Palestine Polytechnic University

Deanship of Graduate Studies and Scientific Research

Master Program of Architecture – Sustainable Design

# The 20-minute neighborhood concept as a model for developing new expansion zones (The case of Hebron)

**Sajida Yousef Zaaqiq**

Supervisor

Dr. Abdelrahman Halawani

*Thesis submitted in partial fulfillment of requirements of the degree*

*Master of Architecture- Sustainable Design*

February, 2025

The undersigned hereby certify that they have read, examined, and recommended to the Deanship of Graduate Studies and Scientific Research at Palestine Polytechnic University:

The 20-minute neighborhood concept as a model for developing new expansion zones

(The case of Hebron)

**Sajida Yousef Zaaqiq**

in partial fulfillment of the requirements for the degree of Master in Architecture- Sustainable Design

**Graduate Advisory Committee:**

Prof./Dr. ……,……..

(Supervisor), University (typed)

Signature:———————————— Date:————————————

Prof./ Dr. ……, ……..

(Co-supervisor), University (typed)

Signature:———————————— Date:————————————

Prof./Dr……,……..

(Internal committee member), University ( typed).

Signature:———————————— Date:————————————

Prof./Dr. ……,……..

(External committee member), University (typed).

Signature:———————————— Date:————————————

Thesis Approved by:

Dr. Nabeel Arman

Dean of Graduate Studies & Scientific Research

Palestine Polytechnic University

Signature:……...…… Date:…..……...……

The 20-minute neighborhood concept as a model for developing new expansion zones
(The case of Hebron)

Sajida Yousef Zaaqiq

# ABSTRACT

High automobile ownership rates have helped to develop low-density, car-dependent suburbs, contributing to urban sprawl. Prompting a shift in municipal policy that prioritizes local accessibility, has also emphasized the value of active travel, such as walking and cycling, . This has renewed interest in compact urban planning, which seeks to maximize land utilization and encourage sustainable development. As cities expand rapidly, there is a greater necessity for planning frameworks that embrace sustainability and a greater focus on active transport. The 20-minute neighborhood concept, which allows inhabitants to reach key services like stores, schools, and healthcare within a 10-minute walking or biking in each direction back and forth, has grown in popularity as a practical solution to satisfying these demands. Urban expansion in Palestine is unplanned and scattered, resulting in sprawl and inefficient land usage. The absence of comprehensive urban planning standards frequently leads to unregulated growth, with expanded neighborhoods and infrastructure constructed without proper planning for amenities, services, or transit systems. Therefore, resolving unplanned urban sprawl in Palestine necessitates the implementation of harder land use restrictions, sustainable development models, and comprehensive planning programs that encourage appropriate density, accessibility, and transit connection. This study introduces the 20-minute neighborhood concept as an ideal framework for developing new expansion zones, emphasizing important urban planning elements such as land use, population density, transport, amenities, and public services. Examining cities worldwide that have effectively applied this concept, like Melbourne (Australia), Scotland (UK), and Wyndham. The study assessed the current performance of an existing neighborhood in Hebron, Palestine, through a field survey and analysis of the neighborhood's basic components (infrastructure, buildings, distribution of services and dwellings, land use, and population density). The technique included mapping the distribution of residential buildings and calculating walking distances to quantify accessibility based on journey times between residences and facilities using the buffer zone analyst tool by ArcGIS Pro 3 software. The findings helped in proposing interventions to implement the 20-minute neighborhood concept and developing a theoretical model for this concept, which was then applied to an expansion area in Halhul town located in the north of

Hebron, where a model for a 20-minute neighborhood was developed that can be generalized to all similar expansion areas in Palestine, as this approach aims to generalize the findings and improve urban planning efforts in these regions. Finally, recommendations were made at multiple levels, including those for future urban planning, such as the need to consider the proportionality of population density with services and public transport, the availability of public transport infrastructure within neighborhoods, as well as recommendations for planners, local municipalities, and decision-makers, and others related to future research.

Keywords: 20-minute neighborhood, density, mixed land use, sustainable city, active transport.

مفهوم حي العشرين دقيقة كنموذج لتطوير مناطق توسع جديدة

(حالة دراسية: الخليل)

ساجدة يوسف حسن زعاقيق

المستخلص

ساعد ارتفاع معدلات ملكية السيارة في تطوير ضواحي منخفضة الكثافة تعتمد على السيارات، الامرالذي ساهم في التوسع الحضري ,مما دفع إلى التحول في سياسة البلديات التي تعطي الأولوية لإمكانية الوصول المحلي بالاضافة الى التأكيد على قيمة السفر النشط مثل المشي وركوب الدراجات. وقد أدى هذا إلى تجدد الاهتمام بالتخطيط الحضري المدمج الذي يسعى إلى تحقيق أقصى قدر من الاستفادة من الأراضي وتشجيع التنمية المستدامة. ومع توسع المدن بسرعة اصبح هناك ضرورة أكبر لأطر التخطيط التي تتبنى الاستدامة فضلاً عن التركيز الاكبرعلى النقل النشط. لقد اكتسب مفهوم حي 20 دقيقة شعبية كبيرة كحل عملي لتلبية هذه المطالب والذي يسمح للسكان بالوصول إلى الخدمات الرئيسية مثل المتاجر والمدارس والرعاية الصحية في غضون عشر دقائق سيرًا على الأقدام أو بالدراجة ذهابًا وإيابًا .

ادى التوسع الحضري في فلسطين الغير مخطط والمتناثر إلى التوسع العمراني واستخدام الأراضي بشكل غير فعال،حيث يؤدي غياب معايير التخطيط الحضري الشاملة في كثير من الأحيان إلى نمو غير منظم و تشييد الأحياء الموسعة والبنية الأساسية دون تخطيط مناسب لوسائل الراحة والخدمات و أنظمة النقل. لذلك يتطلب حل التوسع الحضري غير المخطط له في فلسطين تنفيذ قيود أكثر صرامة على استخدام الأراضي، ونماذج التنمية المستدامة، وبرامج التخطيط الشاملة التي تحدد على الكثافة المناسبة، وإمكانية الوصول، والاتصال بوسائل النقل.

تقدم هذه الدراسة مفهوم حي العشرين دقيقة كإطار مثالي لتطوير مناطق التوسع الجديدة مع التركيز على عناصر التخطيط الحضري المهمة مثل استخدام الأراضي، والكثافة السكانية، والنقل، والمرافق، والخدمات العامة من خلال دراسة المدن التي طبقت هذا المفهوم بفعالية في جميع أنحاء العالم مثل ملبورن (أستراليا)، واسكتلندا (المملكة المتحدة)، ووينديهام. ثم قامت الدراسة بتقييم الأداء الحالي لحي قائم في مدينة الخليل في فلسطين، من خلال المسح الميداني وتحليل المكونات الأساسية للحي (البنية التحتية، المباني، توزيع الخدمات والمساكن، استخدام الأراضي، والكثافة السكانية). حيث تضمنت المنهجية رسم خرائط لتوزيع المباني السكنية وحساب مسافات المشي لقياس إمكانية الوصول بناءً على أوقات الرحلة بين المساكن والمرافق باستخدام أداة تحليل المنطقة العازلة بواسطة برنامج ArcGIS Pro 3.0. وساعدت النتائج في اقتراح تدخلات لتطبيق مفهوم حي العشرين دقيقة وتطويرنموذج نظري لهذا المفهوم، ومن ثم تم تطبيقه على منطقة توسع في بلدة حلحول الواقعة شمال الخليل. حيث تم تطوير نموذج لحي العشرين دقيقة يمكن تعميمه على جميع مناطق التوسع المماثلة في فلسطين، الهدف من هذا النهج تعميم النتائج وتحسين جهود التخطيط الحضري في هذه المناطق. وأخيرًا، تم تقديم توصيات على مستويات متعددة، بما في ذلك تلك الخاصة

بالتخطيط الحضري المستقبلي، مثل الحاجة إلى النظر في تناسب الكثافة السكانية مع الخدمات والنقل العام، وتوافر البنية التحتية للنقل العام داخل الأحياء، بالإضافة إلى التوصيات للمخططين والبلديات المحلية وصناع القرار، وغيرها المتعلقة بالبحوث المستقبلية.

الكلمات المفتاحية: حي العشرين دقيقة، الكثافة، الاستخدام المختلط للأراضي، المدينة المستدامة، النقل النشط.

# DECLARATION

I declare that the Master Thesis entitled" The 20-minute neighborhood concept as a model for developing new expansion zones (The case of Hebron)" is my own original work, and herby certify that unless stated, all work contained within this thesis is my own independent research and has not been submitted for the award of any other degree at any institution, except where due acknowledgment is made in the text.

Student Name: Sajida Yousef Hasan Zaaqiq

Signature:———————————— Date:————————————

# DEDICATION

I dedicated this work to my beloved parents, Dad and Mom, whose unwavering love, support, and encouragement have been my constant source of strength throughout this journey. To my sisters and brothers, and to my tutors and colleagues at Palestine Polytechnic University. Thank you for believing in me when I doubted myself. This achievement is as much yours as it is mine.

# ACKNOWLEDGEMENT

Firstly, I thank the Department of Architecture at Palestine Polytechnic University (PPU) for allowing me to complete the master's study.

I would like to express my deepest gratitude to my advisor, Dr. Abdelrahman Halawani, for their invaluable guidance, support, and encouragement throughout this research. Their insights and expertise have been instrumental in shaping the direction of my work, and I am incredibly fortunate to have had the opportunity to learn from them.

Finally, I am deeply grateful to my family, particularly my parents, for their unwavering love and support. Your belief in me has been my greatest source of motivation, and I could not have completed this thesis without your encouragement.

To all who have contributed to my academic and personal growth throughout this journey, I extend my heartfelt thanks.

Table of Content

List of Abbreviations

| | |
|---|---|
| 20MNs | 20-minutes neighborhoods |
| (CTBUH) | Council of Tall Buildings and Urban Habitat |
| (CBDs) | Central Business Districts |

# List of Figures

# List of Tables

Chapter 1

# Introduction

## 1.1 Preface

Urban development in the twenty-first century faces significant problems, including fast population expansion, environmental sustainability, and socioeconomic disparity. In response to these difficulties, the "20-minute neighborhood" concept has arisen as a potential urban design approach. This concept envisions a neighborhood in which occupants may satisfy the majority of their everyday necessities (work, education, shopping, healthcare, and enjoyment) during a 20-minute walking or cycling to and from their homes(Chau et al., 2022). The 20-minute neighborhood exemplifies how to create more sustainable, resilient, and egalitarian urban settings by encouraging walkability, lowering dependency on autos, and strengthening local economies (Chau et al., 2022; Grodach, Kamruzzaman, & Harper, 2019).

The term "20MN" means a place with easily accessible, secure, and pedestrian-oriented access to the areas people want to go to and the amenities that people need nearly every day: transport, grocery shopping, nutritious food, school, parks, and social services.

Palestine faces a myriad of challenges, from geopolitical constraints to socio-economic disparities, that make urban planning approaches insufficient. This study aims to provide a nuanced understanding of how the 20-minute neighborhood model can be adapted to the local context, offering a practical framework for creating more accessible, and livable communities in new expansion zones.

## 1.2 Research Problem

Ideal: Mixed-use communities enhance livability by ensuring equitable proximity to neighboring amenities, infrastructure, and job prospects, fostering vitality, social integration, and intergenerational bonds. In addition, inhabitants may conveniently meet their daily needs within a short distance from their homes without using motorized transport. The incorporation of the 20MN concept into sustainable urban development applications seeks to reduce emissions and encourage sustainable and health-conscious urban design by boosting cycling and walking, a goal that cities worldwide are increasingly pursuing(Chau et al., 2022).

Reality: Urban planners and designers are recognizing the impact of car ownership on low-density suburbs, where public transit is ineffective. The rapid expansion of urban areas necessitates the development of livable neighborhoods, prompting a new sustainable planning strategy. This has reignited curiosity about compact city planning; furthermore, the COVID-19 pandemic has boosted policy emphasis on active travel, aiming to improve local environments by providing easy and secure walking, cycling, or public transit options.

Palestine's urban growth often leads to unplanned sprawl, causing inefficient land use, inadequate connectivity, and limited access to essential services. This leads to increased reliance on private vehicles, higher transport costs, and environmental degradation, affecting daily necessities and overall living conditions.

Urban and transportation experts are advocating for redesigning public amenities to promote local living, including active travel like cycling. Therefore, the 20MN concept gained popularity, but its specific architectural principles remain underexplored for future development and execution.

Consequences: The 20MN concept emphasizes the importance of well-connected, mixed-use communities with easy access to jobs, amenities, and transport. It promotes walking and biking, improves wellness, and reduces pollution. These communities involve establishing friendly environments for all ages and provide better assistance for the elderly.

The 20MN concept, a sustainable planning technique, has gained popularity but has not been properly applied to Palestine's unique urban challenges. The research problem, therefore, is the lack of a localized model to guide expansion zones in Palestine into sustainable, walkable communities. This study aims to explore its application and improvement in new urban areas.

The focus of this research will be on Palestinian city expansion zones. To build a 20MN, three components must be present: sufficient residential density, good local transport, and an adequate supply of expected facilities and services.

### 1.3 Research gap

- Previous studies indicate a lack of understanding of how the 20-minute neighborhood concept is being applied in urban areas, with no resources accessible to areas contemplating implementation. As a result, instruction is needed on how to execute 20-minute neighborhoods into practice and evaluate their success.

- There is little information accessible on the detailed principles for building the 20-minute neighborhood concept, which might aid future planning and execution.
- There are no formally created 20-minute neighborhoods that may serve as case studies because the concept is relatively new.

## 1.4 Research Questions and Hypothesis

Hypothesis: The concept of a 20-minute neighborhood may be successfully applied as a framework or a model for creating sustainable growth zones in Palestine. This approach aims to enhance access to vital services and improve the general well-being of people. So, the study conceptualizes the concepts of 20MNs in the expansion zones and expected extension areas in the Palestinian context. It also assesses the strengths and limitations of achieving this concept based on a set of indicators.

Applying the 20-minute neighborhood concept in Palestinian expansion zones, along with closeness to public transportation and vital amenities, will result in more walkable and self-sufficient communities, minimizing urban sprawl. It also reduces travel costs and dependency on private cars, and implementing this concept in Palestine will result in a more sustainable and livable urban development model.

The research answered the following questions:

Main question: How can the concept of a 20-minute neighborhood be modified to serve as a model for creating sustainable expansion zones in Palestine?

The research also answers the following sub-questions:

- What are the major components of the 20-minute neighborhood concept, and how do they apply to Palestine's socioeconomic and urban contexts?
- What adaptations are required to adapt the 20-minute neighborhood concept to Palestine's specific political, geographic, and cultural facts?
- How does having accessibility to public transport and important services affect Palestinian neighborhoods' quality of life and sustainability?
- Can implementing the 20-minute neighborhood concept reduce urban sprawl and increase accessibility in Palestinian cities?

## 1.5 Research Objectives

The purpose of this study is to examine how the 20-minute neighborhood may be adapted to Palestine and used as an approach for enhancing the condition of life in urban areas especially in the expansion zones and future extension cities, and assess to what extent may be achieved this concept. In line with this aim, the research investigates how the 20-minute neighborhood concept has been implemented and operationalized in cities. From this viewpoint, the study aims can be described as follows:

The primary purpose of this research is to present access to orientations and process models for the 20-minute neighborhood concepts in terms of land use, residential density, planning for transport, amenities, and services. To apply it to surrounding expansion zones (outer suburbs) and expected extensions, and assess how well they achieve its principles.

while the sub-objectives are as follows:

- Identify key components of the 20-minute neighborhood concept and its principles relevant to sustainable urban development.
- Analyze current neighborhoods in Palestine, with an emphasis on the accessibility of basic services, public transport, and walkability.
- Create a localized model of the 20-minute neighborhood concept that reflects the reality of Palestinian expansion zones. And develop a procedure for modifying extension regions that encircle the city to create 20-minute neighborhoods within it.
- Assess the potential effect of the 20-minute neighborhood concept on accessibility, reliance on private automobiles, and general quality of life in Palestinian cities.

## 1.6 Research Significance

The relevance of this study stems from its ability to solve major urban planning issues in Palestine by investigating a sustainable and adaptive strategy for neighborhood development, also, creating a model of a 20-minute neighborhood and generalizing it for future neighborhoods, serving as a guide point for planners to implement this concept in future projects. So, the study significantly contributes to theoretical understanding and practical applications.

The research findings have the potential to enhance Palestinian urban planning policies and development plans, assisting urban planners and local governments in creating livable neighborhoods. This research has the potential to impact future urban development initiatives by presenting a model that prioritizes sustainability, accessibility, and walkability.

This study proposes a framework for developing more sustainable, walkable, and self-sufficient neighborhoods in Palestine by adopting the 20MN concept. This is consistent with worldwide initiatives to encourage ecologically responsible urban development, decrease carbon emissions, and limit urban sprawl. It also highlights the probable advantages of establishing neighborhoods with easy accessibility to vital services and amenities. This may dramatically enhance people's quality of life by lowering journey times, cost of transport, and reliance on private automobiles while encouraging healthier, active lifestyles.

Furthermore, the study yields an accessibility rating that reflects the extent to which persons living in the selected area can satisfy their daily needs with a 10-minute walk. Based on such ratings, geographical groups of well-serviced locations will be identified as the top candidates for the 20MN. This approach of finding locations that resemble 20MN may allow policymakers to choose regions for planning.

## 1.7 Research Limitations

- Difficulties in gathering data and maps for the study area. Because it is difficult to communicate with the Ministry of Local Government and Municipalities.
- Having difficult access to Hebron City by public or private transportation regarding to the restrictions of the Zionist occupation.
- The research was undertaken during the Gaza Strip war, making it extremely difficult to visit Hebron, conduct a field survey, and contact the Hebron Municipality, particularly in the first month of the war, due to the dangerous environment and the expansion of checkpoints everywhere.

## 1.8 Research Structure

This research is divided into four parts as follows:

- First part: is a conceptual analysis of the thesis, which will be handled in Chapter 1. It provides a brief overview of the study and identifies the conceptual model upon which it is based. The conceptual study includes an introduction to the 20MN and the history of its emergence, as well as a discussion of the research problem and the research gap through a literature review, followed by the research questions and hypothesis, research objectives and significance, limits, and limitations. The chapter concludes by providing a comprehensive description of the research structure.

- Second part: the theoretical study (research background) is covered in both the second and third chapters. Chapter 2 introduces the concept and definition of a 20MN, as well as the history of its development, attributes, criteria, and the 20MN Model. It ends by providing the foundations of the built form of the 20MN by discussing the livability and its typology, as well as providing examples of 20-minute cities, the pillars to evaluate it, explaining how to measure the 20MN, the literature review of Urban Verticality, also illustrates the GIS-based technique for the 20MN.

  Chapter 3 presents worldwide cases of 20MN and examples of new successful interventions.
- Third part: provides the research methodology in Chapter 4, which is the thesis's core.
- Fourth part: Chapter 5 covers the practical study, discussion, and results presented, in which case studies in Palestine (a neighborhood in Hebron city) are analyzed, assessed, and evaluated of a 20-minute neighborhood concept in the study area by survey campaign and using Arch GIS Pro 3, and suggested interventions on the case study to achieve a 20-minute neighborhood. According to this, the theoretical part of this concept was concluded and applied in the expansion zone in Halhul town to reach the final model of 20 MNs.
- Fifth part: The final chapter (Chapter 6) includes a conclusion and recommendations of the study to provide a final model of a 20-minute neighborhood in expansion zones.

Chapter 2

# Theoretical background

## 2.1 Preface

Well-resourced neighborhoods are crucial for a city's success and community growth, addressing social justice, mental health, and belonging. They provide access to resources, activities, government, and enterprises, promoting personal and environmental well-being (Stanley & Stanley, 2014). The growing importance of neighborhoods is linked to the international trend toward decentralized service delivery systems in sectors like energy, water, health, welfare, and transport (Stanley & Stanley, 2014).

Older cities' central neighborhoods, with their local centers, transportation, services, and recreational areas, have been impacted by urban architecture. For example, London's high streets and Barcelona's local squares have disappeared due to funding cuts and changing consumer preferences, impacting planning narratives (Briefings, 2018) (Dolega & Lord, 2020).

In Poland, the 19th century had a significant impact on city formation, with many references to model towns, including Ebenezer Howard's "Garden City"(Blazy, Hrehorowicz-Gaber, Sandu, & Hrehorowicz-Nowak, 2022). Garden cities should be self-sufficient, affordable, green, low-density, and collaborative, offering local jobs, affordable housing, community engagement, green spaces, and pollution-free environments (Ayele, de Looze, Schouten, & Both, 2023).

Asian cities adopt compact cities for sustainable urbanism, benefiting economic, environmental, and social outcomes. Supported by global and local authorities for 30 years (Bibri, Krogstie, & Kärrholm, 2020). which incorporates density, mixed land use, transport networks, and environmental technology (Haarstad, Kjærås, Røe, & Tveiten, 2023).

Portland's compact city concept, a "20-minute neighborhood," has gained renewed interest in design due to rapid urban growth and the desire for livable neighborhoods (Thornton et al., 2022). A 20MN was defined as “a place with convenient, safe, and pedestrian-oriented access to the places people need to go to and the services people use nearly every day: transit, shopping, healthy food, school, parks, and social activities”(Thornton et al., 2022). Paris, Edinburgh, Seattle, and Belgium have proposed similar concepts, while England focuses on 20-minute neighborhoods with economic, environmental, health, and safety advantages(Thornton et al., 2022).

The 20MN concept aims to improve environmental, health, and economic aspects while reducing inequality among various communities worldwide (AlWaer & Cooper, 2023). The 20MN concept has now been adopted by several European municipal and national governments, transforming it from a planning and design paradigm to a policy framework for future urban governance (van der Horst et al., 2021).

## 2.2 Definition Of 20-Minute Neighborhood Concept

Several definitions of the 20MN have evolved to include additional active modes of travel (such as cycling) and even other sustainable modes (such as public transport). The 20-minute city is the most recent embodiment of planning techniques such as New Urbanism and Smart Growth, with an emphasis on human-scale design meeting accessibility-oriented planning(Lindner). Cities all around the globe are increasingly adopting the concept of the 20MN as part of wider sustainable urban development efforts (Kamruzzaman, 2022). It is a political objective for governments all over the world; the major benefit of this program is that it provides access to natural space (NS) within 800 meters of where they live(Calafiore, Dunning, Nurse, Singleton, & Environment, 2022). To construct a 20MN, three components must come together(Gower, Grodach, & Research, 2022):

- Optimal residential density,
- Adequate local transport.
- In addition, an appropriate supply of anticipated services and facilities.

Previous studies emphasize the importance of supporting active travel networks and public transport infrastructure in connecting people and their neighborhoods with vibrant, liveable, healthy, safe, and accessible areas while reducing automobile reliance and emissions. Local planning strategy and goals must be matched with measures to meet national and global climate targets while also constructing a stronger, more equitable, economically, socially, and environmentally sustainable society(Mackenzie, 2022). 20MN is a simple and transparent tool that, when used as part of a larger plan, may empower communities and coordinate stakeholders' efforts and activities toward a timely solution to our crucial climate challenge(Mackenzie, 2022).

Table 2.1: Comparison of 20MNs definitions used by government agencies, professional and voluntary organizations (Portland, 2021):

| Organization | Definition |
|---|---|
| Melbourne City in Australia | The 20-minute neighborhood concept is based on "living locally"—allowing occupants to cover the majority of their daily requirements within a 20-minute return walk from their houses, with accessibility to safe cycling and local transportation choices. A 20-minute trip is equivalent to walking 800 meters from a house to a destination and back (ten minutes each way). |
| Portland City in the USA | A 20MN has easy, secure, and pedestrian-oriented accessibility to the destinations residents want to get to and the amenities they use daily: transport, shopping, school, parks, excellent food, and social activities, all of which are in proximity to dwellings. |
| Scottish Government | The Scottish Government's draft National Planning Framework defines 20MN as a technique of establishing linked and frequently compact neighborhoods so that residents can satisfy most of their everyday needs within an acceptable walk, or cycling within about 800m distance of their homes. |
| Sustrans | ".. . . . ...ensure that it is easy for people to meet most of their everyday needs by a short, convenient and pleasant 20-minute return walk" 10 minutes there, and 10 minutes back |
| Royal Town Planning Institute (RTPI) | 20MN is a concept of developing cities that has quickly gained traction among policymakers, legislators, and the general people throughout the world. The main assumption is an urban planning plan that generates areas where everyday amenities are accessible within a 20-minute walk. |

## 2.3 The Historical and Chronological Development Of 20MNs Concept of Compactness or Urban Verticality

In actuality, the 15-minute city is an 'ideal geography' that varies according to the kind of transport utilized and the consequences of various shed levels. Simultaneously, in terms of physical planning, 15-minute cities rely largely on features that have previously been utilized as design flagships, such as accessibility, walkability, density, land use mix, and design variety(G. Pozoukidou & Chatziyiannaki, 2021).

### 2.3.1 Urban Verticality (Vertical Urbanism)

Establishing a 24-hour city or neighborhood has been a characteristic of the New Urbanist planning paradigm, which emphasizes high-density mixed-use design, walkability, and transit-oriented urban development (B. Bereitschaft & Scheller, 2020).

Urban studies have historically been mainly flat, with no vertical dimension. This horizontal predominance is partially based on the fact that a lot of cities across the world, particularly hubs of information creation, are plain cities(Jin, 2022). Verticality, as opposed to horizontal urbanism,

is both a part of locals' everyday lives and a stunning experience for outsiders, which has been mobilized by the local government for place-making and city branding(Jin, 2022).

At the beginning of the twentieth century, Frank Lloyd Wright and Le Corbusier developed conflicting visions of cities that formalized the opposition between horizontal and vertical city growth. While the first, along with Broadacre metropolis, proposed a vast and rural metropolis, the latter created a vertically growing city by liberating the land from infrastructure for roads and reconnecting it to nature, people, and social life(Cangelli, Vettori, & Environment, 2019). In both cases, the initiatives intended to alleviate problems emerging from the tremendous urbanization of the early twentieth century, which caused problems like pollution, social disorder, and urban periphery poverty, while also demonstrating a strong belief in technical advancement (Cangelli et al., 2019).

The concept of vertical urbanism was first used in architecture to emphasize the need to construct vertically to make cities more compact. Other academics have focused on the three-dimensional volume of cities, combining vertical with volumetric urbanism(McNeill et al., 2019) (Shih et al., 2018) (Nethercote, 2018).

Volumetric cities are composed of density, functional mix, compaction and compression, complex networks, and a high level of urban interaction. Therefore, volumetric urbanism varies from vertical urbanism due to it does not necessitate verticality; rather, verticality is viewed as a result of space compression. A volumetric city may have little skyscrapers but is intensely compacted and internalized through closely linked structures and areas, from the skyline to the ground. In this environment, interior hallways and levels linking buildings become the city's new streets alive urban character emerges (Bruyns, Higgins, & Nel, 2021).

As cities deal with significant population growth—2.5 billion people by 2050—and disastrous sprawl, lawmakers, planners, and architects are becoming more interested in the vertical city model. Given the large-scale issues with skyscrapers, any advances in planning, design, and construction would be enormous(Al-Kodmany, 2018). The Old Walled City of Shibam is considered an example of a historical vertical city model.

#### 2.3.1.1 Old Walled City of Shibam

Shibam, built in the 16th century and surrounded by a defensive wall, is one of the earliest and greatest instances of vertical construction-based urban planning. Its spectacular tower-like constructions sprout out of the cliff, earning the city the nickname 'Manhattan of the Desert'(Unesco). The city consists of buildings up to seven stories and is heavily built on a defended, rectangular grid pattern of streets and squares. As such, the historic walled city of Shibam and its surroundings in Wadi Hadramaut are remarkable examples of human habitation, land use, and city planning (Unesco).

Figure 2.1: Old Walled City of Shibam (Yemen)(Unesco).

