources to enable the desired lifestyle changes. These will involve adapting the transport system to people's travel needs through the adoption of robust land use and urban designs—especially those that encourage the increased use of public transport—while promoting cycling, walking, and ride-sharing facilities (MME).

TOD offers an opportunity to achieve anticipated regional growth patterns while simultaneously maintaining or improving the quality of life throughout neighborhoods in the region. This vision can be achieved by channeling growth into compact areas to solve prevailing environmental problems that accompany—and are often caused by—the existing traffic difficulties. This realization answers the key question "Why would we want TOD?" However, the question "How do we make TOD happen?" is the most pressing question at present and its answer remains at a formative stage. Promoting the widespread adoption of the TOD concept requires the application of smart growth strategies, which include lowering the ratio and extent of automobile dependence, increasing the rate of cycling and walking, developing safer and more economically-integrated transit stations, increasing the connectivity and accessibility of adjacent areas, promoting mixed-use development, and creating attractive, appealing stations. TOD can further be implemented to increase the value of a transit system by increasing its accessibility, which is defined by Owen and Levinson (2015) as the number of destinations over a given travel time.

Since accessibility is a function of proximity to destination and travel speed, the development of stations in close proximity to each other enhances accessibility, regardless of the travel speed. Similarly, situating mixed-use or single-use developments close to the stations can or may increases the proportion of the population that benefits from enhanced access to transit infrastructure (Tilahun & Fan, 2014). In their study of automobile availability in 50 mega metropolitan regions in the United States, Levin et al. (2012) observed that areas with a high density of destinations have a higher accessibility rate, regardless of slower travel speeds. TOD has a higher likelihood of success, regardless of the negative effects (e.g., slow traffic) of a subsequent increase in travel demand.

The present study investigates the feasibility of using TOD to increase the accessibility of transit destinations in Doha using the downtown Msheireb area as a case study. The study intends to create a model of sustainable urban planning that promotes the integration of efficient urban land management and transportation planning. It further intends to achieve its objectives by exploring the "new urbanism" theories that form the basis of the TOD concept (Figure 4). Ultimately, the overall goal of the study is to analyze the role of TOD in strengthening the quality of urban life from environmental, physical, economic, social, and mobility perspectives.

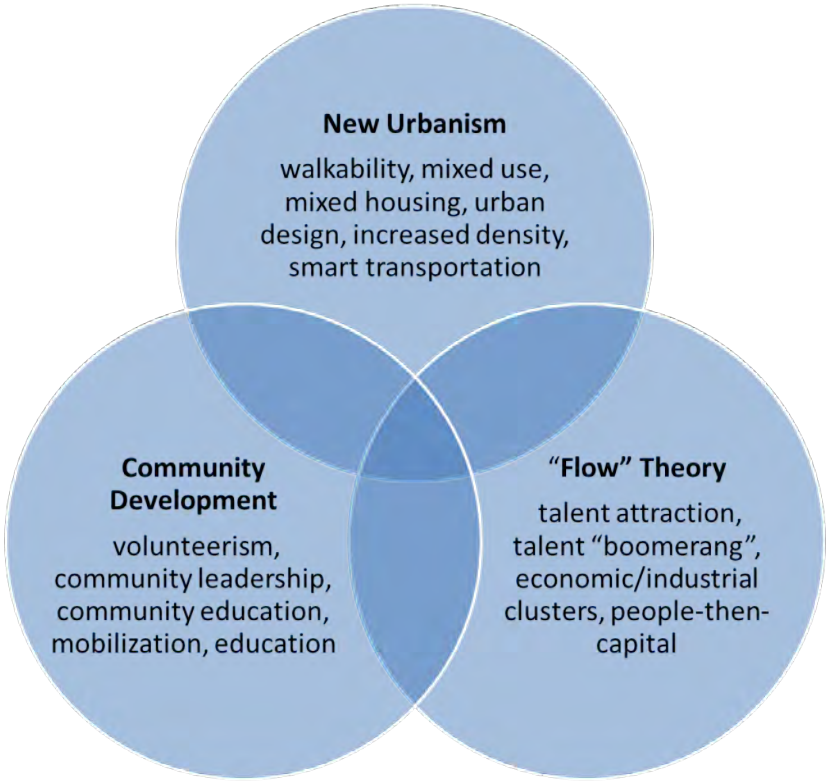

Figure 4. New urbanism model (Source: Pete Saunders, 2012)

Research Aims and Objectives

The purpose of the present study is to explore the potential for the Doha Metro system to achieve sustainable urban development goals. The study assesses the concept of TOD in its entirety to determine its suitability as a critical tool for promoting sustainable urban development. The objectives of the study are:

1. To identify the need to create sustainable urban development in the city in response to rapid urbanization and relevant environmental issues. The importance of sustainability was emphasized through The National Development Framework and Qatar National Vision 2030 (QNV 2030), which serve as the platforms for defining the scope and ethos of the sustainability concept. The urban development plans and policies suggested in this study can help to transform Qatar into an advanced economy with a strong cultural identity. In other words, the development plans and policies devised in the present study can help create a growth model that offers a balance between the past and the future.
2. To process the role of TOD as a tool and its potential for achieving the sustainable urban development approach by creating desirable and resilient built environments based on a more holistic design rather than an individual approach.
3. To assess whether the urban transport development approaches used in the identified study area can be fairly classified as TOD-type development using a physical comprehensive performance-based assessment index method structured into economic, environmental, and social factors as well as built environment diversity and travel behavior.

4. To examine if any changes might be required to make the urban development approaches suggested in the study TOD compliant or highly effective TOD-based approaches by creating compact mixed-use development and pedestrian-friendly green fields around major transit stations.
5. To explore policy and urban planning barriers that hinder sustainable development that must be overcome to achieve the envisaged changes and propose an urban design master plan and planning guidelines with recommendations for replicating the developed TOD concept throughout the rest of the country.

The Research Questions

The present study seeks to answer three main questions designed to establish the issues and benefits related to achieving sustainable development in public transportation. The guiding question attempts to establish effective strategies to be harnessed to retrofit appropriate TOD into the urban design, land use, and transportation system within a 1 km radius of metro stations in the Msheireb area in Downtown Doha. The supporting questions are as follows:

- What criteria can we use to assess the efficacy of TOD as a tool for evaluating the conditions of the study area and what strategies can be used to preserve its heritage?
- What proportion of the built environment, urban design, and transportation system in the study area qualify as TOD? If there are gaps, how can they be improved?
- What urban planning strategies and guidelines have been put in place to replicate or attune the TOD concept in the study area?

Chapter Summary

Changes to economic well-being in Qatar over recent decades have led to a major improvement of the nation and its human development. Rapid changes in the country's economy gave rise to unplanned development and the sudden congestion of people into centric urban areas, especially Doha. The chaotic use of urban land together with a rapid population increase has negatively impacted the development of road infrastructure and the city-wide connectivity of neighborhoods. In this light, the government of Qatar has initiated a national comprehensive development framework (QNDF) that has given rise to the Doha Metro network, which has been designed with the principles of TOD in mind. The Doha Metro project is expected to inject a new breath of life into the city of Doha's built environment by increasing the accessibility of public transit and improved connectivity between neighborhoods.

In this study, the TOD concept is extensively explored to assess and investigate how effectively it can be leveraged to facilitate the integration of mixed-use development, urban planning, land management, and transportation system to enhance the sustainability of Doha. The present study explores how the TOD concept can be used to strengthen the TOD-ness of Doha Metro station. The study specifically uses the Msheireb area in Downtown Doha as a case study to explore strategies for integrating efficient land use, urban design and planning, and transit infrastructure to enhance the TOD-ness of a built environment and the feasibility of replicating the concept in other cities and towns nationwide. While adapting a built environment facing classical problems of urbanism (e.g., sprawl, traffic congestion, and poor connectivity) to TOD is a challenging task, it is achievable. The current study aims to overcome the identified challenge by using the principles and philosophical techniques espoused by the new urbanism movement as the platform for integrating TOD into the study area to make it

more sustainable, livable, and conducive.

This concept was chosen for use in the present study because it considers pedestrians' well-being as a major pillar of sustainable urbanism. It has a fully developed principles that encourage the integration of pedestrian facilities (e.g., social gathering areas, cycling space, walkways, and refreshment spots) in addition to the features supported by TOD (Figure 5). These principles work in coordination with Barton and Grant's, 2010 theory, which sensitizes the design of projects to promote pedestrian convenience, comfort, and sociability. This study aims to achieve several goals: 1) To analyze the urbanization problems faced by Doha by evaluating the highest profile sustainable project in the country; 2) To investigate the effectiveness of the TOD concept; 3) To assess the level of TOD-ness in the Msheireb project; 4) To examine the strategies that should be adopted to make development projects more compliant with TOD principles ; 5) To explore the policy and strategy limitations that hinder sustainable development.

Figure 5. TOD principles (Source: Lloyd Alter, 2020)

CHAPTER 2: LITERATURE REVIEW

This chapter presents an analytical literature review of issues related to the topic of this thesis. This research aims to determine the potential for TOD to achieve sustainable urban development. The structure of the literature review chapter is based on the understanding of conceptual terms and new urbanism theories that serve as the basis for TOD and are necessary to comprehend for the modeling of a new pattern of sustainable vernacular urban planning that supports the integration of transportation planning, land use, and cultural/identity heritage to enhance livability and urban quality of life in Qatar. Notably, it follows several principles that address physical, social, economic, environmental, and mobility concerns. The chapter is divided into two main sections: the disciplinary context and the geographical context. The first section outlines major insights on sustainable urbanism in the GCC regional context as well as the context of Qatar, which is the focus of this research. In this section, the contribution to sustainability derived from TOD implementation will be explored, followed by defining the TOD concept, its assessment criteria, and cultural heritage.

The second section provides an overview of urbanism in the GCC regional context and analyzes urbanization and development in Qatar, with a particular emphasis on the setting of the Msheireb case study.

The third section is the chapter summary, which will summarize the main elements of the literature review that are pertinent to this research.

Disciplinary Context

This part of the literature review outlines major trends in sustainable urban development in the GCC region and Qatar. Particular attention will be given to sustainability derived from TOD implementation. The TOD concept and its assessment criteria will be analyzed, while the final portion of this section will be dedicated to

exploring the importance of cultural heritage.

Sustainable Urbanism

The first section of the literature review aims to analyze sustainable urbanism in the GCC regional context and the specific context of Qatar. However, an evaluation of the various definitions of sustainability and sustainable development is first necessary since it will be fundamental to TOD planning and implementation in Qatar.

The terms "sustainability" and "sustainable development" are relatively recent in the profession, and their use has become central to many areas of development discourse. In 1987, The Brundtland Commission was the first to define sustainability and sustainable development as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). However, this definition was deemed to be "…very ambiguous…" (Jacobs, 1999, p. 22). Appleton (2006) added that the ambiguity stemmed from the terms "needs" and "development" since needs are defined in anthropocentric terms and nature is used as an instrument to satisfy them regardless of the damages to nature. Furthermore, the same author wondered how one could determine the needs of future generations since it is impossible to take actions without compromising the ability of future generations to satisfy their needs (Appleton, 2006, pp. 13–14). The term development is also ambiguous because it does not clearly explain or define the type of development (e.g., environmental, economic, social, or other) and how it will be sustainable for the needs of the present generation without jeopardizing the needs of future generations.

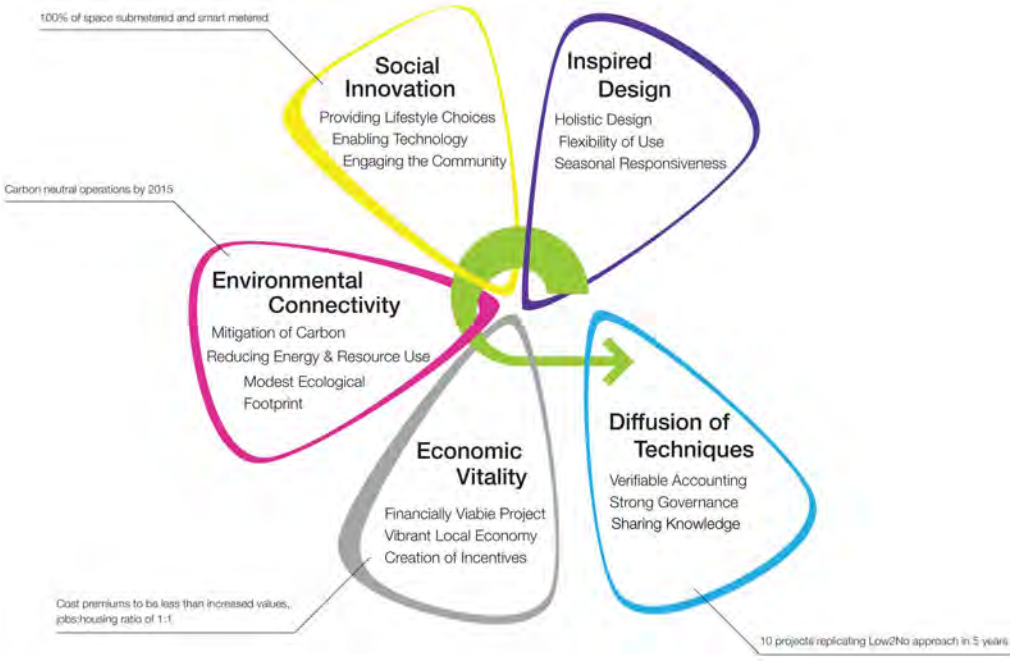

Figure 6. Sustainability framework principles (Source: Low2no, 2012)

Another definition of sustainability was provided by Ben-Eli (2015):

"A dynamic equilibrium in the process of interaction between a population and the carrying capacity of its environment such that the population develops to express its full potential without producing irreversible, adverse effects on the carrying capacity of the environment upon which it depends." (p. 3)

This definition emphasizes the importance of the ratio population and carrying capacity while recalling the Malthusian idea of a balance between a population, its activities, and the natural resources necessary for its survival (Hardin, 1998). This definition underlines some deficiencies of the Brundtland definition since it concentrates only on economic growth without considering the carrying capacity.

The Sustainability Leadership Institute defines sustainability as "…the capacity of a system to engage in the complexities of change consistent with deep values of human purpose: sustain life." This definition is what Elkington (2018) defined as the

"triple bottom line" theory with three Ps—i.e., planet, people, and profit—that include all aspects of life necessary for human beings to survive while considering carrying capacity, care for the environment and economy, and the needs of all people. Thus, it integrates all of the previous definitions.

With a clear idea of what sustainable and sustainable development are, it is clear that sustainable urbanism cannot avoid considering the triple bottom line since contemporary urban research on sustainability largely focuses on environmental concerns by "…exploring more efficient urban structures as well as technologies to reduce energy waste…the sustainability of urban environments is highly dependent on economic growth and social equity." (Wiedmann et al., 2014)

The concept of sustainability in terms of the triple bottom line is very new to the GCC. Sustainable development has become a central point in the development of GCC countries. The social contract that ties the governments of GCC countries to their citizens is the result of lease on oil and natural gas fields. The social contract implies that citizens have particular privileges that they expect. In this discourse, urban development plays an important role since most citizens have moved to cities where jobs—particularly the government jobs that many citizens aim for—are located. The increasing number of citizens in major cities is one reason for promoting sustainable development. Moreover, there is a need for economic diversification away from the main income resources (i.e., oil and gas) for Qatar and to "…convey a particular message about the arrival of modernity in the region to a global audience" (Gardner, 2014, p. 349). However, economic growth—which is the main goal of the GCC countries—poses serious challenges to the implementation of sustainability.

One of the main problems derived from the mobilization of people to major cities in the GCC is increased vehicular traffic, which can result in pollution as well as

lower levels of livability and sustainability. Some actions that can help cities meet urban sustainability standards include "…improving public transport, encouraging non-motorized modes, creating pedestrian zones, limiting the use of private cars…" (Pojani & Stead, 2015, p. 7785). This problem has been tackled in Dubai and Doha through massive infrastructure transportation reform.

The vision of Qatar National Development Plan (QNV) 2030—is based on the pillars of sustainable development integrating sustainability: economy, social, health, and environmental. The urban master plan has also integrated sustainability in its development actions. Sustainable development is not merely a goal to achieve, but "… it is a process of uniting, formerly independent, social, economic and environmental policies into a systems approach" (Richer, 2014, p. 14) to make a space livable.

Livability is necessary to offer a higher quality of life without stress. This is obtained by reducing traffic, enhancing services, and providing public places that foster interaction. This goal can be achieved by the implementation of TOD to redesign public spaces while reducing traffic and offering concentrated services.

Public spaces are crucial for social interactions among people (Gehl, 2010; Whyte, 1980). At different levels, the rate of interaction between people depends on their ability to feel comfortable within an environment (Qawasmeh, 2014). It is in public spaces that different generations come together to interact. This implies that attaining connections requires promoting the exchange of ideas and expanding knowledge about forms of socialization. In a collective approach, public spaces play a significant role in learning from different cultural settings. People who utilize public spaces become motivated by the impact of others and learn from behaviors they are exposed to during social interactions (Ibrahim et al., 2019). In this regard, public spaces have the potential for bringing together ideas for improving lives and offering improved

suggestions to individuals.

According to Shaaban (2019), communities that offer accessible public spaces consider the urban setting as an environment in which people can flourish. The primary concern among residents using public spaces is the assurance of safety. Although Harb (n.d.) reported that walking is part of Islamic culture, this situation is no longer the same for people living in a developed setting where traffic is a challenge. Notably, high levels of congestion discourage people from venturing outside. One challenge pertaining to the creation of pedestrian walkways relates to architectural design and infrastructure in places with ancient buildings that affect plans and efforts to change the environment (Mohamed et al., 2016). Concerns among people also affect the steps that a region can take to ensure that public spaces remain secure and appropriate for individual enjoyment.

According to Harb (n.d), a pedestrian-friendly environment is one that integrates everyday events like shopping, living, and working within the same area. The notion of making public spaces accessible must consider reducing the time spent on a journey. In most cases, the purpose of walking is to avoid the use of motorized means to reach destinations (Qawasmeh, 2014). By finding solutions to reduce the gap, walkability in urban cities must consider the proximity strategy of different locations to allow people easy access from one place to another. From a security perspective, meeting strangers should be of concern to people when sharing public spaces (Zayed, 2016). Instead, there should be a focus on togetherness and contributing to healthy lifestyles. Some arguments were related to reduced time for social activities due to the demanding nature of the working class.

Livability is central to the sustainability vision described in the QNV 2030. To pursue improved livability, the government has developed plans to build infrastructure

to reduce traffic (e.g., highways) and a large number of stations for the Doha Metro that connect every part of the country. In its plans, the government adopted the "…TODs as a comprehensive planning model ensuring that the development of the urban fabric, mixed-use facilities, activity nodal areas, and public services are centered around multimodal transit stations" (Furlan et al., 2018; Knowles & Ferbrache, 2019). The combination of the Doha Metro and the TODs "…will maximize the integration between transport systems and land use through the development of sustainable, vibrant, livable, compact, and mixed-use communities" (Furlan et al., 2020). This thesis concentrates on how TOD development in Msheireb, Downtown Doha, will enhance urban quality of life while preserving built heritage.

TOD Concept and Assessment Criteria

TOD concept

The TOD approach is increasingly being adopted in various cities worldwide to transform cities suffering from traffic congestion into more sustainable livable spaces. Various definitions of TOD are offered in the literature that differ in their scope and specificity. However, all definitions share some common elements, which include "Mixed-use development, development that is close to and well-served by transit, development that is conducive to transit riding" (Cervero, 2002, p. 6).

TOD is a type of urban development that maximizes the amount of residential, business, and leisure space within walking distance of public transport. In the words of Calthorpe (1993), TOD is "moderate and high-density housing, along with complementary public uses, jobs, retail, and services, concentrated in mixed-use development at strategic points along the regional transit system". TOD is just as important as regional connectivity since it aims to reduce the use of private cars while intensifying the use of public transportation to achieve sustainable urban growth

(Cervero, 2002). As Calthorpe explained, supporting communities' close interactions by creating a walkable environment is what makes TOD successful.

The TOD concept is trying to appear in Qatar, where sustainability is at the center of its QNV 2030. The aim of creating a vibrant, livable, and sustainable community where mixed-use areas priotrizing pedestrians being a focal point around an efficient railway system driving Qatar to implement successful TOD. This will lead to living a lower-stress life while also reducing damage stemming from high traffic density. It is also the key to the rising climate change and pollution issues, which is a serious problem in Qatar that can be reduced through the implementation of TOD (Transit Oriented Development Institute, n.d.).

The TOD concept is generally described as including a central transit stop for any public transportation in a mixed-use areas with high density extending from the heart of the area planned to be pedestrianized than the rest of the developed areas by minimizing the area dedicated to vehicular use and utilize smaller block sizes. (Transit Oriented Development Institute, n.d.). Generally, TOD occurs within a one-quarter to a half-mile (400 to 800 meters) radius or within a walking distance of five to seven minute from a transit station (Sustainable Cities Institute, n.d.).

Several institutional issues surround TOD that are derived from many areas such as community, collaboration, participation, and regulations role for developers, governmental municipalities and transit organizations (Cervero, 2002, p. 10). Cooperation in these areas is fundamental for the success of TOD since projects can be assessed in terms of benefits and risks.

The benefits include improving livability since TOD reduces traffic congestion and thus improves air quality (Burdett and Philipp 2018; Mulley 2012). It can also alleviates parking issues while creating green buildings and walkable neighborhoods.

However, there are economic, political, and social risks to consider.

The economic risks involve the common idea among developers that TOD is difficult to make profit. With some conventional developers of institutions demand the investments to design a car-oriented qualities in order to recieve a greater financial profit in their view. Besides, the initial cost of TOD is higher compared to other infrastructure even though it becomes more cost-efficient over time. Thus, municipalities do not generally have financial sources for TOD projects since the available sources are invested in more known infrastructure that is perceived to be immediately profitable (Sustainable Cities Institute, n.d.).

An additional issue is that regulations and frameworks usually neglects TOD since most municipalities have their lands utilized for suburban development, individual purpose, and vehicle use. In this case, laws and regulations should be modified or designed anew to include spaces and resources for TOD.

Another risk that should be evaluated is community resistance. People living in the neighborhood of a proposed TOD can oppose its implementation if they worry that it will change the character of their neighborhood and lower the value of their properties (Sustainable Cities Institute, n.d.). One risk that is particularly true in Qatar is that people/ professionals do not understand the benefits of TOD. Thus, there is a need to raise awareness and explain the benefits of TOD compared to the perceived privileges given by the use of private cars. In some cases, people are not particularly interested in using public transportation for multiple reasons, including the comfort of door-to-door mobility and avoiding the heat of walking in the street, especially in the summer season.

TOD Assessment Criteria

Regarding the TOD assessment, there is no exhaustive quantitative measurement. To evaluate existing TOD, some studies have measured criteria such as

"walkability" and used the following indicators: access, land use, market support, land availability, job opportunities, desnity of population, existing facilities siginificance as a main stop, regular transit boardings, ultimate time per vehicle trip, walkable setting, land development, TOD promptness from business view, and local community endorse. However, other criteria and indicator assessments have been offered by Sing et al. (2014), who sought criteria and indicators to assess existing TOD and planning future projects. Multiple indicators have been used under Spatial Multiple Criteria Assessment (SMCA) framework that resulted in a more comprehensive assessment of TOD (Sing et al., 2014). The criteria and indicators that they utilized for assessing the possibility of TOD are presented in Table 1.

Table 1. Potential TOD index (source: Singh et al., 2014)

Criteria	Indicators
What are the various densities?	Residential density Employment density Commercial intensity/density
How diverse is the land use?	Land use diversity
Does the design of urban space encourage walking and cycling?	Level of mixed-ness of land uses w.r.t residential land use Quality and suitability of streetscape for walking Quality and suitability of streetscape for cycling Density of controlled intersections/ street crossings
What is the current level of economic development?	Private investment in the area Number of business establishments Tax earnings of municipality Unemployment levels

When assessing TOD, several factors should be considered. These factors include land use that comprises parking needs, zoning guidelines, design strategies, in

addition to transportation system policies and priorities that impact the economic, environmental, and social goals. However, the assessment of these factors is affected by the perspectives of individual evaluators. For example, high transit means and affordable housing may be created through TOD, however it may lead to social diversity absence or shopping and entertainment options (Renne, 2008, p. 117). However, TODs should be regularly evaluated to detect changes and consequently adapt them to new necessities.

Renne (2008) presented a method to evaluate sustainability that facilitates the continuous control and modification of policies according to the outcome of TODs. This method is based on the outcome of a survey that highlighted the following six aspects of TOD outcomes: travel behavior, local economic activities, built environment, social environment, natural environment, transportation activities, and community viewpoint. Renne (2008) used readily obtainable data on economic activity and institutional changes, policy context, and public perception (pp. 116,117,121).

Table 2. Potential travel behavior measures and indicators (Source: Renne, 2008)

Measure	Indicator
Vehicle Use/ Modal Split	Vehicle kilometers travelled (VKT) per household Number of trips per day, by mode, per household Method of journey to work (residents) Method of journey to work (employees) Method of other journey (visitors)
Trip Lengths	Average daily commuting time and distance (residents) Average daily commuting time and distance (employees)
Transit Quality	Number of high frequency, line haul and local public transport services available Integration of services both spatially and timetable
Vehicle Ownership	Number of vehicles per household
Pedestrian Accessibility	Ped Shed

Table 3. Potential local economy measures and indicators (Source: Renne, 2008)

Measure	Indicator
Range of Businesses	Number of retail, commercial and industrial businesses (possibly on GIS) Suitability of local retail for residents (Index of Retail Variation)
Business Success	Rate/ Number of vacant buildings/units (retail, commercial, industrial) Number of jobs in area (by, categories, FT/PT) Number of people in home- based employment
Range of Housing	Number of residential units (houses/flats/apartments) Number of rental and owner- occupied residences Number of affordable housing units (to be defined) Range of 1, 2 and 3+ bedroom
Financial Base	Property value (over time) Percentage of income spent on housing and transport Taxes collected by local government ($)

Table 4. Potential natural environment measures and indicators (Source: Renne, 2008)

Measure	Indicator
Air Quality and Pollution	Estimate emissions based on VKT
Energy use (people)	Estimate car fuel use based on VKT
Noise	Average and Peak noise levels
Stormwater Retention	Volume of water

Table 5. Potential built environment measures and indicators (Source: Renne, 2008)

Measure	Indicator
Vibrancy	Resident population (density) Pedestrian counts Area/number of vacant land parcels
Attractiveness	Subjective measure of façade quality Subjective measure of streetscape quality (inc. pedestrian amenity) Number of heritage buildings preserved Public Art
Safe and inviting area	Quality of lighting Security at railway station Facilities (incl. retail) at railway station CPTED (Crime Prevention Through Environmental Design) Building Frontages - SAFE assessment (measures to be determined)
Mixture of uses	Number of mixed-use buildings Housing/Population density
Space for people rather than cars	Area of plazas and parks Area/number of auto-oriented land uses Area/number of pedestrian-oriented land uses Bicycle parking spaces Bicycle traffic volume Presence of Principal Shared Paths (PSP) and on-street bicycle lanes Number of traffic calming features Auto traffic speed and volume

Table 6. Potential social environment measures and indicators (Source: Renne, 2008)

Measure	Indicator
Safety and Security	Public perception of neighborhood, crime, pedestrian and bicycle safety
	Recorded incidents of crime, pedestrian and cycle accidents
Ownership	Public perception of community Perceived quality of retail environment Community support for further (re)development
Residential diversity	Breakdown of population by age, education, ethnicity and income level and household formation (size)
Opportunities for advancement	Number of libraries, theatres, galleries etc.
	Number of other community facilities
	Perceived quality of community facilities
	Number of festivals and events Perceived quality of events
	Educational Opportunities

TODs should be assessed for their sustainability as well as their complete performance. For this reason, a wide variety of indicators are required. By using a sustainability framework and clear goals, it is possible to determine the indicators that should be used in each specific context to achieve a particular goal. This implies that specific indicators will be selected for specific goals that need to be assessed.

This research aims to assess the success of the Msheireb TOD in terms of urban quality of life enhancement and cultural heritage. To achieve this, a package of assessment criteria and indicators that can evaluate the current situation and provide direction for new planning was required. In this case, the present study utilized the

assessment presented by Renne (2008) and the application of the indicators related to travel behavior and the built environment. (Table 2 and 5)

It was important to first prioritize the research goals, establish a sustainability baseline against which the outcome of the TOD analysis can be measured, regularly repeat the assessment to validate the outcome, and agree with the stakeholders on the analysis of the results (Renne, 2008, p. 146).

Priority was given to urban quality of life enhancement over cultural heritage since the outcomes for cultural heritage preservation in TOD development will affect urban quality enhancement.

Purpose of TOD in Qatar

The purpose of TOD in Qatar can be summarized in two points: 1) to enhance urban quality of life and 2) to preserve cultural heritage.

Urban quality of life enhancement

Travel behavior and built environment are the two main measures used to assess the urban quality of life derived from TOD.

The first measure, travel behavior, analyses several areas that use specific indicators to determine the success of TOD. These indicators include:

- Vehicle use: vehicle mileage traveled, number of trips per day (by mode) per household, and the method of the journey for residents, employees, and visitors
- Trip length: average daily commuting time and distance for residents and employees
- Trip quality: number of high-frequency, line haul, and local public transport services available
- Vehicle ownership: number of automobile per house
- Accessible by pedestrians: built on pedestrian shed.

Traffic flow indicators—i.e., the number of ride services provided to and from the station and transit ridership— happen to be the most significant for the flourish of TOD among all other indicators since they help to design a successful built environment that includes the necessary facilities (e.g., the number of parking spaces for shoppers, commuters, residents and passengers).

The second measure is built environment diversity, which includes urban fabric quality, pedestrian friendliness, and mixed-use facilities among other areas that can be assessed based on the following measures and specific indicators:

- Livability: desnity of residents, unoccupied plots, pedestrian activity
- Design quality: conserved buildings, quality of buildings, quality of streets, and art installatios for public
- Safe and appealing areas: transit stations security, safe and friendly environment of building frontages (SAFE assessment), Lighting quality, and envrionemntal planning for crime avoidance
- Mixed-uses: density of housing ratio, number of mixed-use built forms, and availaibility of spaces where people-oriented rather than being car-oriented

Regarding the built environment, one of the most important design elements for successful TOD is density because people will not be attracted to transit stations without it (Pushkarev & Zupan, cited in Cervero et al., 2002). Furthermore, mixed-use facilities are also important since people will not use transit stations with limited facilities because they will be prevented from accessing many destinations and necessary facilities. Areas that are compact and offer a range of amenities in addition to a pleasant landscape, civic squares, tree-lined pathways, and other amenities are more attractive and enjoyable to live, work, or shop in. Besides variety, mixed-land offers several benefits to the passengers that can internalize trips within neighborhoods, thereby

providing residents and passengers all of the required facilities within walking distance, which avoids the need for car use and the associated stress of traffic and parking. In addition to these positive aspects of mixed-use lands, there are also benefits from the supply and entrepreneurship perspectives, such as shared parking that reduces expenses, infrastructure loads and facility sizing, and the bi-directional use of infrastructure since activity centers become both trip origins and destinations (Cervero, 2002)

The importance of the "… '3 Ds' of built environments (density, diversity, and design) is as important around transit stations as anywhere else" (Cervero & Kockelman, cited in Cervero et al., 2002, p. 80).

Part of Qatar's master plan includes the regeneration of many areas to enhance the quality of life through sustainability. Msheireb Downtown Doha is one of the areas that is under regeneration with a focus on sustainability. When the initial modernization of the area occurred in 2005, the area was in a state of negligence, and public authorities perceived livability to be very poor since "…the overall population density was around 500 inhabitants per hectare" (Al Fadala & Furlan, 2018, p. 459), while services and connectivity were insufficient. Transportation was not efficient, parking lots were not sufficient for the number of people visiting the commercial area, pedestrian areas were minimal, and pedestrian and bicycle paths were absent. The natural environment was also not considered in the old Msheireb, which lacked parks, recreational public areas, and facilities that enhance livability. Moreover, historical buildings were in poor condition due to a lack of maintenance.

Cultural Heritage

Cultural identity is one of the most important factors in enhancing livability along with "… compact, pedestrian-friendly and mixed-use neighborhoods where the public realm provides the arena for social interactions" (Al Fadala & Furlan, 2018, p. 446). Therefore, urban identity is largely concerned with the general appearance of urban areas as an expression of a person's identity, a reflection of where the person lives, and the activities he or she is engaged in; however, the identity of space is reliant on people socialization activity (Sajjadzadeh, 2013).

Notably, the formation of an urban identity is dependent on the characteristics and values of a city. Urban identity is a reflection of the unique characteristics and values that are generally achieved by a city. These characteristics and values are characterized by cultural and socioeconomic components that are distinct from other cities (Sirel, 2005).

Urban identity is a rapidly changing and dynamic notion involving all those living in the city that are fully participating. Therefore, an urban identity is not only made up of buildings, streets, and squares, but also involves the people living in the city (i.e., its active participants). Therefore, a city's identity is not determined from the inputs but rather from the outputs and qualities emerging from efforts initiated by local residents. Identity can be considered the total number of characteristics that make up the description and differentiation assets with the aid of cultural and natural properties (Gündüz, 2005).

Certain important aspects should not be overlooked when dealing with identity. For instance, coherence is an important concept that aids in the formation of identity. Quality of life, cultural heritage, social needs, local factors, and features that are dependent on topography are major components of identity (Gürsel, 1996). Variety,

authenticity, and locality make it easier to identify the concept of identity. Neighborhoods, despite being small units in a larger urban setting, are as important as the other factors. A complete urban city should be composed of local traditions, architecture, and lifestyles, which are geographically characterized components (Ilgın & Hacıhasanoğlu, 2006).

To fight the loss of identity due to globalization, the QNV 2030 established a framework for all development to ensure that cultural heritage, traditions, and values are preserved. Since the announcement of the QNV 2030, all development projects in Qatar have considered the conservation of national heritage and cultural identity. This can be detected in the development of the Grand Mosque, Souq Waqif, and other areas in the country (Al Fadala & Furlan, 2018, p. 450) This attention to heritage and cultural identity is largely considered in the Msheireb project, where one of the five quarters is the Heritage Quarter "… that features four heritage houses that have been restored and turned into the Msheireb Museums, including a traditional adobe courtyard house known as the Mohammed Bin Jassim House—originally the house of the son of the founder of modern Qatar" (Msheireb catalogs, p. 37).

Given that "…cultural heritage is a non-renewable resource…identity, artistry, local traditions, architecture, and memory are society's cultural values, which are embedded in the urban built heritage of cities [and] it is about conserving the asset's value by creating new style according to existing values" (Al-Thani et al., 2019, p. 7) and that Msheireb aims to achieve sustainability that enhances livability (of which heritage is an indicator), the creation of an environment in which people would like to live due to the maintenance of economic, environmental, and societal wellness should immediately be accomplished to satisfy the current needs and desires of the community (Al Matwi & Mohannadi, 2019). To achieve livability, it is clear that Msheireb faces a

challenging task in balancing sustainability and livability in relation to the inclusion and preservation of heritage.

Applying sustainability and livability to the broader concept of cultural heritage has raised concerns because these concepts seem to collide with the preservation of heritage, which should not change over time. Furthermore, "…the preservation of cultural heritage extends beyond physical features to include the socio-cultural characteristics of Arab society that are still practiced daily" (Furlan & Al Mohannadi, 2020, p. 6). The challenges include considering climatic, socioeconomic, and sociocultural factors that present both risks and opportunities.

The use of new technologies help to improve the services, building of new infrastructure, and preservation of cultural heritage, while the new connectivity system reevaluate the historical sites due to the new plans that need to include lines and stops near cultural sites along with services, facilities, and signage for visitors.

The integration of sustainable urbanism, sustainability, and livability principles ensure the continuity of meeting basic needs for future generations while preserving cultural heritage to maintain and reinforce the Qatari identity over time.

Geographical context

This section offers an overview of urbanism in the GCC regional context while focusing on urbanization in Qatar and the Msheireb case study setting. Generally, urbanism refers to life within a city, while urbanization refers to the development of urban areas.

The term urbanism refers to the culture or the way people live in a city and how the city offers services and facilities, while urbanization refers to the process of people moving out of rural areas and into a given city. The process of urbanization requires the adaptation of cities to the needs of new residents and the new needs brought by

globalization.

Overview of Urbanism in the Regional Context

Across the GCC, urbanization began after the discovery of oil in 1950's. Many people moved to the cities to enter government jobs that were largely sought due to their high salaries and benefits. The increasing urban population required a development of city structures including housing, streets, services, and all types of facilities. This increase in city populations was not only due to the citizens moving to cities from rural areas but was also linked to the demand for foreign human capital, which has continued to increase. Over time, GCC countries have experienced a population increase that has largely consisted of foreign workers and resulted in the continuous expansion and modernization of cities. However, the concept of sustainability has only made GCC countries reflect on their detrimental modernization methods within the last decade. Consequently, recent urban regeneration planning has placed the concept of sustainability at the core of development to address common social well-being issues such as population density, connectivity, social activities and interaction, environmental problems (e.g., pollution and a lack of green spaces), and the promotion of awareness for the conservation of neighborhoods, urban areas, and structures for the needs of future generations.

To achieve sustainability, the principles of sustainable urbanism have been applied in new regeneration projects in GCC countries. Some examples in the Gulf include the transportation system in Riyadh, which is more complex than it was 10 years ago. Although transportation systems are a key aspect of modern cities, existing complications in this sector have posed challenges in urban transport throughout most of the world. However, urban transportation systems are a core determinant of the economic and social growth of a city. According to Dimitriou (1990), there are two

categories of transport challenges faced especially by the third world countries. The first challenge involves factors such as increased car ownership, insufficient transport facilities, poor traffic rules, poor traffic enforcement, poor control of land use, poor urban planning and expansion, an increasing human population, and mixed traffic. On the other hand, Dimitriou categorized the second set of challenges into manifestation challenges that include an increase in road accidents and traffic congestion. For instance, the historical development shaped the modern transportation system of Riyadh (oasis plural) in the Kingdom of Saudi Arabia. Starting as a walled city, it has expanded from less than 1 km^2 in 1920 to a modern sprawling city of 1500 km^2. Riyadh is located on the Najd Plateau at an elevation ranging from 660 m in the north to 580 m in the south. The western side of the city has a famous landmark watershed called Hanifah.

The planning of Riyadh city took an initial compact design due to the perception that it would not become as highly populated as it currently is. For instance, the road networks were intended for a compact city and did not leave room for future expansion (Figure 7). In an attempt to solve the problem of traffic congestion, city planners opted for more traditional methods such as adjusting roads and adding more lanes to existing roads. This method has worsened the state of roads, posing a major challenge for the transportation system. Notably, the economic boom experienced in Riyadh from the 1950s to 1970s made it become a car-oriented city (Al-Mosaind, 2001). For instance, the total number of vehicles that were used between 1968 and 1996 in Riyadh increased from 26,880 to 670,300. According to Al-Hathloul (2002), the first road was built in the 1940s and was followed by the construction of a railway line to the east in 1951. In 1952, the first airport was built to the north.

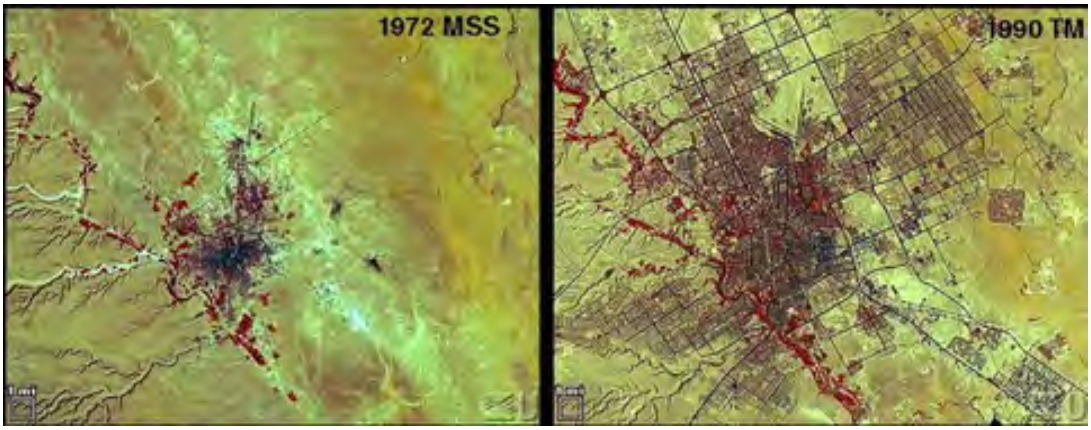

Figure 7. Aerial photographs of Riyadh in 1972 and 1990 (Source: Arriyadh Development Authority - ADA)

The most vital element of the transportation system in Riyadh is its roads network. Approximately 50 years ago, the urban and physical planning of Riyadh was split into several stages of the city's physical development. The Al- Murabba complex of King Abdelaziz outside of the old city marked the first stage. Moreover, the general features of traditional urban design were preserved. The 1950s to late 1960s marked stage two, which introduced modern architecture into the city. For instance, new designs for space, materials, building types, and street patterns were introduced. These patterns took a gridiron design with large square-shaped lots and rectangular blocks. Riyadh's Master Plan—which was developed by Doxiadis and started in the late 1960s—marked stage three. Doxiadis' plan was composed of a supergrid and a superblock of 2x2 km that provided a rational local system. This plan proposed an urban area of approximately 300 km^2. One of the major goals for the growth of Riyadh was a balanced transportation system that is strongly tied to the hierarchy of streets with well-distributed functions (Doxiadis, 1971). The hierarchy that was planned for the circulation pattern included four major freeways, expressways, arterial roads, local

roads, and collector roads (Doxiadis, 1971). Nevertheless, the economic boost from oil in the 1970s and modifications to the master plan by SCET – international a french company marked the fourth stage of the city planning process. This stage involved setting aside approximately 850 km^2 to accommodate 1.6 million people. An important feature of the SCET update was the defined path of the ring road and the planned implementation of Fahad Road (Al-Mogren, 2016; Middleton, 2009). The final phase of Riyadh's transport system development involved changes made through the MEDSTAR project (managed by the Arriayadh Development Authority (ADA)) in the 1990s and the start of the Riyadh Public Transport Network (RPTN) in 2012.

The most critical part was the construction of roads in the northern suburb. The noticeable road in the region is the Oiran land, which was designed according to the features of the grid pattern of Riyadh. The accepted structural plan had a more curved road structure that was more organic. Since the eastern suburb is an area with less development in terms of the road network, the method will be more useful for future growth and road development. The roads in Saudi cities are similar to those of America in terms of patterns for urban area expansion, while the same roads differ from those found in Western Europe (Figure 8). The recent public transport system is a solution to decongesting the high traffic stemming from car dependency in the city of Riyadh. The expansion of the transport system in Riyadh has had an impact on cultural, social environmental, and economic factors. Due to the growth of the city, public transport will be of much benefit in facilitating the movement of people, thereby promoting the development and wellbeing of citizens. Riyadh also has a well-established railway system that facilitates the movement of people to strategic points such as public institutions, bus terminals, recreation facilities, and the airport (Figure 9).

Figure 8. Riyadh network system (Source: https://omrania.com/)

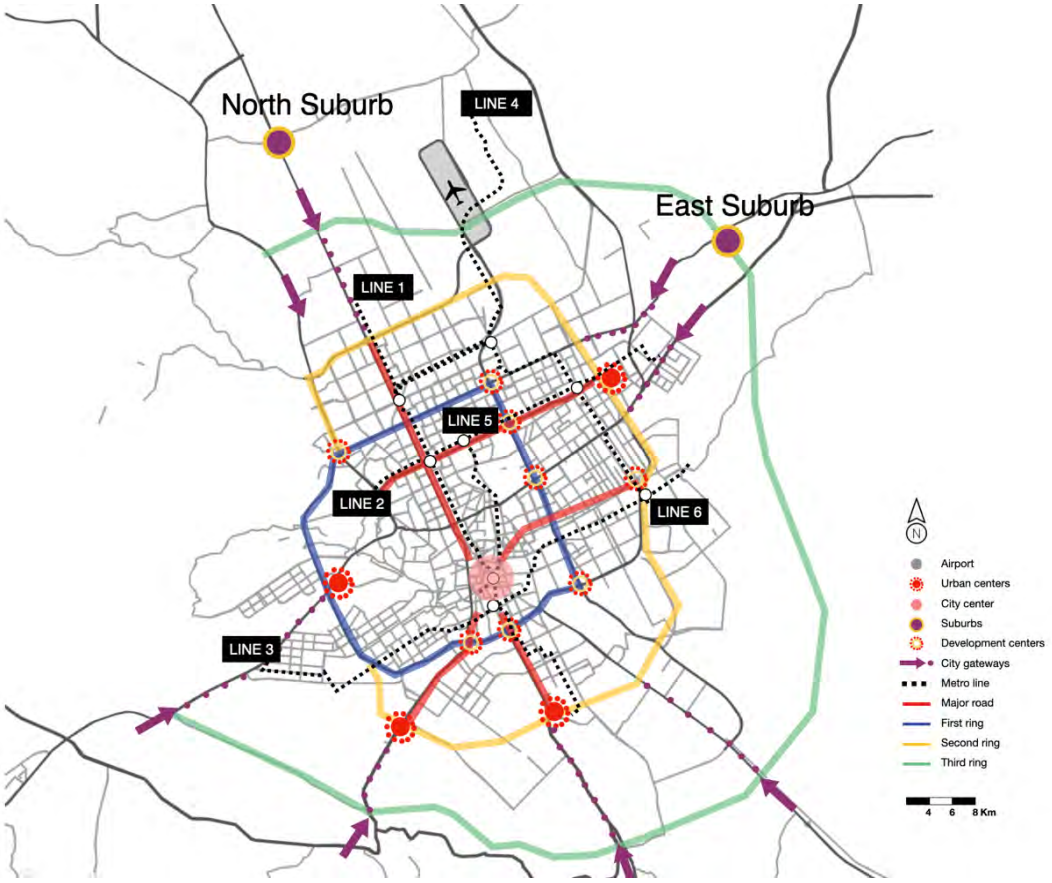

Figure 9. Riyadh transportation network system (Source: Author)

Additionally, the railway system has a positive impact on the TOD of bus stations, high-density areas as well as the nodes at metro, whose role is to change the lifestyles of people travel behavior. Since city planning has been a point of concern for several years, Riyadh still requires a more integrated public transport system to serve the people living in the suburbs.

The Context of the Research Study: Urbanization in Qatar

As Salama and Wiedmann (2013) argued, "each economic development stage is usually accompanied by spatial transformations of built environments as well as changing structures in urban societies leading to new types of cities" (p. 3). This is what Qatar has witnessed in the decades after the discovery of oil (Figure 10).

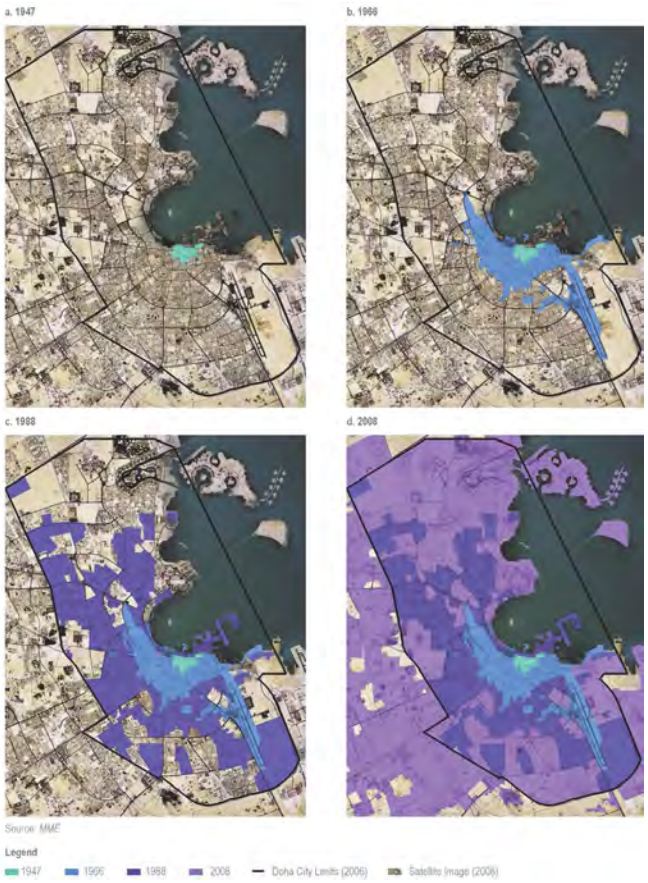

Figure 10. Boundaries of Doha since 1947 (Source: MME)

Urbanization in Qatar began following the discovery and independence from Great Britain. When Qatar—as a new nation-state—started to improve its economy through oil exports, its rapid economic transformation also led to changes to the fabric of the society, particularly in the 1970s and 1980s. Traditional settlements located along the coast and in the desert modified their structure to meet the new needs of the population, although many people moved to the city to study and work. Consequently, the capital city, Doha, saw a rapid population increase due to the relocation of Qataris from rural settlements to Doha, the arrival of a large number of expatriates as well as higher birth rates and lower mortality rates due to improved living conditions. (Figure 11). The need to transform the structure of the city and the inexperienced rulers who designed the new development strategies led many of them to adopt the rules and regulations of neighboring Arab countries that had previously experienced urbanization and generally had a European influence due to European presence during the years of the protectorate in the Middle East and North Africa (MENA) region (Salama & Wiedmann, 2013, p. 27). The result was a city that did not reflect the character of the Arab society but was necessary to rapidly develop a city that could host a growing population, meet the needs of lifestyles that are very different due to the sudden wealth of the country, meet the needs of the growing and diversified expatriate population constituted by an increasing number of Westerners. In recent decades, Qatar recognized the need for another facelift of the country, new infrastructure, and new concepts that were required to meet both the growing number of people as well as the issue of sustainable development. The task of the government was then "…to draw up plans and development strategies with the aim of fostering urban consolidation. As a result, … a new phase of an investor-driven urbanism [was initiated]" (Salama & Wiedmann, 2013, p. 37). The master plan for this new development included exclusive and exclusionary

man-made islands, attractive new suburban districts, and mixed-use cities or enclaves within the city to attract domestic and foreign investors. Additionally, large-scale projects, high-rise agglomerations emerged along the urban periphery, while business districts emerged along main growth corridors such as West Bay in Doha (Salama & Wiedmann, 2013, p. 39).