- Site Plan Analysis of Shibam City

The city has been divided into four sections with two vertical axes flowing north-south and one horizontal axis crossing east-west. Most of the service buildings are situated on the city's southeast side, near the main entrance. The palace, mosque, school, market, government buildings, and public service shop establishments are all centered around the city's biggest squares these are limited-height buildings, and the person who enters the city gradually moves from this basic region to neighborhoods with some privacy via a network of narrow streets (Figure 2.2)(Al-Asta, Al-Dhubhani, Engineering, & Technology, 2023). The usage of buildings in the old city of Shibam Hadhramaut varies from one location to another, as indicated in (Figure 2.3,Figure 2.5), the west and north sides of the city are dominated by residential buildings, accounting for 53% of the total general plan. Commercial use covers which are approximately 3%, while religious buildings cover which is approximately 4% of the total general plan of the city(Al-Asta et al., 2023).

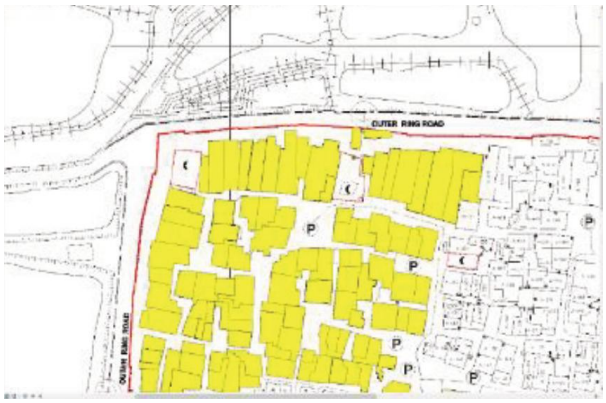



Figure 2.2: The process of creating three-dimensional urban plans for building uses for the historic city of Shibam Hadhramaut (Al-Asta et al., 2023).

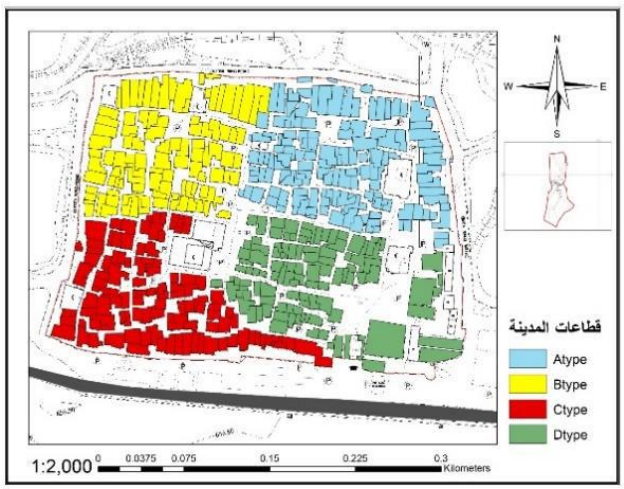



Figure 2.3: Dividing the historic city of Shibam Hadhramaut into four sectors (Al-Asta et al., 2023).

Figure 2.4: Elevation of Shibam Hadhramaut historical city (Al-Asta et al., 2023).

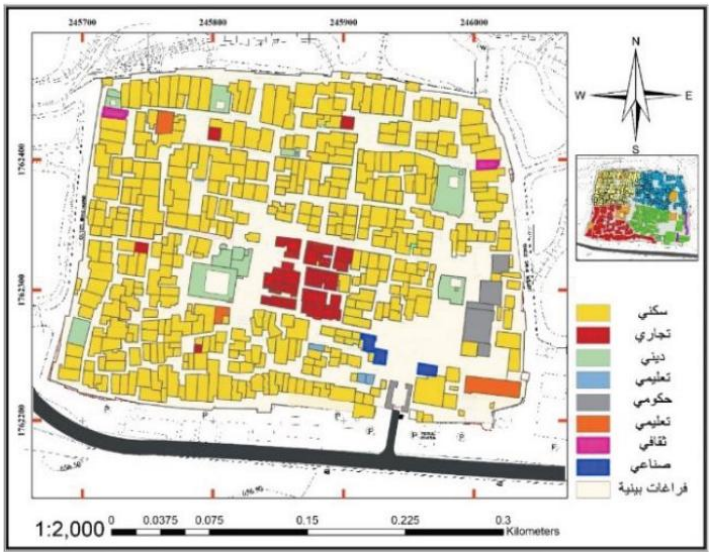



Figure 2.5: Map of building uses for Shibam Hadhramaut (Al-Asta et al., 2023).

Figure 2.6: Site plan for the old city of Shibam Hadhramaut (Al-Asta et al., 2023).

Figure 2.7: Isometric views with different vanishing points of the old city of Shibam Hadhramaut (Al-Asta et al., 2023).

### 2.3.1.2 Le Corbusier's Theories of Planning

Le Corbusier's planning philosophy differed from H. Prost's standardization concept, while the Charte d'Athènes advocates embraced innovative ideas over traditional city planning (Coskun). Le

Corbusier's industrial advances were influenced by his laws, promoting "rational city" concepts and one-man-hand design. He advocated for angle and high-rise structures, rejecting green spaces as modernity reflections. His planning ideas were influenced by public health and urban modernization (Coskun).

H. Prost's Beaux-Art plan and Le Corbusier's Anvers planning utilized a diagonal schema, overlooking the city's historical structure, using tall buildings. This approach, pioneered by Le Corbusier in Brazil and Algeria, influenced his architectural style and later in Paris (Coskun).

### 2.3.2 High-Rise Building

The number of high-rise buildings is increasing globally as the population grows and technology advances. These mixed-use, office, or residential buildings serve as emblems of both power and status. Residential high-rise structures are important in this trend because of their deep social and architectural implications. Due to their excellent size and population density, these buildings have a tremendous influence on the city(Pala, 2023).

Definition of High-Rise Building(Pala, 2023):

- High-rise buildings are subjective and vary by nation, city, and context. A "tall building" is a multi-story structure with elevators for access to objectives (Challinger, 2008).
- The Council on Tall Buildings and Urban Habitat defines a "tall building" subjectively based on context, proportion, and relevant technology (ctbuh.org, 2019).
- The CTBUH classifies taller structures as supertall or mega tall, with supertalls being 300 meters or taller and mega tall 600 meters or more (ctbuh.org, 2019).

#### 2.3.2.1 Suburban High-Rises

The number of high-rise buildings is increasing globally as the population grows and technology advances. These mixed-use, office, or residential buildings serve as emblems of both power and status(Pala, 2023). Residential high-rise buildings are important in this trend because of their substantial social and architectural implications. Pala, E.E., in 2023, theoretically analyzed the concepts of living in high-rise structures and "residences" with their philosophical, sociological, and urban aspects, and used that theoretical framework to investigate several residences in South-Western Ankara(Pala, 2023).

### 2.3.3 Motivations for The Emergence of the 20-Minute Neighborhood Concept

The 20-minute city is a popular urban design approach for low-transportation communities. While meeting residents' demands in local neighborhoods is not a new concept, urban and transport planners are increasingly tasked with re-structuring transportation and public services to facilitate people 'living locally'. The existence of a 20-minute city is viewed as a sign of urban success and has gained political recognition as a result of the pandemic(Calafiore et al., 2022).

The COVID-19 pandemic has focused governmental attention on active travel, with the 20-minute city emerging as a global urban mobility target. The emergence of the "local" neighborhood inside cities, as well as the modal shift of some urban transit patterns, have lent support to the concept of meeting inhabitants' daily and weekly requirements near their homes through more active travel(Calafiore et al., 2022).

#### 2.3.3.1 Impact of COVID-19 Pandemic

The COVID-19 pandemic exposed flaws in global infrastructure, highlighting the need for improved public health legislation and medical technologies to prepare for future pandemics (B. Bereitschaft & Scheller, 2020). It necessitates changes to physical and institutional infrastructure, particularly in cities due to increased susceptibility to airborne infections (B. Bereitschaft & Scheller, 2020).

During the lockdown, neighborhood experience deteriorated in older neighborhoods, with houses performing better due to private outdoor space and high-quality green space (Mackenzie, 2022). Cities should promote public green spaces, expand sidewalks near businesses, and streamline permission processes to combat COVID-19 and future pandemics, promoting healthy living and reduced mobility (B. Bereitschaft & Scheller, 2020).

COVID-19 lockdowns have refocused attention on local centers' role in social and economic resilience, health, and sustainability. European governments have adopted the 20-minute concept, transforming it into a strategy for future urban administration (van der Horst et al., 2021).

### 2.3.4 The Goals of the 20-Minute Neighborhood Concept

The 20 MN concept seeks to offer people who have the opportunity to satisfy their daily requirements in a 20-minute non-motorized excursion from home. There is presently no evidence that the 20 MN promotes increased walking for transportation or pleasure(Ayala et al., 2022). The concept of a 20MN is straightforward. The residents' daily and weekly requirements must be

covered within a 10-minute walk in both directions from their residence. Thus, time compared to active movement is the fundamental spatial descriptor used to offer regular services(R. Dunning, Calafiore, Nurse, & planning, 2021).

20MNs emphasizes the value of well-connected, mixed-use neighborhoods and communities that have easy access to important functions and services, public transport, and open spaces. Shorter distances combined with a reprioritization of public places encourage more active modes of travel, resulting in public health advantages and lower environmental pollution(Calafiore et al., 2022). Mixed-use developments increase livability, allowing individuals to have fair access to local resources, services, and employment opportunities, improving vibrancy, social cohesion, and intergenerational connections(R. Dunning et al., 2021).

### 2.4 The Attributes (Features) of 20-Minute Neighborhoods

20MNs involve environments that are regarded as welcoming to people of all ages, meet changing needs throughout their lives, and provide greater assistance for elderly citizens. Furthermore, there is evidence that 20MNs may be more resilient to many of the negative consequences of stringent public health regulations, such as those adopted during lockdowns during the COVID-19 pandemic(Chau et al., 2022). The four attributes of 20MN suggested in the literature (Gunn et al., 2017):

- Ecology: for a sustainable and green city.
- Proximity: Living closer to work.
- Solidarity: human ties via solidarity.
- Participation: Encourage residents to actively participate in improving their living spaces.

Walkability and pedestrian priority are at the foundation of 20MNs. A 20MN is 800 meters (approximately half a mile) away, or 20 minutes in time (based on healthy individuals' typical walking times). While public transport should be encouraged, it is not frequently sufficient for crossing these distances inside a neighborhood; instead, public transport is a means of connecting neighborhoods(Ming & Fong, 2016). bicycle may work if there was adequate bicycle infrastructure, but the goal of the 20MNs is to prioritize pedestrians and walkability (Roosli, Isa, Mohamad, & Othman, 2022).

## 2.5 The Criteria For a 20-Minute Neighborhood

The two most important factors in attaining a 20MN are distance and features. According to research, individuals are ready to walk for no more than 20 minutes to satisfy their daily requirements locally (Badland et al., 2014). Users can walk 2 km or cycle 5 km in 20 minutes while still having access to other forms of public transportation. A 20-minute neighborhood must include (Roosli et al., 2022):

- To optimize active transportation, areas should be safe, accessible, and well-connected for pedestrians and cyclists.
- They should also provide excellent public realm and open spaces,
- Offer services and locations that encourage local living.
- Improve public transport to link people to employment and services.
- Provide dwellings and population densities that support local services and transport.
- Promote healthy local economies.

The key criteria for a 20MN to be effective in supporting the local living area and, as a result, offering important opportunities and services locally, include access to quality transport that connects people to employment and high-level services. The more people a 20MN can handle, the wider range of options it can provide. However, as the population grows, more land is required to provide certain possibilities and services. For example, the criterion for providing open green space is 5 square meters per person. Essentially, this means that the fixed land area of a 20MN must be divided between competing purposes. As a result, the 20MN concept confronts a unique challenge: more people are required to provide enough activities, yet more opportunities necessitate less residential space to accommodate them(Shatu & Kamruzzaman, 2021).

### 2.5.1 Public Transport Service Requirements

- Minimum service levels

Public transport services have been broadly categorized as mass transit, where the focus is on long-distance trunk movements and social transport, and focus on providing a local social safety net access service, with connectivity to trunk services. The objective should be to provide a level of service that allows most people to conduct the majority of their desired activities without the need for a vehicle. When users need or want to travel, the combination of mass transport and local transit

ensures that they may accomplish their goals without having to wait for extended periods. It will also decrease the need for automobile ownership(Stanley & Stanley, 2014).

- Community transport

In Australia, the inability to address the transportation needs of many groups of disadvantaged people, such as the elderly and those with disabilities, has resulted in the establishment of a type of informal transport known as community transport. While it encompasses a variety of service kinds, it often refers to enterprises that offer service transport to their clients or components. For example, an organization that offers homes for the elderly may acquire a minibus to take residents on daily excursions. Community transport often serves specific individuals rather than the wider public, and services are rarely integrated with other community transport services or other modes of services(Stanley & Stanley, 2014).

### 2.5.2 Active Transport

The active transport component of infrastructure planning concentrates on the bikeability and walkability of neighborhoods. Simple practicality is an important concern for making the city more bikeable and walkable(Stanley & Stanley, 2014). Active transport options include walking, cycling, electric cycles, rollerblades, and skateboards (Stanley & Stanley, 2014). Some initiatives that can help increase the use of walking and cycling include(Stanley & Stanley, 2014):

a) Improving pedestrian infrastructure through wide footpaths, non-slip surfaces, lighting, "eyes on the street" design, shade trees, seating, weather protection, pedestrian-friendly facades, adequate crossing time, and community involvement.
b) To reduce traffic issues, provide separate bike lanes, clearly marked paths, well-lit roads, secure cycle storage facilities, workplace showers, and bridges that accommodate all users
c) Improving transport connectivity for walkers and bicycles.

These examples are not complete, but they demonstrate how neighborhood-level urban design can promote walking and cycling, while also enhancing urban density.

## 2.6 The 20-Minute Neighborhood Model

The Scottish Government has set an 800-meter distance from Melbourne's 20MN model, focusing on walkable neighborhoods and healthy, liveable communities. The model includes six categories: travel, employment, access to commerce & and healthcare, education, greenery, recreation,

housing, and safety, aiming to create a strong sense of community (Victoria State Government, 2024).

Carlos Moreno proposed the 15-minute city, an innovative urban design idea focused on the proximity of services(Moreno et al., 2021b). Working with Paris Mayor Anne Hidalgo, they created a place-based urban planning strategy to convert Paris into a people-friendly city(Moreno et al., 2021b), The "Ville Du Quart D'Huere" strategy aims to create a 15-minute city, removing over 75% of parking spaces and installing dedicated cycling routes on all Paris streets, ensuring residents can meet their daily needs within 15 minutes (Mackenzie, 2022).

15-minute" concept suggests that inhabitants can enhance their quality of life by fulfilling six essential social functions: living, working, commerce, healthcare, education, and recreation (Moreno et al., 2021b). 15-minute city characteristics are shared by previous design flagship programs, focusing on service proximity, and rethinking citywide resource allocation to improve accessibility, walkability, density, and design diversity (Mackenzie, 2022).

(Moreno et al., 2021b)offer a modified "15-minute city" framework to enable urban recovery from COVID-19, building on Moreno's (2016) original proposal. They claim that cities would be better positioned to deal with the pandemic's consequences on city people if the four dimensions (listed in Table 2.2 ) were emphasized (Mackenzie, 2022).

Table 2.2: four dimensions of the 15-minute city framework adopted from (Moreno et al., 2021b)

| Dimension | Attributes |
|---|---|
| Density | Appropriate density to sustain local services and economy while also providing appropriate outdoor spaces for recreation. |
| Proximity | Proximity of amenities over accessibility improves control of infections and security in the context of a pandemic.<br>Access to groceries, healthcare, recreation, culture, transport, and education |
| Mixed land use | Mixed-use neighborhoods are critical to the economic sustainability of urban centers.<br>Recognizing that every individual has the same requirements.<br>Social involvement is essential to ensuring that a diverse variety of demands are fulfilled and that no one is left behind. |
| Digitalization | Sharing bicycles and sensor technology for safety<br>Online shopping.<br>Digitalization to enable working from the house. |

### 2.6.1 Public Spaces and Corridors

Public space in cities holds political and symbolic value, but planners also consider its functional and morphological relevance (Bianchi, 2018) (Bocca & Environment, 2021). As a result, the 15-minute city aims to restore dignity to disconnected metropolitan areas, making more space accessible to families (Ware, Lobos, & Carrano, 2020). Furthermore, The evolution of urban forestation and ecological turn emphasizes the importance of green components in modern metropolis landscapes (Bocca & Environment, 2021). So, proper implementation of wide and well-maintained bikes and walking trails can stimulate active transport and leisurely physical exercise(B. Bereitschaft & Scheller, 2020).

Cities with abundant green spaces and corridors can serve as models for other cities. Oslo, Norway, for example, the city's substantial 60 $m^2$ of green space per resident has seen a rise in green space utilization during the COVID-19 lockdown (B. Bereitschaft & Scheller, 2020). Indeed, European cities have a large number of green spaces, with approximately 18 $m^2$ per citizen, twice the World Health Organization's recommendation (Maes, Zulian, Günther, Thijssen, & Raynal, 2019). Increasing the number and accessibility of green spaces is expected to increase regular contact with nature (B. Bereitschaft & Scheller, 2020).

### 2.6.2 Accessibility

Accessibility assesses the ease of access to opportunities and captures more aspects of sustainable cities than traditional mobility measurements, concentrating on the total capacity to travel and typically suggesting quicker speeds to overcome distances (Capasso Da Silva, King, & Lemar, 2019). The 20-minute city demonstrates how accessibility may be used as a local sustainability strategy. Improved accessibility is more than simply a transport aim; it also promotes sustainability and climate action. According to research, focusing planning activities on more bikeable infrastructure may boost their utilization. Site designs and real estate development should address how design components like curb cuts, driveways, and building frontages contribute to permeable sites that promote walking and cycling. Improvements to the road network alone are unlikely to be adequate, but important, to encourage alternatives to driving(Capasso Da Silva et al., 2019).

### 2.6.3 Walkability

Indeed, in addition to accessibility, the 20-minute city has a strong pedestrian experience, which architect Steve Mouzon (2012) refers to as Walk Appeal. The latter concept is based on perceptual

criteria such as quick shifts of view, rest areas, big pedestrian and cycling zones, a high sense of safety provided by shop windows, and elements (goals) in the medium distance (1 block to 2 miles) that are recognized as areas were, for example, outdoor activities can be carried out. The greater the Walk Appeal rating, the more inclined individuals are to walk instead of driving(Bocca & Environment, 2021).

## 2.7 The built-Form

A growing body of research has shown linkages between travel and the built environment. These links provide chances to modify the urban environment in ways that are more likely to help the 20 Minute City become a reality. Ewing and Cervero's (2010) meta-analysis provides the most complete evaluation of the relationships between travel and the built environment. The writers stress the five aspects of built form and how they impact automobile travel distances(Stanley & Stanley, 2014): Density, land use diversity, design (especially street network features), destination accessibility, and transport distance. Their stated impact elasticities are particularly intriguing since they demonstrate the relative sensitivity of distinct response variables to changes in a variety of probable causative inputs.

## 2.8 Livability And The 20-Minute Neighborhood

"Livability" is a recent way of assessing the success of planning in reaching the objective of balanced and healthy living (Whitzman et al., 2013). Livable cities offer social inclusion, affordability, accessibility, health, safety, resilience, attractive environments, and opportunities for people to live their lives and raise families to their fullest potential (Whitzman et al., 2013).

The Melbourne Plan, its most recent urban strategy, lists 'livable neighborhoods and suburbs' as one of the 'competitive advantages that fuel our city's current performance'(Victorian State Government, 2013). A key livability-related mechanism proposed in Plan Melbourne Plan Melbourne proposes a 20MN city development to improve health, reduce travel costs, and decrease car emissions, enhancing livability (Whitzman et al., 2013).

The 20MNs concept, originating from Portland, is a neighborhood-based plan ensuring high-quality, reliable essential services for those within 20 minutes of active transport (Lynch). A successful neighborhood includes 20-minute active transport access to housing, commercial services, public schools, recreational facilities, affordable transportation, and civic amenities, built at a walkable and bikeable human scale, meeting all ages and abilities (Whitzman et al., 2013).

## 2.9 Typology Of 20 Minutes Neighborhood

Classification distinguishes neighborhoods based on design features, allowing for manipulation and improvement. Techniques vary based on spatial scale, with urban areas classified as monocentric, polycentric, sprawl, or linear (Kamruzzaman, 2022).

(Kamruzzaman, 2022) this study derives five different typologies of 20MNs in Melbourne. These five typologies' solutions can be labeled and characterized as: typology 1(Isolated and circular 20MNs), typology 2(Semi-compact and semi-linear 20MNs), typology 3(Compact and linear), typology 4(Organic 20MNs), typology 5 (Semi-compact and circular 20MNs) (Figure 2.8).

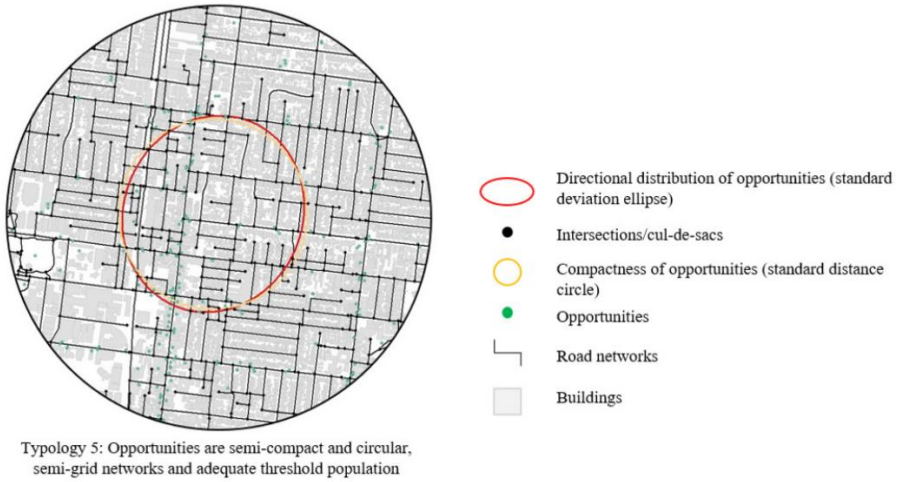



Figure 2.8: The best typology of 20-minute neighborhoods in Melbourne (Kamruzzaman, 2022).

## 2.10 Evaluation Pillars Of 20-Minute Neighborhoods

Previous studies have studied case cities that have embraced this new model of city vision. The research focuses on understanding how the concept of 20-minute cities fits the legacies of different cities represented by traditional planning principles in the context of three evaluation pillars: inclusion, safety, and health. Implementing a 20-minute city implies a shift in planning emphasis from neighborhood accessibility to urban functions to the proximity of urban functions inside neighborhoods, as well as significant systemic changes in resource allocation patterns and governance schemes across the city (G. Pozoukidou & Chatziyiannaki, 2021).

- Inclusion

Inclusion refers to the people's "right in the city" in which active engagement, even though insurgent tactics, becomes part of the construction of space, neighborhood, and society. Co-planning methods and involvement in decision-making are seen as critical components of space

creation for cities to address the numerous and complex environmental, social, and economic challenges. Inclusiveness refers to the ability to "hear" inhabitants' voices via debate, co-design, and collaboration in decision-making with local authorities and stakeholders. It also considers the perspectives of all local groups, particularly those who face socio-spatial exclusion, such as people with diverse cultural backgrounds, transportation challenges, the elderly, young people, and students, to reduce their vulnerability through empowerment programs (G. Pozoukidou & Chatziyiannaki, 2021).

- Health

The second pillar is concerned with ensuring healthy urban settings in both spatial and social dimensions. The number, distribution, and accessibility of public and green areas are critical for maintaining healthy urban settings (G. J. E.-M. J. f. E. I. Pozoukidou, 2020). Green areas are commonly considered to encourage physical activity through "walkability", improve social and psychological well-being, enhance air quality, and reduce noise (Europe, 2016). Furthermore, green spaces have a vital societal role in reducing health inequities by giving access to infrastructure and benefits to all people, independent of class or age group(G. Pozoukidou & Chatziyiannaki, 2021).

- Safety

The third pillar is the security of metropolitan areas. Creating public areas where inhabitants and tourists feel comfortable is a long-standing goal in urban planning. It is a multifaceted problem, and numerous techniques and design interventions have been offered to counteract violent and criminal behaviors. These included a diversity of land uses that encourages continuous use of space at different times of day, increased visibility at night through the use of proper lighting, and so on(G. Pozoukidou & Chatziyiannaki, 2021).

The orientation of "city life" towards the street might provide a sense of safety in the urban setting. This is consistent with Jane Jacobs' view that "there must be eyes upon the street, eyes belonging to those we might call the natural proprietors of the street". Furthermore, Mehaffy argues that cities operate better when inhabitants have some control over their spatial organization(Mehaffy, 2014). This is connected to the various degrees of public and private space during the day and span of our lives, which must be constantly adjusted by residents and tourists within the context of citizen-centered design. In this strategy, public involvement is critical so that people feel in charge of the

place, and passive community surveillance becomes an active safety net (G. Pozoukidou & Chatziyiannaki, 2021).

## 2.11 Literature Review

### 2.11.1 Mixed-Use Neighborhood

(Hachem-Vermette, Singh, & Buildings, 2019) presents a method of optimization for combining residential and commercial buildings in a mixed-use neighborhood to improve energy performance and reduce GHG emissions. It examines numerous characteristics concerning the kinds of buildings, such as density, floor area, and the percentage of particular types of buildings in the overall constructed area. The results are shown in

Table 2.3 (Hachem-Vermette et al., 2019).

Table 2.3: The results of (Hachem-Vermette et al., 2019).

| Type of buildings | Ratio to the total area of land |
|---|---|
| Commercial building | 22%-32% |
| Several combinations of residential structures that improve energy performance while lowering GHG emissions are formed by | 50% of detached houses<br>50% of combined townhouses and apartment units (with different ratios) |
| On the commercial side, near-optimal combinations of commercial building space consist of | 46–75% offices<br>18–45% retails<br>6–9% supermarkets. |

(Seong, Lee, & Choi, 2021) supported urban planners' widespread opinion that mixed land use encourages walking in Seoul, an East Asian city, by examining the influence of mixed land use on the travel mode choice of housewives and jobless persons who do non-commuting trips on weekdays. Using binomial logistic regression on commute information, it was discovered that the greater the number of mixed-use neighborhoods the greater the number of people who choose to walk instead of driving.

The nonlinear association between the land use mix index and the decision to walk was verified. Mixed land use increased walking, but reversed when complexity increased. Factors like location, income, and dwelling type also influenced walking decisions. For example, higher-income households and those living in apartments are more likely to choose driving over walking when their neighborhood environment is controlled (Seong et al., 2021).

UN-Habitat presents a technique for summarizing and refining current sustainable urban planning theories to foster a new and sustainable interaction between urban people and urban space while also increasing the value of urban land. This strategy is founded on five principles that promote the three essential characteristics of sustainable neighborhoods and cities: compact, integrated, and connected (Habitat, 2014). Table 2.4 below summarizes these principles.

Table 2.4: The principles of technique that summarize and refine current sustainable urban planning theories to foster a new and sustainable interaction between urban people and urban space while also increasing the value of urban land.

| Formula | Ratio |
|---|---|
| Streets | - At least 30 % of the land<br>- and at least 18 km of street length/km². |
| High-density city | - At least 15,000 people/km$^2$ |
| Mixed land-use | - At least 40 % of floor space should be allocated for economic use in any neighborhood. |
| Residential buildings | - 20% to 50% of the residential floor area should be for affordable housing.<br>- Each tenure type should be no more than 50% of the total. |
| Limited land-use specialization (Single-function blocks) | - Should not cover more than 10% of a neighborhood's area. |
| High-density mixed-use urban areas | - At least 30 % of land is allocated for roads and parking.<br>- At least 15-20% is allocated for open public space. |

Even though the social mix is a socio-spatial concept that is difficult to quantify, empirical facts based on best practices in Europe may be used to establish a numerical benchmark. In Holland, regions governed by the VINEX policy are set aside for new housing, 30% of which must be affordable. In Ireland, new "set aside" rules require that 20% of new development be set aside for affordable housing (inclusionary zoning). In the United Kingdom, the mechanism is called planning gain, and the requirements for affordable housing are typically set at roughly 25% of new construction, except in London, where the amount is being raised to 30-50%(Habitat, 2014). Table 2.5 summarizes the ratio of land use categories in mixed-used neighborhoods.