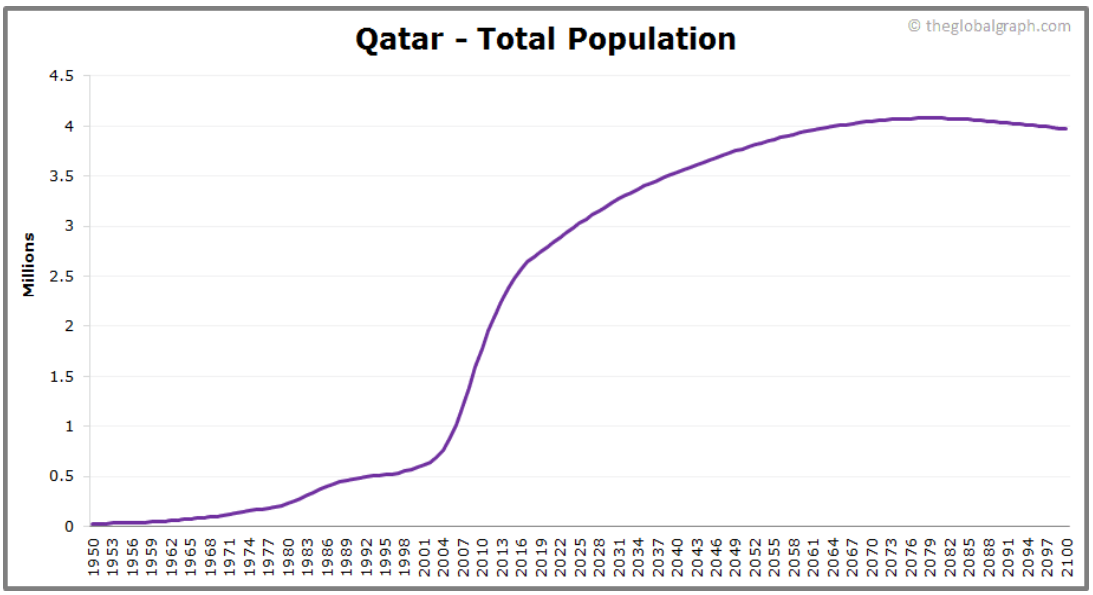

Figure 11. Population Growth Chart (Source: worldpopulation.theglobalgraph.com)

However, due to the different types of structures, this development led to a higher population density in areas that were previously low-density residential areas. Thus, instead of single houses, buildings were needed to accommodate the increasing population. However, the second phase of modernization was recognized as not meeting the needs of Qatar. Notably, between 2000 and 2010, a new understanding of modernization was formed that was not linked to Westernization, as per recent developments in the GCC. In 2008, Qatar announced its new vision for the country, the QNV 2030, which has a new understanding of modernization that encompasses all areas of development. The QNV 2030 focuses on a different type of urban architecture while

incorporating new urbanism concepts and sustainability, with a particular focus on preserving cultural heritage.

The transformation that subsequently follows economic development should consider five main aspects: historical context, local governance, image-making, people, and sustainability (Salama & Wiedmann, 2013). These important basic factors must be deeply studied so as not to conform to or become influenced by globalization, which would otherwise lead to development that lacks the heart, soul, and identity of the country and result in the development of a shapeless city that could belong anywhere in the world.

The QNV 2030 states that all development projects should consider the five aforementioned factors and the traditional urbanism concept to foster a sense of community by promoting the notion of the "… reintegration of all components of community life (working, living, shopping, and entertainment) into cohesive developments comprised of neighborhoods and cites which are linked with transit and set in a regional framework" (Howard, 2005, p. 29). Most new projects in Qatar include the concepts of sustainability and livability by implementing new and diverse modes of transportation, pedestrian areas, parks, and public open space for public activities to promote social integration, mixed-use lands, and connectivity to ease the use of services and facilities. Similarly, a pedestrian-friendly environment in The Pearl development in Doha considers the priorities of people when designing spaces within the public realm. However, not all of these characteristics were present in the earlier phases of modernization. For example, in the Pearl, cars are still required to move from one quarter to another since the design of the streets only permits walkability within each quarter. The developer at the Pearl has had to deal with several logistical challenges in pedestrianizing busy service roads:

> The pedestrian bridges and conversion of service roads will also take some of the pressure off the main trunk road of the Pearl, which is becoming busier as more hotels, shops, and restaurants open on the man-made island. Pedestrian bridges will free the trunk of pedestrian crossings, lights, and speed bumps, which will increase the speed of traffic flow.

One visitor to Pearl stated:

> We boarded the monorail to the far end of the Pearl and set out to explore. There is a beautiful boardwalk around the far edge but no pedestrian crossings to get there. There is an exclusive hotel in the area that does not want day trippers wandering through. The sidewalk needs to be transformed to focus on the livability aspect apart from walking. Apart from overpasses and pedestrian crossings, even underground passage as the main crossing facilities should be a point of concern (Harvey & Rodriguez, 2017).

Lovasi et al. (2012) found that the effective adoption of TOD integrates walking and cycling spaces; hence, it will help in the enhancement of health-related problems like obesity while promoting healthy behaviors such as walking. Recent studies (i.e., Belzer & Autler, 2002; Calthorpe, 1993; Schlossberg & Brown, 2004) have found that TOD plays a crucial role in improving walkability and enhances pedestrian movements through the provision of improved transit services/stations, thereby leading to an increased number of people using the metro system due to its efficacy. Similarly, Cervero and Arrington (2008) found that TOD reduces vehicular/traffic congestion. Park et al. (2015) found that improved walkability among pedestrians is associated with various cost-related benefits. However, biking and walking to and from transit stations should be encouraged to ensure the effectiveness of TOD (Bernick & Cervero, 1997;

Calthorpe, 1993). Improved walkability will allow pedestrians to reach their amenities without using vehicles.

The 27 principles of new urbanism strategic design and planning, development works, and public policy adopt three layers of urban heirachy: the state, including the suburbs, towns, and cities, the block unit, including built forms and streets, and the neighborhood, including walkways and districts (Figure 12) (Howard, 2005, p. 32). Thus, in certain areas flagged for TOD-based regeneration in Qatar, it is natural to avoid the risks presented by numerous critics of new urbanism, who stated that despite the "…many attractive ideas, it may have difficulty dealing with a wide range of contemporary issues that generally fall into five broad categories: scale, transportation, planning and codes, regionalism, and marketing" (Fulton, 1996, p. 1). In certain central areas, TOD will help to minimize or repair these risks. For example, TOD in the context of Qatar would resolve the issue of walkability between neighborhoods by promoting connectivity. Additionally, TOD in Msheireb Downtown Doha could help to improve livability.

Figure 12. Principles of new urbanism (Source: Green, 2014)

The context of the research study Qatar (QNDF 2032, QNMP, QNV 2030)

Among the developments aimed at building a sustainable knowledge-based economy. the QNV 2030, the Qatar National Development Framework 2032 (QNDF-2032), and the Qatar National Development Strategies (QNDS) 1 and 2 have designed plans to achieve several goals through the execution of extraordinary projects in infrastructure and the regeneration of various areas (Figure 13). This has resulted in rapid urbanization that was also due to the expansion of highways and public system networks to meet the development needs of hosting the 2022 FIFA World Cup

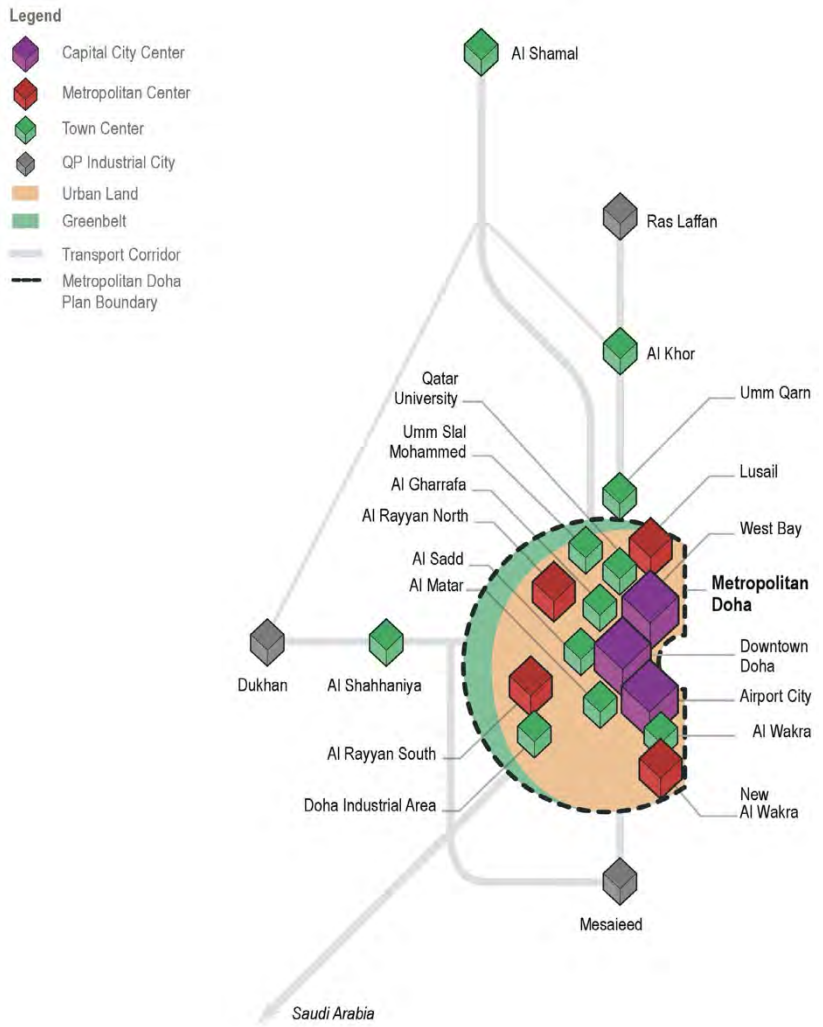

Figure 13. Planned hierarchy and location of urban capitals in 2032 (Source: MME)

One of the goals of this development is to enhance the transportation system. The construction of the Doha Metro is part of a new system that will grant easy connectivity between various areas in the city through its four lines and approximately 100 stations. While this new connectivity will result in reducing traffic and pollution, TOD is necessary to meet the new needs of areas and passengers while strengthening the additional social, environmental, and economic benefits of the facilities and services that TOD will provide. One of the main TOD projects in Doha is the Msheireb Downtown Doha. However, the current mode of TOD is considered a model for urban regeneration to promote the sustainability and livability of cities, there remain doubts regarding the necessary regeneration work since it could clash with preservation.

To demonstrate that global policies are effectively implemented in local developments to ensure efficient results, the QNDF 2032 governance shows care for the Qatari identity by aiming to avoid the loss of Qatari cultural heritage and identity, which is evident in the following statement:

> "Throughout Qatar, a more sensitive understanding of the built environment and cultural heritage is required. In the QNDF, the emphasis is placed on quantitative and qualitative improvements in the design and provision of parks, gardens, walkways, and open spaces. The use of best practice principles in new energy-efficient building design while conserving the nation's historic and cultural assets is also promoted." (QNDF 2032)

TOD in Msheireb should represent a compromise between the needs and requirements of innovation and the heritage preservation of the site and way of life. TOD in Msheireb should maintain—and eventually sustainably enhance—the specificities of the area, which include it being a central commercial hub in the heart of the city and near the corniche. There is a lively shopping area near Souq Waqif that has very traditional

architecture, commerce, and activities. It has a predominant historic value that all GCC countries have in common due to its historical roots in Islamic architecture. In fact, it is a tourism destination for many GCC citizens. It should also follow the recent regeneration of Souq Waqif in terms of architecture has become an attraction for residents and tourists alike due to the preservation of culture through buildings and everyday life.

Msheireb Case Study Setting

Msheireb is one of the main historical areas in central Doha, located south of the Amiri Diwan and near the markets in Souq Waqif, the corniche, and the historic Koot Fort. Msheireb is bordered by Al Rayan Road (north), Jassim Bin Mohammed Street (east), Msheireb Street (south), and Al Diwan Street (west), which function as connections to the corniche road and other areas in the city. (figure 14)

Figure 14. Location of Msheireb within Qatar (Source: MDD catalog)

The Msheireb development project aims to regenerate an area that was once a mixed-use neighborhood where Qatari people lived in traditional single-story houses with a courtyard and narrow streets connecting them. It aim to revive the heritage included in the Msheireb district and to readdress the function of the traditional

commercial center by demolishing the interventions performed during the modernization period following the discovery of oil in the 1950s including the old residential neighborhood, which does not fit the older fabric (Al Fadala & Furlan, 2018, pp. 456, 459). Moreover, it involve the implementation of new urbanism principles to achieve sustainable neighborhoods. The regeneration of Souq Waqif has maintained the structure of the old area by preserving the plan, materials, and architecture of the old traditional houses. On the other hand, Msheireb project aims to preserve the essential architectural characteristics of the original sites into a new sustainable development.

The Msheireb project started in 2010 and is being built in four phases on a land area of 31 hectares (310,000 square meters). It include commercial, residential, retail, hospitality, and civic spaces that aim to eliminate the deficiencies of the old Msheireb in terms of density, connectivity, natural environment, transportation, parking, and services. Msheireb offers unique connectivity thanks to its four main access points (Abdullah bin Thani Street, Wadi Msheireb Street, Khail Street, and Al Kahraba Street) and a public transportation system that includes an internal tram, taxis, buses, and the main metro rail station that connects the area to the rest of the city. Msheireb provides an underground parking facility with over 10,000 parking spaces for cars that enclose pedestrian and bicycle paths and parking (MDD catalog).

The full range of services offered in Msheireb are connected by a pedestrian-friendly environment, while an underpass will facilitate an enjoyable walk to Souq Waqif. Parks as well as open public spaces for various activities and entertainment are located at various points in Msheireb, leading to a decrease in population density that is expected to be under "…200 inhabitants per hectare" (Al Fadala & Furlan, 2018, p. 459). Notably, the sustainability and livability of the area doesn't jeopardize its history and identity. The conservation of heritage is a primary concern since old and new

buildings are reflecting the sense of identity, which is one of the indicators of attractiveness in the built environment to enhance livability.

To achieve this, the entire area was first demolished except for the historical buildings. Then, it was divided into five quarters. The Msheireb Heritage Quarter is where the original historic buildings have been maintained and reopened as museums where visitors can learn about the history of Qatar and the old style of Qatari life. Notably, it includes the Msheireb Prayer Ground and space for new cultural activities. The Diwan Amiri Quarter is an important extension of Doha's key civic and administrative areas, including the Amiri Guard Building and Qatar National Archive. The Retail Quarter is where residents and visitors can enjoy shopping and a variety of entertainment. The Mixed-Use and Residential Quarter strikes a balance between work and leisure with fully equipped neighborhoods, offices, and retail offerings as well as the Business Gateway surrounded by number of retail, entrantinment and dining options which is considered a professional realm (MDD catalog).

The design of the Msheireb Downtown Doha Project aimed to separate/divide the neighborhoods into five distinct quarters, which would involve a significant combination of civic, commercial, residential, hospitality, and retail regions. All quarters are constructed in closer proximity to one another, thereby enhancing convenience for users walking through shaded patios/corridors. The five quarters include restaurants, hotels, cafés, cultural sites and spaces, advanced retail spaces, international learning institutions (i.e., international academies), luxurious residential properties, as well as offices. The quarters consist of Diwan Amiri Quarter, Heritage Quarter, the Mixed-use and Residential Quarter, as well as the Business Quarter, which are discussed in the following sections:

Business Gateway Quarter

Numerous business amenities, retailers, restaurants, eateries, and hotels (i.e., the Mandarin Oriental Hotel) comprise the Business Gateway (Figure 15). Moreover, it hosts numerous commercial buildings, such as offices at Al Diwan Street, covering 193 km^2 and incorporates the Msheireb metro station on Sahat Al Nakheel, social amenities (e.g., schools and mosques), financial institutions, as well as commercial and residential areas. The Business Gateway is connected with a transportation node that provides access to different means of transport to ease movement and traffic flow. For example, public transportation services play a key role in connecting the communities.

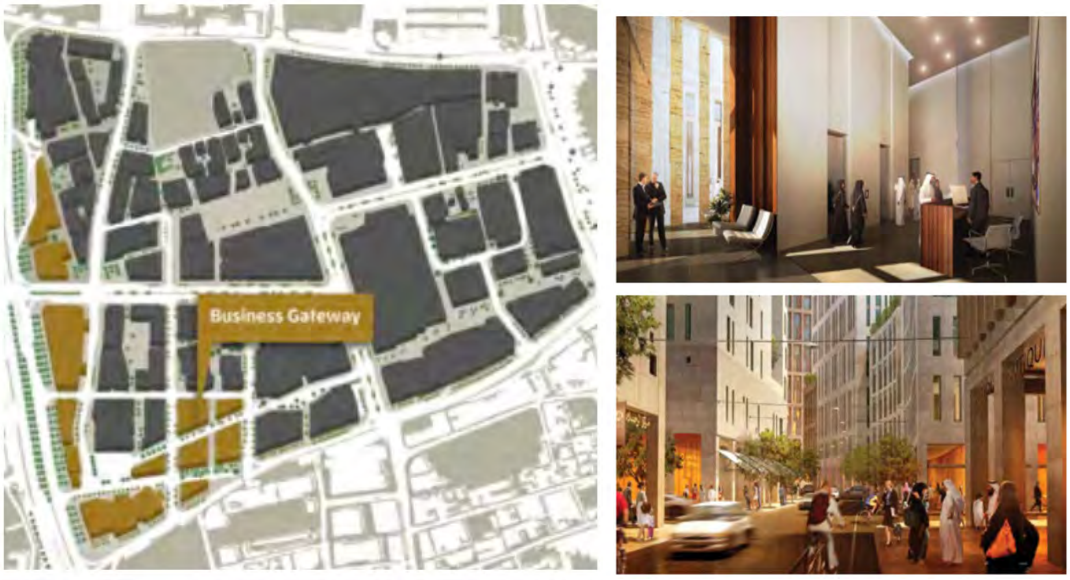

Figure 15. Msheireb Downtown Doha Business Gateway Quarter (Source: MDD catalog)

Mixed-use and Residential Quarter

The Mixed-use and Residential Quarter includes recreational/leisure areas, commercial/retail spaces, and offices (Figure 16). Community parks have been integrated with leisure opportunities and linked to the residential/commercial quarters. shopping areas, social amenities, and a mosque are located in the center, while the Western ends incorporate learning institutions, office buildings, and apartments. Also,

it has integrated community parks with residential, commercial, and retail properties. Al Kahraba Street features well-designed townhouses as well as commercial properties such as apartments with enhanced security, technological features, and contemporary top-notch finishes and fittings. Residential properties with retail

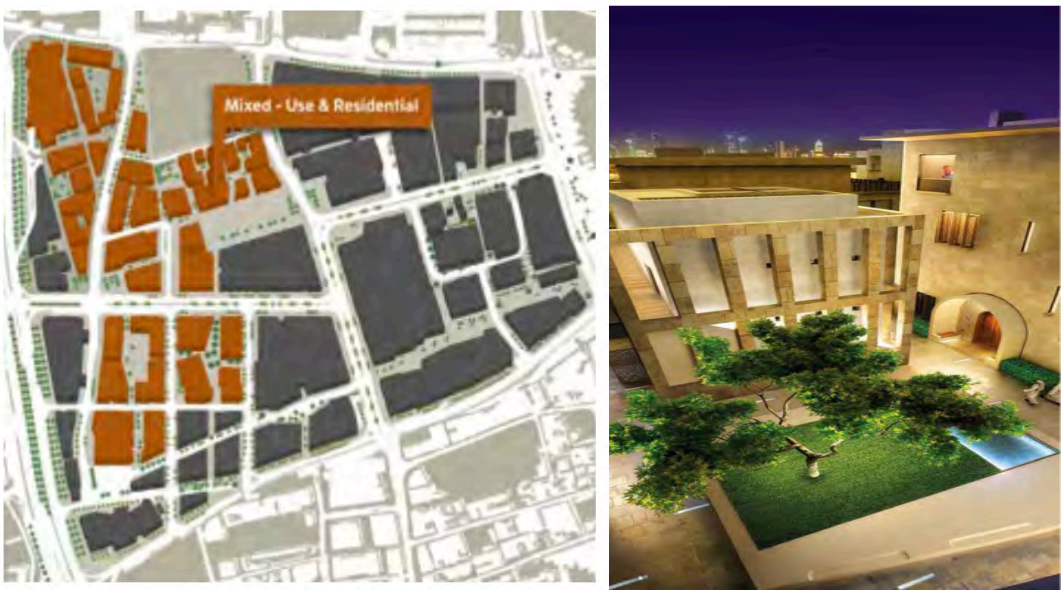

Figure 16. Msheireb Downtown Doha Mixed-use and Residential Quarter (Source: MDD catalog)

Retail Quarter

The Msheireb Development Project is comprised of Barahat Msheireb, which consists of public squares with a wider variety of eateries and cafés that meet the needs of different users (Figure 17). The Retail Quarter consists of diverse cultural structures that include reception halls, social gathering spaces, beautiful galleries, art house cinemas, and exhibition halls. These cultural spaces attract various individuals coming to enjoy cultural or community shows, live performances, and other Arab traditional events (both local and international). For example, the Mandarin Oriental Hotel mostly offers these activities. Lastly, Barahat Msheireb is designed using a retractable roof that adapts to changes in temperature and thus maintains the thermal comfort of building

users, especially during hot and cold seasons (Figure 18).

Figure 17. Msheireb Downtown Doha Retail Quarter (Source: MDD catalog)

Figure 18. Msheireb Downtown Doha Baraha Square (Source: Msheireb Properties)

Heritage Quarter

This includes spaces that aim to restore Qatari heritage, hence making it a cultural destination (Figure 19). The quarter includes the restoration and preservation of the Prayer Ground, which has resulted in the creation of spaces for novel cultural events. Also, it has led to the conversion of four heritage houses (e.g., the Mohammed Bin Jassim House, the Radwani House, the Bin Jelmood House, and the Company House) into museums. This area presents the historical diversity of Qatar, which is represented in traditional courtyard houses as well as the Msheireb Prayer Ground, which is nearly 100 years old.

Figure 19. Msheireb Downtown Doha Heritage Quarter (Source: MDD catalog)

Diwan Amiri Quarter

This area is adjacent to the Amiri Diwan and the Al Koot Fort and situated at the Msheireb project's northeast end (Figure 20). It is an extension of the civic and administrative area of Doha. The quarter comprises Diwan Annex, the Qatar National

Archive (an iconic structure storing the cultural and historical documents of Qatar), and the Amiri Guard Building. Conversely, the Emiri Diwan Quarter of the greater Msheireb Urban Regeneration Project focuses on creating a utility structure that is deeply-rooted in Qatari cultural heritage as well as modernism and Western architecture (e.g., greenhouses with glass) (Salama & Wiedman, 2013).

Figure 20. Msheireb Downtown Doha Diwan Amiri Quarter (Source: MDD catalog)

The Msheireb Downtown Project was planned with a clear goal to provide the highest standard of livability and sustainability for the future. As evidenced by the following quote:

> Msheireb Downtown Doha is a shining example of Qatar's determination to innovate, not just for innovation's sake, but with the end goal of improving the quality of life and ensuring that Qatar's heritage and culture evolve as the country grows. (MDD catalog)

Msheireb attempts to combine Qatari heritage with the latest technology focused on sustainability and livability while being centered on rebuilding the built

environment. Green spaces for socialization and intercultural exchange are combined with the return to the Qatari roots to re experience the feel of belonging and community. The creation of mixed-use developments compromises 193,000 m^2 for commercial purposes, 197,000 m^2 for residential buildings, 105,000 m^2 for retail, 116,000 m^2 for hotels, 26,000 m^2 for cultural sites, 600 m^2 for the mosque, 113,000 m^2 for schools, 100,000 m^2 for governments, and 8,000 m^2 for the community. This represents a combined total of 764,000 m^2 and more than 100 buildings.

The main aims of the Msheireb Master Plan include: (MDD catalog)

1. To regenerate the city with the aim of creating a modern Qatari homeland deeply-rooted in Qatari culture and traditions.
2. To integrate the public in Doha for individuals to share walkable amenities and public spaces while living in adjacent neighborhoods.
3. To apply modern sustainable technologies to achieve sustainable development and mitigate the effects of climate change.
4. To enhance the sustainable way of life through a TOD that will decrease traffic congestion.
5. To promote a mixed-use and integrated smart transport system through TOD.