Table 2.5: Summary the ratio of land use categories in mixed-used neighborhoods.

| Formula | Ratio to the total area of land |
|---|---|
| High-density city | At least 15,000 people/km$^2$ |
| Streets and parking | at least 30 % of the land |
| Mixed land-use | 22- 60% of floor space should be allocated for economic use in any neighborhood. |
| Residential buildings | 30-50% of land area<br>- 20% to 50% of the residential floor area should be for affordable houses<br>- 50% of detached houses |

| | |
|---|---|
| Public open spaces | 15-20% |
| Limited land-use specialization (Single-function blocks) | less than 10% |

2.11.2 The 20-Minute Neighborhood Concept

In 2021, previous research investigated the "15-minute city" concept as a structural and functional element for rebuilding modern cities, with a focus on three case cities that adopted this new city vision model. The research focused on determining how the concept of 15-minute cities fits into the legacies of various cities as characterized by traditional planning principles, within the context of three assessment pillars: inclusion, safety, and health. The authors contend that the 15-minute city method is not a radical new concept because it draws on long-standing planning ideas. Nonetheless, it applies these concepts to accomplish bottom-up well-being promotion while proposing a new way of thinking about optimum resource allocation on a city-wide scale. As a result, the implementation of the 15-minute city indicates a shift in design emphasis from neighborhood accessibility to urban functions to the closeness of urban functions inside communities, as well as significant systemic changes in resource allocation patterns and governance systems across the city(G. Pozoukidou & Chatziyiannaki, 2021).

AlWaer, Husam Cooper, and Ian, in 2023, have distinguished goals and means - between the desired outcomes of the 20MNs and the methods available to accomplish them and separated the intended objectives of the 20MNs from the tools available for obtaining them. The paper found that achieving the goal of weaving the 20MNs at scale into existing urban, suburban, and rural neighborhoods will necessitate significant effort to make sure that all the components and key players in the planning's place system of delivery are in line with the support of one another. Until this is accomplished, more research will be required on (1) how to operationalize the 20MNs and (2) how to quantify its performance (AlWaer & Cooper, 2023).

- Desired results derived from the literature review:

According to C40 (2020), 20MNs and 15-minute cities have five common characteristics(AlWaer & Cooper, 2023):

1. Goods and services, particularly fresh food, groceries, and medical facilities are valuable and accessible to everyone.

2. A wide range of housing types, measurements, and tenures are available to meet the diverse needs of individuals and households.
3. A wide range of workplace options can be found to accommodate a variety of working habits and scenarios, including co-working areas, retail, and hospitality facilities.
4. Green and recreational places provide high-quality and regular opportunities to interact with natural elements.

(O'Gorman & Dillon-Robinson, 2021) provided a reduced list comprising only three essential characteristics for an area to be able to operate as a 20MN:

1. Features and infrastructure: These include vital services such as stores, facilities, healthcare facilities, active transportation infrastructure, and green areas.
2. Quality of services and experience: A particular "level of quality and experience" for this infrastructure and services must be provided.
3. Engagement and behavior change: An "engaged social prepared to modify or adapt their behaviors" is required to ensure that positions perform like 20MNs on the ground, necessitating unique solutions created following community demand.

A realistic definition of the 20MN was created and applied to two Australian state capital cities: Melbourne (Victoria) and Adelaide (South Australia). Have been used in Melbourne and Adelaide's metropolitan boundaries. This technique might be extended to various situations as a first step in measuring the presence of 20MN and monitoring the concept's subsequent deployment(Thornton et al., 2022). Also, in 2022 some researchers reported a collective effort of one instructor, six lectures, and 175 undergraduate students to investigate if Melbourne's aspirational proposal for 20MNs in Melbourne's outer suburbs can be achieved, and if so, how it may be outperformed (Olsen, Nicholls, et al., 2022). A unique technique for detecting where 20MNs could exist through a large city region and evaluating how their presence matches socio-spatial disparities was proposed. The technique employed in this study offers two results: the identification of places that approach 20MNs based on critical service accessibility and the evaluation of equality in the Liverpool City Region(Lindner).

The progress of a community initiative including University Sains Malaysia, PLAN Malaysia, the Penang Disaster Management Committee, and community organizations has been investigated. To assess if this neighborhood in Balik Pulau is suitable for consideration as a pilot project capable

of fulfilling the same standards as the pilot project in Melbourne, Australia. This city project intends to analyze the characteristics and criteria, investigate the study area's readiness to confront disaster based on the assessed attributes and criteria and improve the study area's resilience by practicing the traits and criteria of the 20-minute city. The findings indicate that understanding the feasibility of these features and criteria will aid in the development of an effective disaster management plan, resulting in a community that is resilient and competitive in terms of distances and features, as practiced in 20MNs in Australia(Whitzman et al., 2013).

Ali, M., et al. in 2023, analyzed 13 communities, including Bur-Dubai and Business Bay, to represent ungated communities and eleven major gated communities. These locations were chosen based on the development's socioeconomic position and population density. The study looked at 14 key services divided into five categories: educational, health, social, entertainment, and religious. The data for this study were gathered through desktop research, site visits, and resident interviews. The data layers were created using ArcGIS Pro 3.0, which was utilized to conduct the network analysis. To examine the present walkability status in Dubai's most key areas in 15 minutes(Ali, Ali, Gawai, & Elaksher, 2023). The findings show that 28.25% of residents in ungated communities have access to vital services within 15 minutes, which is comparable to gated neighborhoods where people rely on automobiles to access numerous amenities. Furthermore, the findings indicate that service distribution patterns and walkability infrastructure outside these areas should be improved to achieve greater walkability scores. It focuses primarily on the resident neighborhood sector, with development goals centered on the 15–20-minute paradigm. The plan's objective includes: Ensuring that resources are used in the best-planned way and developing attractive, safe, and inviting neighborhoods. Increasing vegetation or landscape regions to improve the quality of life for both residents and tourists(Ali et al., 2023).

The absence of formal design guidelines for the 20MNs concept has been addressed to enable future planning and execution. Furthermore, because the concept is new, there are no professionally defined/designed 20-minute neighborhoods that may be utilized as case studies. As a result, the study concentrated on existing Statistical Areas (SA1) in Greater Melbourne and selected those having 20MNs characteristics. The research talked about five different 20-minute neighborhood typologies: Isolated and circular; semi-compact and semi-linear; compact and linear; organic; and semi-compact and circular. The findings suggest that, while a 20-minute

neighborhood may be designed in various ways to encourage the use of active transport, rating type 5 should be prioritized {Kamruzzaman, 2022}.

(Caselli, Carra, Rossetti, & Zazzi, 2021), in 2021, utilized self-reported data from exercise and nutrition studies targeting adults (n = 843) living in Melbourne or Adelaide, Australia. They discovered that neighborhood design in Melbourne contributed to suggested activity levels by boosting walking for transportation, but this was not true of walking for transport in Adelaide or walking for pleasure. While 20 MN has the potential to be a significant tool for increasing walking for transportation, its implementation may not be appropriate in all circumstances and may be less useful for other types of activity(Caselli et al., 2021). Also, the planning procedures and regulations targeted at building 20MNs in Melbourne (Australia) and Scotland (UK) have been reviewed and contrasted. The parallels and contrasts in adopting place-based approaches to 20MNs addressing 21st-century concerns in important areas such as health, well-being, equity, environmental sustainability, and community resilience were examined using case studies(C. Moreno, Z. Allam, D. Chabaud, C. Gall, & F. Pratlong, 2021a).

Several studies have investigated the indicators associated with achieving 20-minute neighborhoods. The 20MNs in Melbourne Statistical Areas (SA1) have been identified and evaluated for their optimal population density. According to the findings, 19 different sorts of possibilities and services may be provided in 36 dwellings/ha (optimum) at an average distance from the CBD(Shatu & Kamruzzaman, 2021). Also, previous research pointed to a set of planning requirements in various combinations of density and distance factors, and the author's previous study focused on the city's potential to construct a travel infrastructure for public and active transportation(Lindner).

The association between distance to the closest green space and frequent usage over time was investigated, as well as whether frequent use and variations in use were designed by income and housing tenure over time. The results show that time-based metrics of access alone do not account for underlying socioeconomic inequalities in natural space utilization. To avoid exacerbating existing inequities, policymakers must take a cautious approach to activating and monitoring the 20MNs. The study's findings revealed that closeness to natural space predicts frequent usage and that providing natural space is congruent with the 20MNs strategy. Also suggests that the 20MNs strategy should be operationalized and monitored with an emphasis on enhancing access to and

usage of these places for persons living in social housing and on low-incomes (Olsen, Nicholls, et al., 2022).

The 20-minute city's political popularity stems from its apparent equitable treatment of all people; yet, the ideal geography fails to take into account the variation in transportation and demands among age groups. If 20MNs are to guarantee equity for those with restricted mobility, residents must understand their location and closeness to resources that match their requirements. Dunning, R.J., et al. in 2023, provided a novel exploration of the subject of age and mobility in cities by comparing the 20-minute city to a geodemographic classification of older people in Liverpool City Region, England. This creates a new model of service accessibility that takes into account the diverse mobility needs of older people. And found that lower walking speed leads to a large reduction in service accessibility, but that this reduction varies greatly across various older person groups. This emphasizes the necessity for 20-minute city development to account for the demands of varied elder geodemographic groups, as well as a more rigorous definition of the 20-minute city in terms of equality, to avoid the problems of certain comparable urban planning concepts(R. J. Dunning et al., 2023).

### 2.11.3 Density

Density is the measure of how many people, buildings, or activities are concentrated in a given area, often expressed as population density (people/km$^2$) or building density. Dwelling density is commonly used as a metric of urban density due to its apparent simplicity and ease of communication (Morley et al., 2023). The need to achieve a variety of land uses, garner sufficient public support for these services, and offer suitable open green spaces to the population highlights the importance of carefully determining the optimal density for 20MNs (Moreno et al., 2021b) (Mackenzie, 2022).

Edinburgh City Council recommends a minimum density of 65 dwellings/hectare, particularly in mixed-use buildings on brownfield sites. A "critical mass" of the population enables locations to support more amenities and services within walking distance. Higher populations and more populated locations might enable other forms of transportation such as frequent bus service and car and bike sharing programs, thereby lowering car dependency and usage (Douglas & Beautyman, 2020; Mackenzie, 2022). Table 2.6 shows the optimal density for 20MNs according to the literature review.

Table 2.6: Optimal Density for a 20-Minute Neighborhood according to literature review.

| Literature review | Density |
|---|---|
| Melbourne plan (Mackenzie, 2022) | 92 persons/hectare = 9200 persons/ km$^2$, or 36 dwellings/ hectare = 3600 dwellings/ km$^2$ |
| Edinburgh City Council (Mackenzie, 2022) | a minimum density of 65 dwellings/hectare = 6500 dwellings/km$^2$<br>Not: The average number of persons in the household is 2.8. |
| (Barton et al., 2021) (AlWaer & Cooper, 2023)proposed that 20MNs might support all the core amenities | It would require at least 10,000 people at a density of 50-90/hectare = 5000-9000 persons/ km$^2$ |
| According to (Barton et al., 2021), if everyone lives within 400 meters of shops, the population density may support a school, shops, and other community activities. | - 3,200 dwellings<br>- Density population of about 7,360 people. |
| According to (Insight Focus, 2022), bus stops should be no more than 5 minutes away from dwellings for bus travel to be a viable alternative to cars(AlWaer & Cooper, 2023). | An effective bus service requires a population density of 100 persons /hectare = 10000 persons/km$^2$ |
| (Jafari, Singh, Giles-Corti, & Place, 2023) The results suggest that the optimal density is that most people would have access to places within walking distance of 800 m-1 km. | 30–35 dwellings/hectare<br>=3000/3500 dwellings/km$^2$ |
| In sustainability analysis of a neighborhood, the result of the paper after examination of numerous cities is that high density is (Habitat, 2014): | - At least 15,000 people per km² =150 people/ha or 61 people/acre.<br>- 15000- 60000 people/ km² |

According to(Barton, Grant, & Guise, 2021), 20MNs capable of supporting all of the services mentioned in (Table 2.7) would require at least 10,000 people living at a density of 5000-9000/km$^2$, based on the proximity of the pedestrian paths.

Table 2.7: Facilities required to support 20 MNs, source: (Barton et al., 2021).

| Local facility | Illustrative catchment populations |
|---|---|
| Local shop | 1,500 |
| Nursery/first school | 2,000 |
| Primary/middle school | 4,000 |
| Community centre | 4,000 |
| Post office | 4,000 |
| Local centre | 6,000 |
| Primary/middle school | 4,000 |
| Small secondary school | 8,000 |
| Health centre (4 GPs) | 10,000 |

**Source(s):** Barton *et al.* (2021)

### 2.11.4 GIS-Based Technique for the 20-Minute Neighborhood

Several approaches and frameworks have been created to assess the success and advancement of 20MNs (or similar) concepts across the world. These range from simple quantifiable benchmarks (Portland - whole neighborhoods) to in-depth research using GIS-based tools that combine

qualitative and quantitative data to map performance against a specific metric (Climate Xchange report/Sustrans tool)(Mackenzie, 2022).

The evaluation methodology is based on defined components of a 20MN generated from location and well-being outcomes, such as Stewardship, Movement, Spaces, Resources, and Civic (Service, 2021). Following this, Sustrans is creating a self-service GIS-based tool for planners, architects, and experienced urban specialists to aid in the organization of community discussions. The tool will also provide details on how a neighborhood performs regarding the facilities and services demanded for 20MNs (Mackenzie, 2022).

Caselli, B., et al. in 2021, used a GIS-based methodology to assess 20MNs' pedestrian accessibility to urban services and spaces. The approach that was adopted included assessing walking distances as well as mapping the resident population distribution. The technique was then used to examine the present performance of an existing neighborhood in Parma, evaluating accessibility based on home-facility journey times and resident population reachability. A reflection was offered on what had been learned and the potential contribution that the technique may make to urban monitoring and planning(Caselli et al., 2021).

To assess pedestrian accessibility to local services. In this study, the 15-minute city theme was addressed with an analytical model created and designed using GIS to examine current circumstances of accessibility to neighborhood amenities for all inhabitant social categories. The technique was used in a peripheral location where pedestrian access to nearby facilities is not widely favored and should be enhanced. The study demonstrated that the reflection on the experimental approaches of mobility network update for advancing the concept of the 15-minute city, such as the Barcelona Supermanzana model, shows how sectorial interventions can still compete and be a component of a coordinated management system to begin an overall adapting process of the city's urban spaces(Caselli et al., 2021).

Data analysis with ArcGIS Network Analyst tools resulted in several simulations that mapped walking durations and the quality of pedestrian access to nearby services. In particular, the model pilot application generated, first, a pedestrian isochrone map based on a selection of public schools (middle schools) and walking distances of 3, 5, and 10 minutes; second, a closest services map based on the same public amenities and mapping all the fastest home-service paths beginning with

every dwelling number; and third, an assessment of the level of quality of the most rapid paths, determining potential criticalities(Caselli et al., 2021).

The updated model also depicts the exact distribution of the resident population and highlights the key neighborhood centers, which are urban hubs well supplied by essential businesses and services such as supermarkets, grocery stores, pubs, drugstores, and banks. The revised research application focuses on preschool facilities (kindergartens) and the newly mapped neighborhood cores(Caselli et al., 2021).

## 2.12 Conclusion

The 20MNs is a comprehensive urban planning approach that combines compactness, verticality, walkability, and sustainability to create more livable, accessible environments. It addresses the challenges of rapid urbanization, environmental sustainability, and social equity by promoting active transport, green mobility, and health.

Urban design plays a crucial role in shaping the physical and social fabric of 20MNs. It involves public transport services, active transport options, and vibrant public spaces to enhance accessibility, reduce dependence on private vehicles, and improve the quality of life for residents. Prioritizing walkability, mixed-use development, and green spaces can create functional, aesthetically pleasing, and socially engaging neighborhoods.

According to the literature review Figure 2.9 summary of the Common characteristics of 20MNs.

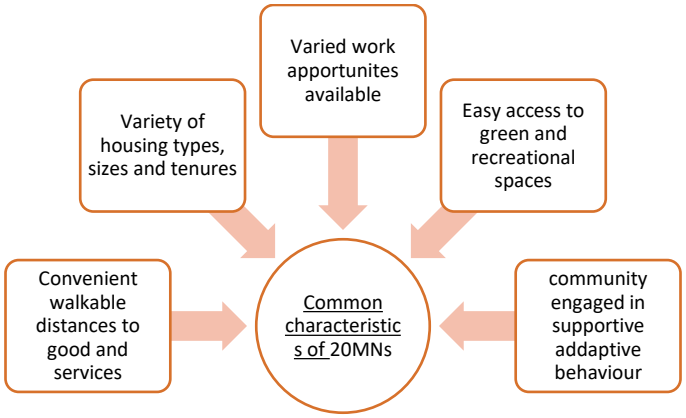



Figure 2.9: Common characteristics of 20MNs. according to C40 (2020) (AlWaer & Cooper, 2023).

To evaluate pedestrian access to local services:

- Develop an analytical model using Arc GIS software.
- Choose an expansion zone where automobiles are relied upon to access local services.

- Use experimental techniques of transport network updates to develop the concept of 20MNs, such as the 20MNs model used in cities worldwide.

In summary, the theoretical exploration in this chapter sets the stage for the subsequent empirical analysis and case studies, which will delve into the application of the 20MN concept in the context of Palestinian expansion zones. The principles and criteria discussed here will serve as a benchmark for evaluating the potential of this model to contribute to sustainable urban development in these areas.

Chapter 3

# International cases

## 3.1 Introduction

The 20-minute city overlaps strongly with other related notions, notably "low traffic" and a "livable" area. Throughout the 2010s, these concepts gained traction. This concept has gained global recognition as an innovative approach to urban design that aims to produce sustainable, compact, and walkable communities. This chapter looks at worldwide case studies where this paradigm has been effectively adopted or altered in a variety of circumstances

## 3.2 Case Studies (Example of new successful interventions)

### 3.2.1 Tempe, Arizona

A 2019 case study from Tempe, Arizona, focuses on promoting mobility using a 20-minute time limit for all modes. The study highlights challenges faced by planners in designing for accessibility, including technological issues and environmental quality. The research also demonstrates that Tempe, a typically suburban community with broad roads and single-family houses designed around the vehicle, is extremely accessible via bicycle, walking, and transport in 20 minutes. These findings recommend that planners prioritize accessibility in roadway network enhancements as a component of a sustainability strategy (Capasso Da Silva et al., 2019).

### 3.2.2 Scotland

The Scottish Government defines a 20MN as a location where residents can meet their daily needs within a 20-minute walk, including shopping, leisure activities, schools, local services, work, green space, active travel, and wider connections. Affordable housing is essential for this area.(O'Gorman & Dillon-Robinson, 2021). The Scottish Community Alliance describes the characteristics of a 20MNs as follows(O'Gorman & Dillon-Robinson, 2021):

- Optimizing pedestrian and cycling safety, accessibility, and connectivity;
- Providing high-quality public places and open spaces;
- Supporting local living via services and destinations.
- Improving public transport to link residents to employment and services.
- Providing dwellings and population density to support local amenities and transportation.
- Fostering vibrant local economies.

(Olsen, Thornton, Tregonning, Mitchell, & Medicine, 2022), road and route network analysis was used to build 20 MN catchment areas (800 m) for ten domains in Scotland, all Scottish residential sites were mapped and given area-level socioeconomic status and urbanicity. A dichotomized (yes/no) variable was established to determine if it was within a 10-minute walk to each of the 20 MN domains. To establish 20 MN catchment areas for health, transportation, education, social, and recreational domains; report the number of residential locations throughout 20 MN area catchment areas; and explain variations in access to 20 MN domains based on area-level socioeconomic status and urbanization (Olsen, Thornton, et al., 2022).

According to the findings, one in every five home locations had access to all 10, 20 MN domains (urban: 28%, rural: 5%). The percentage of residential sites with access to at least one facility varied by domain; 91% had access to at least one public transportation station, while 84% had access to a public open space. There was less access to health care services (42%) and healthy food shops (50%). Across all domains, access to at least one facility was greater in the poorest communities. Access to 20 MN domains was most prevalent in locations with poor individual health status (Olsen, Thornton, et al., 2022).

The program for Government 2021 commits the Scottish Government to work with local government and other partnerships to advance the aspirations for 20MNs: Places designed so that inhabitants may fulfill the great majority of their day-to-day requirements within a 20-minute walk (about 800 meters) of their house; via safe walking and cycling paths; or public transportation. This project supports this by(O'Gorman & Dillon-Robinson, 2021):

- Considering the aspiration for 20MNs in Scotland, taking into consideration the country's diverse settlement patterns, and highlighting measures that might enhance the concept's execution, as recommended by baseline analysis results.
- Analyzing worldwide evidence of interventions' performance in meeting these goals, includes identifying particular success factors, place-making impacts, impediments to success, regulatory frameworks, financing methods, and stakeholder participation and buy-in.

- **Elements of a 20-minute neighborhood in the Scottish context**

Three criteria guarantee that neighborhoods are walkable, liveable, and prosperous. The first category is 'features and infrastructure', which includes vital services such as stores, active

transportation infrastructure, and green space. Second, despite the availability of these characteristics, there must be a 'degree of quality and experience' with these services and infrastructure. Finally, an 'engaged society prepared to adapt or adjust their habits' is required to ensure that locations function as 20MN on the ground(O'Gorman & Dillon-Robinson, 2021).

A 20MN's characteristics, infrastructure, and services were captured in five dimensions: stewardship, civic, movement, resources, and spaces, aligning with the 'Place Standard' and 'Place and Wellbeing Outcomes' (O'Gorman & Dillon-Robinson, 2021). This extends to both urban and rural habitation locations. However, the evaluation does not allow for the conclusion that the necessary level of service or infrastructure is in place. It also does not conclude that these areas are operating as 20MNs (O'Gorman & Dillon-Robinson, 2021). Based on the study's conclusions, five first goals for building 20MNs in Scotland have been set out(O'Gorman & Dillon-Robinson, 2021):

- Scotland has the chance to be a GLOBAL LEADER in executing this idea across the country, demonstrating its feasibility in both urban and rural regions.
- Each neighborhood in Scotland should be facilitated to be a 20MN.
- Communities should be empowered to make changes in their neighborhoods to satisfy their everyday needs fairly and equitably.
- The concept should allow individuals to actively travel to promote their health and well-being without being restricted by transportation costs.
- The 20MN concept should be the goal that unifies all other relevant policies in a specific area.

To achieve these goals, eight proposals have been made for policy, national and local delivery, and more research(O'Gorman & Dillon-Robinson, 2021):

- Increased focus on minimizing private automobile trips. This may be accomplished through offering excellent quality active travel infrastructure as part of reallocating space away from private automobiles and toward alternative modes, as well as by redesigning public transportation to be more flexible in rural and urban contexts.
- Defining the concept, its framework, and financing at the national level.
- Identifying local aim, delivery, and involvement by communities. Further evaluation of a variety of demonstration locations chosen to guarantee diversity of neighborhood kind,

includes locations, current scores across quantitative and qualitative indicators, and levels of deprivation.

- A countrywide assessment of walking distances and visual perceptions should be conducted to refine the concept of 20MNs and assist in the development of implementation instructions.
- Mapping to provide a precise baseline that may be used to help construct national and local goals as well as track national and local outcomes.
- Examine if Local Authorities are implementing the Place Principle, identifying hurdles and strategies to overcome them.

- **What area can be considered as a walkable neighborhood?**

The Scottish Government defines the walking distance as 800 meters (Figure 3.1), considering accessibility. This is based on a study conducted in Melbourne(geverment, 2017), where 800 meters is a walk to and from a location, or a 10-minute stroll out and back to home. This distance is designed to be accessible to everybody since people without mobility issues can walk 1,600m in 20 minutes on average(O'Gorman & Dillon-Robinson, 2021).

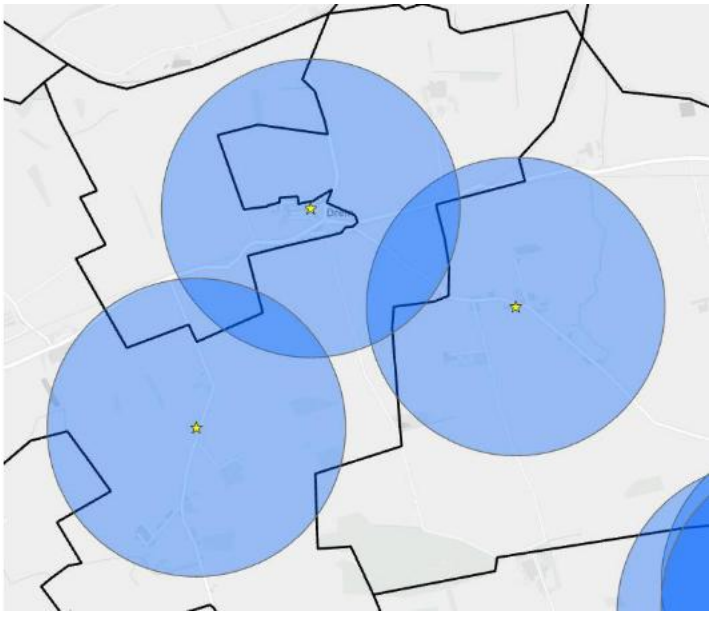


Figure 3.1: Population centers and 800m buffer, (O'Gorman, 2021).

- **Implementation and Approach across Scotland**

a) Edinburgh

Both Edinburgh and Glasgow have devised different ways to implement the 20-minute neighborhood concept in the context of larger strategic plans to combat climate change and achieve net zero objectives while increasing liveability and supporting citizens(Mackenzie, 2022).

Edinburgh City Council has embraced a 20MN strategy called "living well locally" as a key component of its business plan "Our Future Council, Our Future City"(E. L. J. M. C. Council, WEST LOTHIAN COUNCIL, 1997). The concept is a key component of their strategy, which strives to offer and support local services, collaborate with and assist communities in the area, develop sustainable transport networks and connections, and create high-quality, people-focused green and open spaces. The strategy also intends to support the implementation of a digital and smart city strategy that would allow residents to access municipal services online(Mackenzie, 2022).

Van der Horst, D., et al., in 2021, used Edinburgh as a case study of a 20-minute city, using two factors to design a 20MNs: how long a 20-minute walk is, and which services should be deemed significant enough to be accessible to everybody. The purpose of this case study was to investigate whether, when, and how the various iterations can be implemented by local government authorities; how the various approaches complement and sometimes go against one another when utilized in a city like Edinburgh; and to talk about the implications for the potential to usher in a data-driven strategy to '20-minute' urban governance(van der Horst et al., 2021).

The 20MN concept focuses on service distribution and accessibility. The logical first step in adopting this concept is an evaluation effort to better comprehend the distribution of important services around the city. Before the collaborative research between the University and the City, council officers in the GIS department created a city-scale heatmap to assess present and future service delivery patterns in Edinburgh. Also, before the City of Edinburgh Council's formal adoption of the 20MN concept the establishment of this heatmap made something of an experimental structure, with officers determining what might eventually come to be deemed a 'key' service, for which everyone living there are likely to get within a specific period of walking time. These two variables, how long a 20-minute walk is, and the services that should be considered significant enough to be accessible to everyone within this time, would present difficulties to both the research project's implemented techniques and any strategic political agendas that seek to build on it(van der Horst et al., 2021).

b) Glasgow

Glasgow has implemented a “liveable neighborhoods” plan (Figure 3.2), which incorporates the 20-minute city concept into a comprehensive city-wide program aimed at improving neighborhood quality and liveability. A great deal of effort has already been completed. The council has created a toolkit that gives a neighborhood and place-based strategy for addressing concerns, outlines themes, and supplies resources and actual results. It acts as a model method, demonstrating collaborative effort with residents to recognize hurdles and enhance local communities through previously implemented remedies(Mackenzie, 2022).

“This Toolkit… seeks to balance interventions associated with the streetscape and the wider social and economic potential of Glasgow’s districts. To create areas that are an inclusive network of accessible neighborhoods designed for the benefit of all with enhanced public space and integrated green infrastructure.” “In its simplest form and given Glasgow’s commitment to being Carbon Neutral by 2030, we’re looking to reduce the amount of space that road vehicles use and re-balance it with more people-based, environmentally conscious, and community-inspired interventions.” (Figure 3.3) (G. C. COUNCIL, 2021; Mackenzie, 2022).

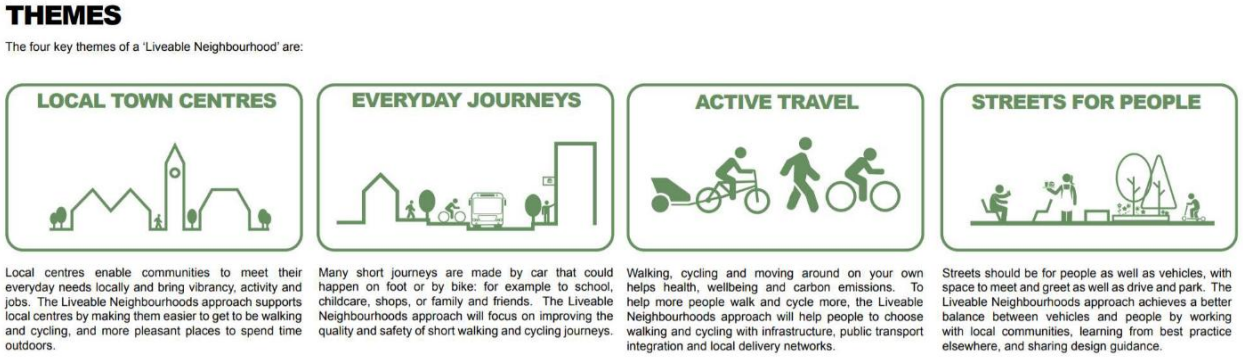



Figure 3.2: The 4 "key themes of a liveable neighborhood" were developed by Glasgow City Council as part of their Liveable Neighbourhoods Toolkit (Glasgow City Council, 2021)

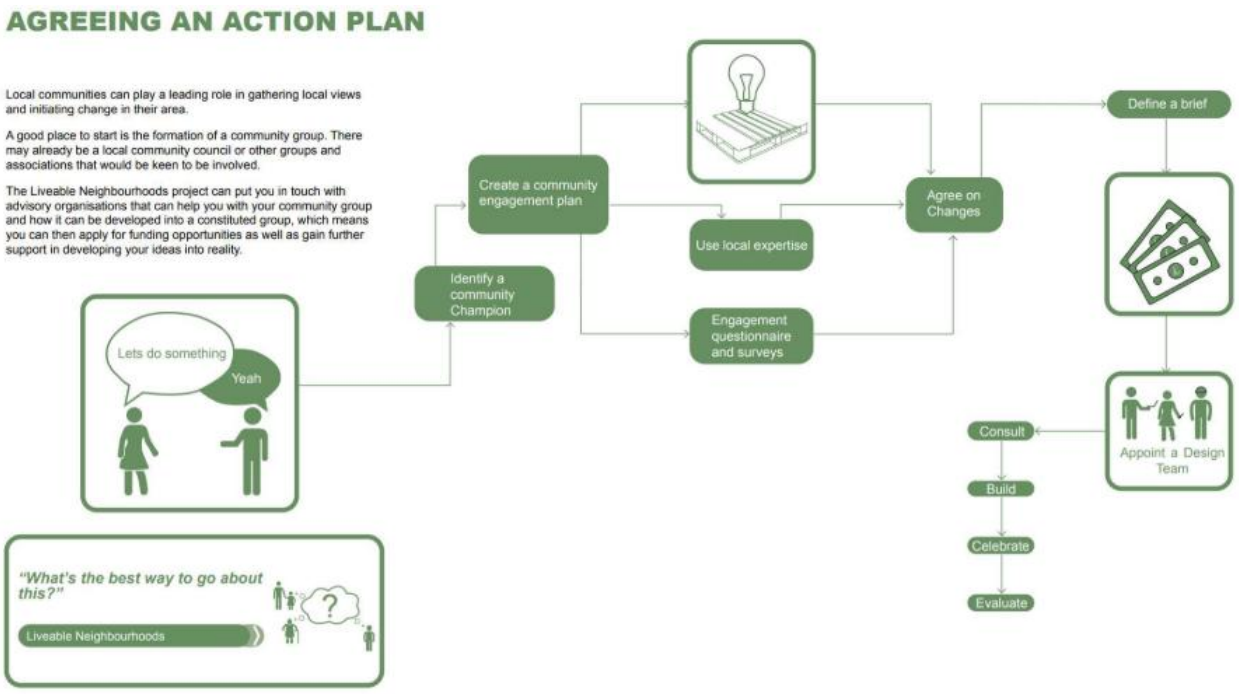



Figure 3.3: Guidance for residents, illustrating how the toolkit can help them make tangible improvements to their local place or communities (Glasgow City Council, 2021)

### 3.2.3 Melbourne

The original layout of Melbourne streets was based on the miasma hypothesis, which held that illnesses were caused by noxious vapors and that broad avenues allowed for appropriate ventilation, while minimum lot sizes prevented slum growth and congestion(Lewis, 1999). Improving public health remained a rallying cry for those advocating reduced housing densities in the latter part of the nineteenth century (Morley et al., 2023; Ross, 2011).

The Melbourne 2017-2050 plan (Table 3.1) aligns with the 15-minute city concept by emphasizing the importance of planning to ensure streets in urban areas are organized in a way that they support accessibility to various parts of the city within 20-minute walking radii, which may necessitate restricting or reorienting existing infrastructures(Moreno et al., 2021b). The strategy is centered on five primary pillars: density, diversity of land use, design, accessibility, and distance to transport. The intended catchment area is approximately 800 meters in 20 minutes, and the plan is divided into seven strategies, 90 policies, and 23 directions. The key components of this method are the 'neighborhood activity centers', which are elements of the 'activity centers' plan(Bocca & Environment, 2021).

Table 3.1: Evaluation of the “Plan Melbourne 2017-2050”, (Bocca, 2021).

| **Plan Melbourne 2017-2050** | |
|---|---|
| Metrics | Neighbourhood - 20 minutes |
| Urban well-being | Walkability, safe street and space, local health facilities and services |
| Social and environmental sustainability | Community gardens, Local playground, ability to age in place, housing diversity |
| Promotion of the local economy | Activity centres, Local shopping centres, local employment opportunities, |

Planning Melbourne presents 'neighborhood activity centers', i.e. retail goods and services (newsagent, bakery, supermarket), neighborhood recreational facilities (bars and restaurants), health services, and local facilities, to satisfy everyday requirements (geverment, 2017) at the neighborhood and city levels. At the same time, they provide opportunities for social contact and community involvement, as well as serving as 'pedestrian areas' inside the city(Bocca & Environment, 2021). Analyses demonstrate that not all local activity centers are equally supplied or accessible by the public transport network, particularly in the surrounding suburbs. The challenge for Melbourne, which has traditionally relied on cars, is to enhance and support mixed transport, including pedestrian and public transportation, as a driver of a diverse 'lifestyle'. Indeed, the strategy, which involves the formation of a network of neighborhoods, intends to reduce urban sprawl while also providing job and investment possibilities by providing each particular area with a level of self-reliance(Bocca & Environment, 2021).

The 20-minute city project began in January 2018 with the launch of the first pilot project, which underlined the need to incorporate bottom-up techniques into planning and physical initiatives. The objective is sustainable development, by establishing mixed-use settings and dynamic communities. Thus, the location-based approach behind the 20-minute city emphasizes 'place' as the outcome of several disciplines(Bocca & Environment, 2021).

### 3.2.4 Paris

Paris had been one of the initial cities to concentrate on a plan vision based on accessibility within 15 to 20 minutes, declining it in the areas of social innovation, climate neutrality, function decentralization, and the quality of life to promote sustainable economic models and revitalize the region. Moreno's understanding of the 15-minute city is based on four major pillars, which are: - Density: a provided region's ability to promote an ideal number of individuals in the context of service delivery; Proximity (radial nodes that offer access to vital services, both spatially and

temporally). Diversity (requires believing both urban mixite residential, commercial, and entertainment components and cultural and gender diversity, Digitalization (the execution of consisting and engaged procedures, as well as providing actual time delivery)(Bocca & Environment, 2021).

Therefore, 'Paris En Commun' envisions a carbon-free economy and healthy lifestyle for its residents(Euklidiadas, 2020). Paris, where a significant redevelopment of the capital is planned for 2024, will prioritize the usage of bikes to be a carbon-neutral city by 2050. The French capital desires to rediscover the recreational and performance purpose of its public space via a change to sustainable transport, as well as a growth in greenery servicing the city and the construction of social, cultural, and co-working spaces. Paris, with an already well-developed transit system, strives to establish central communities by providing services and open spaces to residents. The risk of this action is the formation of a hyper-center, or an extreme polarization of Paris' rich district, resulting in an absence of access for those with low incomes(Bocca & Environment, 2021).

### 3.2.5 Milan

Following the Paris administration's lead, Milan has initiated plans to transform present transport into sustainable transport, focusing on lowering city traffic and developing swift and reversible adaption solutions prompted by the present emergency. Amongst these strategies, the 'open squares' initiative has experimented with strategic urbanism, such as Piazza Sicilia in the NoLo area (Figure 3.4). This experience, despite preceding the pandemic, showed that it was an outstanding scenario for implementing the Milan 2020 adaptation plan to promote the unusual use and occupation of public spaces. In reality, the Milan Administration has set itself the goal of selecting several locations for the building of a pedestrian network in which to implement traffic control and urban care actions. These initiatives must introduce new qualitative principles, in conjunction with the development of public works and maintenance interventions (Municipality of Milan)(Bocca & Environment, 2021).

At the same time, Milan's primary goal is to build a resilient city. To do this, it has prioritized transport and provided the region with new cycling paths, not only to respond to crises but in addition to considerably expand the network. Additionally, Milan has established Zones linked to the cycling network to minimize traffic-related air emissions and improve urban safety. This is consistent with Jane Jacobs' (1961) concept that there have to be eyes on the street, eyes belonging

to people we could term the natural proprietors of the street. These activities try to reorganize vehicle traffic, remodel public spaces, and encourage pedestrian circulation. These initiatives include temporary pedestrians to allow for motor activity, and outdoor sports (with a focus on children's cities), and the extension of public space available to both citizens and businesses(Bocca & Environment, 2021).

(a) (b)

Figure 3.4: (a) Piazza Sicilia, Milan - before and (b) Piazza Sicilia, Milan – after, (Bocca, 2021).

Table 3.2: Evaluation of the “Milan 2020” Adaptation strategy. Open document to the city’s contribution, (Bocca, 2021).

| **Adaptation stratey** | |
|---|---|
| Metrics | Neighbourhood (15-minute city) |
| Urban well-being | Management of health containment measures, sustainable mobility, children's city |
| Social and environmental sustainability | Urban neighbourhood spaces, air quality, renaturation |
| Promotion of the local economy | Collaborative economies, short supply chains |

### 3.2.6 Riyadh, Saudi Arabia

Saudi Vision 2030 emphasizes sustainability as a key concept guiding its growth plans. These initiatives are centered on the creation of walkable neighborhoods. This emphasis was reinforced with the establishment of the "Humanizing Neighborhoods Initiative" in 2020(Mostafa, 2021). Al-Falah neighborhood is one of the city's first to implement walkability initiatives as part of the humanization effort (Homoud, 2024).

- Future Development Plans and Initiatives

Riyadh has established many strategic frameworks and programs to address the demand for sustainable urban development while also harmonizing with the worldwide movement toward sustainable communities and communal living. Riyadh Comprehensive Development Plan 2030 seeks to increase urban livability, public transportation, and walkability. Furthermore, Riyadh Metro Project is a large transit-oriented development effort that aims to increase accessibility and minimize dependency on private automobiles (Homoud, 2024).

The Saudi Ministry of Housing announced the Humanizing Neighborhoods Initiative, another ambitious plan, in 2020 (Mostafa, 2021). The initiative aims to improve the city's quality of life by developing pedestrian-friendly districts. This strategy seeks to promote a healthy lifestyle via design by creating areas that encourage walking and cycling as alternate forms of transportation in a largely car-oriented metropolis. Al-Falah neighborhood was chosen as a trial project to test this initiative (Homoud, 2024).

- Al Falah background

Al-Falah is a residential district in Saudi Arabia's capital, Riyadh (Figure 3.5). A square created according to the Doxiadis model with a length of (2.0) km and a width of (2.0) km, covering roughly 353.000$m^2$, and inhabited by (38,308) people. Al-Falah is located in the northern portion of Riyadh's major road network. It is also close to other megaprojects, including the Sports Track Project and the Riyadh rail stations (Mostafa, 2021).

The current youthful individuals should be encouraged to connect with their immediate surroundings, improve communication through various events and activities, and communicate with Al-Falah neighborhood community, which gathers in the mosque, school, garden, shops, and small grocery stores favored by locals. As a result, it highlights the importance of creating adequate urban public places to improve these capacities and activities (Mostafa, 2021).

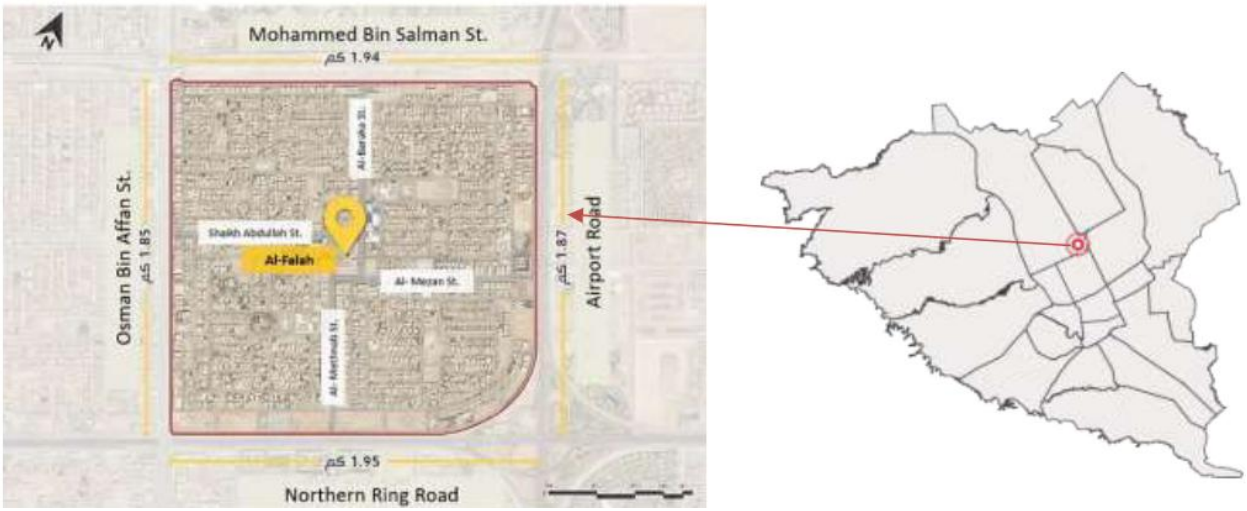



Figure 3.5: Location and urban features of Al-Falah District, (Al-Falah humanizing project, MOMRAH, 2020).

- Project phases

The initiative's first phase, "Upgrading of Public Spaces in Residential Neighborhoods," began in Al-Falah in January 2020 with the improvement of the district's four main roadways. The renovation of the four main roadways includes 12m wide walkways, lighting poles, bollards, tree planting areas, and parking (Figure 3.6). This phase was nearly complete by September 2021. (Figure 3.7) However, it was the direct effect of a lack of necessary parking and a lack of trees and flora (Mostafa, 2021).

Figure 3.6: Upgrading PS and Pedestrian network in Al-Falah, Phase one: main streets, (Al-Falah humanizing project, MOMRAH, 2020).

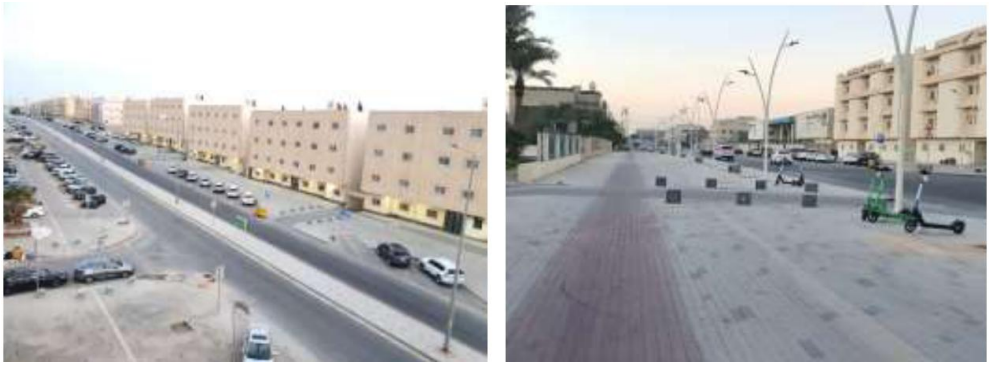


Figure 3.7: Streets condition after Al-Falah Upgrading PS project, (Mostafa, 2021).

(Mostafa, 2021) utilized Al-Falah neighborhood as a case study to investigate the idea of walkability in Riyadh, following the implementation of the Humanizing Neighborhoods Initiative, using a qualitative critical method. The research made several recommendations for creating walkable communities in Riyadh, including improving pedestrian infrastructure, including mixed-use projects, integrating green infrastructure, using smart urban design concepts, and integrating public transit networks. This paper highlights the significance of community involvement, preserving local character, and incorporating a wide range of stakeholders in transforming Riyadh into a pedestrian-friendly city that promotes public health and sustainability.

## 3.3 Conclusion

The case studies on the 20MNs concept demonstrate its importance in reducing urban sprawl, encouraging sustainable development, and improving community well-being. The Scottish Community Alliance describes the characteristics of a 20MNs as follows in Figure 3.8 below:

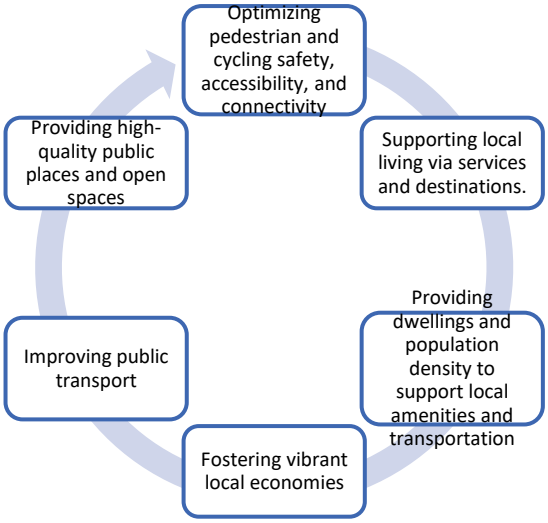



Figure 3.8: characteristics of 20MNs according to the Scottish Community Alliance.

Figure 3.9 below summarize the results of the analysis of case studies of 20 MNs :

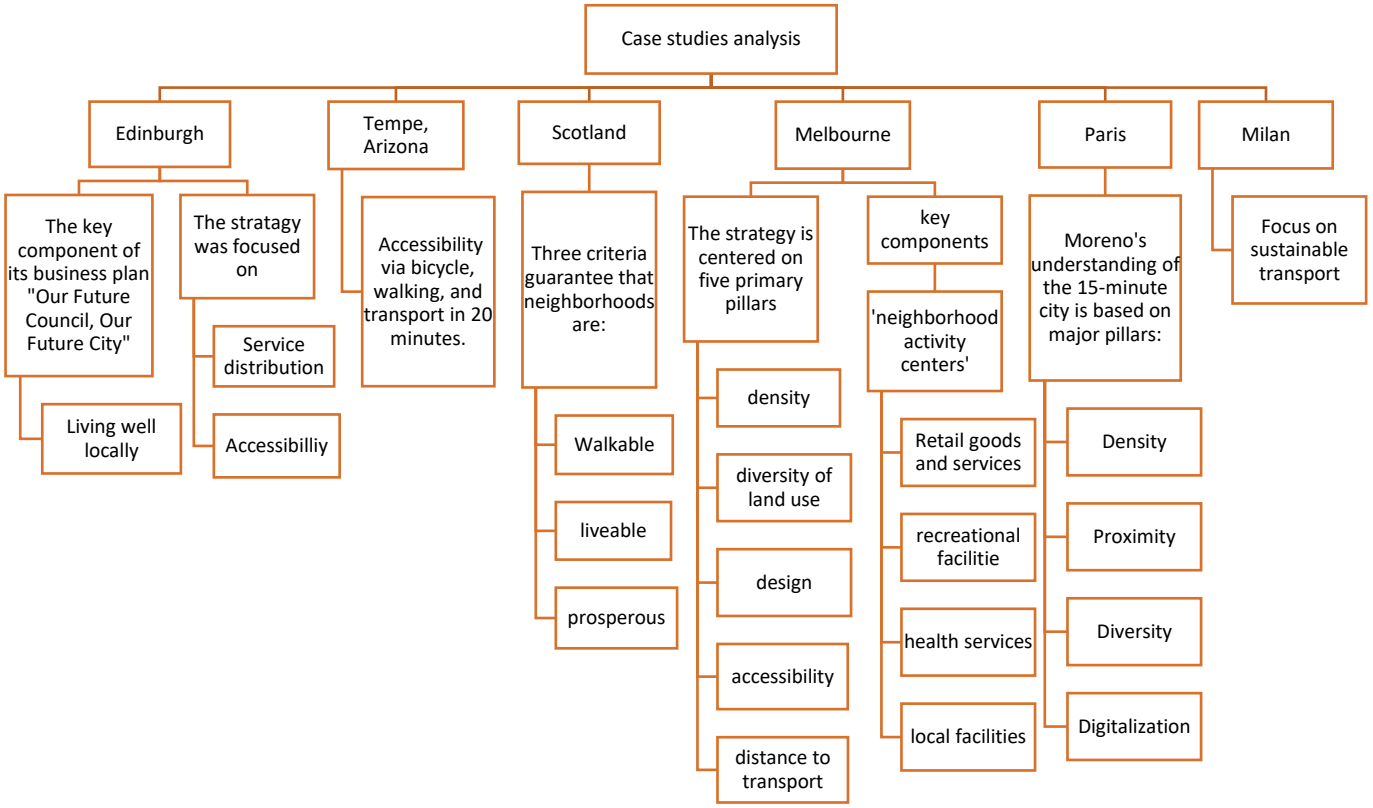



Figure 3.9: The results of the analysis of case studies of 20 MNs.

Chapter 4

# Research Methodology

## 4.1 Introduction

The concept of a 20MN has caught the interest of politicians, built-environment experts, and citizens, and there has been an increased emphasis on developing one. Our study focused on a literature review of journal articles and academic papers published between 2019 and 2023 that investigated 20MNs. Their findings revealed that accessibility and active transport, density, diverse land use, and green spaces are the most often used criteria for this concept.

This study is structured into three major frameworks to guarantee an exhaustive approach. The theoretical and general framework serves as the fundamental context, comprising an introduction, research problem, objectives, and a review of relevant literature, emphasizing the concept of the 20MN. The diagnostic framework examines two case studies from Palestine (Hebron and Halhul), evaluating their socioeconomic, spatial, and urban aspects. Finally, the analytical and conclusive framework, which incorporates diagnostic phase findings to assess the applicability of the 20MN principles, identify gaps, and propose urban planning interventions, resulting in actionable recommendations for improving urban expansion zones (Figure 4.1).

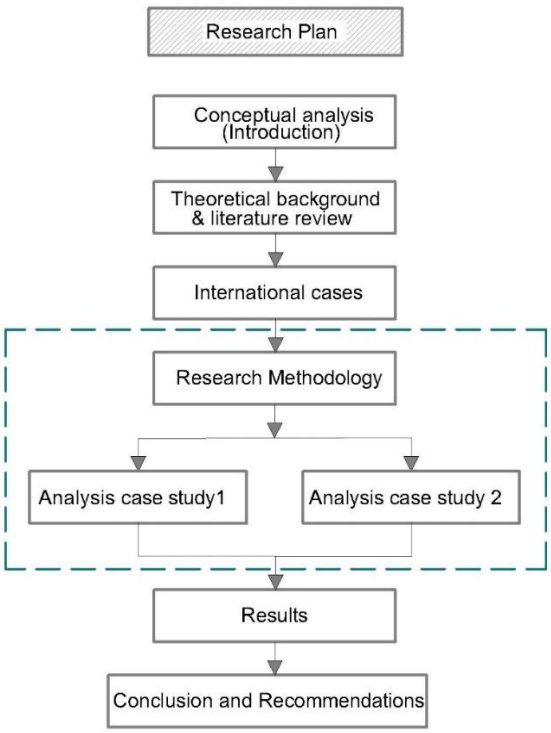



Figure 4.1: Research Plan.

The study explores the use of the 20MNs concept as a model for sustainable expansion zones in Palestine. It employs both theoretical and practical research methodologies, including historical, descriptive, analytical, and case study methods. The historical method examines urban growth evolution, while the descriptive method analyzes socioeconomic and spatial conditions. The analytical method evaluates data to identify gaps and patterns. The case study method is applied to selected areas in Palestine, Hebron, and Halhul, using tools that include interviews for qualitative data collection, urban survey campaigns, and GIS for spatial analysis and theoretical application testing. These methods provide an integrated framework for achieving the study's goals (Figure 4.2).

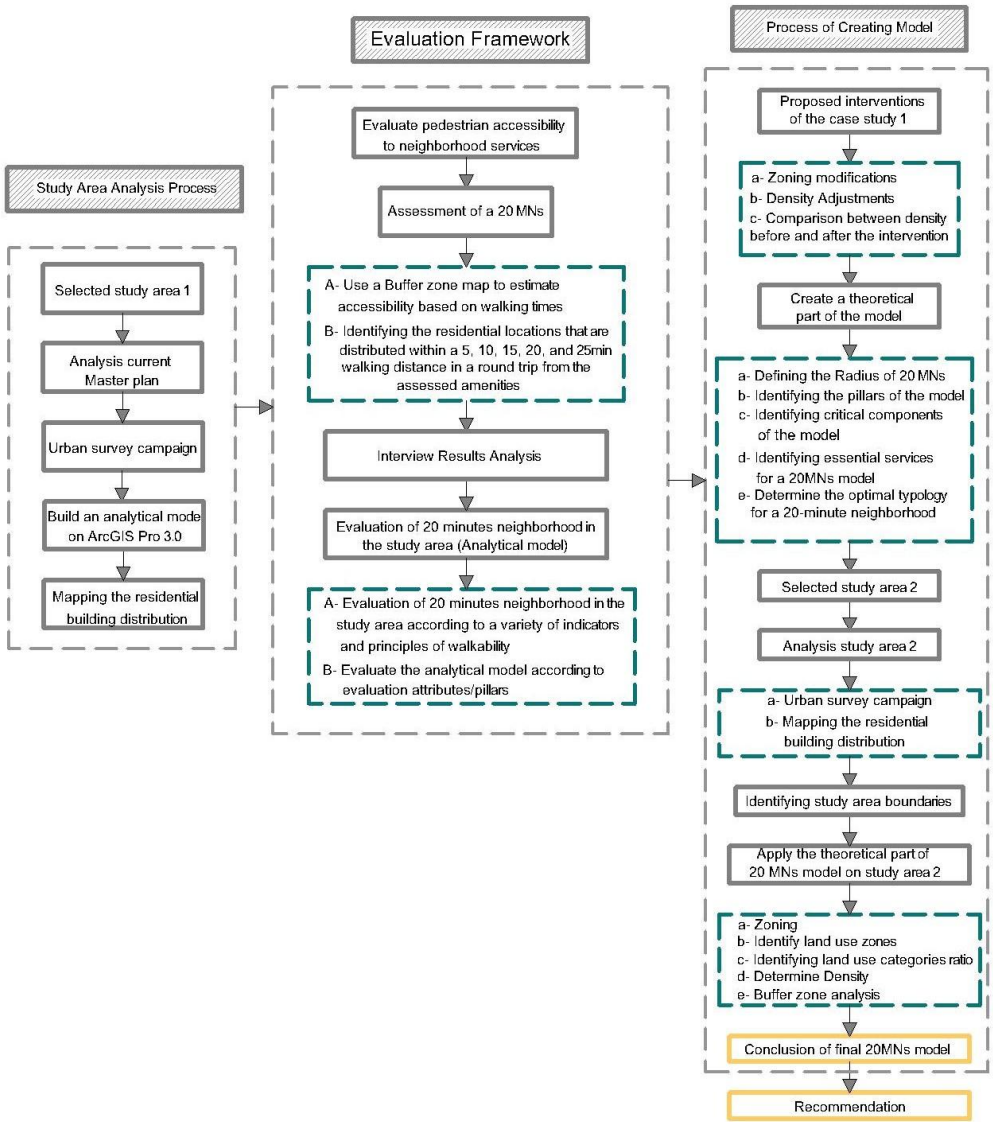



Figure 4.2: The research methodology framework.