The project's master plan addresses the following key challenges: (MDD catalog)

1. Creating an image that depicts the culture and heritage of Qatar.
2. The effects of modernization on Qatari traditions.
3. The effects of the local climate on the usability of space and urban regeneration developments.
4. Uneven land ownership that affects development.
5. The short-term goals focus on profitability rather than meeting sustainable development goals and promoting the use of green energy.

The design of the area is meant to consume less resources, waste, operation, and reduction in CO2. Msheireb is targeting gold ranking in the Leadership in Energy and Environmental Design (LEED) within all their buildings which is internationally recoginized assessment certificate system established by Green Building Council in the US, on the other hand, only few buildings aspired for platinum ranking. This sustainability strategy aims to stop the use of isolated and energy-intensive land use, urban sprawl, and the over-reliance on car transport that past projects have relied on and fostered. (MDD catalog)

Sustainability is also achieved through the design of the area (Figure 21). For example, streets are oriented to capture fresh air coming from the sea, while the buildings are massed to provide shade in the streets due to their height (reaching 30 floors in many cases) and light color, which helps to reduce the need for air conditioning.The use of photovoltaic solar panels and hot water panels on rooftops facilitates the generation and storage of enough energy for electricity and hot water use in the buildings.

Parks and green areas will be decorated with efficient irrigation systems and endemic plants that survive without the need for a large amount of water. The transportation system, which offers a variety of modes with very frequent rides and stops, will also encourage people to walk or use bicycles due to the pedestrian and bicycle paths. Moreover, it creates a more hospitable environment for walking by enabling streets that are not interfered by cars due to the 10,000 parking spaces available underground at different levels.

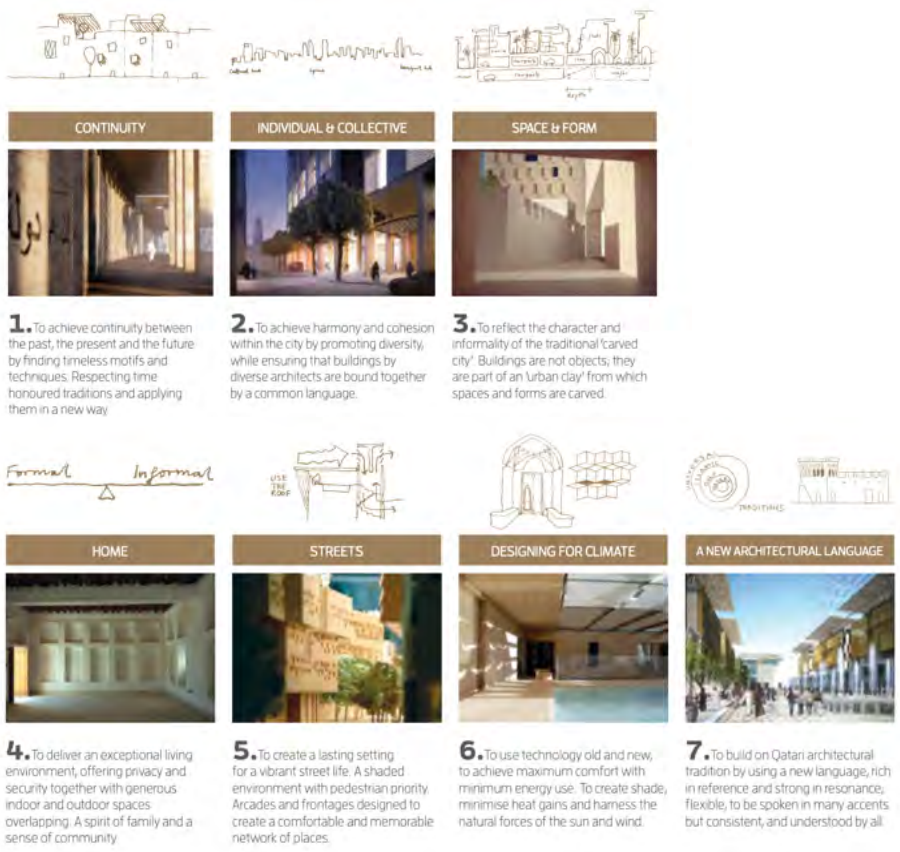

Figure 21. The seven languages of Msheireb project design (Source: MDD catalog)

When the last phase of the project is completed, Msheireb can cater to a residential population of 2,100 people, 20,000 employees, and 50,000 visitors per day. One of the goals of Msheireb is to bring together a "…variety in the demographic mix…" (Law & Underwood, 2012, p. 139) that aims to establish Msheireb as the right place for business and profitable investment, especially for foreigners, in order to attract foreign capital.

In building an image of the country as being full of investment and business opportunities (in addition to branding as meetings, incentives, conferences and exhibitions - MICE), Msheireb implements the five factors that any development should consider: historical context, local governance, image-making, people, and sustainability. However, only when the project is finished will it be possible to

determine whether all of the goals have been achieved. For that purpose, an evaluation of the project will be necessary after some time.

Chapter Summary

The concept of sustainability has come to the fore in recent decades since the necessity to meet the economic need for profit, the needs of people, and the need to preserve resources for the future has become an important issue. Therefore, the concept of sustainability is the base of sustainable urbanism, which combines the need to focus on economic growth and social equity with the need to address environmental concerns using technologies that help to reduce energy waste.

Sustainability has only recently become a focal issue in GCC countries. After the discovery of oil, massive population growth and the changing needs of cities have led to the modernization of cities' infrastructure, transportation, and housing, which has resulted in increased traffic and pollution levels. Notably, the first phase of modernization quickly became obsolete. The continued population growth and related problems led to the formulation of new plans that adopted new urbanism strategies in GCC countries. In particular, Qatar launched the QNV 2030 in 2008, which revolves around four sustainability-focused pillars.

The aim of QNV 2030 is to improve the quality of life of people while considering economic, human, social, and environmental growth and preserving Qatari culture and heritage. To achieve this ambitious goal one, of the most important points is improving livability, which is necessary to offer a high quality of life without stress. Through the QNDF-2032 and the QNDS 1 and 2, QNV 2030 aims to improve livability by redesigning spaces through new infrastructure that reduces traffic, facilitates the regeneration of various areas by implementing mixed-use lands, and creates new and diverse modes of transportation (e.g., Doha Metro) to promote connectivity to the

services and facilities offered at stations, pedestrian areas, parks, and open spaces for public activities to promote social integration, while simultaneously maintaining Qatari heritage. The plan to redesign spaces and build new infrastructure includes the construction of the Doha Metro, which offers the possibility to easily connect various areas of the city while reducing traffic and parking issues. Various areas of the city are connected through TOD projects that were redesigned to meet the needs of residents, workers, visitors, and passengers to strengthen social and environmental economic benefits. In fact, the TOD concept consists of mixed-use development around a well-served transit station that aims to reduce the use of private cars and parking issues while providing residential, business, and leisure space within walking distance of public transport to improve urban quality of life. An example of a sustainable TOD project is Msheireb Downtown Doha, which will improve urban quality of life while preserving built heritage. Msheireb is one of the oldest quarters of Doha where Qatari people were living and trading. It is a clear example of how the principles of new urbanism can be applied to obtain sustainability and thus enhanced livability. However, TOD projects should not only be assessed based on sustainability concerning a particular aspect of life but also for their complete sustainable performance through a variety of measures and indicators that should be formulated according to the assessment needs each time a TOD is assessed.

The purpose of TOD in Msheireb is to enhance urban quality of life and preserve cultural heritage. To achieve this, the most appropriate specific measures to assess quality of life are travel behavior and the built environment. The analysis of indicators that assess travel behavior (e.g., vehicle use, trip length, trip quality, vehicle ownership, and pedestrian accessibility) are important to designing a successful built environment that includes necessary facilities (e.g., the appropriate number of parking spaces for

shoppers, commuters, residents, and passengers). TOD for the built environment includes the assessment of urban fabric quality, pedestrian friendliness, and mixed land-use facilities via specific indicators such as the vibrancy of the area, population density, landscape attractiveness, safety, and the number of mixed-use buildings and services that should be provided for the needs of residents, visitors, businesses, and passengers. Msheireb serves as a good example of implementing the principles of urbanism to help regenerate an area and make it fully sustainable while ensuring that people's present needs are met and resources for future generations' needs are preserved. Moreover, it is also an example of a strong effort to combine what is right for society with what is right for each citizen while attempting to observe ethical rules without jeopardizing morality.

CHAPTER 3: RESEARCH DESIGN

'Urban designing is an argumentative process in which participants in it learn as they go along. They learn about goals and means as perceived by different stakeholders, they learn from the evidence that each provides for its views' (Coleman, 1988, p. 127).

Urban design refers to the interdisciplinary field of research incorporating higher standards of utilization based on the participatory approach design. It incorporate public realm and investors by which the advocate is the urban designer (Brown, 2014). In academic study, especially in urban and architetcureal design fields, it is considered a common practice. It mainly depend on analytical methodologies of participatory observation in order to produce urban planning strategies and plans (Amedeo et al., 2009; Groat & Wang, 2002; Newman, 2007; Taylor et al., 2016; Yin, 2014).

Urban design also involves the execution and planning of societies, streets, and public-oriented domains among the structures, societies, suburbs, and urban settings of cities on a larger scale that is shaped by the needs of everyone. It is formed by multifaceted variables such as lifestyle, the actions of the humans, and their activities. Notably, they can attain their stated goals. The major goal of urban designers is to ensure that city-forming urban areas are accessible, sustainable, desirable, and efficient. Moreover, it entails an interdisciplinary topic that requires an awareness and knowledge of relevant interdisciplinary topics covered by economists, engineers, and sociologists. Thus, the objective of the present study is to investigate and evaluate how Msheireb Downtown Doha was formed by situations that define the program for rebuilding the region while simultaneously ensuring that it is conducive for most people. Hence, this objective is only attainable through the evaluation of relevant ideas covered in the literature, which state the major factors for the establishment of TODs and their

systematic data evaluation about their performance. For the present study, data collection involved the analysis of multidisciplinary literature related to sustainable urbanism, culture, livability, heritage, and their relevance to the Framework for National Growth for Qatar.

To classify the major factors with the intent of creating the TODs (e.g., land use, diversity, urban design, public realm, infrastructure, and accessibility) through a comprehensive evaluation of Msheireb, the latest sustainable urban development in Doha was used as the case study.

This study attempts to combine modeling and observation methodologies that utilize the participatory mode of investigation, direct research, field studies, and on-site evaluation. Variation within the methodology ensures a richer form of development and promises a more reliable outcome via diverse feedback methodologies while considering qualitative urban design and sustainable development based on TOD. This study utilized the observation approach to assess the urban sequence of a sustainable form of development within the region. Notably, this study assesses the development of regions within a radius of 1 km. Based on this context, it made use of the TOD methodology to assess the chosen radius via associated indicators to simultaneously enhance quality of life and ensure the preservation of the built form of heritage.

Research Methodology [Qualitative]

The research methodology is divided into three categories;

1. The theoretical framework entails the overall picture regarding urbanism in a geographical context as well as a conceptual review of the associated concepts (i.e., definitions regarding the sustainable form of urbanism, transit-based development, and the cultural form of heritage with specific reference to Qatar). An evaluation of sustainable TOD in Qatar is provided based on TOD

assessment tool.

2. An applicable methodology using TOD evaluation indices is presented via an analysis of urban design and sustainable development based on the context of Qatar. The analysis entailed a case study of the selected area based on TOD and two factors: built environment diversity and travel behavior.
3. The suggested design of the current urban master plan should meet every TOD indicator. The urban planning suggestions will define the model for other areas. An index of TOD evaluation was adopted by considering references to various indicators necessary to attain the study goals.

The literature review in the previous chapter serves as the theoretical framework for this study. For instance, the review presents the data collection tool, the mixture of research methodology, and the methodology itself. It also serves as an embedded study following the examination of major objectives and offers insight into the issue. Thus, the literature review explores the disciplinary context of TOD and related topics to understand the issues, opportunities, and challenges associated with this sensitive and sustainable form of adaptation, growth, and development in Qatar from a sociocultural perspective. Simultaneously, it also offers a summarized overview of studies on urban growth and development in Qatar to assess the potential need for a TOD planning scheme.

Studies of local and regional urbanism and their historical context were the primary and secondary sources of conceptual data. Exploration of the TOD ideology and it being based on the sustainable development umbrella and was also a primary source of basic knowledge of TOD as a conceptual model. This process involved the assessment of various detailed cases from various governmental bodies to collect data associated with

transportation and urban planning systems as well as their rules and regulations within the region. For the literature review, the TOD evaluation index approach was explored. This exploration encompassed ideas concerning urbanism within Qatar and the Western urban model. The effects associated with sociocultural aspects of the TOD were also investigated. Notably, some of the most valuable theoretical references were extracted from academic papers.

The literature review contributed to the collection of information on major TOD planning concepts within global and domestic contexts and also initiated an exploration of the suggested neighborhood for this study. It simultaneously entailed defining and collecting knowledge on TOD indices for assessing the performance of a possible compact public transport system.

In this exploration, the urbanism of the region and nearby areas was filed in books that were considered essential sources for the examination of relevant information. Additionally, it involved the study of numerous drawings archived by multi-administrative specialists to gather information on transportation frameworks, metropolitan planning, as well as local rules and guidelines. Regarding the writing of this thesis, a chosen area was investigated based on the TOD standards approach. This involved utilizing known information about neighborhood urbanism in Qatar and the Western urban model to serve as an indication for additional examination. The impact of socio-cultural aspect on TOD neighborhoods is additionally being researched.

The literature review aided in (1) gathering data on TOD from global and regional perspectives, (2) starting the investigation of the chosen area of study, and (3) characterizing TOD evaluation performance in modern urban settings. TODs have become well-known models that empower metropolitan development. To investigate the degree to which existing regions or settlements can be changed to successful travel

destinations, it is important to research and characterize evaluation records for TOD to estimate the adequacy of establishing a public hub with minimal vehicular traffic. As proposed by Renne (2009), through the use of exhaustive assessment indices, physical performance can be categorized into five key groups: (1) travel behavior, (2) economic environment conditions, (3) environmental diversity, (4) built environment diversity, and (5) social diversity (Renne 2009)

TOD Assessment Indices

City planners contend that modern metropolitan planning should be based on procedures aimed at decreasing the use of private vehicles and expanding the utilization of public transportation. Therefore, this will permit (i) increased personal metropolitan satisfaction by delivering livable urban communities, (ii) reduced costs per family unit, land use shortcomings, and urban sprawling. Subsequently, cities need to incorporate public trabsportation into TOD to be integrated.

TODs have become mainstream models for new development and renewal in and around travel corridors. Thus, investigating and comprehending the degree to which existing zones or settlements can be applied, it is fundamental to characterize the evaluation lists for TOD to survey urban changes and promote the movement from suburbia to compact public transport-oriented hubs. As proposed by Renne and Well (2006), the utilization of a holistic assessment indices tool (grounded on physical performance measures), can be organized into five key classes: nature of travel, economic diversity, built environment diversity, social diversity, and ecological diversity.

In 2020, (1) interviews with five experts from different administrative organizations working implicitly with TOD (the MME, Qatar Rail (QR), and Ashghal Public Works Authority (PWA)) were conducted. (2) Moreover, 100 residents of Qatar

used the Metro station participated in a questionnaire on TOD applied principles in the area. Out of the five classifications considered, travel behavior and the diversity of the built environment were identified as the most appropriate for evaluating the presentation of the chosen TOD (Appendix A presents copies of the Questionnaire and interview forms). Specifically, the items in the lists that follow were recognized by participants as most appropriate for the subjective evaluation of the two chosen classifications below, and as seen in table 7:

Travel behavior:

- Parking (number of parking spots for customers, suburbanites, and residents).
- Traffic stream (transit ridership, number of excursions to/from train stations, mileage traveled by residents in vehicles).

Built environment diversity:

- Urban design quality (building facade, metropolitan texture quality, presence of people on foot, concealed porches, organization).
- Pedestrian applicability (subjective rating of streetscape, walker movement).
- Diverse land use (number of mixed-use offices).

Table 7. Indicators measured in the research study (Source: Renne 2008, analyzed by the author)

Indicator	Measure
Travel behavior	Parking Mobility
Built environment	Design quality Urban fabric Pedestrian friendliness Land use

Case Study [Strategy]

The purposes of this examination is (i) to evaluate the manageability and groundbreaking capability of the "Msheireb Downtown Doha" TOD as a metropolitan socioeconomic hub, (ii) to provide appropriate answers regarding metropolitan personal satisfaction in the area, and (iii) to anticipate TOD as the future model for practical urbanism in Qatar. Since urban design is an interdisciplinary field that requires participatory approaches, the chosen case study was first investigated through an assortment of oral and visual information. Participation in classes led by Arch. Fatima Fawzi, a senior designer for Msheireb Downtown Doha, was important to understanding the master plan measures. Site visits inside the zone and roads were directed by Msheireb Properties and provided direct data on the desire for and testing of this feasible advancement venture. Msheireb properties also provided visual documentation, site guides for the region, site visits, perceptions, structural drawings, and before and after photos of the site.

Data Collection Methods

Information was gathered to answer three sub-questions:

What are the appraisal rules for TOD as an instrument for assessing the current state of the examined region, and by what means can legacy conservation be accomplished in a similar sense? What is the current state of TOD in the study area (Msheireb Downtown Doha), and what knowledge gaps should be addressed? What are the metropolitan planning methods and rules for retrofitting TOD in the study area? The following strategy was used to address these questions:

1. The literature review and the site analysis for addressing the assessment criteria tool for TOD through the following:
    - Literature review (i.e., the 6 Ds, travel behavior, and built environment, etc.).

- Master plan analysis (i.e., heritage preservation, sustainable development, TOD implication, etc.).
- Existing policies analysis (i.e., policies for intervention, etc.).

2. The site analysis assessed existing obstructions and gaps in the study area through:
    - Maps/visual material collected from different governmental authorities, site visits, and observations.
    - Focus group discussions (with MME, Msheireb Properties, QR, ASHGHAL etc.).
    - Structured interviews (with MME, Msheireb Properties, QR, ASHGHAL etc.).
3. Findings as per TOD categories helped to determine:
    - The urban design (i.e., master plan).
    - The urban planning (i.e., recommendations and criteria for every category).

Since the examination focused on metropolitan TOD examples in practical situations, exploring the context was a primary focal point of the study. TOD, which contributed in the new urbanism hypothesis and is characterized as the primary point of tactical urbanism, was utilized to dissect/survey the zone being examined with feasible and social criticism by utilizing two out of the five measures proposed by Renne et al. (2005) which is travel behavior and built environment.

TOD recently has become a mainstream apparatus to advance development. In the West, various individuals and associations are being empowered by TOD since it can prompt more significant levels of travel ridership and energize financial situations, ecological protection, and expanded social variety in networks and districts. These all-

encompassing objectives are summed up in the Ahwahnee Principles (introduced in 1991) that guide new urbanism development (Newman & Kenworthy, 1999). The principles movement has become synonymous with the push for TOD in the United States since the early years of the 1990s. Notably, it is difficult to characterize all urbanist projects as TOD; however, most TOD advances the fundamental ideas of new urbanism. The focal point of investigation in this exploratory study was restricted to the list of conducted travel and the variety of assembled conditions, both of which are characterized as the most compelling markers of TOD evaluation files. The examination of conducted travel involved information on stopping and portability modes.

Built condition diversity was addressed via plan quality, urban texture, pedestrian benevolence, and land use. The accompanying advances depict the cycle of the previous approach for the TOD appraisal list:

- TODs application was investigated in the locale.
- Several pointers were utilized for evaluation in a chosen territory around a metro station.
- Maps/drawings/pictures of the chosen region were gathered and prepared for investigation.
- Walking perception/interviews/surveys in the zone were recorded for additional examination.
- An urban plan plot to propose an improved groundbreaking strategy.
- Metropolitan planning rules and guidelines.
- Essential and secondary sources.

In light of the goal of dissecting a socially supportable urban area example of TOD in Qatar, a literature review of sustainable urbanism history and social legacy was

used to cover the disciplinary setting of this exploration. Correspondingly, contextual analysis information was gathered, examined, and dissected to provide a comprehensive assessment. It is essential to note that the assortment of data, plans, and sketches was provided by legislative specialists dealing with transportation, land use, and urban planning sectors (e.g., members of the Ministry of Municipality and environment, Qatar Rail, Ashghal PWA). Information was also provided by the beautification committe group in Doha and the Qatar Museums Authority. The examination of the study area covers the following factors: Travel behavior and built environment indicators. The investigation of the chosen area depended on demonstrating that these two indicators were optimal, while exploration of TOD ideas, evaluation instruments, and applications in the study area were used to comprehend the urban planning strategies that should be utilized, their social effect, and their connection to TOD.

General information about the investigation region was gathered through oral and visual information. Oral information was assembled by attending a few seminars and having discussions on transportation framework and improvements in Qatar (e.g., a workshop hosted by Arch. Fatima Fawzi (Senior Designer at Msheireb Properties), Eng. Dr. Saad Al Mohannadi (President of Ashghal public works), and the QR Transportation Director. Such seminars and talks provided background data on the desires and difficulties of social sustainable metropolitan advancement in Doha and assessed urbanism before the discovery of natural sources in the 1950s. The process of examination relied on a few visits since the majority of participants availability were limited. Information on architectural plans, standards, guidelines, and urban planning quality were gathered from the organizations liable for this sector in Qatar. The chosen TOD area aims to foster economic improvement and permit access for all. The study

area initially worked to follow all manageable TOD norms.

Discussions and interviews were organized between August and September 2020 with five members from the chosen governmental sectors. Later on, members were required to complete a list of questions via email (Appendix B presents a copy of the questions form) to determine the significance of each step for the selected TOD. Likewise, 100 local residents were engaged and requested to examine and assess the suggested indices and whether the survey require further investigation. Notably, many participants outlined there is an urge to assess air quality effect as one of TOD indicators to reevaluate environmental considerations of TOD and the other issue was to reconsider the importance of cultural identity and heritage within the area of TOD selected due to its relativeness within the community. Moreover, the exploratory examination used inductive and deductive techniques based on participatory perceptions, direct qualitative observation, field studies, and on-site investigations.

Since the collection of information examined for the studied zone featured the issue of sustainability, it is critical to notice Qatar in fusing their venture toward more sustianble developmenet within this era. This type of speculation will most likely increase collective mindfulness since the provision of services is satisfactory for everyone involved. To guarantee the correct execution of rules and guidelines regarding sustainable urban planning, capable specialists and authorities were identified to accomplish the goals of QNV 2030 (QNDF, 2014). Regarding secondary sources, the author derived concepts from an article titled, “An Integrated Design Strategy for the Urban Regeneration of West Bay, Business District Of Doha, Qatar,” (Al-Thani & Furlan, 2020) which provides a summary of the thesis approach and methodology. It aligns with the thesis and provides an assessed and abbreviated adaptation for distribution purposes. The majority of the applicable information on urbanism in the

GCC and Qatar are explored in-depth in the westbay article, which was examined in the literature review section in this thesis.

Chapter Summary

Urban planning includes the modification and reshaping of the physical highlights of city locales, neighborhoods, regions, roads, and public spaces with the point of making urban areas more livable and sustainable. Urban design contribute to open spaces and configurations based on human needs by tending to numerous physical, social, practical, and natural elements. Currently, one of the significant difficulties of urban planning is the over-reliance on vehicular access to characterize the manufactured condition, either deliberately or by chance. Car-based planning transformed the needs of urban planning since the city's format had to incorporate streets and expressways, while metropolitan regions had to spread. Such practices isolated the city and smaller neighborhoods, which influenced social associations and the livability of open public spaces. The notion of new urbanism involves making a sustainable assembled condition through smallness and increasing livable and walkable open spaces. Using TOD and improvements focused on walkability would prompt different advantages on the metropolitan scale, including the decrease of natural effects. The conservative neighborhood is another methodology of new urbanism used to diminish travel and limit endless suburbs. Based on the concise literature review done previously, it is unmistakable that walkability, the availability of different types of public transportation, connectivity, mixed-use developments, accessible networks, and green spaces are significant elements of the livable city model.

Research method is a commonly applied methodology in urbanism and architecture that involves two stages: (1) regional examination of the investigated zone and (2) vision initiation as an approach to deliver concrete ideas for the study area's

transformation through explicit planning devices. Specific focus is given to the transaction between regional examination (of on-site investigations) and planning investigations (proposal for a master plan) (Fucile et al., 2017; Secchi, 2007; Tadi et al., 2017). This systemic study using the design approach consisted of researching and considering potential interdependencies and opening possibilities between streams at an urban planning and design scale. Likewise, the proposed structure adds to the definition of a complete methodology for the urban aregeneration of the chosen site and ultimately provides knowledge related to interdisciplinary exploration and administration for TOD in Qatar and other GCC nations. After setting the theoretical background and examination of the site conditions, the authors note several key factors that respond to the identified challenges and provided alternative perspectives and design strategies on the issues raised in the study.