## 4.2 Data Collection Criteria

This study's theoretical component included a deep literature review, which is detailed in chapters 2 and 3. The review relies on scientific journals, research papers, and books. The research methodology is based on an extensive literature review and case study analysis. The literature research was utilized to identify 20MNs, their motivations and goals, their attributes and criteria, how to build the 20MN model and typologies, their evaluation pillars, and how to measure them. The review also sought to examine case studies of this concept throughout the world.

The practical part consists of analyzing the study area to build a process model of 20MNs and applying it to the expansion zone area using Arc GIS Pro 3.0 programs and other digital tools like Google Earth and Geomolg (the first-ever integrated spatial information system in Palestine). This study relies on several data sources, including:

- Deep literature review: The research methodology is based on an intensive literature review and analysis of worldwide case studies.
- Field survey: The purpose of the field survey is to gather data concerning the urban features of the neighborhood. The field survey was conducted by observation, with images of the research area's features and facilities. The site master plan and photos were used to document data. The collected data was arranged to provide a comprehensive overview of neighborhood features such as housing density, infrastructure, public facilities and services, open spaces, and green areas.
- Interviews: The research included open interviews to gather comments and complaints from residents of the study area, as well as to gain a better knowledge of their requirements.
- Maps and spatial data: Map layers have been used to document the progression of urban development. All of the map layers were created using the ArcGIS Pro program, this data was obtained from Hebron Municipality and was used to evaluate the pillars and elements of the 20MNs in the study area, which include: public transport, dwelling density, and population density of local services and amenities, accessibility to services and facilities, walkability, diversity, and mix land use.

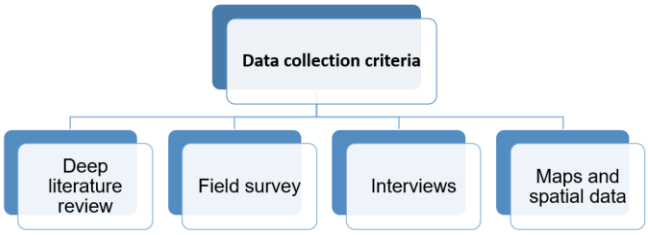



Figure 4.3: Data collection criteria.

## 4.3 Data Analysis Criteria

The literature research was used to determine how to assess the region's ability to build 20MNs. So, through the analysis of the case studies and data obtained through the literature, the model and orientation of 20MNs will be created and should be able to answer the question of what the optimum population density for a 20MN and the services should be available in the neighborhood and its locations.

### 4.3.1 Identifying Distance and Features Within a Specific Radius

Each 20 MN region was evaluated based on the availability of necessary services within 800 meters of the road and path network. This distance corresponds to a conventional 10-minute walk, a key component of the 20 MN concept (DELWP, 2017) (Calafiore et al., 2022). By analyzing the road and path network, how readily inhabitants might reach these facilities on foot or by bike was determined, taking into consideration direct distances and realistic travel paths. Any services outside of the 800-meter diameter were highlighted as needing further connectivity interventions or enhancements to increase accessibility and meet the 20MN targets. This technique helped to guarantee that all regions of the research area were evaluated consistently and completely, following the 20 MN model.

Key components and services that should be available in 20MNs

Several amenities' kinds have been identified as essential distinctive characteristics of a 20MN. After researching the literature, five types of services were identified as important services that compose a 20MN. The assessment took into account the following services, which correspond to the following primary groups:

1- Education services: Baby daycare, kindergartens and primary schools.
2- Health services: health centers, hospitals, pharmacies, and medical clinics.
3- Social services: groceries, daily needs shops, public transport, active travel, parking.

4- Entertainment services: parks, green areas, cinemas, sports facilities (swimming pools, gyms, football courts, basketball courts, etc.)
5- Religious services: mosques and churches.

The suggested services for the 20MN concept are based on two major reference points (Ali et al., 2023):

- Neighborhood-level accessibility excludes city-level amenities like universities and commercial centers.
- The research area did not include facilities such as libraries or social counseling services. The only commercial services recognized for everyday essentials were supermarkets and certain types of commercial services such as open markets. Other commercial outlets, such as auto repair and outfits stores, were not included in the study, because they are not necessary services owing to their unpredictable demand.

## 4.4 Study Area Selection Criteria

Two study areas were selected for this study according to critical criteria to confirm their fit for the 20MN model. The first case is an existing study area that was chosen to benefit from its analysis to determine neighborhood composition and appropriate density, highlight residents' issues, and zoning space uses and residential unit types, to use these data in developing the final model. As for the second case, a new expansion region was chosen to evaluate and enhance the final model to ensure its success and to generalize it to other comparable growth areas throughout Palestine.

### 4.4.1 The Criteria for Selecting Study Area 1 are:

- The neighborhood needed to be adequately connected to existing infrastructure, including roads, public transport, and pedestrian walkways, as well as provide a variety of necessary amenities, including education, health, entertainment, religious, and social services. To determine its potential to support the 20MN concept.
- The selected region should include both developed and undeveloped land. This will allow for assessing the theoretical model's interventions for land use distribution, density, and access to services.

4.4.2 The Criteria for Selecting Study Area 2 are:

- The project aims to expand the 20MN concept to expanding regions, so the study area should be a new expansion area.
- The paper addresses the issue of urban sprawl in Palestine. The research region should be challenged to this issue and inefficient land use.
- It should be that the area be classified as A or B, according to Oslo Accords.
- The slope of the area should not exceed 30%.

4.5 Study Area Analysis Process

A- Selected study area 1

The above criteria were used to select the research area, which was located in the northern part of Hebron. The area has been identified as having the community's essential services, as well as an opportunity for expansion to execute the suggested interventions and address the challenges associated with implementing the 20MN. A local street runs through it, with numerous basic services scattered along it, while side streets branch out to access the residential neighborhoods. A region of 1000 m in diameter was chosen to investigate the possibilities of expanding to the 25MNs.

B- Analysis Current Master Plan

The master plan of the research region was analyzed as follows:

1- Land-use categories analysis was conducted following the master plan, and the percentage distribution of residential, commercial, public services, and recreational areas was estimated. Land-use categories ratio was calculated according to this equation:

Land-use area ratio = (Land use area / total area of the land) *100%

2- Population density calculation: The number of dwelling units, population distribution, and residential density were determined, according to this equation:

- Floor area for construction = (Area building percentage per dunum * area of land use)
- Number of dwellings in floor area = (Floor area for construction/ Average floor area of the dwelling in Hebron)
- Number of dwellings in residence area = (Numbers of dwellings in floor area * Maximum number of floors allowed for construction)

- Number of residences = (Number of dwellings in residence area * The average number of households in west bank)

C- Urban survey campaign: streets and walkways, green areas, public transport, services, and facilities were analyzed.

D- Mapping the residential building distribution

## 4.6 Evaluation Criteria and Framework

### 4.6.1 Evaluate Pedestrian Accessibility to Neighborhood Services

#### 4.6.1.1 Build An Analytical Model on ArcGIS Pro 3.0

The 20MN theme is addressed by an analytical model developed and designed through ArcGIS Pro 3.0 software for evaluating existing and accessible neighborhood services for all residents in the study area within 20 minutes, showing the percentage of dwellings that can access a particular service within a given time frame. This study used a GIS-based model with buffer zone analysis to assess pedestrian access to neighborhood facilities using ArcGIS Pro 3.0 software. It is built on a structure for data and consists of a range of layers, including:

- Pedestrian pathways and streets,
- Education services: Baby daycares, kindergartens, and primary and secondary schools.
- Health services: health centers, hospitals, pharmacies, and medical clinics.
- Social services: groceries, daily needs shops (Local retail like supermarkets and small retail shops), clothes shops, furniture shops, and parking.
- Recreation services: sports facility (gym), restaurants and coffee shops, beauty and barber salons, wedding halls, hotel, playground, and one small park.
- Religious services: mosques
- Residential Buildings.

Which are executed through open data and field surveys. Through the following:

A- Draw Paths

The network contains all main and minor streets, as well as all pedestrian paths available in public spaces, and was drawn as shape file data according to the municipal register database of Hebron municipality.

B- Urban Survey Campaign

An urban survey campaign is an important component of this research approach since it collects primary data from citizens, urban planners, and municipal governments in the studied region. This survey will give helpful data about the present level of urban development, availability and accessibility to crucial amenities, and the people's lived experiences in these neighborhoods. The outcomes of the survey assisted evaluate how well the present urban form matches with the 20MN concept and highlighted opportunities for improvement.

The maps were acquired during a large urban survey effort. Through the data supplied, it can be determined if the paths can meet the needs of residents. Type of streets available, condition of roads, sidewalks, public spaces, green areas, safety measures, services and facilities that are available in the study area, the challenges residents face in accessing services, public transit, and other amenities, and most crucially, the time factor have all been studied as possible implications on the quality of the walking experience.

C- Mapping The Residential Building Distribution

Mapping the distribution of residential buildings is an important aspect of spatial organization studies. This research shows how residential areas are distributed over the urban environment, their proximity to critical services, and their interaction with transport networks. This contributes to the overall objective of adopting the 20MN concept by examining the link between dwelling placements and access to services.

A detailed spatial distribution map of residential areas has been generated to analyze the accessibility inside the 20MN and demonstrate the distribution of residents within the region. In this study, the locations of inhabitants were established using building usage maps received from Hebron Municipality, as shown in Figure 4.4.


Figure 4.4: The procedure for mapping the distribution of dwellings begins with the municipal register database and a shape file of streets and building number maps.

### 4.6.2 Assessment Of a 20-Minute Neighborhood

#### 4.6.2.1 Use a Buffer Zone Map to Estimate Accessibility Based on Walking Times.

The accessibility assessment in the study area was carried out through buffer analysis by using the ArcGIS Buffer Analyst tool to estimate the service areas in the neighborhood and establish the catchment regions for chosen communal amenities. Seven buffer maps were created as a result of buffer analysis, which identified service areas for social, recreation, health, religious services, schools, kindergartens, and baby daycares, within five benchmark travel times of 5, 10, 15, 20, and 25 minutes. The speed was taken at 40 m/min. As a result, the map displays all service areas that a pedestrian may reach in a roundtrip of 5, 10, 15, 20, and 25 minutes from the selected facilities. In actuality, for each link in the pedestrian network, a "cost" value, i.e., the ratio of connection length to pedestrian walking speed, assumed at 3 km/h, has been calculated. The National Research Council (2000) advises a walking speed of approximately 4-5 km/h. However, in urban areas with a significant number of older walkers (such as Italian cities), it implies a walking speed of 1.0 m/s (around 3.5 km/h). Adopting a lower number allows for greater accessibility to all road users, especially those who are most vulnerable (Caselli et al., 2021).

#### 4.6.2.2 Identifying The Residential Locations That Are Distributed Within a 5, 10, 15, 20, and 25-Minute Walking Distance in A round Trip from The Assessed Amenities

This step Illustrated the distribution of residential locations, taking into account the distance from the analyzed services available in the neighborhood. This approach helps visualize how well residential areas are connected to essential amenities such as schools, healthcare, grocery stores, parks, and public transportation. Through buffer zone maps can identify residential locations that are distributed within a 5, 10, 15, 20, and 25-minute walking distance from the assessed facilities. Where it was determined the number of residential units and their ratio that are distributed within a 5, 10, 15, 20, and 25-minute walking distance from every selected service that includes: (baby daycare, kindergartens, schools, health, social, recreation, and religious facilities).

### 4.6.3 Interview Results Analysis

The analysis of interview findings is an important qualitative component of the study, offering valuable insights into the opinions of many stakeholders such as urban planners, local governments, and residents in the selected area. This research contextualizes the quantitative data from surveys and spatial analysis, providing a better understanding of the difficulties, possibilities, and lived experiences associated with urban growth and the 20MNs concept. It also provides a

more thorough grasp of the local context, ensuring that urban development proposals are both acceptable and responsive to the needs of community members.

### 4.6.4 Evaluation of 20 Minutes Neighborhood in the Study Area (Analytical model)

#### 4.6.4.1 Evaluation Of 20 Minutes Neighborhood in The Study Area According to a Variety of Indicators And Principles of Walkability

In this step, various research methods were employed to obtain valid assessments of 20-minute walkability, including ArcGIS Pro 3.0, random resident interviews, site visits, the indicators and principles of walkability, and the evaluation of the study area. Assessment of the study area is done according to a variety of indicators and principles of walkability which are: population density, mixed land use, neighborhood amenities and services, accessibility, and safety, according to (Ali et al., 2023):

| **Principles** | **Standard Indicators of Walkability** |
|---|---|
| Population Density | - The density of dwelling units in the 20MNs ranges between 3000- 6500 dwellings/km$^2$.<br>- Population Density was calculated according to this equation:<br>The density of dwelling units = Number of dwellings in residence area / total land area<br>Density of residents = Number of residences / total land area |
| Mixed land use | - Provide integrated residential, recreational, and civic uses that are essential to daily living, as well as a diversity of local employment opportunities and suitable workspace.<br>- Access to public transit.<br>- Offering a choice of housing options. |
| Neighborhood amenities and services | - Religious place<br>- Local Shopping Centers and Services (Retail, Shop, or Showroom).<br>- Restaurant / Cafe (Fast Food Outlet or Takeaway, Restaurant or Cafeteria)<br>- Sports and recreational facilities<br>- Local Schools and educational opportunities<br>- Local health facilities and Services<br>- local plaza, parks, and playgrounds. |
| Accessibility | - Providing facilities and public transit nodes within walking distance.<br>- Provide street furniture such as softscapes, shade devices, and so on. |

| | |
|---|---|
| | - Provide accessible buildings and places for children, those with special needs, women, and elderly people. |
| Safety | - Provide pedestrian and cycling routes, crosswalks, and barriers.<br>- Minimum sidewalk width, lighting, traffic calming availability, and speed limits.<br>- Offering an eye on the street idea via an active street façade and apartments with street views. |

#### 4.6.4.2 Evaluate The Analytical Model According To Evaluation Attributes/Pillars

Evaluating the analytical model of the 20MN concept as applied to a study region in Palestine involves assessing it to a set of key assessment attributes or pillars. These pillars often encompass the key criteria that define good urban planning and development. Here is a recommended evaluation technique that may be utilized in the analytical model based on the following pillars in Table 4.1, according to (G. Pozoukidou & Chatziyiannaki, 2021) :

Table 4.1: Pillars and evaluation attributes of the 20-minute neighborhood.

| **Pillars** | **Spatial Planning** | **Evaluation Attributes** |
|---|---|---|
| Inclusion | Physical Planning | Housing: Variety and affordability of housing options |
| | | Proximity to services: a variety of services at the place of residence |
| | | Building density: average building density |
| | | Land use mix: a variety of land uses, including housing |
| | | Accessibility: Access to rapid transit systems (rail, metro, tram) |
| | | Multimodality: Alternative modes of transportation and their interconnections |
| | Community Building & Planning Process | Co-design processes for the production of space |
| | | Bottom-up initiatives for the improvement of quality of life |
| Health | Physical Planning | Proximity to healthy and affordable food through fresh food markets and community urban gardens |
| | | Proximity to basic healthcare |
| | | Connectivity and multifunctionality of green and open spaces |
| | | Active mobility (walking, biking, scootering, etc.) |
| | | Proximity to Cultural and Recreational opportunities |
| | Community Building & Planning Process | Cooperation of stakeholders and community for the interest of special groups (children, old people, people with disabilities, etc.) |
| | | Interaction between citizens in creating cultural, and recreational activities (urban gardening, walking teams etc.) |
| Safety | Physical Planning | Urban features that enhance the feeling of security |
| | | Safe sharing of public space (including road space) for cultural and recreational activities |
| | Community Building & Planning Process | Lively neighborhoods in terms of the variety of activities in public space |

| | | |
|---|---|---|
| | | Participatory practices that include people of all ages and abilities to combat physical and social isolation |
| Overall Proximity of Urban Amenities | | |

## 4.7 Process of Creating Model

### 4.7.1 Proposed Interventions of The Case Study 1

After studying the research region and evaluating the 20MN inside it, the interventions must be proposed by developing a spatial model to meet the main pillars of this concept. Interventions have been made in the following strategy:

a- Zoning modifications: The interventions were proposed to enhance public transport, public spaces, and public services. The interventions involve changing the land use zoning in the study area, to redistribute land for residential, commercial, and public purposes in a way that improves proximity to services and achieves diversity.

b- Density Adjustments: The change in land use caused changes and improvements in population density. Density calculation is done by using this equation:

(numbers of dwellings/ total area of the district)

c- Comparison between density before and after the intervention was done to reach an appropriate density so that services are accessible and optimally utilized.

### 4.7.2 Create a Theoretical Part of The Model

a- Review previous literature to have a thorough understanding of the 20MN concept. This involves researching urban design and planning ideas, reviewing prior research that focuses on compact, walkable communities and accessibility measurements, and investigating real-world applications of the 20MN model in places such as Melbourne, Portland, and others.

b- Defining the Radius of 20 MNs to answer the question ‘How far can people travel in 20 minutes, and how? ‘Which specifies the variables on which the 20MN is based.

c- Identifying the pillars of the model which are:

- Density: identifying the ideal population density for supporting local amenities without overcrowding based on global guidelines, case studies, and local analytical model (study area 1).
- Proximity: Accessibility to services through 20 minutes in around trip walking or cycling.
- Diversity of land use: Diversity of buildings, land use, and transport options, and identifying their square area.

d- Identifying critical components of the model that a 20MN must have.

e- Identifying essential services for a 20MN model,

f- Determine the optimal typology for a 20MN based on previous studies.

g- Determine the best ratio of land use categories to total land area.

### 4.7.3 Analysis Study Area 2

Analysis case study 2 was done through the following steps:

a- Urban survey campaign: This urban survey effort intends to collect data on case study 2's existing conditions to establish its appropriateness for the 20MN model. This survey examines a variety of issues, including land use, access to services, and infrastructure.

b- Mapping the residential building distribution by using ArcGIS Pro 3 software.

### 4.7.4 Identifying Study Area Boundaries

Determine the research area's boundaries based on the criteria mentioned above.

### 4.7.5 Apply The Theoretical Part of the 20 MIN Model on Study Area 2 Through the Following Steps:

a- Zoning: Identify residential, commercial, and recreational zones, as well as the distribution of services that should be included in the model. The goal is to map the spatial distribution of land uses to determine the possibility of redistributing or enhancing certain regions to align with the 20MN concept.

b- Identifying land use categories ratio.

c- Determine Density: Density is calculated based on the land use zoning plan and its ratio to obtain the acceptable density, to see if the neighborhood is sufficient in density to support walkability and accessibility to local amenities.

d- Buffer zone analysis

Using the ArcGIS Pro 3 software and Buffer Analyst tool. Analyze buffer zones to verify that all services are easily accessible by walking or cycling. This entails mapping buffer zones (400m) around essential amenities to determine the number of households that can access them within 10 minutes, while a buffer zone of 300m is created around education services to ensure that kids can reach them in less than 10 minutes. This study determines if the zoning meets the 20MN accessibility and walkability demands. This will assist in visualizing 20MN's potential and identifying places that may require enhanced accessibility or infrastructure.

### 4.7.6 Conclusion of final 20 MNs model

Create final zoning maps and 20 MN theoretical diagrams as a guideline for implementing 20 MN that show residential regions, service distribution, public spaces, and street networks.

Chapter 5

# Discussion and Results

## 5.1 Case study 1: Neighborhood in Hebron city

### 5.1.1 Hebron City

#### 5.1.1.1 Location and Areas

Hebron is a Palestinian city in the southern West Bank around 30 kilometers south of Jerusalem. Hebron Governorate is the West Bank's biggest governorate, and it is Palestine's third-largest city, after Gaza and Jerusalem. The governorate is home to more than 700,000 people, while the city boundaries have a population of 201,063. Hebron has an area of 74.102 $km^2$(Alimi & Gamson, 2007) (Beilin, 2004).


Figure 5.1: Location of Hebron within Palestine(Wikipedia).

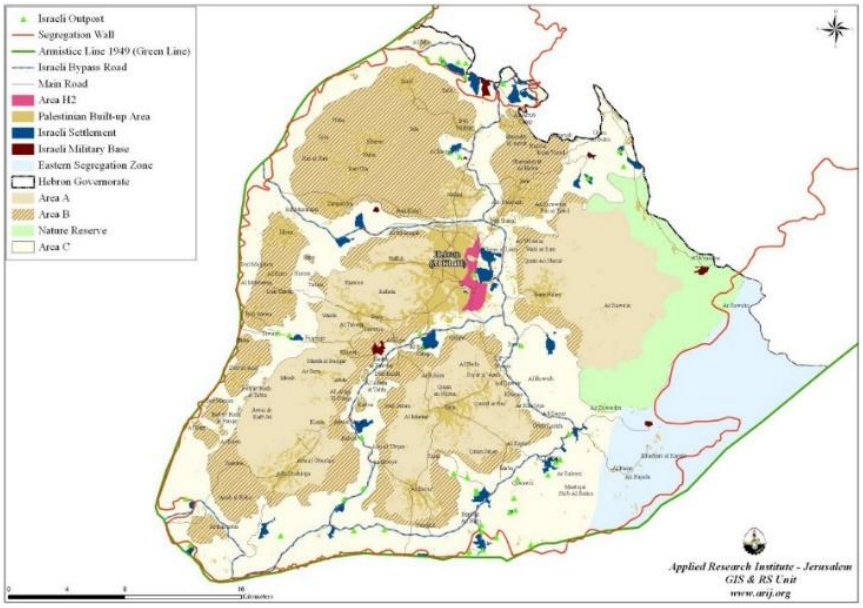



Figure 5.2: Hebron Governorate (A. R. I. J. (ARIJ)).

#### 5.1.1.2 Study Area Analysis

This study's case study was conducted in the northern part of Hebron city, a predominantly residential region with an area of around 785,000 $m^2$. The diameter of 1000 m was selected following previous literature reviews, which suggested a diameter of 20 MNs is 800 m to allow people to meet all of their daily needs in no more than 20 minutes round trip. In the current investigation, a diameter of 1000 m was used to assess the neighborhood if it extended for 25 minutes. Figure 5.3 shows the border of selected study area 1.

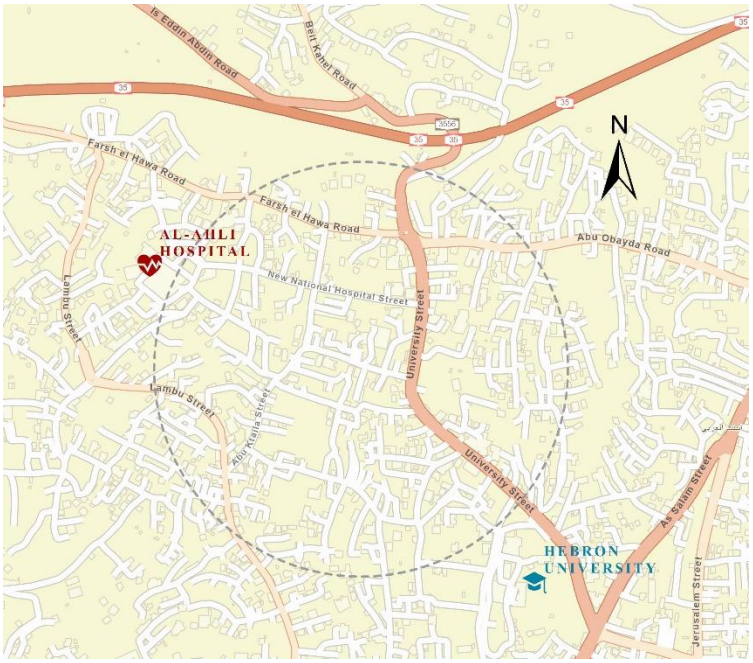



Figure 5.3: Border of the study area (the district of study), (Arc GIS Pro 3).

5.1.1.3 Current Master Plan

According to a master plan of Hebron displayed in Figure 5.4, which shows the distribution area into multiple parts. The study area was divided into zones according to building and organization rules, illustrated in .

Table 5.1, as the following:

- Commercial longitudinal: Approximately 14% of the land is planned for commercial and mixed-use buildings, with a maximum building height of 23 meters, six floors, no front setback, a 4m side setback after 14m depth, and a 4m back setback.
- Residence area: 64.8% of the study area was set aside as residential, divided into residences B, C, and D, as well as Villa residences, as shown below (Authorities, 2011):
  1- Residence (B): The front setback must be at least 5 m, 4m from the back, and 3 m from the sides, respectively, with a building percentage of 42% per dunum. The number of floors that can be built is 5 and one roof, with a maximum height of 18 meters.
  2- Residence (C): The front and back setbacks must be at least 4 m and 3 m from the sides, with a building percentage of 48% per dunum. In addition, number of floors is five and one roof with a maximum height of 18 m.

3- Residence (D): All setbacks must be 3m from all sides, with a building percentage of 52% per dunum. And number of floors is 5 with a maximum height of 15 m.
4- Villa residence: The building percentage shall not exceed 30% per dunum, with 5 m setbacks on the front, back, and sides. with a height of no more than 12 m, a total of 3 stories, and one roof.

Engineer Dima Arsan, the head of Al-Bireh Municipality's Buildings and Cultural Heritage Department, says, "The majority of the licenses are in residential areas (B) because the housing regulations for this type of residence area are considered logical and affordable for everyone in terms of purchasing land and license fees. The 42% buildable area equates to around 420m$^2$. As for areas (A), they are more expensive in terms of land prices" (Aliqtisadi, 2016).

Arsan adds, "You may find residential buildings on one of the streets that are more than five stories high, and their number may exceed thirteen floors, depending on the geographical character of the country. Usually, the level in the system is determined from the middle of the upper street, thus everything below the street is called ground floors and is removed from the number of stories"(Aliqtisadi, 2016).

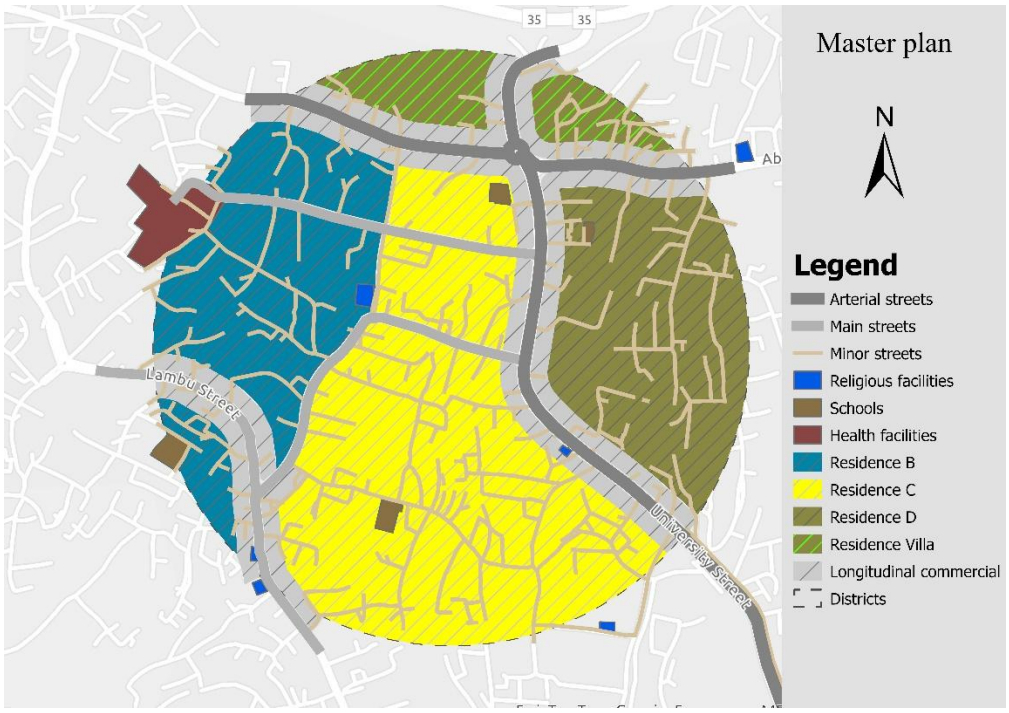



Figure 5.4: Master Plan of the study area (Municipality).