CHAPTER 4: FINDINGS

Data Collection

The data collection, analysis, and results of this study will be discussed in this chapter. The study setting was the transportation system, and data were collected on this topic. Also, the chosen case study methods were documented, which includes data collection, photographic or illustrative documentation, and the analysis of sites and master plans. This documentation aimed to study the case study and evaluate the TOD approach to the selected case context. The data analysis section examines travel behavior and the built environment within the selected area of investigation through the application of TOD principles. The results and discussion section fill the analysis gaps of TODs application related to the evaluation criteria of travel behavior and built environment indicators. The outcomes measure the hypothesis of this research study, which examine if the current developments lack linkage between each other. Additionally, the outcomes aim to deliver answers to the research questions, significantly the question of whether the urban form and transport system can be integrated to retrofit TODs principles in the selected area alongside urban planning/design strategies.

Railway System in Qatar

Qatar faces common problems associated with an increasing population and the higher utilization of privately-owned vehicles. The increasing number of vehicles has necessitated the expansion of transport systems and networks to accommodate the rising population, which corresponds to a higher demand for public transportation. For example, in the past two decades, the number of road users (pedestrians and vehicles) has increased significantly. As result, key public transport systems such as existing Qatari bus services face various limitations and constraints, particularly in the country's

capital. Doha has an extensive bus system that includes 27 bus transport systems that operate within the capital and 14 bus transportation lines plying various routes and connecting the city to various towns and regions throughout the nation. The main users of bus services are often low- and middle-income individuals and the service's rate of recurrence ranges from 30 to 60 minutes. Due to the notorious traffic congestion in Doha, it is observed that buses frequently reach their destinations late, especially during peak/rush hours. Therefore, most people choose taxis over buses as an alternative means of transportation. The Qatari government has constructed the first railway system in Doha due to the rapid urbanization that led to a sudden growth of the transportation network in the nation. The initial phase of the metro will be ready before the 2022 FIFA World Cup, while the final phases will be completed four years later (2026). The purpose of the metro network is to connect the city using 100 stations with four lines in an overall system length of approximately 360 km which include stops at the new Doha International Airport, the hotel areas, villages, stadiums, key residential and commercial regions, as well as other cities and towns (Shaaban & Hassan, 2014).

The Doha Metro project is a large Qatari government project that aims to create a major national railway system with a budget of approximately 9 billion USD. The current launched phase is made up of three metro lines (red, green, and yellow) centered in Doha, (figure 22) with an additional line that will open in the future. The construction process of the metro lines began in 2013 and consists of two phases. Phase 1 involves the production of three lines with 37 stations. Phase 2 will include the initiation of blue line and extension of all current lines and the addition of 60 more stations. All these expansion are planned to be completed by 2026 (Qatar Rail).

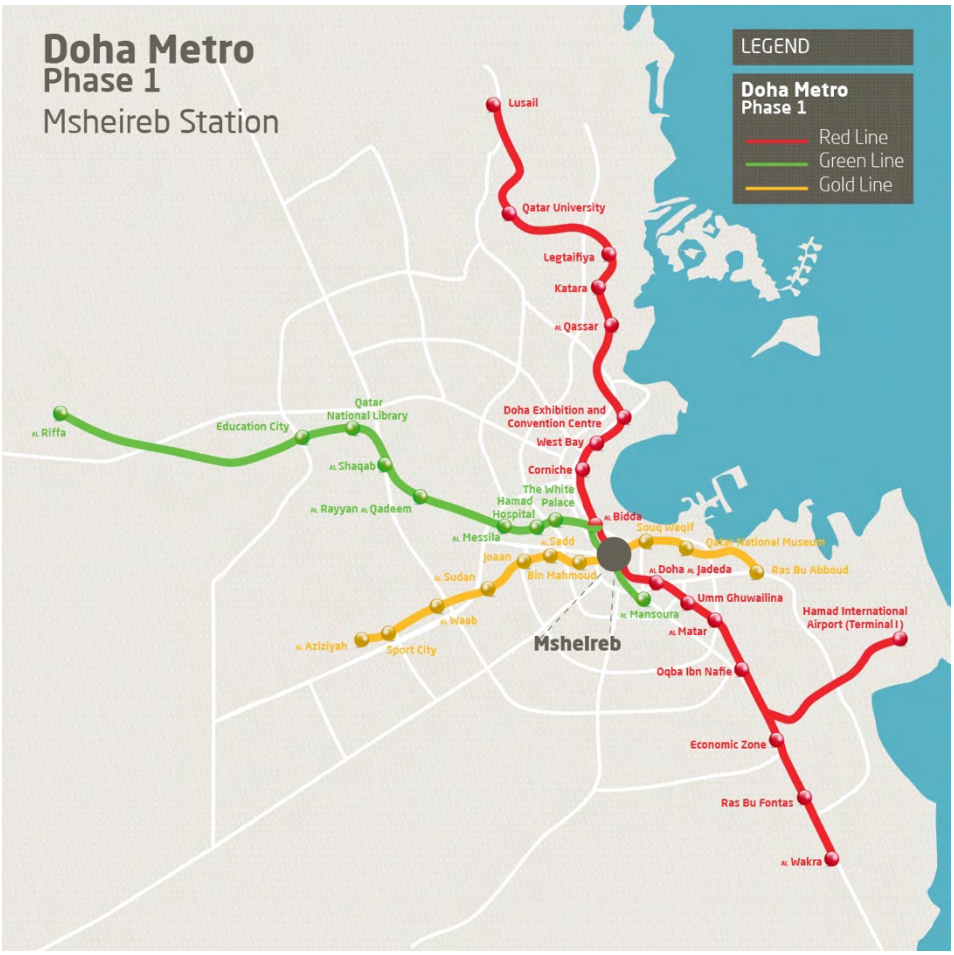

Figure 22. Doha Metro project network map (Source: Qatar Rail)

The network connects Qatar's main residential and industrial hubs through a high quality railway system with high end amenities moving people in a short travel distance with high speed getting up to 350 km/h. The metro network is planned across Qatar to connect major facilities such as, neighborhoods, world cup events, and hotels. The network will also be exteneded to link Hamad international Airport and Doha port. The lines run through tunnels and on an overhead railway. The majority of underground Doha Metro lines are at the forefront when it comes to its generation. Professional tunnel boring machines (TBM) have beed utilized for the excavation of the underground. The approach to sustainability is implemented into the Doha metro

network and verified by the achievement of Global Sustainability Assessment System (GSAS) Railways for the stations (Qatar Rail).

The current working lines are the following: red line which includes 18 stations, while the green and yellow lines have 11 stations each. The red line runs from north to south for a distance of 40km, whereas green line runs from east to west covering 22km, and the yellow goes from east to west covering 14km. Red line which is the longest runs from the coastal road of Hamad Airport to Lusail, Westbay and Pearl with an interchange connected to the Education city. Yellow line runs east-west between Hamad Airport, old airport, and industrial areas, while the green line runs from the middle of Doha to the west districts of Education City, as seen in (Figure 22).

Currently, most individuals do not use Qatar's exisiting transportation system (Shaaban & Kim, 2016a, 2016b). Thus, the construction and completion of the new metro service will have significant impacts, which will include attracting an adequate number of commuters (e.g., regular transit users) and—most importantly—reducing traffic congestion in Doha. Also, the design of the metro services will increase mobility inside Doha since many individuals will be switching from buses to metro services due to their perceived efficiency. The metro service focuses on promoting pedestrian, vehicular, and cyclist movements within the metropolitan areas of the city. For instance, streets adjacent to the transit stations will play an important role in supporting diverse modes of movement, including walking, cycling, and vehicle use (figure 23). Therefore, an assessment critera was essential to evaluate the livaility surrounding metro stations. Catchment areas (i.e., station localities) produce numerous passengers (i.e., people) using public transport systems.

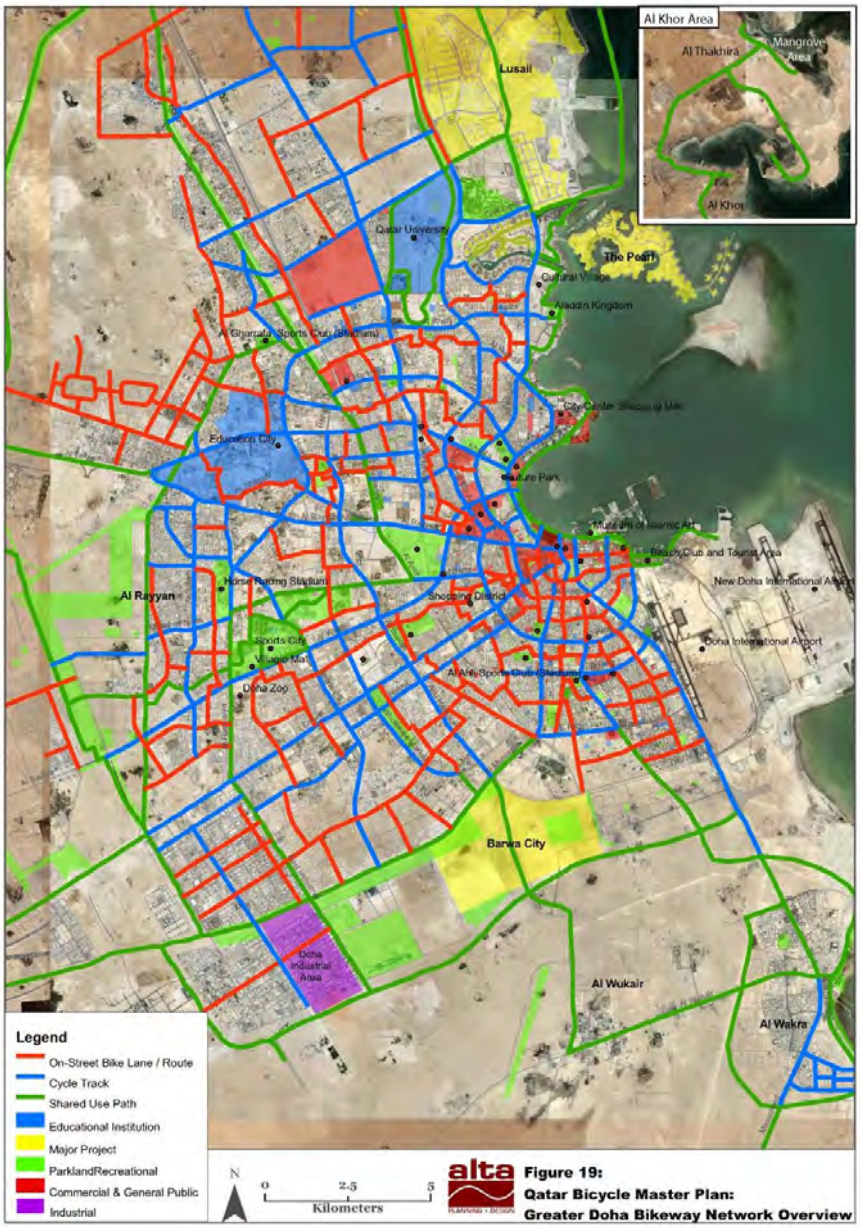

Figure 23. Qatar bicycle network system (Source: MOTC)

Landex et al. (2006) found that streets that surround or are adjacent to transit stations tend to be critical in supporting numerous transportation modes, which include bicyclists, pedestrians, and/or buses, among other key users. Thus, a detailed analysis of these catchment areas will provide useful insights into how to enhance and promote a TOD Doha while increasing the accessibility of stations.

TOD refers to the expansion of existing transport systems to promote the

increased use of transit nodes while meeting the needs of different types of users, such as bikers, cyclists, walkers, etc. The purpose of TOD is to decrease the number of private vehicles, which will result in reduced carbon and greenhouse gas emissions. Also, it will focus on promoting healthier behaviors and reducing congestion, which supports a reduction in the number of vehicles used for travel while encouraging people to use the new metro transit systems due to improved service delivery and efficiency (Belzer & Autler, 2002).

The purpose of this study is to evaluate the key indicators of TOD to assess/measure the diversity and mobility in the selected catchment. Specifically, the main objective of this research was to investigate the connectiveness among areas such as design quality, transportation modes, walkability, and access/use of sidewalks in the chosen metro station in Qatar's capital, Doha. Since the selected major station where red, green, and yellow lines intersecting is Msheireb Metro station, it is investigated and analyzed with regard to its urban form, transportation facilities, urban connectivity, and user experience to demonstrate its usefulness while considering travel behavior and built environment indicators as part of TOD assessment.

Msheireb Metro Station

Msheireb Metro Station, a rapid transit station, is the largest station in Doha. Its geographical location is Downtown Doha. Msheireb Metro Station is anchored at the junction of Al Diwan and Wadi Msheireb streets (Figure 24). The station began construction in 2013 and opened to the public in 2019. Built as an eco-friendly structure, it is the main interchange station of the Doha Metro network and the only Doha Metro station to be certified under both GSAS and LEED. Since Msheireb Downtown Doha is constructed above this station, it will become a landmark in the city due to Msheireb's urban restoration project. Thus, it is considered the most important station in the Doha Metro system. Dr. Markus Demmler noted, "This is one of the biggest metro stations anywhere in the world."

Figure 24. Msheireb Metro Station railway lines (Source: Msheireb Properties, annotated by the author)

Msheireb Metro Station is a major station where red, green, and yellow lines intersect. It stands out as the point where the three metro lines run in a parallel cross with the yellow line situated underneath (Figure 25). It operates as a transfer station between the Doha metro's red, yellow and green lines. Red and green lines are assigned with the same platforms adjacent to each other, whereas the platforms of the yellow lines are situated on the east of the rest and it runs vertically perpendicularly to the other lines. On the other hand, Msheireb station creates a link between passengers and proposed stadiums. (Figure 24)

Figure 25. Msheireb Metro Station map (Source: Msheireb Properties, annotated by the author)

The station is characterized by a unique landmark (an extravagant entrance shelter) that is used by both locals and tourists (Figure 26). It is characterized by an immensely sheltered entrance that passengers connect with throughout the station (Figures 27 and 28). The canopy is designed using traditional architectural elements in an attempt to

blend harmoniously with nearby buildings in Msheireb Downtown Doha. The transfer areas and lobby are present in level B1, while transfer zones to the red and green line platforms are present in level B2, and platforms for the yellow line are present at level B3. Enhanced aspects of indoor environments are considered, such as thermal comfort and computational fluid dynamics (CFD) for occupants to recieve air at relaxing speed, temperature, and humidity. In addition, a sensor of CO2 available in compact spaces and platforms to enhance air movement. Moreover, acoustic treatment of MEP, walls and cielings to minimize the background noisr and reverberation. More qualities involve uniform lighting and illumination, ventilation system, and low-emission supplies and no smoking within the station (Qatar Rail).

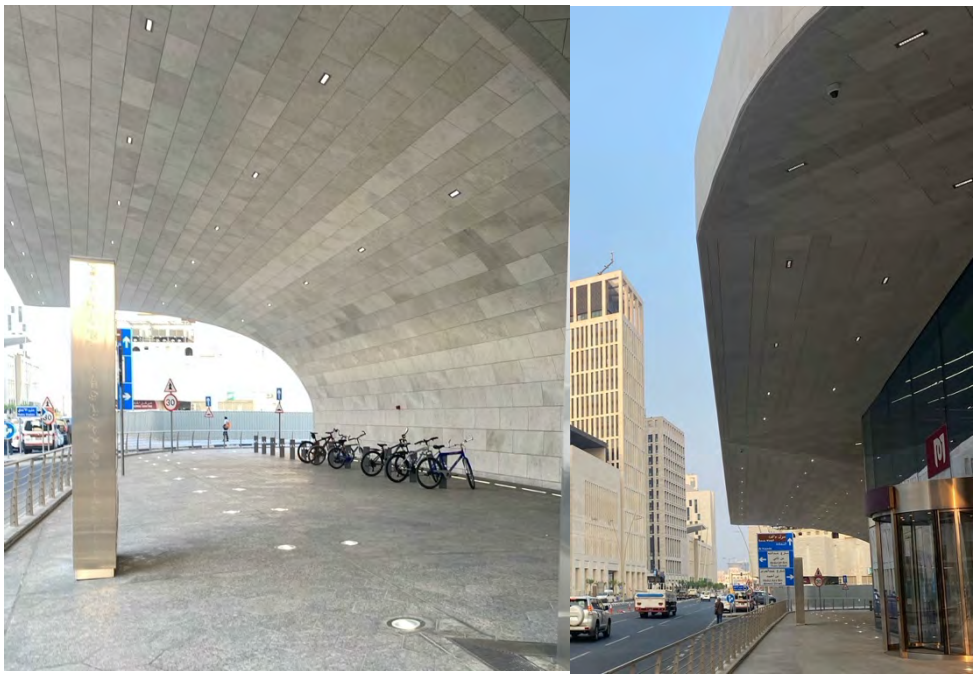

Figure 26. Msheireb Metro Station entrance shelter (Source: Author)

Figure 27. Msheireb Metro Station section (Source: Qatar Rail, annotated by the author)

Figure 28. Msheireb Metro Station interior renders (Source: Qatar Rail)

Msheireb History

Msheireb, is a region that comprises 310,000 km^2 of land. The catchment area comprises the Msheireb Downtown Doha project due to its proximity, operational functionality, and prime location (Figure 29). The history of Doha dates back to more

than a century ago when the Al Thani tribe settled there in 1847 with other clans in Al Bidaa. While it began as a fishing village (Adham, 2008). It has grown to become a modern city in the Middle East and the Arab world. Early settlers settled in the fishing village due to its source of water (i.e., Wadi Sail) and proximity to the coastline for trade purposes. People settled in Al Bidaa and carried out economic developments along the coastline, which was divided into eight settlements that belonged to Qatari tribes and the clans/groups of Persian immigrants. Although the key centers of social interaction included the mosque, market, and harbor, every social clan/group lived in their designated region (Buainain, 1999).

Figure 29. Location of Msheireb Downtown Doha (Source: MDD catalog)

Through time, Al Bidaa was named Doha. Msheireb settlements represent the old historic city center of Al Bidaa. The old original Msheireb neighborhood was the central business district of Doha, which was linked to the waterfronts via corniche route. As the population increased over the years, the inhabitants maintained a close association with the coastline. The traditional local markets, such as Souq Waqif, were connected to old *wadi* routes that enabled increased accessibility and movement over the area. Over the century, the Souq Waqif and *wadi* was renamed Msheireb or Al Kahraba Street. Al Kahraba Street is historically significant because it was the first street to have an electricity connection in the nation. Thus, it played an important role as a commercial hub. The construction of structures in Msheireb occured using local materials and the design of most structures, transport networks, and vehicular movements were inspired by Islamic or Arabic architecture (Jaidah & Bourennane, 2009). The high density of its built regions was influenced by the growth of Doha as a commercial center. The area is surrounded by many focal neighborhoods such as Al Asmakh and Al Najada. (Figure 30)

The hot climate led to the design of shades on exposed walls and walkways to reduce the glare of the sun and to provide shade for walkers, respectively (Wiedmann et al., 2013) (figure 30). The market in Doha extended in key roads from port to the inland areas, featuring generally, a typical design of Islamic port cities. Before oil discovery, the central business district of Doha was characterized by the Friday mosque, palace, and traditional markets, which played a crucial role in the growth of the city. The oil/gas exploration and mining that began in the 1950s led to the exponential growth and development that transformed Doha into a modern city (Figure 31). The development of Doha ushered in modern urbanism through master plan design, construction, and implementation.

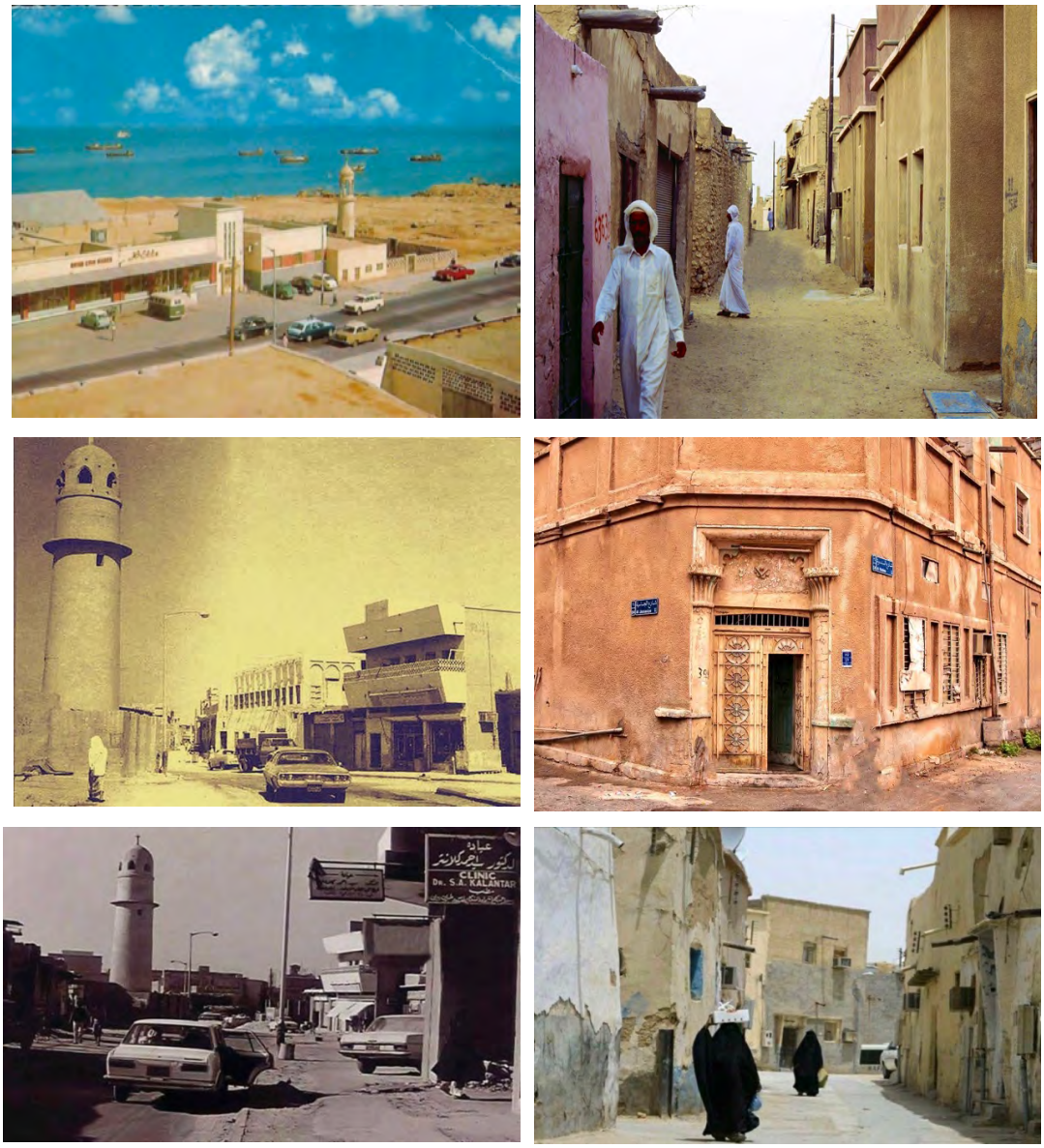

Figure 30. Old Doha and Al Asmakh area between 1950 and 1980 (Source: Archives of Atiq AlSulaiti & Sultan AlJassim)

Figure 31. The Al Najada and Al Asmakh areas during the late 1950s (left), mid-1940s (top right), and late 1970s (bottom right) (Source: Archives of Atiq AlSulaiti & Sultan AlJassim)

Msheireb's population was diverse and consisted of people from various countries and cultures; thus, the regeneration plan integrated the cultural and historical uniqueness of Msheireb. Most of the buildings are of similar height and color. However, in recent years, Msheireb has become a site of interest after being designated for Msheireb Downtown Doha, which aims to restore the cultural heritage of Qatar and redefine the route of Doha's development.

Msheireb Downtown Doha Project: The Heart of Doha

The strategic purpose of the project focuses on reversing the development model dependent on energy-intensive structures (or energy inefficient structures), isolated land use, and transportation systems. The goal of the project is to revive the old commercial district using a modern architectural language inspired by cultural heritage

value as well as the traditional architecture of Qatar. Additionally, the project signifies the country's need to ensure the growth and evolution of Qatari culture/heritage while meeting the needs of the ever-growing population and showcasing the country's ability to innovate through smart modern cities. This sustainable project focuses on regenerating the traditional commercial center with a budget of approximately 20 billion QAR. The main sponsors of this project include the Qatar Foundation and the government. Her Highness Sheikha Mozah Bint Nasser will head the project. Msheireb Properties undertook the design and will implement the project. Also, the project will apply the latest sustainable technologies (i.e., sustainable construction materials) while following the highest standards in green building design, which will promote sustainable development and mitigate the effects of climate change, respectively.

Ensuring thermal comfort for all users remains a challenge in Qatar due to its hot climate. The ancient *fereej* (a typical old neighborhood) was used to cool building structures and meet the various needs of users. However, most people now have air conditioning installed in their properties (homes or offices) for cooling. Thus, the current project will promote the thermal comfort of users by using an all-inclusive strategy to deal with issues related to walking distance, vehicular distance and movement, as well as the provision of shade. The master plan will integrate the "cul-de-sac" concept (a narrow passage), which is borrowed from Islamic architecture (Figure 32). Also, the master plan will use the *fereej* ideology in developing the master plan to provide cooling. The project focuses on establishing a fine-grain urban fabric that includes the diversion of vehicles to underground services and parking while creating adequate vehicular access as well as shade, thus facilitating modernized urban life. The project focuses on preserving the sense of traditional heritage and culture while adapting to modernization. The project aim to have long-term benefits for the city and

significant implications on the transport system and sustainable living. The sustainable neighborhood goals and principles—including signage systems, wayfinding, open spaces, traditional local architecture, parking strategies, transportation network systems, walkability, and/or pedestrian paths—are being factored into the regeneration project.

Data Analysis

Site Analysis

The data were collected through interviews and observation (i.e., visual data such as site photographs and maps). The area consists of various streets serving as access points within the adjacent areas. These streets, which border the neighborhoods, include Al Diwan, Al Rayan Jassim, Bin Mohamed, and Msheireb streets (Figure 32 and 33).

The Master Plan

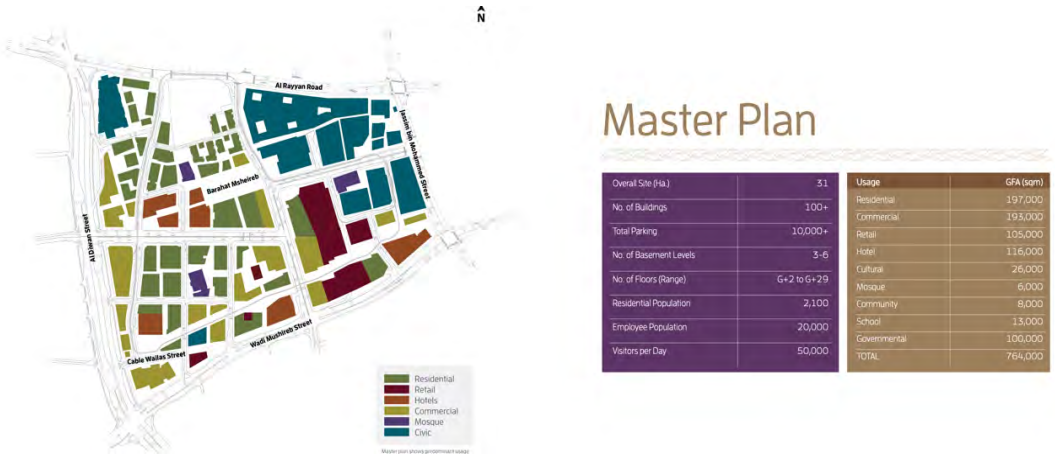

Figure 32. Msheireb Downtown Doha Master Plan (Source: MDD catalog)

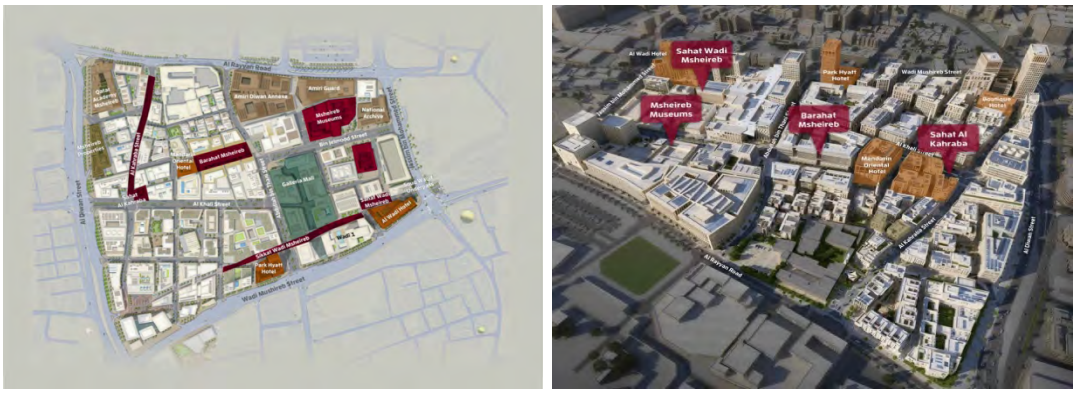

Figure 33. Msheireb Downtown Doha land uses (Source: MDD catalog)

Sustainable strategies were used in the design of the Msheireb Downtown Doha Master Plan, such as accessibility, parking, traffic flow strategies, street design strategies, and pedestrian orientation. Msheireb Downtown Doha is being analyzed to demonstrate that the nieghborhood can achieve it aims by addressing urban issues and implementing TOD indicators adopted in the study such as, Travel behavior and built envrionment. The aim is to examine the relationship and connection of Msheireb Metro Station with the rest of the neighborhood, as shown in figure 34 the entrances and exits around the selected metro station. The following sections outline significant observations of the existing study area and suggestions that could help planners achieve a sustainable neighborhood.

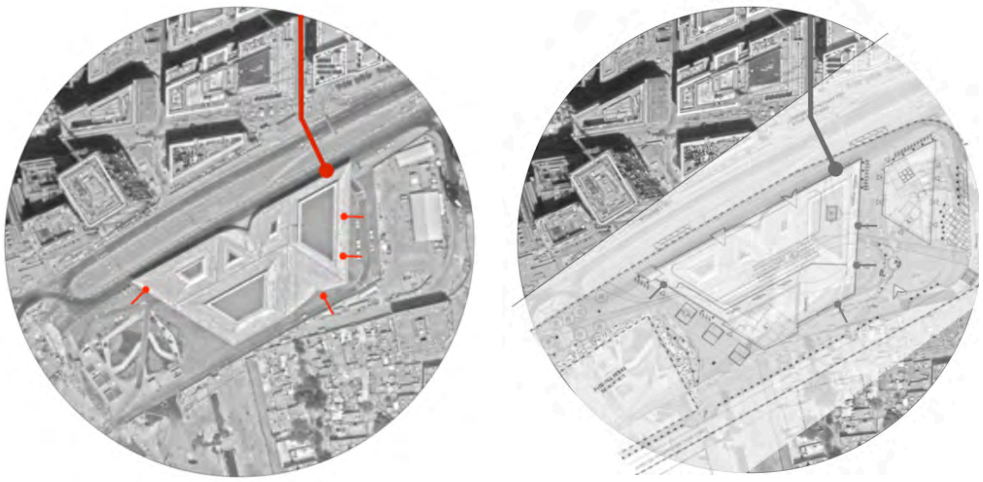

Figure 34. Msheireb Metro Station map (Source: Qatar Rail, analyzed by the author)

Site observations were made to measure certain aspects of the Msheireb metro station to collect data regarding the most important features of the station that users may experience. These measures include (1) the demographics of users, (2) crowdedness and peak times, (3) convenience for pedestrians within and outside of the station with clear signage, (4) connections such as the presence of taxis and buses within the metro station, (5) the presence of free and shaded parking, (6) the presence of facilities such as advertising screens, waiting areas, and handicapped services, (7) safe environment, and (8) tickets stations within the metro.

It is observed that Msheireb Metro Station is the busiest station due to its strategic location and its interchange system design. During the morning, many expat employees use the metro station to change lines or settle. In the evenings, the metro station peaks to the point where one can barely find a seat. The same trend occurs on weekends, except locals were increasingly noticed in the metro on their way to visit the Msheireb development facilities. It was noticed that coming from northern neighborhood stations to Msheireb Metro Station consumes more time than in a car. (Shown in Figure 35)

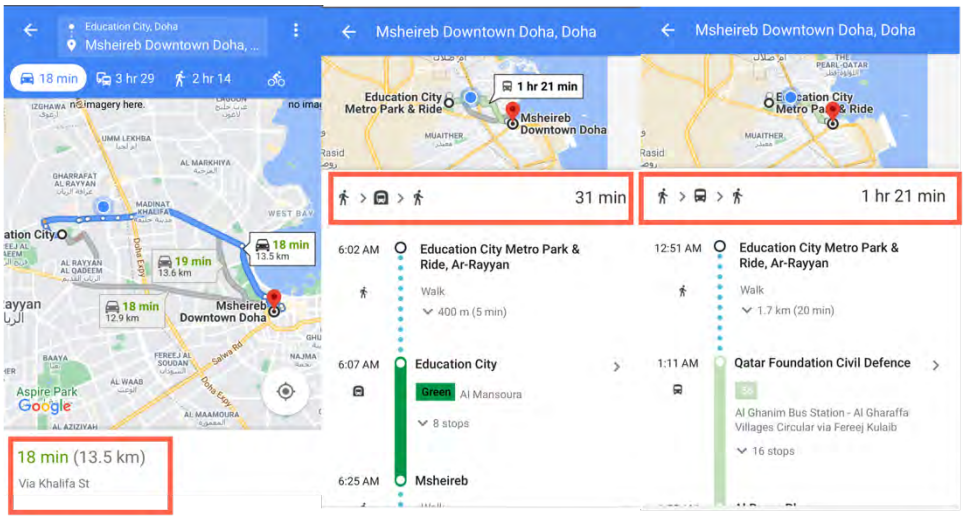

Figure 35. Difference in mobility time to Msheireb by car, bus and metro (Source: Google map, input by author)

A questionnaire was completed by 100 participants. Overall, 70% of participants were female and 46% of the respondents were aged 25–34. The sample was 75% Qatari and 61% were employees. Moreover, 66% of the participants were living outside of Doha, which implies that they require public transportation to reach central Doha. The metro system was used on-daily basis by only 5% of particpants, which is negative, in light of 16% using it monthly. While the majority of the population is not using the metro system since they prefer to drive cars, they stated that the stations cannot be easily accessed. On a positive note, 49% of participants were willing to change their transportation habits. Many respondents claimed that it is faster to arrive at their destination when using their private cars since using the metro takes time and involves driving their cars before and after. Others stated that since metro stations are far from residential areas, they do not use them. Many others used the metro for entertainment purposes only since it is not connected to where they live or work. Few did not use the metro at all since they are still unfamiliar with the lines and stops. A

diversity of metro stations were visited by the public, and the most visited station was Msheireb, followed by Katara and then Doha Exhibition and Conventiion centre (DECC) stations. The least-used metro stations were Alshaqab, Hamad hospital, and Education City. Since these are the least-visited stations, a thorough investigation is required since Al Rayyan has the largest population in Qatar. Nearly half of the respondents indicated that metro stations are not located within a walkable distance from where they live, while others had not even considered walking to a metro station. Since it is efficient for passengers coming from the southern, eastern, western stations of Qatar, it will allow them to save time. Metrolink buses are free feeder buses that can be used by passengers to travel to and from nearby locations to the station. Notably, the metro is family-friendly, with dedicated areas designated for their needs to accommodate wheel chairs as well.

Analysis Based on Travel Behavior

Analysis below focuses on the Travel behavior in the catchment area by doing a pedestrian shed indicator to assess the sufficiency of parking and assessing modes of mobility in the study area.

(A) Parking

The past decade has been characterized by Doha witnessing increased motor vehicle use. This is a development that has led to a decline in pedestrian connectivity, increased traffic congestion, and the use of the public realm. Since motor vehicles are the most commonly used form of transport in Qatar, there has been an over-reliance on this form of transportation. However, there were only limited alternate forms of transportation until recently. Over time, an increasing number of cars ultimately translated into insufficient parking areas. However, car users in Msheireb are gaining access to on-site parking spaces (Figure 36). Additionally, they also have access to

multistory parking. Although some are metered, a larger proportion is free. However, no one is permitted to park at night. The main concern in the area is an oversupply of parking areas that dominates the pedestrian character of the neighborhood and downtown area. (Figure 37) On the other hand, the safety of pedestrians has been compromised by road users constantly seeking parking areas (Furlan, 2019).

Figure 36. Parking around Msheireb station (Source: Author)

Notably, Msheireb and Souq Waqif have underground parking that can accommodate 10,000+ cars, which has led to the optimization of valuable land that is centrally located while increasing pedestrian connectivity (Figure 36). The project consists of a large railway station that users (i.e., workers, shoppers, commuters, and residents) can use when carrying out their daily activities. The project also features commercial/retail spaces and museums that will attract business people and tourists, respectively. Thus, there is a need for efficient car parking facilities in the area. The existing parking spaces will become an integral aspect of digital integration, modernism, and the mobility chain, thus ensuring that Doha remains a smart modern city. The wealth of parking spaces include numerous basement parking spaces for residents and visitors, open-air parking with shades, and larger underground parking spaces. Three to six underground levels have been built in Msheireb to reduce traffic and promote safer streets. While such interventions are very positive, the large supply of parking can result in an even greater car dependency.

Based on the questionnaire responses, participants' perceptions regarding transportation within the Msheireb area is that traffic congestion is the major issue. The area is highly congested due to cars being parked on the street, which harms the essence of the area. (Figure 37) As Mr. Raimund mentioned, parking is allocated along the main roads and it is likely too much parking; however, this occurred in order to follow the guidelines. While one factor that will help to improve metro usage is a reduction in available parking, so people will require the right environment to walk and cycle. Qatar recently applied rules to minimize car parking in commercial/residential facilities 300m from metro stations to support metro users and encourage less car usage. However, traffic reduction strategies are required via design.

Figure 37. Parking around Msheireb station (Source: Author)

(B) Mobility

Over the last few decades, Qatar has been characterized by rapid urbanization, a process that has revolutionized the quality of urban life, livability, sustainability, and transport, with a special focus on the Msheireb area and surroundings. There is a need to have automobile alternatives to address current needs and accessibility. Notably, the success of a metro service can be determined by the ease of walking or riding a bicycle safely when moving to and from any metro station, which mostly relates to car commuters turning to the service (Figures 39 and 42). Msheireb Metro Station is built to serve the neighborhood as well as the important Msheireb Downtown Doha development. Notably, this study investigates the travel distance by foot or by car. The method for assessing this involved the creation of a pedestrian shed from the entry and the exit points of the metro station at 500 m and 1000 m to specify recommendations for improvements. Msheireb Metro Station is located near existing infrastructure, public transport, and local amenities. Key public transportation components available in the studied area include a rail system, tram system, and rapid bus transit. A Detailed Station Site Plan providing links to bus stops/routes, bicycle lanes, drop-off points, and

other information is presented in Figures 41, 44 and 45.

Figure 38. Pedestrian activity (Source: Author)

After doing the survey, it was noticed that nearly all of the participants visited Msheireb using the metro and not their vehicle. Metro users generally find it easy to walk to and from the metro station and they find it is easier to buy tickets from a ticket machine than online. Moreover, the level of security within the station was rated as good in the survey. While the metro users were generally satisfied with the available facilities, the number of services within the station was rated poorly. The majority of participants experienced walking inside Msheireb's heart of Doha but never experienced walking outside of Msheireb's boundaries due to the roads not being suitable for walking. (Figure 40) Most of them would prefer to walk and cycle if these

options were available. (Fgure 43) Alarmingly, most participants did not attempt to cross the road from Msheireb to corniche or other nearby areas in comfortable weather conditions despite the distance being walkable (less than 500 m). (Figure 40)

Figure 39. Vehicle activity (Source: Author)

Figure 40. Conflict between pedestrian and vehicular activity (Source: Author

Figure 41. Bus and tram activity (Source: Author)

Figure 42. Cycling activity (Source: Author)

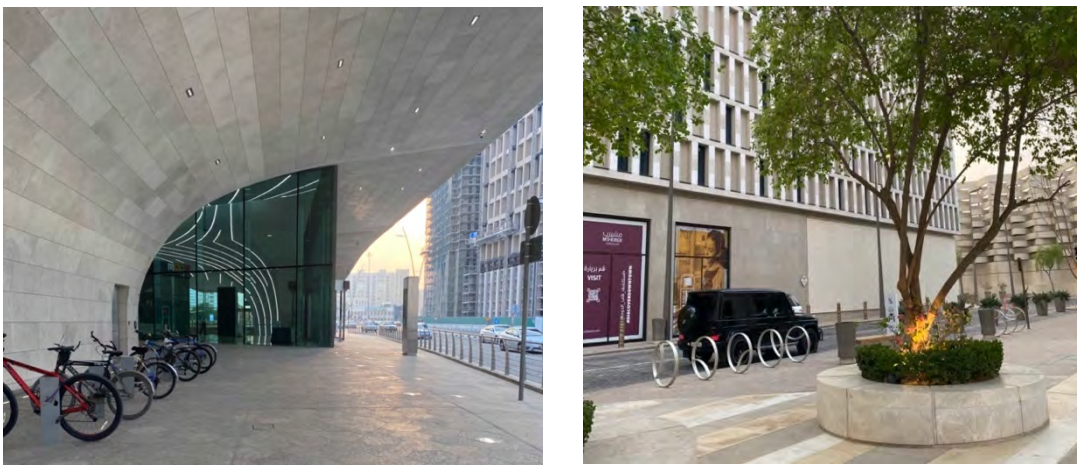

Figure 43. Cycling racks (Source: Author)

The Msheireb Downtown Doha Project aims to develop a smarter integrated and modern transport system/node in Doha that includes an internal tram network that facilitates movement from one place to another in the area during extreme weather conditions, especially during summer. Trams also make it easy for the public to explore the area since it is a new development.

The current constructed metro and tram systems will enhance mobility within the region (Figure 44). Moreover, Msheireb Metro Station will be vital in reducing traffic congestion and easing pedestrian movement. The project aims to introduce various transportation modes such as bus services/terminals, walkways, cycling/biking paths, and bus stops.

Figure 44. Msheireb trams (Source: Msheireb Properties)

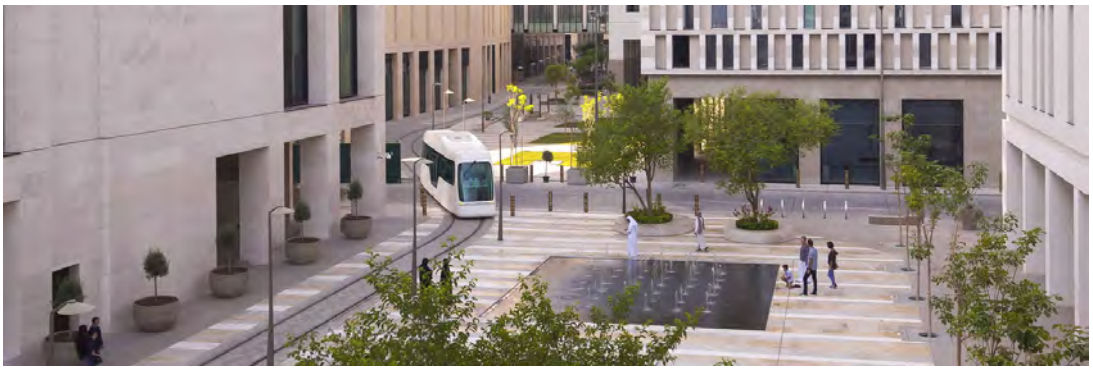

Figure 45. Msheireb tram in the area (Source: Msheireb Properties)

Government companies such as Mowasalat have been at the forefront when it comes to operating both taxis and buses. Additionally, the network of Doha "Metrolink" feeder bus routes has been established to support metro operations. Metrolink is a feeder bus network providing first- and last-mile connectivity to passengers within a 2–5 km radius of Doha Metro stations. Passengers can travel to and from the stations using the free feeder buses. Notably, exponential growth was observed in public bus ridership, which rose by 40% from 2015 to the end of 2019 (MOTC, 2019). This is due to significant transit network enhancement works performed by the Ministry of Transport and communication to boost the performance efficiency of public bus services and increase ridership. There are frequent timetables, smart card purchases, top-up options, and the launch of the Karwa bus mobile application. Public buses are distributed in the area with easy drop-off points near Msheireb Metro Station, such as the Metrolink feeder buses in Wadi Msheireb Street, one primary stop, and two secondary stops. The rest are distributed along Alasmakh Street and Souq Waqif. The adjacent street, Bank Street, includes three stops. However, there is only one Karwa bus station in the investigated neighborhood. Notably, these modes of transport are mostly used by low-income earners (in this case, migrants). Culture and privacy concerns have made locals avoid using taxis and buses.

Analysis Based on the Built Environment

Analysis below focuses on the Built environment in the catchment area by doing a pedestrian shed indicator to assess the design quality, connecitivity, and pedestrian friendliness in the study area.

(A) Design quality

The design of public squares depicts various design principles and elements, which have significant roles. Most designs integrate traditional architecture mixed within Western civilization. The construction of building structures and transport infrastructure in heart of the Doha City illustrates the significance of the public realm based on an Arabic setting and illustrates the necessity for pedestrian spaces (i.e., walkways or cycling paths) in the vehicle-based metropolitan area. Walkways and streets have been designed to offer access to various adjacent neighborhoods (Figure 46). For instance, the pedestrianized street in Msheireb downtown—packed with restaurants, cafes, and retail buildings—is connected with Souk Waqif via the new *wadi sikkat*.

Figure 46. Msheireb corridors (Source: MDD catalog)

The design quality also features the use of sculptures and monuments. For example, the new *wadi* has sculptures in the informal squares as well as open spaces, which serve the critical function of creating visual aesthetics and serenity where people can socialize. The streets, squares, and open spaces are landscaped to offer shade to pedestrians and other users while reducing the glare of the hot sun. Improved street designs are highlighted in Figure 47. Also, the squares and open spaces play an important role in adding a sense of scale and hierarchy (i.e., seeing the city) while also creating serial visions/dynamic views within Msheireb (Figure 47). The main square within Msheireb, which is known as Baraha, is linked with three north-south-running *sikkats* and the new east-west *wadi*.

The design depicts various qualities that meet the needs of users. For example, the design of the grand public square aimed to create a signature aesthetic and take users through Msheireb via the journey of the Baraha, which has enabled users to appreciate the cultural heritage of Msheireb. The existing design features—such as buildings with grandiose structures depicting Islamic architecture and the development of transportation infrastructure such as transport networks and systems—illustrate the metamorphosis from a desert region to what is now modern Doha.

Figure 47. Enhanced streetscape around the area (Source: Author)

Msheireb development has various components that enhance and support the social involvement, sustainability, and livability of the transit systems. These components and features include signage and the design principles of wayfinding. Exceptional signage can be observed in various structures, which creates regions of differing visual character and well-structured paths. On the other hand, the quality of adjacent neighborhoods is in very poor condition compared to the high-level development of Msheireb Downtown Doha. (Figure 51) As mentioned by users, unsafe large road lanes, streets filled with parked cars, and traffic congestion are the main issues that make such areas less attractive for pedestrians.

Based on the questionnaire responses, the perceptions of people regarding the physical design within Msheireb is that the design of the area lacks recreational spaces and services facilities. Moreover, participants noted that it is not possible to perform daily or weekly shopping even within 1 km of the area. Some participants also noted that they would not prefer living there since it is unsuitable at all social levels.

People enjoy being there for leisure purposes but would not prefer to live there due to the housing types and cost, which is not affordable for everyone. The area also lacks a community-like, safe, and accessible feel. Moreover, there are also relatively few job opportunities in the area, which is a major weakness. These perceptions of the community make it difficult for individuals to live there.

Other participants suffered from safety aspects in the area, especially at night due to poor lighting distribution. . There is poor availability of sidewalks around Msheireb Metro station and the neighbor area, which also has a lot of traffic and noise pollution.

(B) Urban fabric

Since the discovery of oil and gas half a century ago has transformed national development, economic development, and growth, which has made Doha one of the Middle East's economic hubs. This has modernized historic centers and neighborhoods in Qatar's Capital, such as Msheireb Downtown. The economic growth and advancement of Msheireb and other cities led to the disconnection and disruption of traditional spaces that represent the cultural heritage of Qatar. The design and development of Doha, Msheireb, and its neighborhoods utilized modern urban planning principles during master plan development and urban planning. (Figure 48) On the contrary, the adoption of urban planning and master plans by Doha City and metropolitan neighborhoods did not consider the application of new urbanism principles related to sustainable development and cultural heritage. The effects of modernism had significant implications on Msheireb Downtown Doha and its neighborhoods. For example, various structures that reflected Qatari cultural heritage and traditions were demolished to pave way for the construction of new modernized buildings. As a result, this partially led to the erosion of the cultural and traditional fabric of Qatari people. The buildings in Msheireb were constructed between 1950 and 1970. Due to their age and neglect, the buildings were poorly maintained and thus at the brink of collapse. Thus, the regeneration program for this region began in 2005 since the original occupants had migrated and the population declined by 300 persons per ha. This restoration and urban planning project aimed to reallocate locals in the Msheireb neighborhood with a focus on introducing sustainability that would lead to novel and sustainable new urban lifestyles.

The aim was to ensure that regenerated and constructed building structures reflect the true historical patterns of Doha. The current project aims to identify and discover the remaining culture, traditional heritage, memorable artifacts as well as the country's history via the derelict structures. The plan further focuses on unifying the facades with marble and including gates for the areas and external building structures, which will reflect unique architectural aesthetics and exquisiteness. Moreover, the project introduced traditional strategies and integrated them into the newly designed structures to provide a sense of identity. Thus, the architectural elements and principles of Msheireb focus on promoting interaction and socialization among visitors and locals. The Msheireb neighborhood project features plazas, open spaces, and other public regions that promote the sustainability of cultural heritage as well as interactions among occupants. Also, the project includes numerous open spaces that host various functions, such as Al Baraha. Furthermore, the project includes tourist destinations.