Regarding streets, 20% of the study area was allocated for streets, with widths ranging from 22-25 m for arterial roads, 18-20 m for main streets, and 4-6-8-10-12 m for minor streets. Table 5.2

Illustrated this ratio, and shown the ratio of land use categories of study area 1 according to the master plan.

Table 5.1: Percentage of land allocated to each type of residence area according to master plan

| **Type of building** | | **Area ($m^2$)** | **Ratio% (area of land allocated to each type of building/ total area of the district)** |
|---|---|---|---|
| Residential building | Residence B | 116380.00 | 14.8% |
| | Residence C | 249745.00 | 32% |
| | Residence D | 117377.00 | 15% |
| | Residence_ Villa | 25178.00 | 3% |
| | Total residence area | 508680.00 | 64.8% |
| Commercial area | | 107865.00 | 14% |

Table 5.2: The ratio of streets according to the master plan.

| **Streets** | **Area ($m^2$)** | **Ratio% (area of streets to total area of the district)** |
|---|---|---|
| Main roads | 69717.00 | 9% |
| Minor roads | 84058.00 | 11% |
| All roads | 153775.00 | 20% |

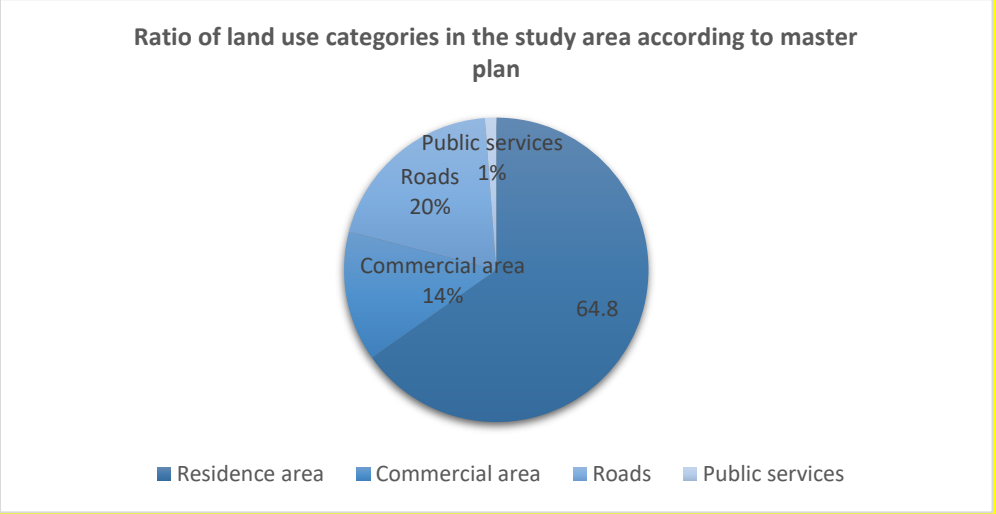



Figure 5.5: The ratio of land use categories in the study area according to a master plan.

### 5.1.1.4 Urban Survey Campaign

1- Streets and Pavements

In the study area, streets are classified into, Figure 5.6:

- Arterial Streets (University Street (Figure 5.7), Farsh el Hawa Road (Figure 5.8)).
- Main streets (Lambu Street, Abu Ktaila Street, Figure 5.9, and New National Hospital Street).
- Minor streets include all other roads in the district.

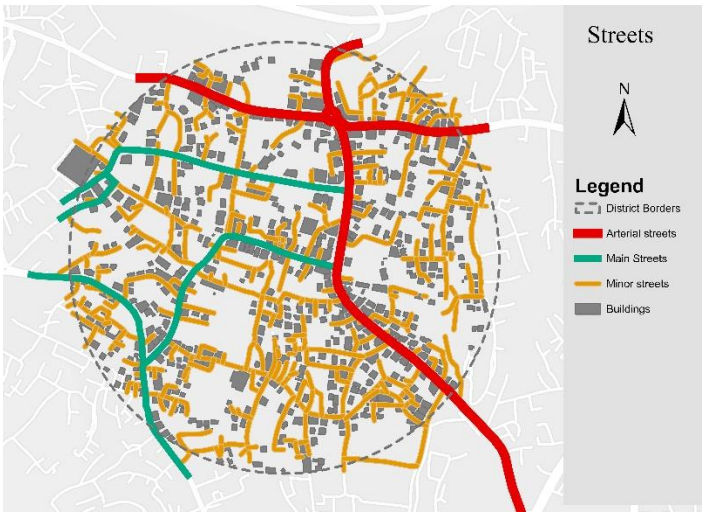



Figure 5.6: Type of streets in the study area, source: the author.

Figure 5.7: University Street.

Figure 5.8: Farsh El Hawa Road.

Figure 5.9: Abu Ktaila street.

2- Pavements and Sidewalks

During the field survey of the research area, which was done at the peak period, when students leave school, the following issues emerged about street pavement and pedestrian walkways:

- The main roads are large and have two sides, each side for one way, and are split by a central island so that each side has parking spots and street pavement for walkers. It turns out that the pedestrian walkways can accommodate four students walking side by side, (Figure 5.10).

Figure 5.10: Images illustrate the major street shapes and pavements.

- Most minor streets are without pedestrian pathways. For example, the minor streets that go to schools have no pedestrian sidewalks along their borders. In addition, several minor roadways that lead to residential neighborhoods don't have sidewalks or pedestrian paths, (Figure 5.11).

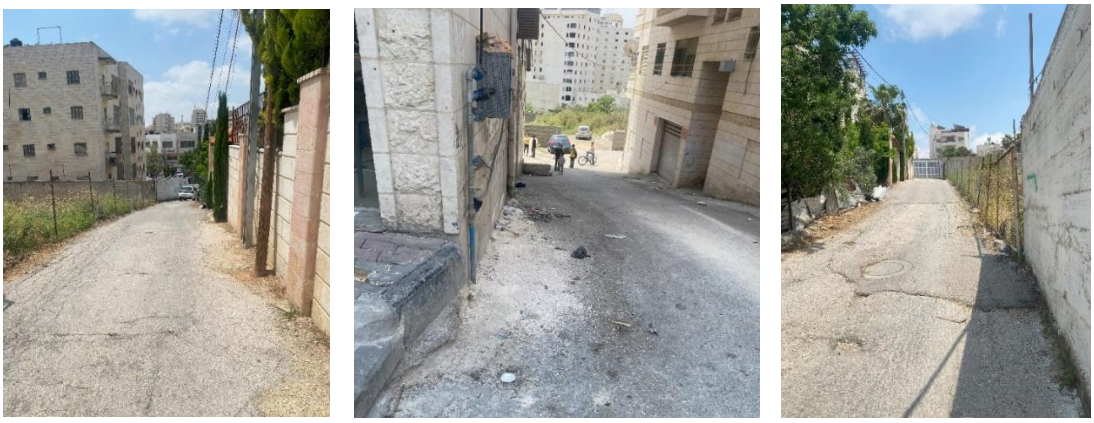


Figure 5.11: Images from the study area illustrate minor streets.

- There are some unpaved minor streets, as shown in (Figure 5.12).

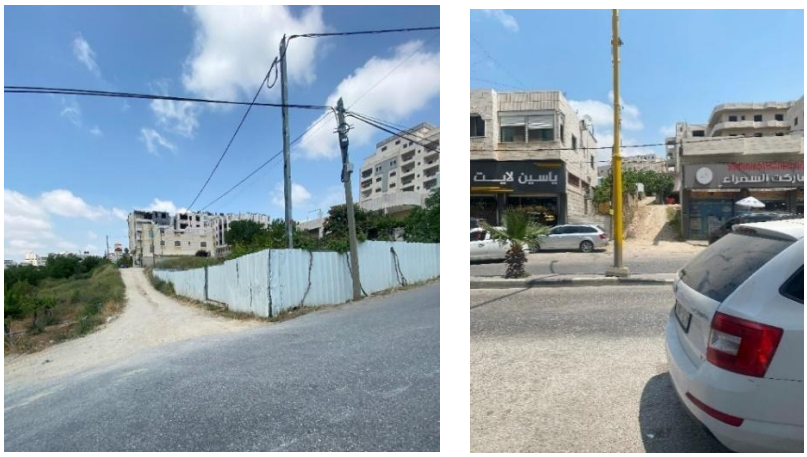


Figure 5.12: Images from the study area illustrate unpaved minor streets.

- On several streets, the continuity of sidewalks and pedestrian walkways has been interrupted, (Figure 5.13). And there are no defined bike lanes in the entire neighborhood.

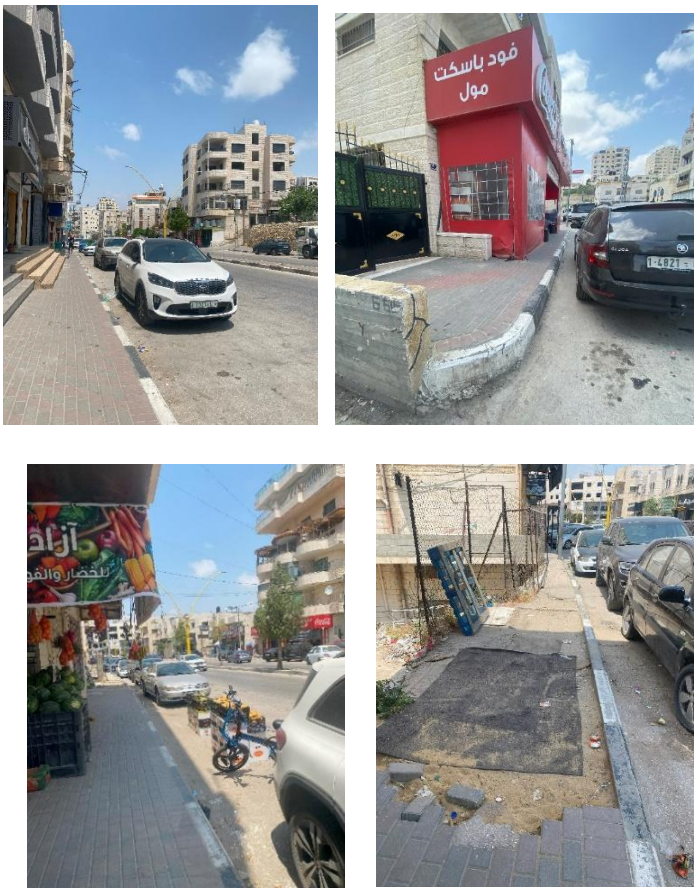



Figure 5.13: Images from the study area showing encroachments on sidewalks.

3- Green areas

- The study area lacks dedicated public green spaces for recreation. However, there are also many empty agricultural lands among the neighborhood's buildings that are owned by neighborhood residents where construction is permitted since they are allocated for future growth.
- Gardens and parks are confined to the homeowners' private gardens, as well as a private garden owned by the Hebron Women's Association that serves as a public garden and is rented for special events.
- In addition, there are two playing fields that the neighborhood's residents can hire. One belongs to Hebron Women's Association and is located adjacent to the association's building, while the other is near Al-Ahli Hospital.

Figure 5.14: Image of private green areas from the study area.


Figure 5.15: Public Park and Five-a-side Playing field, with an area of about 2800.00 $m^2$ (Earth).


Figure 5.16: Playing field near Al Ahli Hospital, with an area of about 425.00 $m^2$ (Earth).

4- Public Transport

Public transport is limited to public cars (Figure 5.17) that can seat four people and buses. However, there is only one bus stop in the region next to Al-Ahli Hospital, and another one next to Hebron University, which is beyond the study area. The public transport system suffers from neglect and inadequate parking lot allocation. Figure 5.18 illustrates existing transit stops.

Figure 5.17: Public cars.

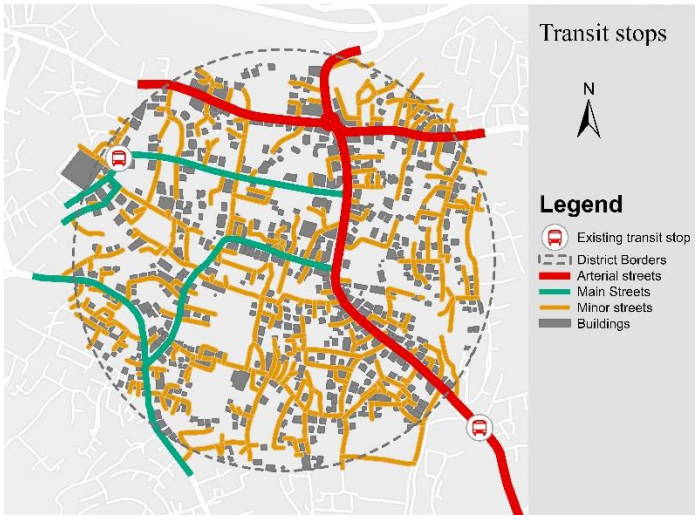



Figure 5.18: Existing transit stop location.

5- Services and Facilities

The results of the urban survey campaign demonstrate that there are various services and facilities inside the border of the study area, which fall into the following major categories:

a) Education services: involve a variety of facilities, including:

- Nursery schools: The district of study includes three Nursery schools, two of them located in the north of the region, and one in the middle, as shown Figure 5.19.

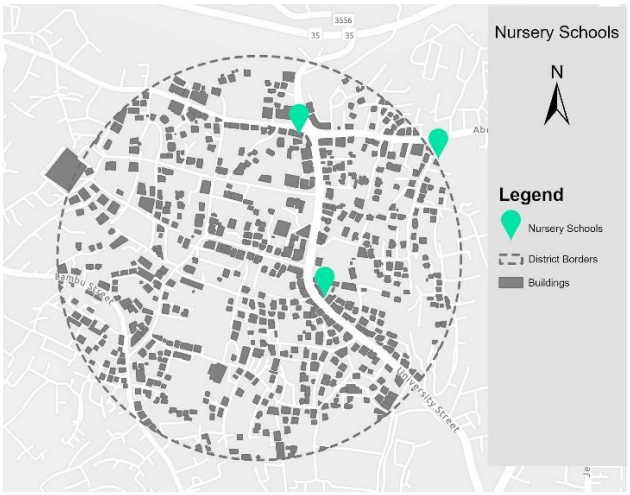



Figure 5.19: Nursery schools in the study area.

- Kindergartens: There are five kindergartens, which are distributed as follows: one is located on the district's northeastern border, two are approximately in the center and accessible via University Street, and the other two are located in the south of the region, Figure 5.20.

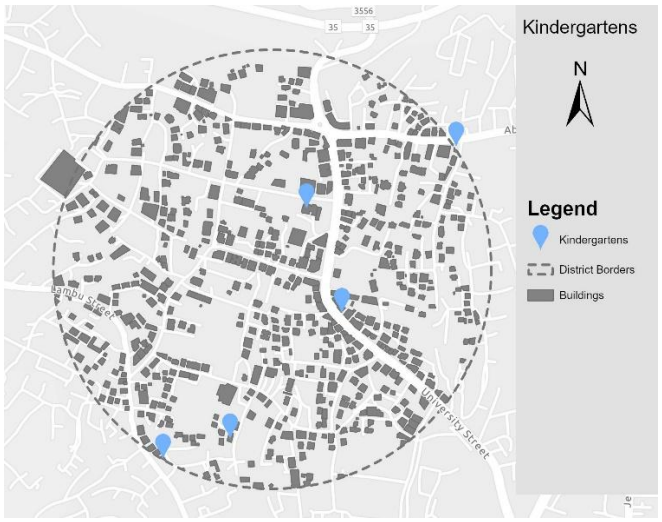



Figure 5.20: Kindergartens in the study area.

- Primary, and secondary schools, there are six schools, Figure 5.21:

1- Harbi Jadallah Abu Al-Daba'at Primary School for boys, is a governmental school, located in the northern part of the district and reachable via University Street.
2- Sodqyya Abu-Aldabaat Primary School for girls, is located in the northern part of the district. It is accessible via University Street and is a governmental school.
3- Dar AL- Ma'rifah Primary School for Boys is a governmental school located in the southwest of the study area. It is accessible through Lambu Street.

4- Ibrahim Abu Al-Daba'at Secondary School for Girls is a governmental school located in the south of the study area. Accessible via Abu Ktaila Street and University Street.
5- Glory International Schools, is a private primary school that teaches students from kindergarten to ninth grade, positioned in the middle of the study area on University Street.
6- Al-Manahel Private School and kindergarten. It's a private school, located in the south part.

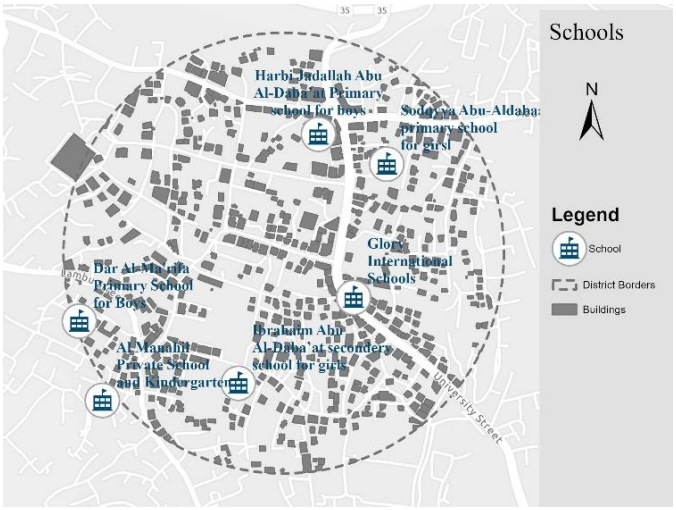



Figure 5.21: The location of schools in the study area.

(A) (B)

Figure 5.22: (A) Harbi Jadallah Abu Al-Daba'at Primary School for boys. (B) Ibrahim Abu Al-Daba'at secondary school for girls.

b) Health services: There are several health facilities in the area (Figure 5.23), including:

- Pharmacies: Two pharmacies are located on University Street, one in the southern section of the region on Abu Katila Street, and another one located beyond the study area boundary but nearby.
- Medical Clinics: There are four dental clinics, one obstetrics and gynecology clinic, a pediatric clinic, and a dental technician.

- Laboratories: the district includes one laboratory.
- health centers: There is one medical center in the study area.
- Hospital: There is AL-Ahli Hospital.

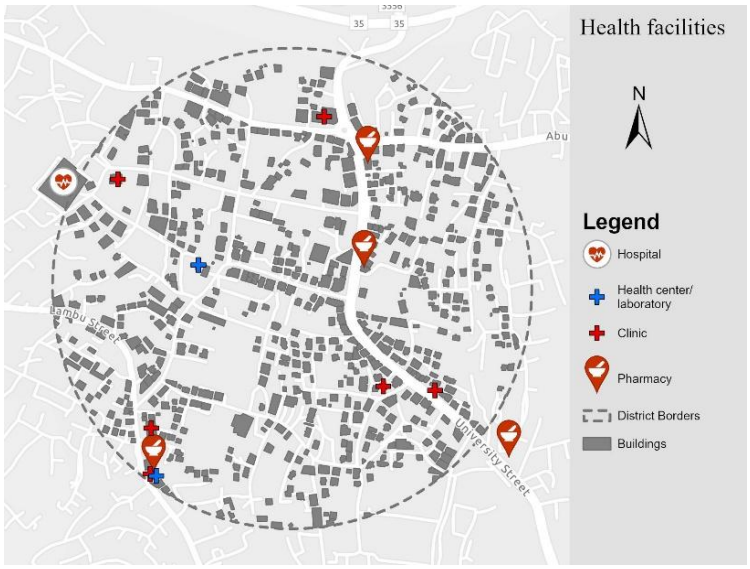



Figure 5.23: Health facilities in the study area.

c) Social services: The study region had a variety of social facilities, including groceries, daily needs shops (Local retail like supermarkets and small retail shops), clothes shops, furniture shops, and parking, (Figure 5.24).

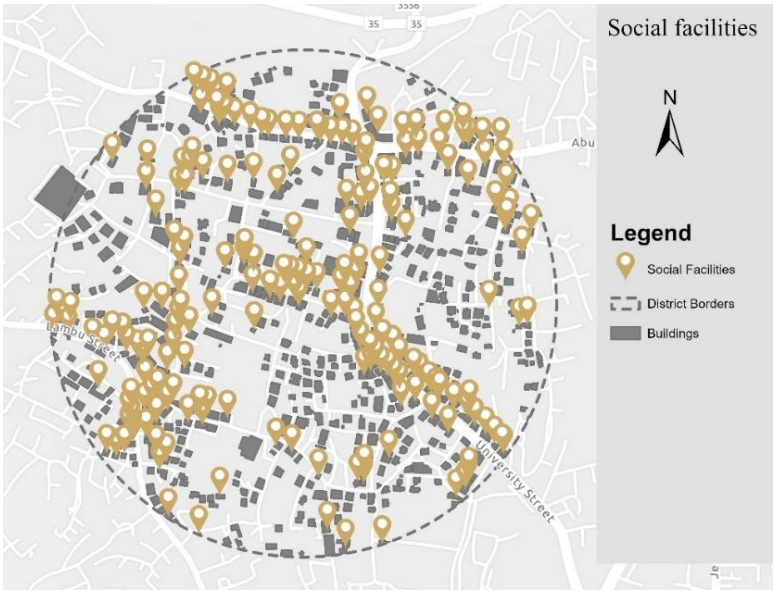



Figure 5.24: Social facilities in the study area.

d) Recreation services: There are several entertainment facilities in the district including one sports facility (gym), many restaurants and coffee shops, beauty and barber salons, two wedding halls (Figure 5.26), one hotel, two playing field, and one small park, Figure 5.25 shows the distribution of these facilities.

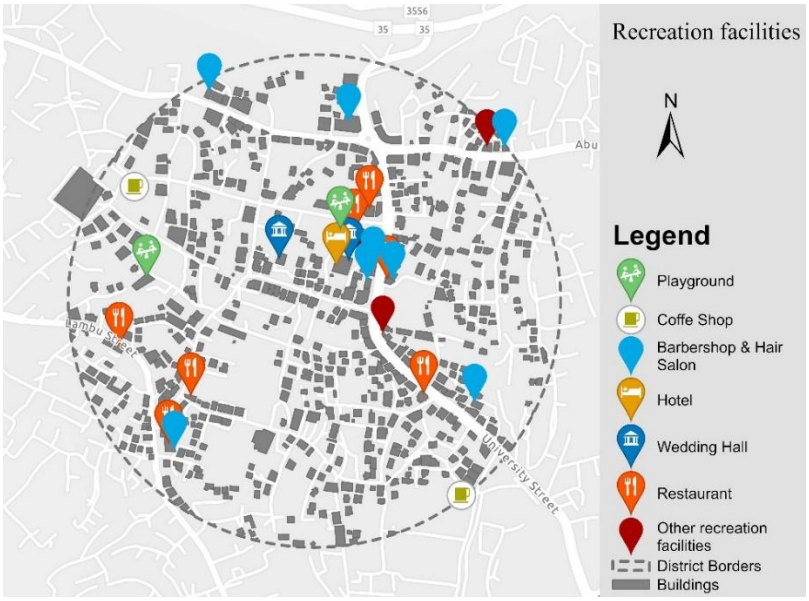
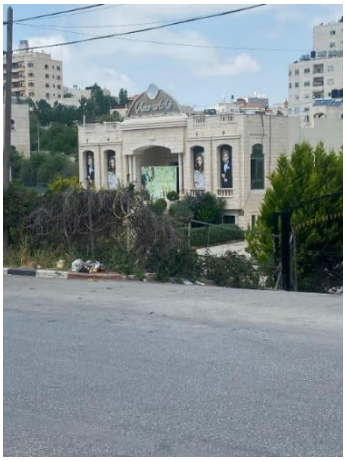



Figure 5.25: Recreation facilities in the study area.

Laverda Halls



Masaya Halls

Figure 5.26: Wedding Halls.

e) Religious services: Figure 5.27 displays religious facilities in the research area, which includes four mosques inside the region's borders and two outside but nearby.

Figure 5.28 shows the examples of these mosques in the district. Table 5.3 shows the account of the five service categories in the study area, and Figure 5.29 Summary of the ratio distribution of services in built-up areas in the district according to the number of services.

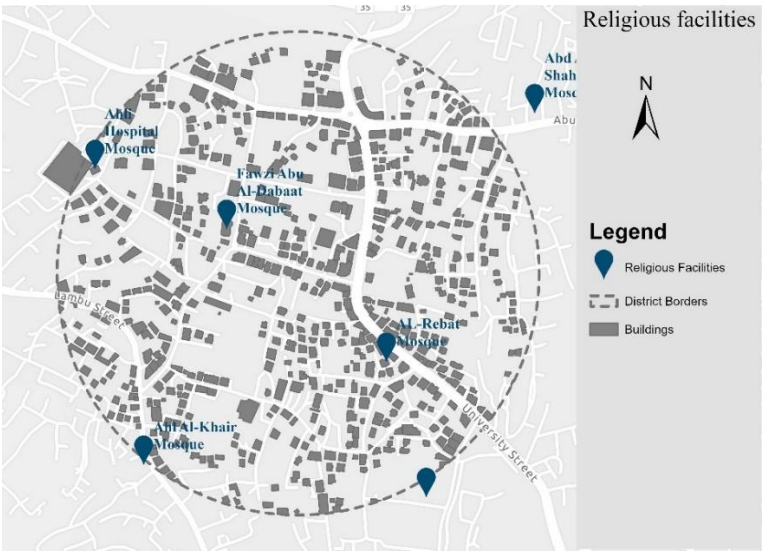



Figure 5.27: Religious facilities in the study area.

Figure 5.28: Fawzi Jadallah Abu Al-Daba'at Mosque.

Table 5.3: The count of the five service categories in the study area.

| Service Category | Service Name | Service numbers |
|---|---|---|
| Education Services | Nursery schools<br>Kindergartens<br>Primary schools,<br>Secondary schools | 3<br>5<br>5<br>1 |
| Health Services | Pharmacies<br>Medical Clinics:<br>- obstetrics and gynecology clinic<br>- pediatric clinic<br>- dental technician<br>- dental clinics<br>Laboratories | 4<br><br>1<br>1<br>1<br>4<br>1 |

| | | |
|---|---|---|
| | health centers<br>Hospital | 1<br>1 |
| Social Services | Groceries<br>daily needs shops (Local retail like supermarkets and small retail shops) clothes shop<br>furniture shop | |
| Entertainment services | Sports facilities (gym)<br>Restaurants<br>coffee shops<br>Beauty and barber salons<br>wedding halls<br>hotel<br>Playing field<br>Park | 1<br>10<br>2<br>6<br>2<br>1<br>2<br>2 |
| Religious Services | Mosques | 6 |

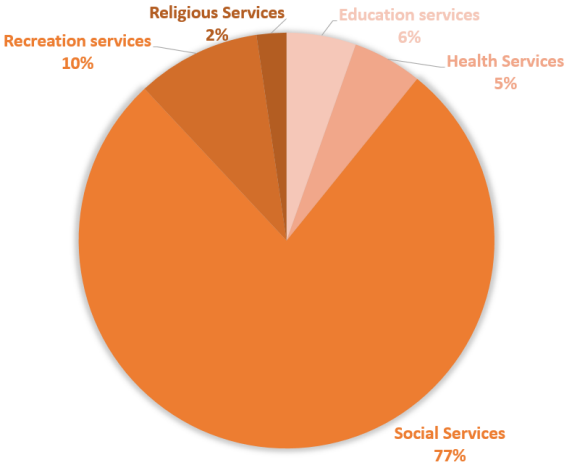



Figure 5.29: Ratio distribution of services in built-up areas in the district according to the number of services.