Based on the survey findings, the outdoor furniture, cafés, shade provision, and integration of landscape design elements and principles are key factors that differentiate the open spaces. Thus, the open spaces focus on meeting user requirements and enhancing socialization.

The site analysis shows that family/residential units can be suitably constructed in the quieter part of Msheireb and Al Rayyan Road in Buisness Quarter. Structures fitting medium-rise massing and residential apartments can be constructed on the south of Al Kahraba Street. These units tend to suit younger families from local or international groups. The third residential area can be situated above the key shopping streets. These residential units cater to the needs of the younger generation since the area hosts numerous activities, particularly at dusk; thus, it will be a good fit for those that enjoy entertainment. Moreover, the study noted an increasing demand for housing

units targeting elite professionals, younger individuals, and high-income earners. Cycling networks, local walking nodes, social amenities, healthcare centers, schools, and mosques serve these residential areas. Thus, there is a need to create vital massing of public spaces for the residents of Msheireb.

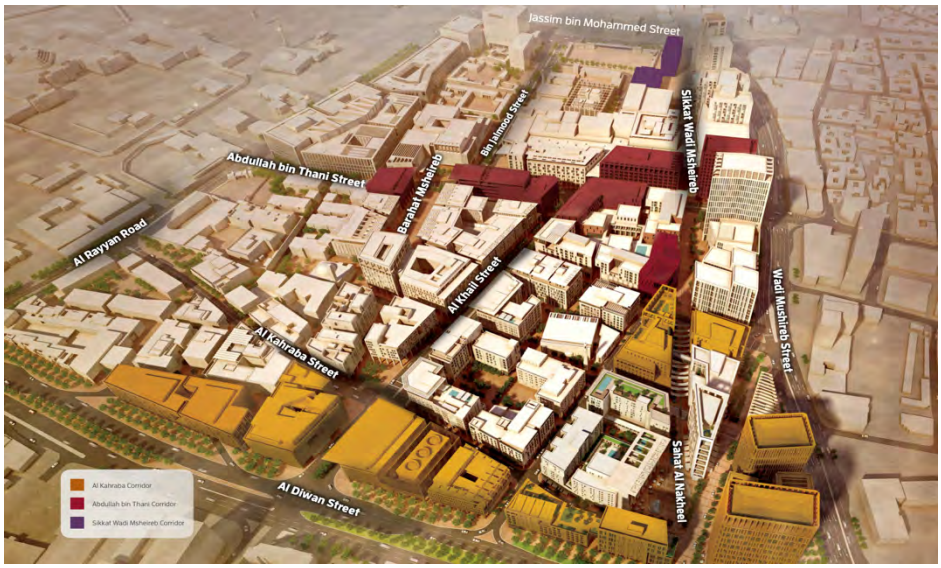

Figure 48. Msheireb corridors (Source: MDD catalog)

Since various groups of people work in Msheireb, the current project proposes the construction of numerous commercial units that can be used as office spaces to meet business needs. The project proposes that office blocks should be constructed at the ends of Al Rayyan Road, Al Diwan Street, and Msheireb Street due to traffic and noise, which are not conducive to homes and livability. The metro station location is the most preferred location for office buildings (along Msheireb Street) due to its location linking to broader parts of the metropolitan area and exceptional views of the beach bays of Doha. Office block structures such as four-story buildings can be constructed in the middle/junction between Msheireb Street and Al Diwan Street to create stronger vistas that end at Al Kahraba Street. Small office buildings (lower than 2–3 stories) can be

situated in either New Ukaz Street or Baraha Street in the Msheireb neighborhood. This aims to bring life and vibrancy to Msheireb's heart to ensure the animation of this area. However, areas adjacent to or along the Al Rayyan Road are ideal for Diwan Annex and other offices, which extends the Emiri Diwan's administrative functions. Restaurants, cafés, and retail buildings aim to bring diverse functionality to the city spaces. Thus, retail activities can flourish in the Msheireb. These activities could include boutiques that sell luxurious brands made both locally and internationally. The retail buildings can create hierarchy in the frame of urbanism. Also, figure-eight-shaped retail and urban frameworks will create a loop connecting the main retail streets. The loop links the newly projected city park along Al Kahraba Street and the Souk Waqif along Sikkat Al Wadi. Moreover, it will connect various *sikkats* and spaces with commercial and residential areas (Figures 49 and 46).

Figure 49. Enhanced streetscape around the area (Source: Author)

Al Kahraba Street in the south is suitable for constructing fine-grained retail units that sell traditional accessories/clothing, while the New Ukaz Street would suit home furnishing stores that require larger floor plans. New Ukaz Street offers greater visibility for stores and retail shops. For stores and malls, blank external facades and could be located in New Ukaz Street and basements (i.e., for food storage compartments). The north-south *sikkat*, which has a galleria, can be used to design spaces for international brands. Also, Reemas Street and the area south of Barahat Al Nouq is suitable for more luxurious retail shops. Including these spaces in the master plan will play an important role in creating retail opportunities, which will attract a variety of clients to Msheireb. The design of these retail spaces/shops will integrate cultural forms and cultural heritage spaces (e.g., museums) that will attract numerous tourists. On the other hand, some existing spaces (e.g., the Eid prayer mosque) can be regenerated to become heritage sites that signify Qatari identity. The master plan also focuses on restoring cultural and heritage sites with cultural or historical significance, which could be named heritage quarters and serve cultural exchange functions between the locals and international visitors. Moreover, including mixed-use quarters will play an important role in creating unique and memorable urban fabric diversity. Moreover, this approach focuses on bringing variety and richness to the inhabitants and users as well as long-term economic growth and variety. The approach will also introduce a townhouse *fereej* in low structures with fine urban grain, low-rise mass, and compacted forms along Al Kahraba Street. The Master Plan of Msheireb is a fundamental urban planning masterpiece and an architectural form that consists of combined tradition and modern architecture as well as urbanism. However, connectivity is a missing feature that must be incorporated into the future development of surrounding areas such as Al Asmakh, Al Najada, Fereej Bin Mahmoud, Al Doha, Al Jadeda, and Old Msheireb.

Since all of these areas are close to the station, further connectivity must be applied to ensure a better and more holistic urban fabric. (Figure 49)

Participants also believed that Msheireb has low connectivity to it surroundings since they cannot walk from one place to another. The low availability of parks and open spaces was noticed, while the availability of bike lanes is there but not well connected to the whole network. Thus, there is a lack of potential for mixed use.

The area moderately supports public transportation since taxis and buses are not available all the time. Also, footpaths in the area are not in very good condition. Above all, services and facilities are poorly connected to the station. Since it is the biggest busiest metro station, it should incorporate all accessibility aspects; however, this requires time to achieve. As Mr. Raimund stated:

> Accessibility is the key. The focus cannot be only on the metro entrance. If we do this, then we are creating isolated islands. Instead, we need to connect the urban fabric level. Building a metro is something bold while making sure that pedestrian footpaths are usable in a proper way is important. But currently, in this case, it is not considered a glory factor. It has recently been identified and we are working on enhancing and trying to improve the accessibility and connectivity between stations and neighborhoods.

Regarding connectivity, Eng. Alkarani mentioned that the only issue facing the neighborhood is connectivity. Dr. Al-Kuwari also stated that most of the facilities near Msheireb Metro Station were only designed to serve Msheireb downtown residents and were not designed with the integration of surrounding areas in mind. At the urban design level, this is causing a serious problem since it contradicts car and human movement at the transportation level.

As Mr. Raimund noted, if the free plots around the Msheireb development could be

used to connect the area to downtown Msheireb, then the metro station would act as a connector to the rest of the nodes.

(C) Pedestrian friendliness

Adverse weather conditions (i.e., hot weather) have minimized walking as a mode of transport in Qatar since daily temperatures can reach up to 45 °C. Additional contributors to limited walking include the poor quality of urban furniture, street crossings, sidewalks, and wide unsafe roads. However, in Msheireb, pedestrians are encouraged through the provision of safe and efficient designs that prioritize walkability and activate the public realm. An escalator is placed at the edge of/under the Msheireb development site, which enables passengers to move directly to the development safely and easily from the metro station. However, due to the ongoing road excavations around the metro station, pedestrians experience difficulty crossing the streets. Additionally, cycling paths as well as roads with special lanes and parking facilities for bicycles are being considered south of the station and throughout the Msheireb development. Meanwhile, throughout the area in which cycle paths are implemented, they are used by delivery men and low-income commuters. Locals are considered new to this culture of diverse transportation modes. Since only a small percentage of the population has started to use public transit, cycling, walking, it is anticipated that more engagement will soon occur as part of this development, which is encouraged by the state.

The master plan includes the design of a large basement parking space/garage that would hold more than 10,000 vehicles for urban dwellers and tourists. This design was inspired by a lattice urban structure and system that focuses on encouraging users to utilize public transport (e.g., buses or commuter trains) to ease traffic congestion. Also, it does allow people to walk comfortably (Figure 50). Msheireb streets consider

the prevailing sea breeze, which creates thermo-comfort and cooler zones during the day, reduces vehicle-generated heat, and minimizes pollution, which ultimately enhances pedestrian friendliness.

Figure 50. Pedestrian crossings and pathways (Source: Author)

Various lighting fixtures, materials, and structures are included in the Msheireb master plan to allow users to appreciate the importance of the old Msheireb downtown area. Other features depicted in the design of Msheireb's streets that promote pedestrian friendliness include the strategic placement of on-site parking spaces with the use of parking curbs to shield pedestrians from vehicular/street traffic, landscaped sidewalks and paths (i.e., using plants to offer shade for pedestrians), and the design of narrow

streets with marked pedestrian crossings that aim to alert pedestrians and slow drivers. The design and development of sidewalks and pavement include the incorporation of a grid or system of shaded *sikas* with lanes that have widths of 4–7 m. The grid enables easy accessibility for cars into a 31-ha space from a broader modern city network.

Similarly, the grid of Msheireb's streets focuses on underpinning an inclusive transportation approach that facilitate private and public transportation. For example, the local tram routes allows users to walk on cooler paths or walkways during the hot summer months. The design of streets includes the provision of shade for pedestrians to mitigate the local climate. For example, shade is provided using colonnades in the east-west oriented streets. However, Msheireb has narrow south-north streets and the ambient temperature of these walking spaces is reduced by shadows naturally cast by buildings in the narrow streets. Grand streets are characterized by shorter distances, which promotes people to use the walkways and paths when exploring Msheireb. The designed streets and paths are user friendly and characterized by key features such as interconnected paths, sidewalks, trails, and parks. For example, Abdulla bin Thani Street and other streets in Msheireb would benefit from well-designed paths with visual aesthetics/characteristics that allow users to appreciate the older Msheireb and revitalize its history. The streets also encompass the use of various design elements. Msheireb's streets consist of interspersed taxi drop-offs as well as bus stops, with Doha Metro lines that would act as a connection between the city and other areas (e.g., Education City, the new airport, and West Bay). Notably, the lack of pedestrian-friendly connections between Msheireb Metro Station and the old neighborhoods remains a point of weakness amid the great investment that is occurring.

Many participants highlighted the need to create pedestrian-friendly walkways between all neighborhoods. As Eng. Al Karanni mentioned, "We tried to make more

than one exit for the stations and place them within four intersections when possible to provide safety for pedestrians." This point was also indicated by Mr. Raimund:

> In most of the stations, it is almost impossible to walk there because they are isolated by big roads. Cars have priority, the top priority. It's the car, and then the car, and then the car, and then there is nothing, and then there are the pedestrians. I know that there are plans and political will to change this, and I have seen some positive changes around.

He described this issue as a worldwide competition for space. Everywhere on the planet, there is competition for space; in this context, cars have dominance. Since we have this issue, it remains difficult to obtain more space for pedestrians or other facilities/open spaces that support pedestrians. However, on a positive note, slow interventions and increased awareness are now occurring.

The existing roads do not make it easy for pedestrians to move from one place to another. Any pedestrian movement is avoided because of competition with green lights. On a positive note, the metro station at least provides an underground connection for pedestrians to cross roads safely. This is considered the only chance for pedestrians to do so. (Figure 51)

Figure 51. Pedestrian crossings and pathways (Source: Author)

(D) Land use

Msheireb is located in the southwestern central district where the metro station is situated and the central business district of Doha (Westbay) are connected by an iconic corniche. (Figure 52) This is because the district is considered as Doha's largest and oldest one. The key heritage sites within Doha include Souq Waqif and Msheireb, which are situated in the southwestern district of Doha. Msheireb development, Doha's historical downtown, is a few steps from Msheireb metro station. It is characterized by small domed mosques, courtyard houses, and narrow alleys that shield pedestrians from the immense summer heat. AlKahraba was the first street in Doha that was provided with electricity, which explains why Msheireb is commercially important. Msheireb hosts approximately 900 residential units and over 100 buildings ranging from 3 to 30 stories in height (Table 8). Msheireb Downtown Doha is supported through a combination of civic, commercial, residential, retail, and hospitality offerings. Additionally, it has been designed for convenience, bearing in mind that each quarter can meet all urban needs. It is characterized by educational facilities, green spaces,

luxurious residential units, offices, treasured cultural offerings, and a variety of hotels. All of these features are located close to each other and near the main station (Figures 52 and 53).

The Msheireb project is also directly adjacent to the Amiri Diwan. Moreover, the site is next to Souk Waqif, one of the oldest mixed-use traditional markets. Also, the historical fort “AlKot” is accessible and within walking distance. The station is also adjacent to low and mid-rise residential and commercial buildings (Figure 52). Additionally, the district stands out as one of the most congested due to a high volume of cars. According to Furlan (2019), it is estimated that up to 25% of the total land has been reserved for parking, utility uses, and transport. Current land use comprises numerous structures, which include retail and entertainment buildings, commercial and residential properties, and cultural sites. Msheireb focuses on merging the courtyard principle into the new building structures. Also, the Msheireb project include key business spaces by regenerating older residential areas and spaces to re-establish sustainability within the city. For example, an important commercial street resulted from the restoration of Kahraba Street.

Figure 52. Msheireb Downtown Doha land use (Source: Msheireb Properties)

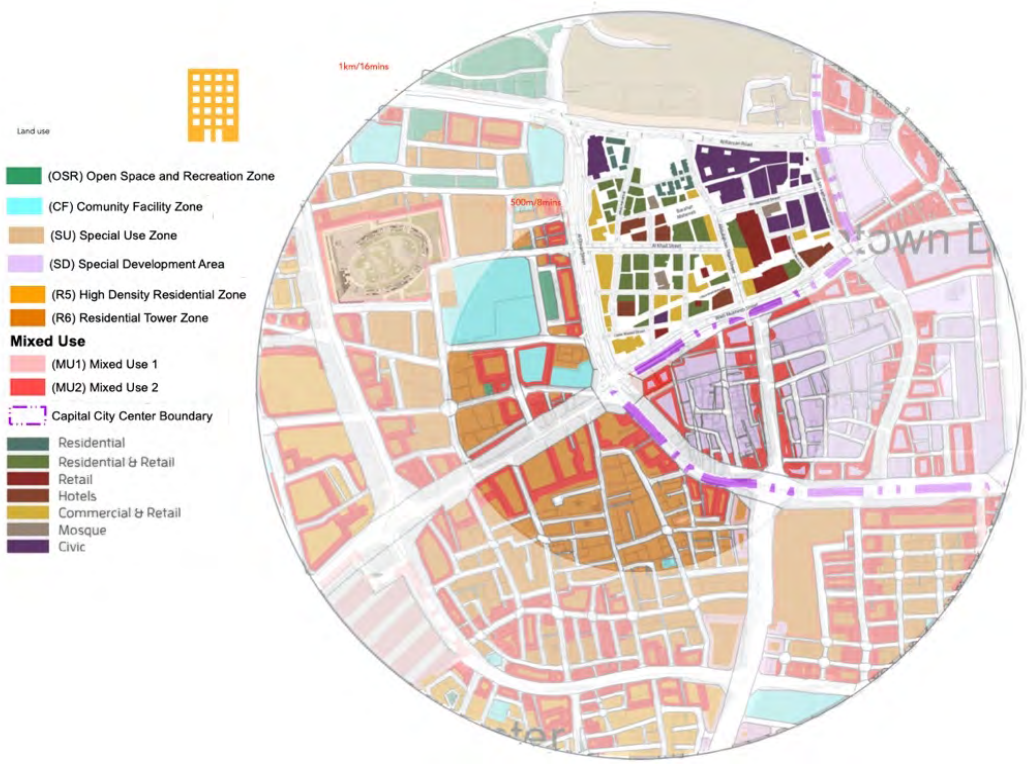

Figure 53. Msheireb land use (Source: Msheireb Properties)

Table 8. Population by zone, area, and population density per square kilometer (Source: MSDP, analyzed by the author)

No. of zone	Zone	Population density (people per km^2)	Area (km^2)	Population
4	Al Asmakh	30,000	0.3	9,791
5	Al Najada	9,491	0.2	2,086
7	Al Souq	1,059	0.3	297
13	Msheireb 13	27,114	0.7	18,278
14	Fereej Abdulaziz	29,513	0.5	15,706

No. of zone	Zone	Population density (people per km^2)	Area (km^2)	Population
15	Doha AlJadeda	33,352	0.5	15,920

Results and Discussion

The study results are grouped into the indicators of TOD, which include travel behaviors and built environment diversity. The results identified urban problems in travel behavior, mobility, design quality, lack of mixed-use structures associated with the connection between the Msheireb downtown area and the surroundings neighborhoods. (Figure 54)

The government has launched numerous projects in Doha to enhance the sense of identity of the city, address socio-environmental problems, and meet the increasing needs of globalization. Numerous projects have been started by relevant agencies (e.g., government and urban planners) to develop the city of Doha and regenerate an architectural uniqueness that depicts the cultural aspects of Qatar.

Figure 54. Msheireb's diverse urban form (Source: MDD catalog)

These projects include the urban regeneration plan of Msheireb and its environs. However, these projects face several urban-related issues that have affected the urban distinctiveness reflecting how Msheireb has informed the identity of its inhabitants and unique representative structures while undermining the prominence and cultural significance of this part of the city. The Msheireb project was a governmental urban regeneration initiative that aimed to address existing urban problems (i.e., socio-environmental problems and meeting the increasing needs of globalization) while fostering the revival and regeneration of this old downtown and connecting it to diverse generations. Also, the Msheireb Downtown Doha project focuses on enhancing the sustainability of this region and preserving the urban identity and cultural heritage of Msheireb and Qatar. Therefore, the following section will include a description and discussion of the urban problems based on the interview/questionnaire findings. The interview results were obtained from relevant engineers, architects, and developers.

Based on the master plan analysis and study findings, the features of the Msheireb Urban Regeneration Project include improved connectivity, improved design quality, the introduction of smart transportation and open spaces, cultural preservation,

improved pedestrian access (i.e., walkability, mobility), and efficient car parking spaces. Generally, the following principles will be observed in designing these features:

- Introduction of an efficient and clear process for managing the project to ensure that the public spaces created (e.g., museums) will remain sustainable;
- Rebirthing the social memories of Msheireb by creating a sense of engagement and identity/belonging in regenerated open public spaces or plazas (i.e., social spaces);
- Identification of how different spaces will be used (e.g., residential, retail and education uses tend to be located in the Barahat);
- Creation of mixed-use amenities;
- Addition of well-designed and exceptional signage in building structures to enhance wayfinding and serve signage purposes;
- Inclusion of environmental traditional systems and addressing environmental issues using architectural principles;
- Use of LEED guidelines, such as measurements and criteria aimed to ensure that the project remains sustainable and environmentally friendly;
- To maintain a sense of identity and preserve the memory of Msheireb, the project will apply a combination of modern and traditional architectural language;
- Introduction of a smart parking system and efficient car parking spaces (e.g., underground car park spaces);
- Provision of diverse public transportation choices that connect the region with its neighborhoods as well as other parts of Doha. This will comprise various design recommendations that include reducing car usage by connecting most areas with pedestrian walkways and bicycle paths. Also, the ground level of the

project will include retail stores to improve connectivity. The project will introduce various tram stations and transit stops to enhance effective mobility in the area.

Travel behavior

The Msheireb Urban Regeneration Project, which is an urban renewal plan, focus on reducing traffic congestion and introducing effective walkways and other key transport-oriented developments to meet the needs of city users, particularly in the downtown district. Also, the project will revive, regenerate, and redevelop the old downtown and its surrounding area to enhance its historic and cultural value and give it a sense of identity.

Based on the interview findings, the urban problems facing Msheireb include transportation issues and environmental issues, which are discussed in the paragraphs that follow. Regarding transportation issues, the Msheireb Downtown Project aims to introduce smart transport systems by integrating key TOD principles to introduce an efficient public transportation network and pedestrian-friendly walkways. Thisinclude the introduction of an efficient and affordable public transportation network that will enhance connectivity across Doha and decrease vehicular usage, which will lead to reduced carbon and greenhouse gas emissions while minimizing traffic congestion. Based on the ineffective pedestrian paths and public transportation networks as well as a lack of smart transportation, the initial design did not place much emphasis on the growing needs of the urban population and lacked the incorporation of key TOD principles. Also, transportation-related problems have been observed in the streets, which have affected pedestrian movement. Therefore, the Msheireb Downtown project focuses on designing public spaces and streets/walkways that meet the needs of pedestrians and cyclists.

Interview participants claimed that is difficult to cross the street around the station because drivers do not give way for pedestrians since the intersections are very large and cars are highly prioritized in the area. Mr. Raimund noted that while Msheireb succeeds in implementing what pedestrians require, pedestrians are neglected in the surrounding areas. This is because pedestrians are an afterthought. Instead, the priority is to satisfy the needs of car traffic, and if there is space left for pedestrians, then they can have it. While Qatar holds the potential for good planning and changes based on the implementation of strong principles, the domestic use of cars is stronger than the need for public transport. Thus, it is simply a city that prioritizes cars. He also noted that this problem originated from the lack of a master plan:

> "The city just grew here in Qatar. I'm not a huge fan of having the railway corridor in the middle of a highway because this will bring up problems of accessibility. But we are lucky in that most of the rail network in Qatar is underground, so we are relatively flexible."

Built environment

Msheireb downtown incorporated well-designed spaces and streets for the public realm, such as walkways and cycling paths that meet the needs of cyclists and pedestrian users and allow easy movement and improved pedestrian and cyclist access to various parts of the city. This goal will be achieved by restoring each path, street, and public space in Msheireb to ensure that they are friendly to cyclists and pedestrians. Furthermore, the project introduces key pedestrian-oriented streets that include design features such as well-designed public amenities or public spaces, the use of plants for landscaping, and the introduction of lighting and unique benches. These features will support the quality and vibrancy of the Msheireb Downtown while meeting the needs of cyclists and users only within Msheireb. Thus, the problem of unifying the old city

via mobility standards remains unsolved.

Many issues affect the quality and usability of the urban natural environment. Thus, Msheireb addressed these issues to improve quality of life. This is achieved by designing and creating open spaces, paths, and parks that play an important role in promoting pedestrian walkways and reinforcing the boundaries between the Msheireb neighborhood and surrounding areas. As Eng. Al-Karani stated:

> Currently, we are supporting all developments to follow GSAS requirements. It's not mandatory, but optional. Currently, we are also trying to follow the form-based code, a zoning code that is supposed to be applied in most of the areas. It is similarly applied in Europe. Regardless of the building function, it needs to follow a holistic form that provides an attractive facade improvement.

The design proposed in figure 55 integrates mobility networks from three main directions, acting as a crucial connection that was built as a framework to fulfill user needs, and aim to solve urban issues within the area.