### 5.1.1.5 Mapping the Residential Building Distribution

The results of this georeferencing process revealed that the residential buildings in the research area ranged from detached homes to apartments and villas, with a total of 2,587 dwelling units distributed across the neighborhood, as seen in Figure 5.30.The region has a diverse range of buildings as follows:

- In terms of height, the buildings varied from one-story to multi-story buildings.
- In terms of use, the buildings varied from residential buildings to mixed-used buildings.
- Housing options included single-family homes, apartments, and villas.

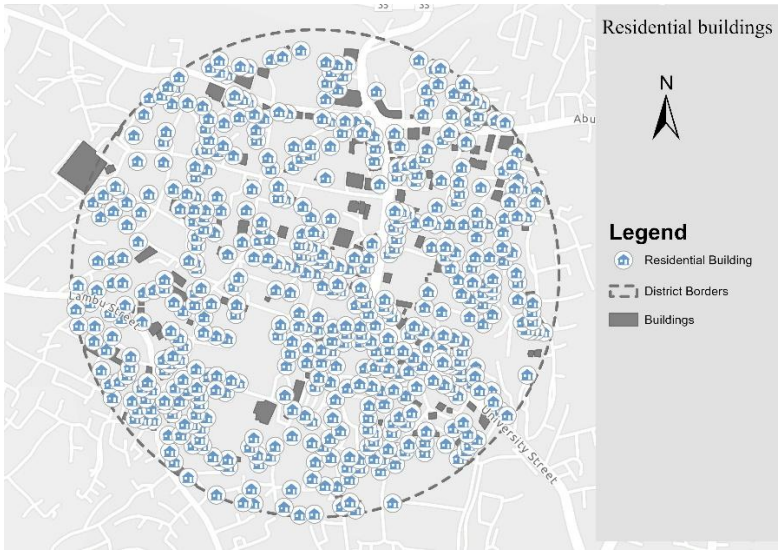



Figure 5.30: Distribution of dwellings in the neighborhood.

### 5.1.1.6 Assessment Of A 20-Minute Neighborhood

- Buffer Zone Map for Assessing Accessibility Based On Walking Times

The accessibility study was done by ArcGIS Pro 3.0 using a buffer analysis tool. The study was divided into two parts. The study was done in two parts. The first part of the analysis was done for the master plan, which resulted in four buffer maps for schools, health, commercial, and religious facilities. Two values for round-trip travel durations were taken: 20, and 25 minutes to study the impact of increasing the 20 MN catchment from 800 m to 1000 m to create a 25 MN, and the speed chosen was 40 m/min.

The second part of buffer analysis was done on the built-up area; eight buffer maps were created with the primary destinations: social, recreational, health, and religious facilities, schools, nursery schools, and kindergartens. Five values for round-trip travel durations: 5, 10, 15, 20, and 25 minutes were taken, and the speed chosen was 40 m/min. The maps below illustrate the outcomes of the analysis.

- Buffer zone analysis of the master plan


Figure 5.31: Buffer zone map concerning school facilities.

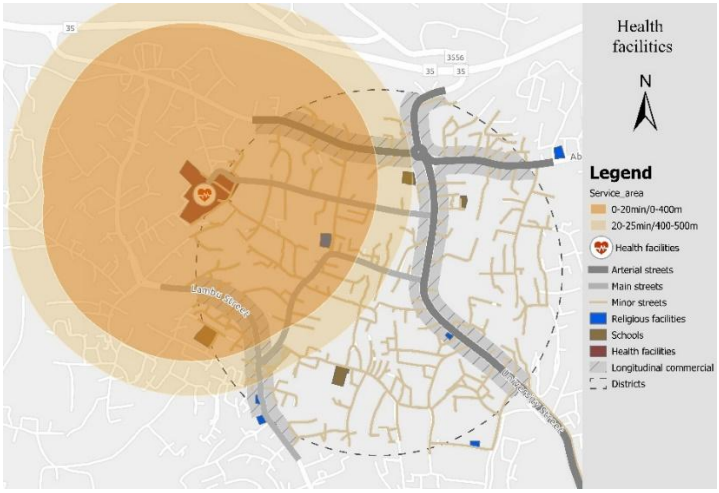



Figure 5.32: Buffer zone map concerning health facilities.

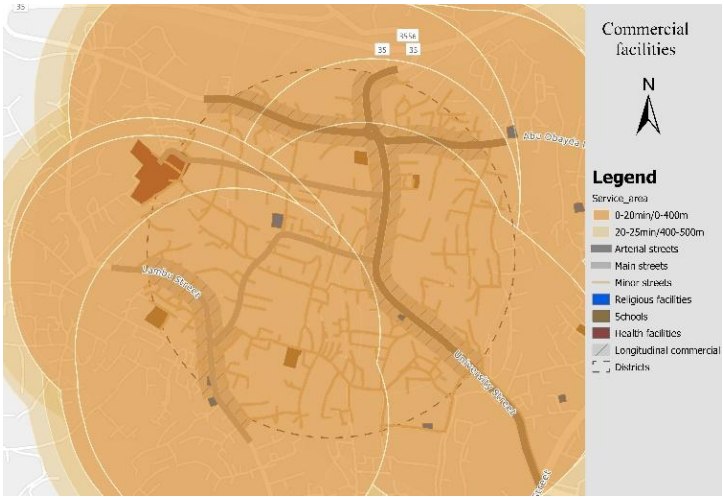



Figure 5.33: Buffer zone map concerning commercial facilities.

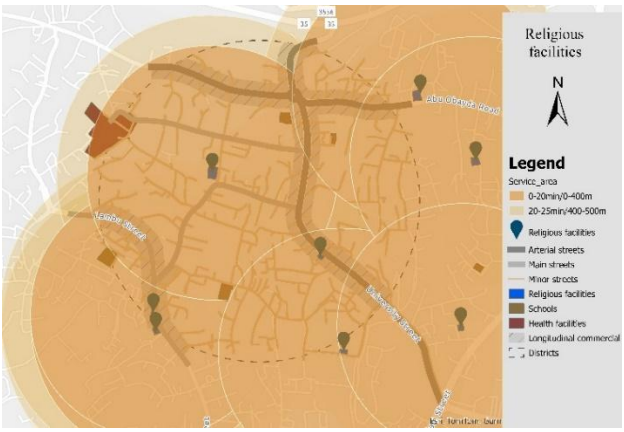



Figure 5.34: Buffer zone map concerning religious facilities.

- Buffer zone analysis of the built-up area

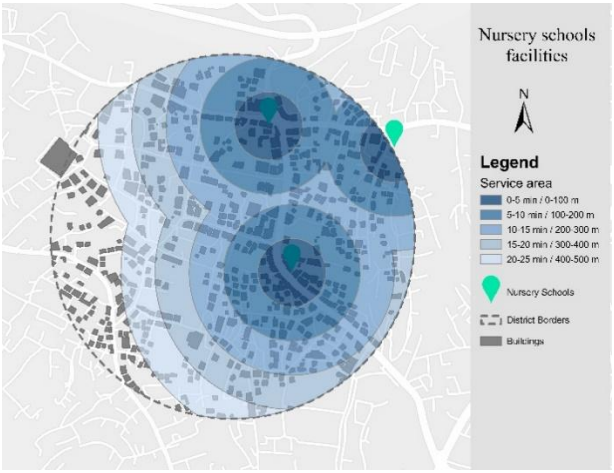



Figure 5.35: Buffer zone map concerning nursery school facilities.

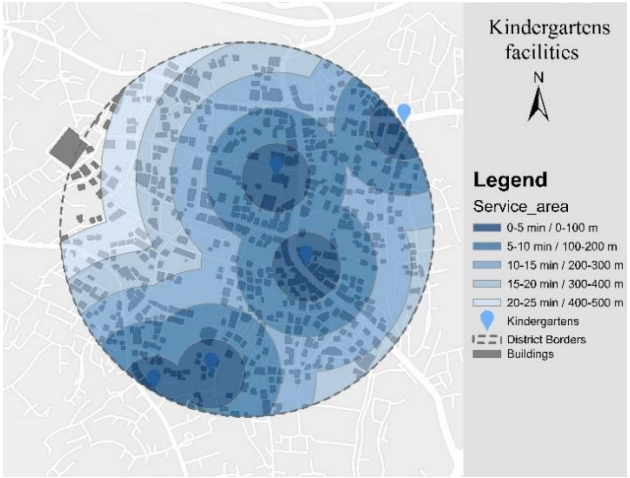



Figure 5.36: Buffer zone map concerning kindergarten facilities.

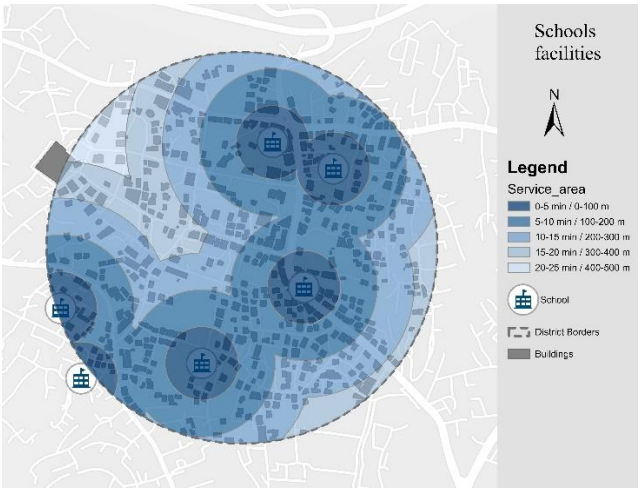



Figure 5.37: Buffer zone map concerning school facilities.

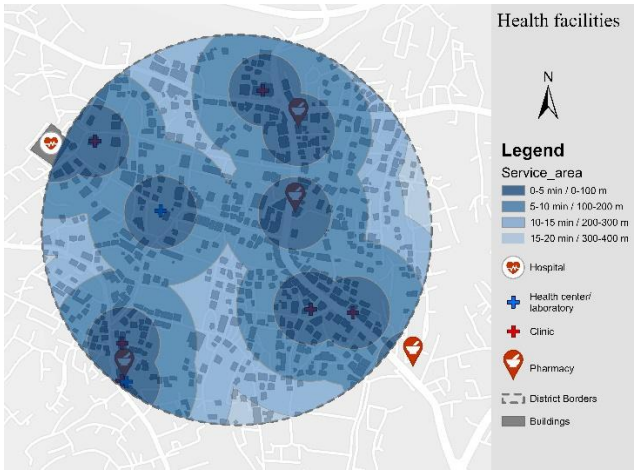



Figure 5.38: Buffer zone map concerning health facilities.


Figure 5.39: Buffer zone map concerning social facilities.

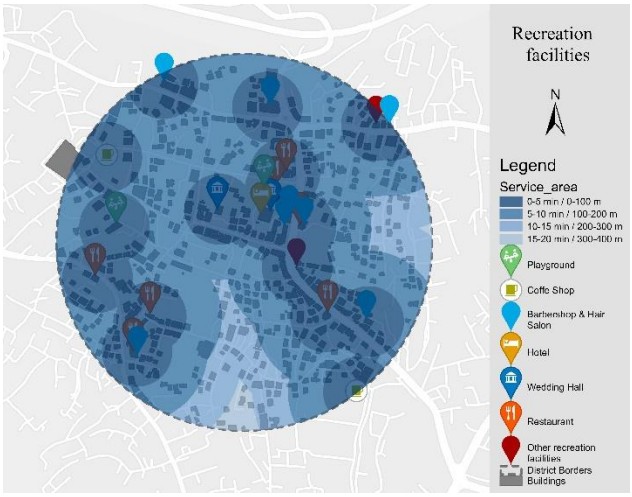



Figure 5.40: Buffer zone map concerning recreation facilities.

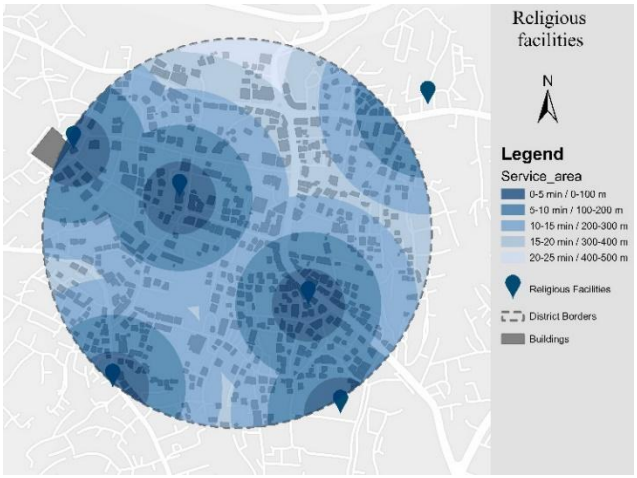



Figure 5.41: Buffer zone map concerning religious facilities.

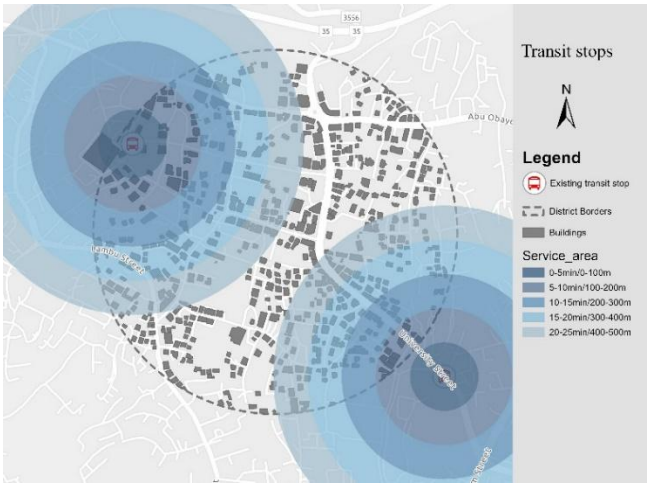



Figure 5.42: Buffer zone map concerning transit stops.

- Identifying The Residential Locations That Are Distributed Within a 5, 10, 15, 20, and 25-minute Walking Distance In A round Trip From The Assessed Amenities

The master plan's accessibility research shows that the distribution of educational, commercial, and religious facilities connects all residential units to the district within 20-25 minutes of travel time. Furthermore, the analysis of hospital accessibility within 25 minutes covers 50% of the study area. The tables below show the distribution of residential units in the neighborhood according to their distance from the analyzed facilities. As shown in Table 5.4, 12% of residential units in the district have access to nursery school located in the same district within walking distance of 5 minutes, 24% within walking distance of 10 minutes, 21% within walking distance of 15 minutes for round-trip, and13%, 19% within walking distance of 20 and 25 minutes back and forth, while 11% of residential units need more than 25 minutes to access any nursery school in the study area.

Table 5.4: Residential units within walking distance from nursery school facilities.

| **Nursery School** | | | | | | |
|---|---|---|---|---|---|---|
| Buffer zone Distance m/ round trip time min | 0-100 m /0-5 min | 100-200 m /5-10 min | 200-300m /10-15 min | 300-400 m /15-20 min | 400-500 m /20-25 min | 0-500 m /0-25min |
| Number of residential units | 300 | 629 | 551 | 330 | 479 | 2289 |
| Ratio of residential units % | 12% | 24% | 21% | 13% | 19% | 89% |

In contrast, 55% of residential units are within 10 minutes or less from kindergartens, while less than half take more than 10 minutes to get there, and just 2% need more than 25 minutes to reach them, as seen in .

Table 5.5, and Table 5.6 illustrates that 59% of them can go to school within 10 minutes on a round-trip.

Regarding health facilities Table 5.7, 77% of dwelling units are within a 10-minute walk. Table 5.8 shows that 95% of residential units are within 5 minutes of walking distance to social services. Also, according to Table 5.9, all residential units in the area can access entertainment services in 10 minutes or less and back at the same time. In addition, 56% of these dwellings are within a 10-minute walk of mosques, and others are within a 20-minute walk in around trips as seen in

Table 5.10, also, 77% of households are located less than 15 minutes from public transit stops (Table 5.11). While expanding the district's diameter to 1000 meters, the result is that 19% of

residential units can access nursery schools within 25 minutes of a round trip, 10% of them can travel to kindergarten and return within 25 minutes, and 7% can reach mosques within this time. Figure 5.43 summarized the tables' results.

Table 5.5: Residential units within walking distance from kindergartens.

| **Kindergartens** | | | | | | |
|---|---|---|---|---|---|---|
| Buffer zone Distance m/ round trip time min | 0-100 m/ 0-5 min | 100-200m /5-10 min | 200-300m /10-15min | 300-400 m /15-20min | 400-500 m /20-25min | 0-500 m /0-25min |
| Number of residential units | 300 | 1115 | 520 | 332 | 247 | 2514 |
| Ratio of residential units % | 12% | 43% | 20% | 13% | 10% | 98% |

Table 5.6: Residential units within walking distance from schools.

| **Schools** | | | | | | |
|---|---|---|---|---|---|---|
| Buffer zone Distance m/ round trip time min | 0-100 m /0-5 min | 100-200 m /5-10 min | 200-300m /10-15 min | 300-400 m /15-20 min | 400-500 m /20-25 min | 0-500 m /0-25min |
| Number of residential units | 405 | 1116 | 653 | 236 | 177 | 2587 |
| Ratio of residential units % | 15% | 43% | 25% | 10% | 7% | 100% |

Table 5.7: Residential units within walking distance from health facilities.

| **Health facilities** | | | | | | |
|---|---|---|---|---|---|---|
| Buffer zone Distance m/round trip time min | 0-100 m / 0-5 min | 100-200 m / 5-10 min | 200-300m / 10-15 min | 300-400 m /15-20 min | 400-500 m / 20-25 min | 0-500 m / 0-25 min |
| Number of residential units | 946 | 1027 | 526 | 88 | --------- | 2587 |
| Ratio of residential units % | 37% | 40% | 20% | 3% | --------- | 100% |

Table 5.8: Residential units within walking distance from social facilities.

| **Social facilities** | | | | | | |
|---|---|---|---|---|---|---|
| Buffer zone Distance m/ round trip time min | 0-100 m /0-5 min | 100-200 m /5-10 min | 200-300m /10-15 min | 300-400 m /15-20 min | 400-500 m /20-25 min | 0-200m /0-10 min |
| Number of residential units | 2450 | 137 | ---------- | ---------- | --------- | 2587 |
| Ratio of residential units % | 95% | 5% | ---------- | ---------- | --------- | 100% |

Table 5.9: Residential units within walking distance from recreation facilities.

| **Recreation facilities** | | | | | | |
|---|---|---|---|---|---|---|
| Buffer zone Distance m/ round trip time min | 0-100 m /0-5 min | 100-200 m /5-10 min | 200-300m /10-15 min | 300-400 m /15-20 min | 400-500 m /20-25 min | 0-500m /0-20min |
| Number of residential units | 1342 | 896 | 322 | 27 | --------- | 2587 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Ratio of residential units % | 52% | 35% | 12% | 1% | --------- | 100% |

Table 5.10: Residential units within walking distance from religious facilities.

| Religious facilities | | | | | | |
|---|---|---|---|---|---|---|
| Buffer zone Distance m/ round trip time min | 0-100 m /0-5 min | 100-200 m /5-10 min | 200-300m /10-15 min | 300-400 m /15-20 min | 400-500 m /20-25 min | 0-500m /0-25min |
| Number of residential units | 360 | 1100 | 819 | 289 | 19 | 2587 |
| Ratio of residential units % | 13% | 43% | 32% | 11% | 1% | 100% |

Table 5.11: Residential units within walking distance from transit stops.

| Transit stops | | | | | | |
|---|---|---|---|---|---|---|
| Buffer zone Distance m/ round trip time min | 0-100 m /0-5 min | 100-200 m /5-10 min | 200-300m /10-15 min | 300-400 m /15-20 min | 400-500 m /20-25 min | 0-500m /0-25min |
| Number of residential units | 96 | 246 | 375 | 689 | 584 | 1990 |
| Ratio of residential units % | 4% | 10% | 14% | 27% | 22% | 77% |

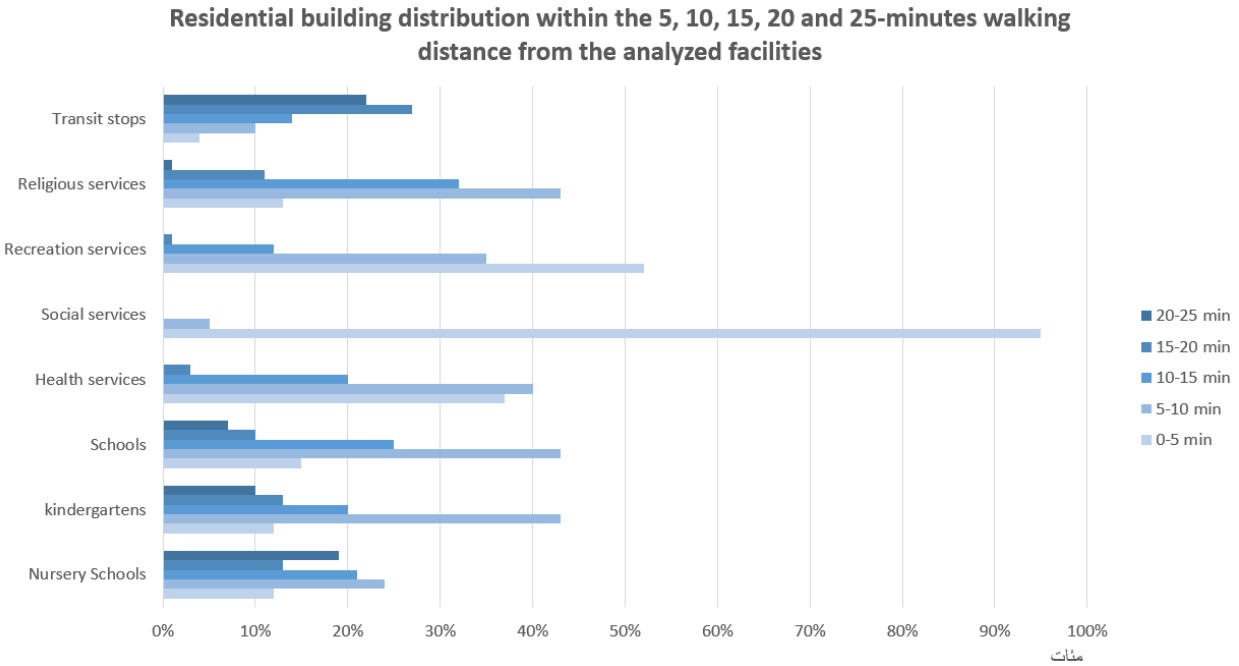



Figure 5.43: Residential units' distribution within 5, 10, 15, 20, and 25-minute walking distance from the analyzed facilities.

5.1.1.7 Interview Results Analysis

The interviews were conducted to collect data and obtain people's reviews about the neighborhood and city facilities. An open-question interview was conducted with a group of inhabitants in the study area; all answers may be found in Appendix A.

A. First Part

- The first part presents the participants' demographic data; the first question revealed that 50% of participants were female and 50% were male.
- The next question is about the number of family members, which is an average of 4.7((PCBS), 2023).
- The third question in this part is intended to gather more data about the living environment and the type of resident housing. The majority of the inhabitants live in apartments.
- Table 5.12 summarizes the rates of results from the first part of the interviews.

Table 5.12: The interview's answers rates-part1 (The demographic characteristics).

| **Gender** | **Male** | | **Female** | | |
|---|---|---|---|---|---|
| **Number of family members** | 50% | | 50% | | |
| **Type of dwelling** | Apartment | Detached house | Apartment | Detached house | |
| | 75% | 25% | 75% | 0.25% | |
| **Neighborhood** | Abu Ktiala | Old Al-Ahli Hospital Road | Abu Ktiala | New National Hospital Road | University street |
| | 75% | 25% | 25% | 25% | 50% |

B. Second Part

The second part of the interview highlighted the area's difficulties and what should be changed within the community based on people's perspectives. All replies focused on social concerns such as a lack of public green areas, playgrounds for children, sidewalk problems and bike lanes, and public transit issues. The answers that came up divided difficulties into three issues:

- Lack of public green areas, and playgrounds: Most residents complain about the absence of public spaces for entertainment and children's playgrounds, except for one park that some residents use. It was pointed out during the interview that many inhabitants are unaware of the park's existence.
- Sidewalk issues and bike lanes: Most residents complain that the sidewalks in most parts of the neighborhood are unsuitable for pedestrians because they are attacked by shop owners who use the pavement to display their goods, particularly car repair shops, which park cars on the

pavement and extend them to the street, causing significant inconvenience to pedestrians. According to one of the residents, "**The students at Ibrahim Abu Al-Dabaat secondary School complain about the presence of car repair shops since they take full use of the sidewalk in addition to the inconvenience they cause. A complaint has been sent to Hebron Municipality several times, but no action has been done yet**." Furthermore, another resident informed us, "**I cannot walk with my little child because pavements are not suitable, and this is considered unsafe, especially for children**."

Another issue that residents face is parking lots near pavement, which prevent pedestrian circulation and are considered dangerous. One resident adds, "**I can't walk with my baby's stroller on the street because the sidewalks are being utilized as parking lots, which obstructs mobility and is dangerous. As a result, I prefer to use my private car than walk around the neighborhood**". Another issue with sidewalks is their absence from many minor streets in the region. Residents also agreed that there are no bicycle paths, thus few people ride bicycles, which is restricted to young male teenagers.

- Public transit issues: Residents of the neighborhood suffer from the absence of public transit stops inside the study area, forcing most to wait on the street until the bus or taxi comes, or to use a private car. This is a major issue for them, particularly during peak hours.

5.1.1.8 Evaluation of 20 minutes neighborhood in the study area (Analytical model)

Due to the unequal availability of services, we used a combination of research approaches to acquire reliable assessments of 20-minute walkability, including ArcGIS Pro 3.0, random resident interviews, and site visits. This study highlighted essential data (population density, mixed land use, neighborhood services, accessibility, safety)(Figure 5.44)(Ali et al., 2023), the appropriate indicators of those principles were assessed based on data from Hebron municipality on service numbers and locations, site visits, and interviews with random community inhabitants,(Table 5.14).

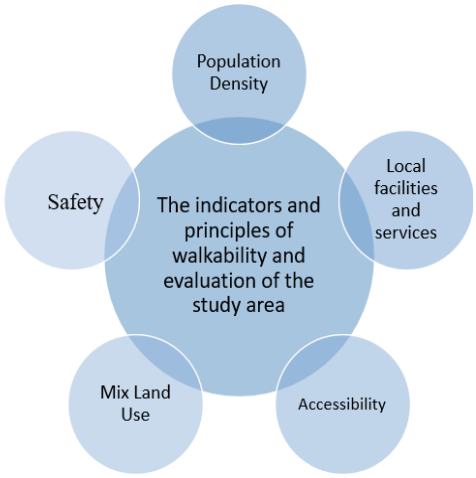



Figure 5.44: The indicators and principles of walkability and evaluation of the study area.