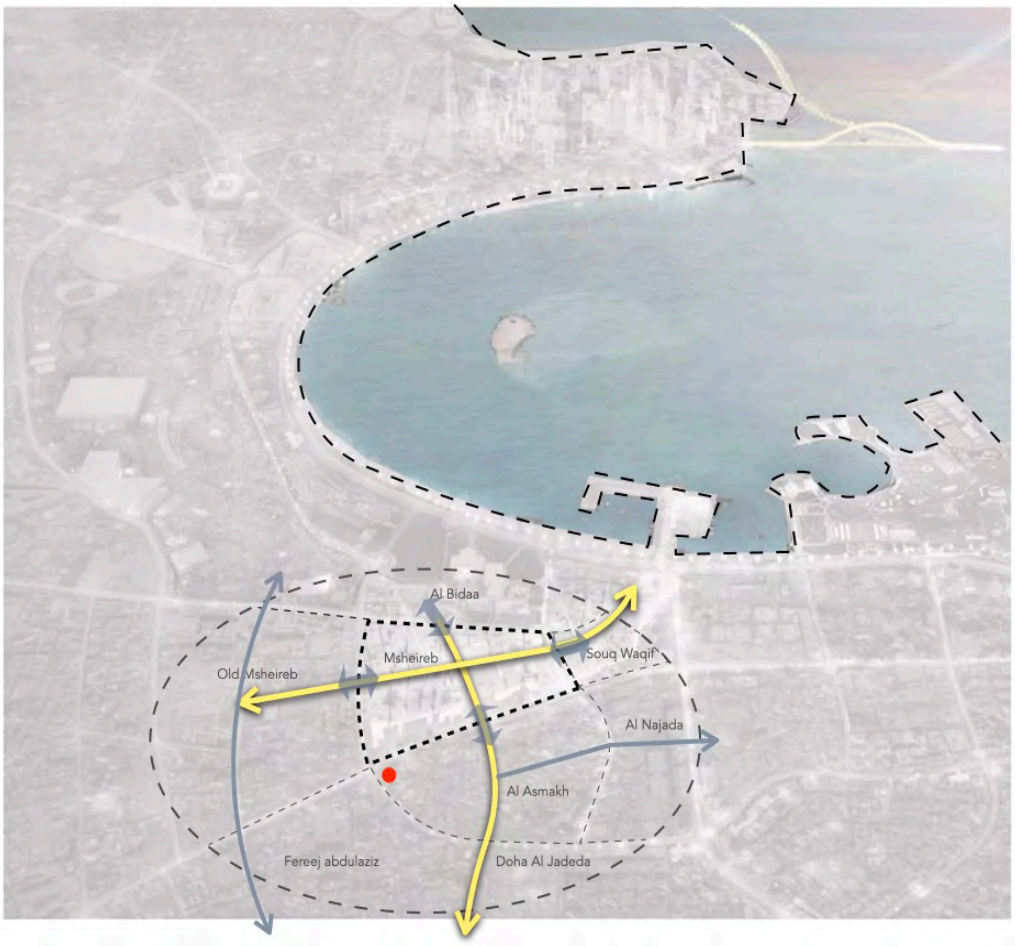

Figure 55. Proposed integrated mobility network (Source: Author)

Recommendations [Urban Planning]

The objective of the transportation system is to provide and facilitate transport within and between designated land use areas to ensure integration and shared space with a focus on leisure and tourism. The project recommends the design of well-connected streets and public spaces, which includes walkways that will play an important role in enhancing mobility and reducing vehicular dependence while promoting the sustainability of the neighborhoods. Thus, enhancing street connectivity is crucial in meeting design, research, and urban planning requirements (Figure 55).

With the Mshiereb metro station being located in the old central part of Doha, a central shared recreational street area must be surrounded by residential and commercial mixed-use zones with a road system intersecting the heart of the town and sub-roads linking with sub-streets to promote access to the older neighborhoods (Figure 56). A journey from the past to the present can create beautiful memories for pedestrians, cyclists, and public transit users. Transformational changes to Abdullah bin Thani Street (adjacent to the metro station) should be made so that can only be accessed on foot. This will also result in it becoming more integrated into the area. (Figure 56). Vehicle access to the recreational street at the center of the town will be regulated in terms of speed and access to guarantee the shared space concept and ensure safety while maximizing aesthetics. To establish efficient internal circulation, the street pattern and road size will regulate the density and speed of traffic to maintain a comfortable environment.

Figure 56. Proposed Mobility Network Master Plan (Source: Author)

Sub-streets will be connected to major streets with parking in critical areas where road transportation is not permitted (i.e., educational zones, recreational areas, and certain residential locations). In addition to bicycle and pedestrian access being connected to roads, there will be an extended passage for cyclists and walkers beyond these roads, including a leisure trail that will host facilities and areas of historical interest (Figures 57 and 58).

The location of residential neighborhoods and commercial areas will be such that access within and between those zones will be short, easy, safe, and aesthetically pleasing. This will be achieved by close cycle access, with a road size that serves the function of community access.

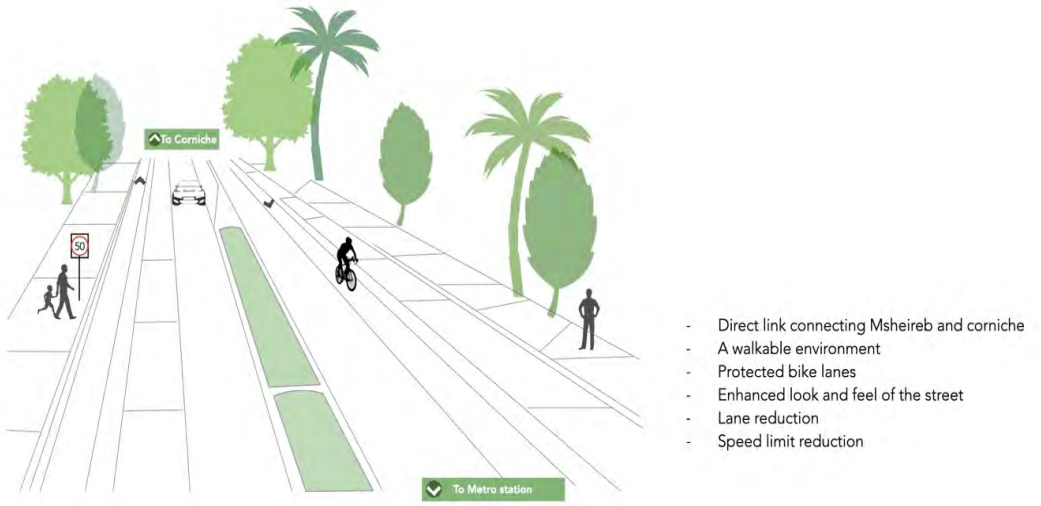

Figure 57. Proposed enhancements for Wadi Msheireb Street (adjacent to Msheireb Metro Station) (Source: Author)

Figure 58. Proposed enhancements for sub-streets to be incorporated in the old neighborhoods surrounding the Msheireb development (Source: Urban Street Design Guide, 2013)

Public transportation will be prioritized in this transport system, with a connection to the national bus and rail networks. While the educational zone will be served by both private and public transport, movement within the zone will be pedestrian-oriented to enhance the environmental focus of its function.

The design of roadways will consider all uses and functions while maintaining the historic aspect of the town and permitting limited high-speed travel for vehicles. Hence, the transport system will provide ease of access to residential, commercial, recreational, educational, and industrial functions within the town through public and private transport, with additional access to specific recreational and historic zones being available for bicycle and foot traffic.

By linking access to the heart of the city with the wider national transport system, effective connectivity will be assured for residents within the area and those wishing to travel to areas outside of Doha. As Eng. Al Karani stated in an interview, Msheireb holds real potential for TOD since it has already achieved most of the required principles. Alasmakh and the remaining areas are currently under development and yet to be integrated. Since the location is very strategic being situated in the capital's center, the areas there need to be preserved. It includes many significant areas such as Souq Waqif, Aldiwan, old palaces, and old museums. Moreover, there are approximately 40 houses dedicated to historic preservation. Notably, mixed land use is critical to achieving TOD objectives. For example, Mr. Raimund stated:

> "Mixed land use is not only for the planning perspective but also for the investment perspective. It's the process of attracting people to visit. First, it's essential to look at who is the target market around public transport. What are their needs? And then satisfy all their shopping needs with good accessibility that is also safe for kids to reach school. The success of TOD might depend on

the connectivity of schools. There is no point if I have great connectivity at one point and on the other side there is absolutely nothing."

Similar to what is occurring in the Msheireb area, connecting schools and offices on the other side of the journey is as important as the developed area.

CHAPTER 5: CONCLUSIONS AND DISCUSSION

Summary of Findings

The present research studied the effectiveness of TODs in an existing neighborhood in Doha. What makes it challenging is that the chosen study area lacks connectivity, mobility, and has a strong identity that needs to be preserved over time. The collected data verified that the quality of life needs to be enhanced since its part of the community's essential and social needs.

As discussed with Eng. Al Karani from MEE, the rail project will affect urban development since they already thought of enhancing 18 urban centers to be more TOD-like in the future. On the other hand, he was certain that the metro network lines and stations will only be highly considered within the capital city center, while transit users will rely on buses and metro links being integrated with the metro network in the remaining neighborhoods to reach their destinations. This indicates that neighborhoods should have a more integral plan and strategy since most people continue to face challenges in reaching metro stations from where they live.

Based on the literature review, it is perceivable that TOD can improve cities and towns by making them more sustainable and vibrant while increasing social interaction. This is directly related to the context of sustainable urbanism, which makes the present topic a contribution to the sustainable urban development of the country.

The method used to apply TOD involved the assessment of two highly effective indicators for the selected study area while considering public needs and participation as well as existing regulations. The findings reveal the straightforward positive effect of TOD on the social, psychological, economical, and cultural forms and values within the perception of people, regardless of era and time.

Travel behavior and built environment diversity were examined in this research, and the results indicate that the effect of mobility, connectiveness, design quality, accessibility, and land use are all essential elements of resilient neighborhoods—and thus a resilient city. The current design of neighborhoods is largely car-centric, which makes it challenging to perceive changes. People's awareness of the various modes of transportation is starting to increase due to the latest investment in Qatar's railway system. Overall, 80% of the participants that engaged in this research indicated that they were willing to change their transportation habits within the right well-designed environment. However, the current design is based on different needs and standards that should instead cater to the requirements of users. Since having an environment where one can practice all modes of mobility within an area is a minimal individual right, it should be a necessity instead of a luxury.

Regarding the theory of the research study, the applied TOD indicators are valid in the context of Qatar. According to the analysis, mobility and design quality have only been partially implemented. Fragmentation remains a problem that originated from the absence of a master plan in the country, which led to the creation of segregated developments and communities with no connections and bonds. The loss of cultural values, built form, and community sense has resulted in the creation of isolated spaces that neglect the essential needs of individuals. Adaptation to a car-oriented city design that does not require need alteration has occurred. Although Doha stands out as a city with high living standards, it is overwhelmed by a large number of automobiles. Notably, it has adopted a transportation planning system (car-centric model) that was directly adopted from North America. As a young city, Doha still lacks a full set of public transportation modes. However, it is currently working on providing several flexible transportation modes. Doha has been at the forefront when it comes to investing

in efficient public transport systems that aim to meet existing demand. Regardless of these factors, cars will remain the most valuable mode of transport due to low fuel prices and high wages among residents. Despite this, Doha Metro stations will make a significant contribution to achieving Qatat National vision goals. Dreams toward a new future are slowly being realized. While considering tradition, the government of Qatar is looking forward to transforming Doha. This is a transformation process that can only be realized by a modern transport system. With one of the world's largest metro stations, Msheireb is already at the forefront when it comes to construction. Msheireb Metro Station should be able to handle at least 600,000 passenger trips in a single day by 2021 (Qatar Rail).

Answers to Research Questions

- What criteria are used to assess the efficacy of TOD as a competitive tool for evaluating the conditions of the study area, and what strategies can preserve its heritage?

  Studies have shown that mobility and built environment are the two most effective indicators used to assess TOD in a neighborhood. A thorough analysis of the site conditions considered the following elements: parking, mobility, design quality, urban fabric, land uses, and pedestrian friendliness.

- What proportion of the built environment, urban design, and transportation system in the study area qualify as TOD? What gaps can be bridged?

  Having the metro station in an optimal location has the potential to qualify as TOD. The main gap investigated was the connectivity of the current urban fabric, two different levels of design perception within a short distance, and the design behavior of all current roads.

- What urban planning strategies and guidelines are put in place to replicate or attune the TOD concept in the study area?

  First, the need for the significant heritage value within the area to be preserved. Second, encouragement of mobility modes within the area to be connected and linked. Finally, the urge to enhance road regulations in terms of speed, design, and location.

Key Findings

The results that support the studied theory are significant to the concept of new urbanism as well as TOD. Although Msheireb has integrated various design features to meet the needs of its diverse users, certain gaps must be filled to achieve a holistic approach. The present study proposes that future research should be conducted on a larger-scale project related to the rebuilding of existing neighborhoods that focuses on creating new and holistic sustainable neighborhoods to meet the needs of an increasingly urban population. In this regard, these sustainable neighborhoods can be attained by:

- Establishing social spaces that replicate a sense of rendezvous and identity;
- Using LEED criteria and other environmental guidelines in managing and controlling the region;
- Creating mixed-use facilities;
- Integrating modern architecture with traditional forms in the design of projects in Doha;
- Providing smart public transportation choices that will link various parts of the city and nation;
- Enhancing walkability on the ground levels of structures by introducing bicycle and pedestrian paths in the region.

Although Msheireb has achieved the aforementioned indicators and aims to create sustainable neighborhoods, it is not yet fully completed. Thus, it is unknown whether it will address the various social and heritage needs of community users as a cultural requirement. Despite the area being well designed, the questionnaire results suggest that locals might not accept living in such a divergent lifestyle. Thus, the present study suggests that an occupancy assessment should be performed to evaluate the needs and expectations of the public.

Contribution to Knowledge

This study contributes knowledge within the context of TOD studies by studying a neighborhood in Qatar. Since this knowledge can be applied across the Middle East, the present study addresses a significant weakness in the literature due to minimal academic interest in this topic. Notably, many of the reviewed studies did not perform a deep analysis of what is currently being faced in this region. The lack of information and data available remains a challenge that requires researchers to have knowledge rooted in the current phenomena so that they may analyze situations and provide valid solutions for relevant issues.

Limitations and Implications for Practice and the Advancement of Research

Despite providing a wealth of useful information, this study includes certain limitations with regards to its originality, the selected study area of analysis, and the site analysis under investigation. First, this method of TOD assessment could be difficult to be applied in the studied region since that its difficult to be implicated effectively. On the other hand, the literature review indicated some similar directions that have been applied elsewhere in the Middle East and Western nations.

Another concern relates to the ability to analyze a completely new area of development with a very recent public transport system that has been met with hesitation by users and the community. This concern made the data collection process challenging since most information is conserved and difficult to obtain due to sensitive materails and data under evaluation, while there were also limitations to reach public users who have experienced the metro system since it's a very new system launched in the late 2019.

STATEMENT

The following research papers are extracted from this master's thesis.

Published:

- Al-Thani, S. M., & Furlan, R. (2020). An integrated design strategy for the urban regeneration of West Bay, business District Of Doha (state of qatar). Designs, 4(4), 55. doi:10.3390/designs4040055
- Major, MD; Tannous, HO; Al-Thani, S; Hasan, M; Khan, A; Salaheldin, H; (2020) "Macro- and Micro-scale Modeling of Transportation Spatial Networks in the City-State of Doha, Qatar," 56th World Planning Congress, International Society of City and Regional Planners (ISOCARP), 8-12 November 2020, Doha, Qatar, forthcoming.
- Marthya, KL; Major, MD; Ellath, LA; Al-Thani, S; (2020) "Understanding Single-Family Housing Market Trends in the Cradle of New Urbanism: Seaside, Florida USA," New Urban Research Session, Congress for New Urbanism 28: A Virtual Gathering, 10-13 June 2020.

Under Review:

- Furlan, R; Al-Thani, S; (2020) "A Sustainable Urban Regeneration perspective for Emerging Cities: The case of the Sheraton Park".

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APPENDIX

Appendix A: Questionnaire conducted Questions

Dear participants,

I am Sarah Al-Thani and I am currently pursuing my master's degree in urban planning and design at Qatar University. As part of my thesis nature, I am inviting you to participate in my research study questionnaire. The purpose of the study is to analyze and assess the performance of (*TOD – transit-oriented development*) on the current urban design in Doha. [THE CASE OF Msheireb Metro Station DOHA]

TOD, or transit-oriented development, means integrated urban places designed to bring people, activities, buildings, and public space together, with easy walking and cycling connection between them and near-excellent transit service to the rest of the city.

The questionnaire consists of (25) questions and will take no longer than 10-15 mins to be completed. All information provided is confidential and used for the purpose of research only. Thank you in advance for participating in this study. If you have any questions you may contact me at althanism@gmail.com or +974-33904215

Part 1- Personal Information

1- **Name:**
2- **Gender:** Male Female
3- **Age:** 18-25 26-35 36-45 46-55 56+
4- **Nationality:** Qatari, Non-Qatari:____
5- **Educational Background:** High school Diploma, Bachelor Degree, Higher education, other
6- **Occupation: (optional)**
7- **Place of residence:** Rawdat Al Khail, Al Mansora, Al Hilal, New Salata, Al

Sadd, Fereej Bin Mahmod, Najma, Alrayyan, Um Slal, Al Dafna, Al Wakra, Other:____

Part 2 – Msheireb Metro station experience

8- How often do you use public transportation, such as bus or a train, taxis etc.?

- Daily
- Weekly
- Monthly
- Seldom
- Never

9- If you answered seldom, why do you rarely use the public transport?

- Cultural/privacy reasons
- Not easy to access
- I prefer private car
- All of the above
- Other: _____

10- Are you willing to change your transportation habit and start using metro more often?

- Yes
- No
- Maybe

11- Which metro stations have you been to?

- Neighborhood metro, specify:
- Other: __
- Never

12- Approximately, how long does it take you to walk to the nearest metro station?

- 5-10 mins
- 15-30 mins
- Not a walkable distance
- I don't know

13- Approximately, how long does it take you to drive to the nearest metro station?

- 5-10 mins
- 15-30 mins
- I don't know

14- Have you ever visited "Msheireb Downtown Doha" by using the metro station?

- Yes
- No
- Only driving

15- If yes, please rate your experience on a scale of 1 to 10, 1 for poor performance and 10 for excellent performance.

- Ease/comfort of getting in and out of the metro station
- Buying tickets online
- Buying tickets from a self-ticket machin
- Different class (VIP and economy) prices
- Separated sections (families, males, females
- Availability of seats all the time
- Security guards inside the metro

- Availability of advertising screens, signages and TVs in waiting areas
- Coffee shops, vending machines, restaurants, and small shops inside the station
- Handicap facilities
- Quality of the facilities and services (e.g., toilets, shops, cafes, etc.)
- Availability of staff in metro station to help with the ticketing

Part 3 – Quality of life perception (Within 1km around Msheireb Metro station)

Since the weather in Qatar within the year is 6 months of comfortable weather and 6 months of hot weather, please answer the following:

16- Have you ever (walked) around "Msheireb Downtown Doha"?

- Yes
- Only in winter
- Never

17- Do you prefer to walk/bicycle or to drive? (in a comfortable weather case)

- I prefer to walk/bicycle
- I prefer to drive (why: ___)

18- Have you ever experienced walking across the road from "Msheireb Metro station" to cornice/ or surroundings?

- Yes : rate your experience (1-10)
- No

19- If no, which one of the following reasons represents your choice?

- Not safe enough
- I prefer to drive
- Large intersections
- All of the above
- Not applicable

20- What do you think about the high dense labors living in the areas around Msheireb? (such as Alasmakh, Alnajda, Old AlHitmi)

- It's acceptable
- It's not acceptable
- I never noticed
- Other:_____

21- Many vacant old residential houses located around Msheireb, what do you suggest?

- Demolishing
- Maintaining
- Other:_____

22- If you experienced Msheireb Metro Station, please refer to the areas highlighted and rank the following indicators on a scale of 1 to 10, 1 for poor performance and 10 for excellent performance.

- It is a better place to live around Msheireb Metro station than other parts of Doha
- The area around Msheireb Metro Station has a suitable living for everyone
- The area around Msheireb Metro Station is clean and well maintained
- The area around Msheireb Metro Station is safe, accessible and pedestrian friendly (availability of sidewalks)
- The area around Msheireb Metro Station is an attractive place
- I can do ALL my weekly shopping in Msheireb area and its surroundings
- I can do my DAY-TO-DAY shopping in Msheireb area and its surroundings
- There is a strong community feeling in Msheireb area and its surroundings
- The area around Msheireb Metro Station is quiet and free from traffic and other

noise pollution

- The area around Msheireb Metro Station is well provided with community facilities, such as recreations, clinics, schools, other service amenities
- There are number of houses around Msheireb Metro Station
- There are number of jobs around Msheireb Metro Station
- There are number of diverse people and affordable housing around Msheireb Metro Station
- High number of intersections around Msheireb Metro Station There are number of access points to all surroundings around Msheireb Metro Station
- Public lighting for pedestrians nearby Msheireb Metro Station
- Availability of sidewalks around Msheireb Metro Station
- Availability of bike lanes around Msheireb Metro Station
- Availability of open spaces/parks around Msheireb Metro Station
- Areas around Msheireb are well connected and walkable

Part 4 – Transportation Perception (Within 1km around Msheireb Metro Station)

23- If you experienced Msheireb Metro Station, please refer to the areas highlighted and rank the following indicators on a scale of 1 to 10, 1 for poor performance and 10 for excellent performance.

- I feel safe walking around the area at night
- The area is well-served with public transport
- Traffic is not a major issue in the area
- The area is easy to walk around
- Footpaths are in good condition
- It is easy to cross the street

- I feel safe from traffic while walking
- Drivers give way to pedestrians crossing the road
- I can easily walk to and from the train station from all around
- Availability of number of transit boarding's within a walking radius (500m)
- Availability of on street parking
- Availability of free parking
- Availability of valet parking service
- Availability of shaded parking
- Availability of air-conditioned parking
- Availability of services connected to Msheireb Metro Station
- Availability of taxi at Msheireb Metro Station
- Availability of buses at Msheireb Metro Station

24- Are there any indicators that you feel are important and not listed above? If so, please list them below by ranking from (1-10).

25- Is there any issue or concern you would like to discuss further? If so, please indicate your name and email address below.

Name:.....

Email:.....

Appendix B: Interview conducted Questions

Mater's thesis research: TODs role in ehnhancing urban quality of life and preserving built heritage: the case of Mshiereb Downtown Doha

Dear Particpants, my name is sarah althani and I am currently pursuing my master's

and Design at Qatar University. As part of my thesis nature, I am inviting you to participate in my research study. The purpose of the study is to collect data/opinion from experts in the field on the performance of (TOD – transit-oriented development) on the current urban design in Doha.

I have conducted this interview questions focusing on the evaluation of the current potential TOD planning strategy in the context of Qatar [The case of Msheireb Downtown Doha] with regards to the physical design, transportation, environment, social and accessibility aspects. Please share your views/opinions to the questions given below.

The interview consists of (13) questions and will take no longer than 15-30 mins to be completed. All information provided is confidential and used for the purpose of research only. Thank you in advance for participating in this study. If you have any questions you may contact me at althanism@gmail.com, +974-33904215

Please tick the box provided to show your consent to be part of the research study

Part 1 – Personal information

1- Name:
2- Field of work/study:
3- Occupation:
4- Role:

Part 2 – TOD

TOD, or transit-oriented development, means integrated urban places designed to bring people, activities, buildings, and public space together, with easy walking and cycling connection between them and near-excellent transit service to the rest of the city.

TOD developments have been shown to reduce car ownership, kilometers driven and increase public transport usage and walking and cycling. Reducing reliance on driving not only reduces pollution including greenhouse gases, but also frees up space in the city for more vibrant, interesting and social uses. Potential locations of TOD are located around transit stations that can be developed as TOD based on the completeness of transportation modes.

1- Do you think Msheireb Downtown Doha is a potential for TOD principles? And how?
2- What do you think about the rail project in Qatar? Do you think it will make a significant urban development change?
3- In your opinion, was there a strategy behind the planning and the distribution of the metro stations in Qatar? Was TOD a factor?
4- What are other potentials for TOD planning in Qatar in your view?

Part 3- Msheireb Metro Station

Sustainable strategies was used in the design of the Msheireb Downtown Doha master plan. Accessibility, parking, traffic flow strategies, streets design strategies, presence of pedestrian-orientation and in-relation and connection to the metro station/ tram which make it a great potential for TOD.

Was Msheireb Metro Station specifically designed to serve the neighborhood residents and visitors to be integrated within an easy walking and cycling connection between them and to bring people, activities, buildings, and public space together? Is it approachable for everyone? Are there a diversity of residential, jobs, commercial and services amenities near by the metro station?

The influence area (TOD zone) for the study is taken as 1 Km around the transit infrastructure station. The indicators below are considered for this zone.

Discussion about the goals and approaches, with regard to each of the themes identified:

- Physical design: refers to elements of the built environment that planners and transportation professionals consider being essential for the success of TOD.
- Transportation: not only refers to the rail network, but also recognizes the importance of planning for access and egress modes.
- Environment: policies and design elements that improve quality of life by protecting and improving environmental standards.
- Social: encompasses the need and awareness to plan a community and transportation network that is accessible for people of different ages, abilities, social backgrounds, and lifestyles.

- Accessibility: refers to generating a system of residential, commercial, and transportation services that allows commuters to access facilities they wish to reach.

With regard to the above themes, please answer the following:

1- The Physical Design of TOD Msheireb Downtown Doha:

Dense/mixed-use/high-quality/pedestrian-friendly environment

2- The transportation of TOD Msheireb Downtown Doha:

Modes of mobility/Parking

3- The built environment of TOD Msheireb Downtown Doha:

Sustainable design elements that improve quality of life

4- The Social of TOD Msheireb Downtown Doha

Diversity of housing types/ how the neighborhood is planned to be accessed for people of different ages, abilities, social backgrounds, and lifestyles. /Does heritage buildings been considered to be preserved?

5- The Accessibility of TOD Msheireb Downtown Doha:

Transportation services are available to be accessed by all residential, commercial facilities.

Part 4 – Views/opinions

1- What are the key elements of a successful TOD?
2- Any advice for TOD professionals involved in the development of future TODs?
3- Do you have any further comments or recommendations regarding this topic?

Thank you for your cooperation.