Table 5.13: The indicators and principles of walkability and evaluation of the study area.

| **Principles** | **Standard Indicators of Walkability** | **Indicators that are available in the study area** |
|---|---|---|
| Population Density | 3000-6500 units/km$^2$ will offer access within 1 kilometer. | According to the master plan:<br>- Population density =53941.4 people/ km$^2$<br>- Dwelling density =11476 units/ km$^2$ |
| Mix Land Use | a. Provide integrated residential, recreational, and civic uses essential to daily living, as well as a diversity of local employment opportunities and suitable workspace.<br>b. Access to public transit.<br>c. Offering a choice of housing options. | a. The connection between residential and recreational amenities is strong and evident. However, the neighborhood needs additional nurseries and educational facilities.<br>b. The main streets provide access to public transit; however, the neighborhood is deficient in terms of bus stops. So, the neighborhood needs to improve infrastructure for public and active transport.<br>c. The neighborhood offers a variety of housing typologies, including apartments, single dwellings, and villas. |
| Local facilities and services | a. Religious place<br>b. Local Shopping Centers and Services (Retail, Shop, or Showroom).<br>c. Restaurant / Cafe<br>d. Sports and recreational facilities<br>e. Local Schools and educational opportunities<br>f. Local health facilities and Services<br>g. local plaza, parks, and playgrounds. | There are several local services and facilities in the neighborhood:<br>a. There are six mosques in the neighborhood.<br>b. Local services include food, daily necessities shops (such as supermarkets and small retail stores), clothing, furniture, and parking.<br>c. There are many restaurants and coffee shops.<br>d. The neighborhood includes one gym, beauty, and barber facilities, two wedding halls, and one hotel.<br>e. The district offers facilities for several educational levels, including 3 nurseries,5 kindergartens, 5 primary schools, and one secondary school<br>f. There are several health services in the area, including pharmacies, medical clinics, laboratories, health centers, and one hospital. |

| | | |
|---|---|---|
| | | g. There are two small stadiums and just tow public park. |
| Accessibility | a. Providing facilities and public transit nodes within walking distance.<br>b. Provide street furniture such as softscapes, shade devices, and so on.<br>c. Provide accessible buildings and places for children, those with special needs, women, and elderly people. | a. The neighborhood suffers from a lack of public transport nodes.<br>b. Some of the pavements are shaded by buildings and trees.<br>c. There are no special parking and places for children, the elderly, and people with disabilities. |
| Safety | (a) Provide pedestrian and cycling routes, crosswalks, and barriers.<br>(b) Minimum sidewalk width, lighting, traffic calming availability, and speed limits.<br>(c) Offering an eye on the street idea via an active street façade and apartments with street views. | a. Major road has pavements and sidewalks but the majority of minor roads within the neighborhood lack these amenities, bike lanes are not available, and there are no cycling routes.<br>b. The width of sidewalks is standard, but issues with traffic calming, and speed limits persist.<br>c. Windows and balconies on the upper floors of villas and apartments provide visibility and street views. |

- **Evaluate The Analytical Model According to Evaluation Attributes/ Pillars**

The analytical model created using ArcGIS Pro 3.0 software can assist in facilitating decision-making by identifying and evaluating present walking accessibility levels in the neighborhood, as well as creating suitable simulations to anticipate possible improvements in public space.

According to a previous research review, a qualitative assessment of spatial strategies using the concept of 20MN was carried out. The techniques were chosen using characteristics that would enable comparison and allow us to make scientifically solid conclusions. A variety of city plans from Europe, Australia, Asia, and the United States were investigated. These included Barcelona's superblocks, Houston's walkable areas, Shanghai's 20-minute Town, Paris's quarter-hour city, Britain's high streets, Portland's 20MNs, and Melbourne's 20-minute districts (G. Pozoukidou & Chatziyiannaki, 2021).

In these cases, the physical perspective consisted of all interventions aimed at (a) developing proximity that allows individuals to get to a multitude of urban services, (b) improving active transport choices, (c) offering transport accessibility, (d) enhancing the environment's safety, and (e) enhancing connections and multiple uses of green and open spaces. Finally, in our study, we are going to try to do a complete assessment of the accessibility characteristic based on the amount and diversity of essential resources locally in the area(G. Pozoukidou & Chatziyiannaki, 2021). Table 5.14 summarizes the overall evaluation of the “Analytical model” based on three pillars.

Table 5.14: summarizes the overall evaluation of the "Analytical model" based on the three pillars.

| Pillars | Spatial Planning | Evaluation Attributes | Evaluation of the study area | | |
|---|---|---|---|---|---|
| | | | Weak | Medium | Strong |
| **Inclusion** | Physical Planning | Housing: Variety and affordability of housing options | | * | |
| | | Proximity to services: a variety of services at the place of residence | | * | |
| | | Building density: average building density | | | * |
| | | Land use mix: a variety of land uses, including housing | | * | |
| | | Accessibility: Access to rapid transit systems (rail, metro, tram) | * | | |
| | | Multimodality: Alternative modes of transportation and their interconnections | * | | |
| | Community Building & Planning Process | Co-design processes for the production of space | * | | |
| | | Bottom-up initiatives for the improvement of quality of life | * | | |
| **Health** | Physical Planning | Proximity to healthy and affordable food through fresh food markets and community urban gardens | | * | |
| | | Proximity to basic healthcare | | | * |
| | | Connectivity and multifunctionality of green and open spaces | * | | |
| | | Active mobility (walking, biking, scootering, etc.) | * | | |
| | | Proximity to Cultural and Recreational opportunities | | * | |
| | Community Building & Planning Process | Cooperation of stakeholders and community for the interest of special groups (children, old people, people with disabilities etc.) | * | | |
| | | Interaction between citizens in creating cultural, and recreational activities (urban gardening, walking teams etc.) | * | | |
| **Safety** | Physical Planning | Urban features that enhance the feeling of security | | * | |
| | | Safe sharing of public space (including road space) for cultural and recreational activities | * | | |
| | Community Building & Planning Process | Lively neighborhoods in terms of the variety of activities in public space | | * | |
| | | Participatory practices that include people of all ages and abilities to combat physical and social isolation | | * | |
| Overall Proximity of Urban Amenities | | | | * | |

### 5.1.1.9 The Results Based on The Analytical Model

Based on the results of previous studies, the best classification for a 20MN is Semi-compact and circular 20MNs as shown in Figure 5.45. By comparing the results of the analysis of the distribution of services, roads, and dwellings in the study area to that classification, it is possible to determine the extent to which the analytical model matches the achievement of the 20MN

classification. Thus, they are similar, as the study area is closer to semi-compact and circular 20MN.

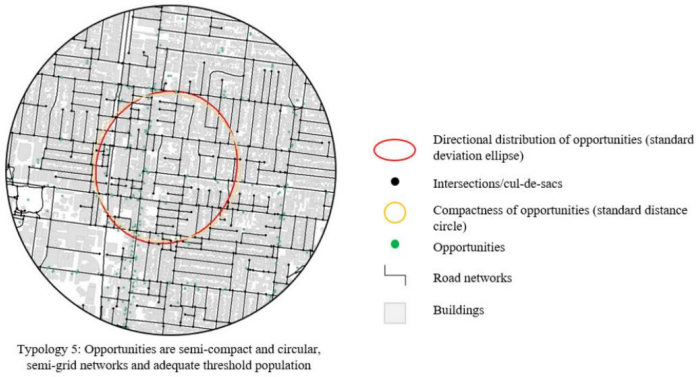



Figure 5.45: The best typologies of 20-minute neighborhoods in Melbourne (Kamruzzaman, 2022).

- Density

According to the literature review, there is no specified density of 20 MN; it varies from one country to another. However, the data show that the density of dwelling units in the 20MN ranges between 3000 and 6500 dwellings per $km^2$. In the study area and according to the master plan, the density of the area is:

- Density of people = 42344 people /0.785 m2= 53941.4 people/ $km^2$= 0.054 people/$m^2$
- The density of dwellings = 9009/0.785 = 11476 units/ $km^2$

This calculation was done based on data from the master plan, as shown in Appendix B. This density is larger than the average optimum density of dwelling units of the 20MN from previous research as Table 5.15.

Table 5.15: Comparison between density results of the analysis of Literature review and worldwide case studies and Master plan of the study area (Analytical model).

| | **Literature review and worldwide case studies** | **Master plan of the study area (Analytical model)** |
|---|---|---|
| **Density of people** | - At least 10000 people/ $km^2$<br>- In high density at least 15000 people/ $km^2$ | 53941.4 people/ $km^2$= 0.055 people/$m^2$ |
| **Density of dwellings** | 3000 - 6500 dwelling units/ $km^2$ | 9009/0.785 = 11476 units/ $km^2$ |

- Mixed-Use Neighborhood

Few research papers have established the proportion of services and buildings with multiple functions in sustainable neighborhoods (Table 5.16).

Table 5.16: comparison between the percentage distribution of land use categories based on previous research papers to the master plan of the study area.

| **Formula** | **Ratio to the total area of land** | |
|---|---|---|
| | **Literature review** | **Master plan of the study area** |
| Streets | at least 25-30% of the land | 20% |
| Commercial and Mixed land-use | 22- 60% of floor space should be allocated for economic and residential use in any neighborhood. | 14% |
| Residential buildings | 30-50% of land area<br>- 20% to 50% of the residential floor area should be for affordable houses<br>- 50% of detached houses | 64.8% |
| Public open spaces | 15-20% | ----- |
| Specified services (single function blocks) (Religious area, Schools area, and part of hospital) | 0-10% | 1.2%<br>(9242.0 $m^2$) |

Note: The area of services was calculated just for the services located at the district border.

- The analytical model illustrates the exact distribution of housing parcels and highlights the primary neighborhood core, which are urban nodes well supplied by essential shops and amenities like parks, grocery shops, supermarkets, and pharmacies. These urban nodes are dispersed along the main street in this case study.
- The analytical model helps to answer the question of what should be prioritized when taking steps to implement the 20MN.
- The proposed technique took into account amenities and activities that meet residents' basic requirements and are easily accessible on a daily or regular basis: community commerce (supermarkets, groceries, drugstores), preschool services, Primary schools, health amenities, parks, recreational amenities, sports facilities, public transit stops, and so others.
- This indicates that, for thorough evaluation, the GIS model should take into account a broader variety of services and amenities, including those situated in the surrounding areas.
- It is reasonable to question if a 20-minute level of accessibility is appropriate for a variety of services. In the case of kindergartens, for example, a shorter time criterion (at 5 minutes) is more acceptable, as advocated by Columbo's Organic urban planning. The 20-minute timeframe used in

the GIS model serves as a benchmark value that, may be revised during the decision-making process while also taking into account a wide range of amenities and services.

- Finally, the findings of this analytical method emphasize the need for localization of community amenities and infrastructure. To develop 20MNs, urban activities and the positioning of facilities must be properly integrated with public transport and active travel. Possible interventions for active travel infrastructures might be envisioned within the time frames of 5, 10, 15, and 20 minutes.

#### 5.1.1.10 The Intervention of The Case Study to Achieve a 20-Minute Neighborhood (Develop the Spatial Model)

The idea behind the concept of a 20MN is grounded on five fundamental principles: Mix Land Use, diversity, density, accessibility and access to transit, and safety. According to this philosophy, neighborhood development should encompass six essential social functions: housing, shopping, education, healthcare, and entertainment (G. Pozoukidou & Chatziyiannaki, 2021).

Table 5.13 and Table 5.14 illustrates the extent to which the analyzed example achieves the principles and pillars of a 20MN, as well as the issues that prevent it from doing so. As a result, intervention must be proposed for that district to become a 20MN. According to the analytical model, there are many interventions have been suggested to apply this concept in the study area.

The interventions have been made at several levels as follows:

- Public transport

According to the analytical model, the neighborhood's main street is modeled as a "neighborhood activity center" (NAC), that provides multiple functions (grocery stores, recreational activities, educational institutions, and health services). So, we should focus on transport and equip the region with cycling lanes and pedestrian paths on major and local roads, and the research suggests a well-developed bus transit network. This is parallel to the view of Jane Jacobs (1961)(Cities, 2020), there must be eyes on the street, eyes related to individuals we may refer to as the street's natural proprietors. Some initiatives that can help boost the usage of walking and cycling are:

- Enhancing pedestrian infrastructure with broad walkways, non-slip surfaces, lighting, shading trees, seats, weather coverage at stops, and walker-friendly facades.
- Travel safety is handled by suggesting several measures to protect the safety of pedestrians and cyclists, such as bicycle lanes, school drop-off zones, and so on.
- Clearing obstructions on sidewalks and constructing pedestrian paths on both main and minor streets, as well as implementing pedestrian paths on the borders of roads that link to schools and other educational institutions.
- Provide pedestrian routes on the sides of minor streets that go to residential areas (Figure 5.46). Also, work on paving the minor roadways.

Figure 5.46: Minor roads where there are no pedestrian paths.

- Remove all parking along the streets beside the pavements and provide separate bike lanes on two sides of the main and minor streets, with clearly signed cycling pathways. This helps to promote walking and cycling connections to public transit.

Figure 5.47: Parking lots near pavements.

- Provide bridges that allow all users (cyclists and pedestrians) to safely cross the road, particularly school students. Figure 5.48 shows an example of this type of bridge, which was proposed for usage.

Figure 5.48: The West Street pedestrian bridges link the neighborhoods of Tribeca and the Financial District to Battery Park City in Lower Manhattan, New York City .

- Increase greening by trees and other plants to shade pavements, pedestrian baths, and cycling lanes. So, to offer shade for walkers and bikers, we recommend planting trees along the sides of the streets. It is consequently advised that a tree line be added between the pedestrian walkway (pavements) and the cycling route in what is called a separated bike lane is a facility designed specifically for bikers that are positioned within or directly adjacent to the roadway and is physically separated from motor vehicle traffic by a vertical feature as shown in Figure 5.49 (FHWA).

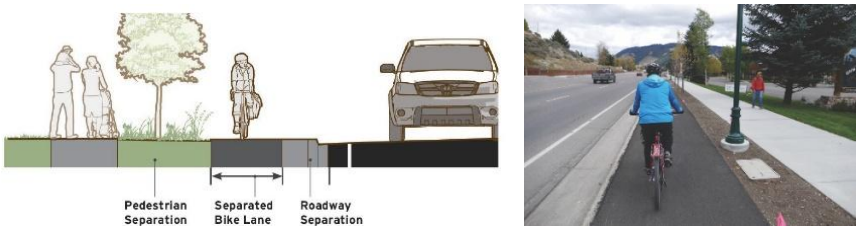



Figure 5.49: Separated Bike Lane (FHWA).

- Placing bus and transit stops on major and near minor streets so that they are accessible from residential areas. Figure 5.50 shows an analysis of proposed transit stop results; the analysis is done according to accessibility. The transit stops were distributed depending on their accessibility to all residents of the study area within a maximum period of 10 minutes.

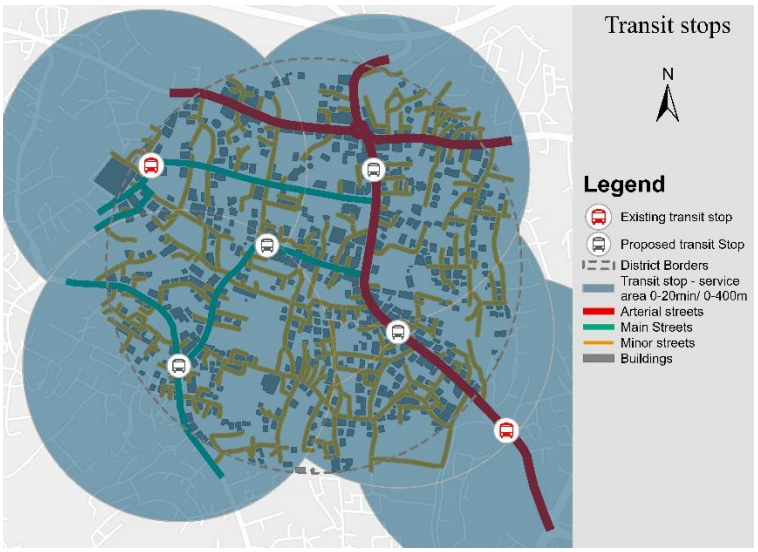



Figure 5.50: Buffer zone map concerning transit stop.

- Connect public transport to neighborhood open spaces.

- Mixed land use: was apparent in the neighborhood's numerous local facilities and services, such as grocery stores, supermarkets, pharmacies, and other amenities. However, the analysis results suggest that there is a lack of some amenities, including:

a- Public spaces

The analysis of the study area highlighted a lack of public places that encourage people to participate in public life.

- As a result, the study recommends expanding public green areas that can benefit the community and creating co-working, social, and cultural spaces.
- The neighborhood contains private large open spaces and empty land that have been set aside for future development. It is recommended that government entities buy parts of these spaces and designate them as public and recreational areas for the neighborhood's residents.
- The creation of a network of green spaces expands walkability possibilities by implementing pedestrian-friendly infrastructure that is accessible to individuals of all ages and disabilities people. Furthermore, green spaces give greater opportunities for relaxation and leisure, as well as social contact and connection with the natural surroundings.
- Other types of places, such as schoolyards, can be added to this network of accessible local open spaces to provide space for other activities, such as sports. Neighborhood landscaping, gardening, and revegetation are all part of the Plan's goal of encouraging skill

and knowledge sharing, promoting social engagement, and fostering community collaborations.

- Figure 5.51 shows the proposed spot for a public park. And Figure 5.52 depicts a buffer zone map study of public spaces, with the outcome indicating the optimal location of the proposed public space based on accessibility. To address the scarcity of public parks while ensuring accessibility for all inhabitants in the research region. It is preferable to set aside at least 10% of the district's size for green areas and public spaces. So should enhance the area's existing open spaces and build new green open spaces.

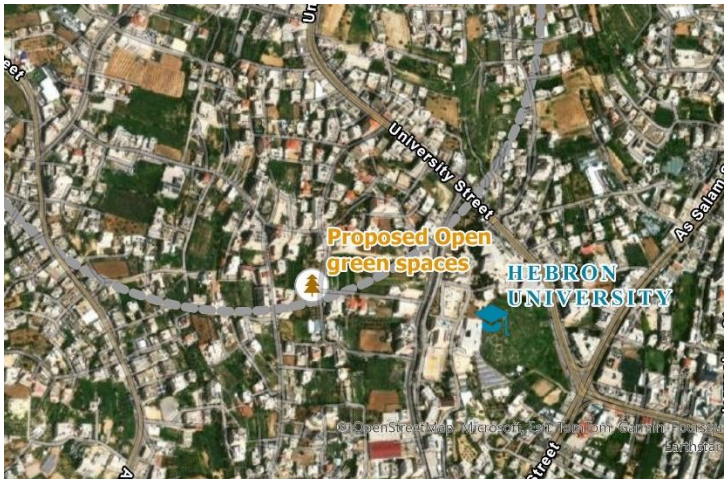



Figure 5.51: Proposed Public space location (Google Earth).


Figure 5.52: Buffer zone map concerning public spaces.

b- Kindergartens and nursery schools: In the case of these services, a shorter time criterion (at 5 minutes) is more acceptable, as advocated by Columbo's Organic Urban Planning. As a result,

of the buffer zone analysis of these services, the neighborhood suffers from a lack of them, Therefore, a number of these services must be provided and distributed so that they can be accessed by all residents within less than 10 minutes. Accordingly, Figure 5.53 and Figure 5.54 show buffer zone map analysis of proposed kindergartens and nursery schools.

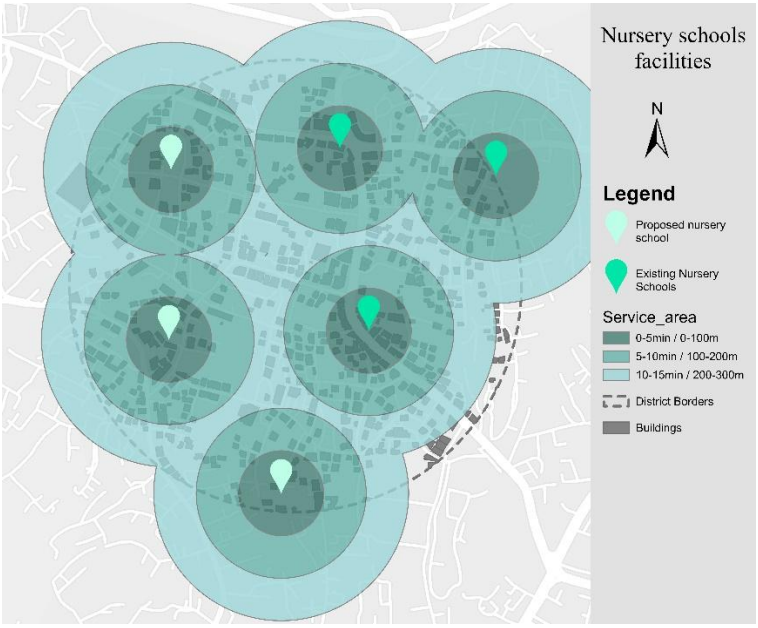



Figure 5.53: Buffer zone map concerning existing and proposed nursery schools.

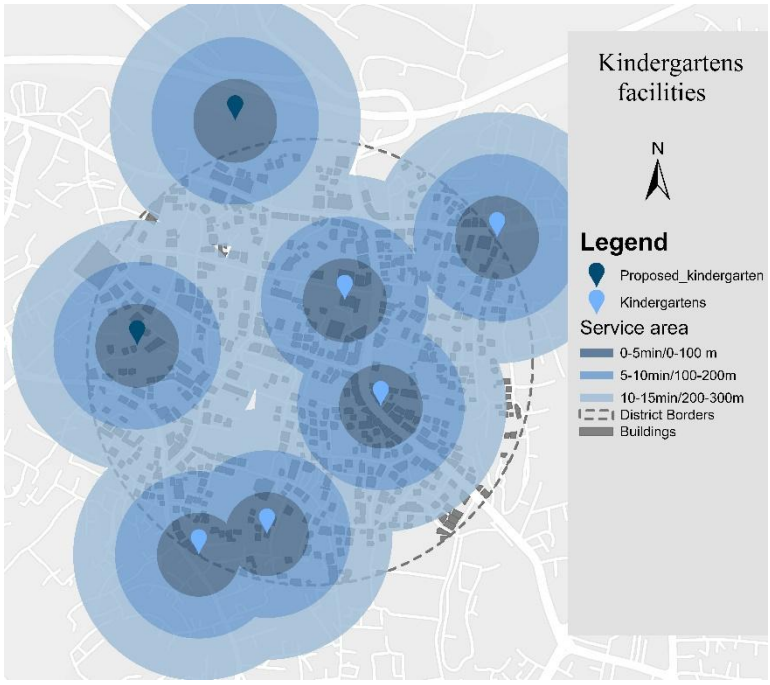



Figure 5.54: Buffer zone map concerning existing and proposed kindergartens.

c- Mixed-used buildings: According to the urban survey and buffer zone analysis for accessibility, it turns out that Commercial and Mixed land-used areas added in a built-up area equal 59620 $m^2$, which constitutes 8% of the district area, (Figure 5.55).

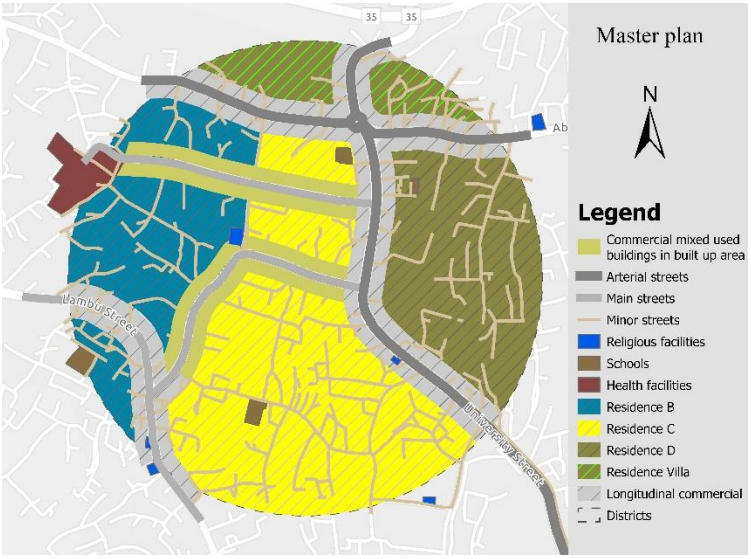



Figure 5.55: Map of commercial and Mixed land-used areas added in a built-up area.

The previous intervention was proposed based on the findings of the survey campaign and buffer zone accessibility analysis, as well as the results of the assessment and interviews with residents. So, following these interventions, the land use ratio in the analytical model has been modified, resulting in a change in dwelling density as shown in Table 5.17. According to this table, the density of dwelling units has decreased in comparison to the master plan, (Table 5.18).

Table 5.17: land use ratio in the analytical model in the master plan and built-up area after interventions.

| **Land use categories** | **Master plan** | **Interventions of built-up area** |
|---|---|---|
| Streets | 20% | 25% |
| Commercial and Mixed land-use | 14% | 21% |
| Residential buildings | 64.8% | 42% |
| Public open spaces | ---------- | 10% |
| Specified services (single function blocks) (Religious area, Schools area, and part of hospital) | 1.2% | 2% |

Table 5.18: Comparison between residence area in the master plan and modified residence area after interventions.

| **Type of building** | | **Residence area in the master plan** | | **Modified residence area after interventions** | |
|---|---|---|---|---|---|
| | | Area ($m^2$) | Ratio % | Area ($m^2$) | Ratio % |
| Residential building | Residence B | 116380.00 | 14.8% | 50454.00 | 7% |
| | Residence C | 249745.00 | 32% | 173365.00 | 22% |
| | Residence D | 117377.00 | 15% | 76034.00 | 10% |
| | Residence_ Villa | 25178.00 | 3% | 25178.00 | 3% |
| | Total residence area | 508680.00 | 64.8% | 325031.00 | 42% |

| | | | | |
|---|---|---|---|---|
| Commercial area | 107865.00 | 14% | 167485.00 | 21% |

Based on previous data in Table 5.17 and Table 5.18, new density calculation after interventions in built-up areas is illustrated in Appendix B. In addition, the final density according to the master plan and built-up area after interventions shown in Table 5.19.

Table 5.19: the comparison between density based on data on a master plan and the optimal density based on the interventions of the built-up area.

| | **Master plan** | **Interventions of built-up area** |
|---|---|---|
| **Density of dwelling units** | 9009/0.785 = 11476 units/ $km^2$ | 7,395/ 0.785 = 9420 units/ $km^2$ |

Based on these findings, despite the interventions that have been proposed for the built-up area, the density of dwellings and population is significantly greater than indicated in previous researches, but higher-density areas maximize accessibility, and with previous interventions on the analytical model can achieve 20MNs. So, in the final section of this chapter, the final model of 20 MN was created based on appropriate proportions and locations for each of the services and residential buildings, while keeping in mind that population density is proportional to the services available in the neighborhood.

## 5.2 Model of 20 Minutes Neighborhood

After analysis of the literature review, case studies from the world, and study area from Hebron, we can conclude a model of 20 MNs, in expansion zones (outer suburbs) in Palestine. Table 5.20 shows the theoretical part of the model.

Table 5.20: Model of the 20-minute neighborhood in outer suburbs (expansion zones) in Palestine.

| **Model of 20-minute neighborhood in outer suburbs (expansion zones) in Palestine** | | |
|---|---|---|
| Diameter | 800m | |
| Variables that the 20MN model plan based on it | - Time of walk = 20-minute stroll out and back to home.<br>- Distance = 800 meters is a walk to and from a location | |
| Pillars | Density | - High density is required to achieve accessibility to all services, and the optimum density is 6500 dwelling units/ $km^2$<br>- The ratio of residential buildings floor is 30-50% of total land area |
| | Proximity | Accessibility to services through 20 minutes in around trip walking or cycling |
| | Mixed land use | Mixed land use<br>- Commercial and mixed-used buildings (residential, commercial, recreational), the optimum ratio is 20-30% of total land area.<br>- Variety Options of dwelling types (residential buildings):<br>a variety of detached and affordable houses, with a percentage of 50% of the total residence floor area for each type.<br>Also, residence B is the best type in Palestine. |
| | | Diversity of transport options |

| | | |
|---|---|---|
| | | - Public transport (bus): Bus stops must be available and distributed in a way that all inhabitants may access the bus in no more than 10 minutes by foot.<br>- Active transport (walking and cycling): must be available bike lanes and optimal safety pedestrian baths.<br>Streets and transport infrastructure allocate at least 25% of the total neighborhood area. |
| Key components of the model are 'neighborhood activity centers' | - Retail goods and services<br>- Neighborhood recreational facilities<br>- Health services, and local facilities.<br>Which are arranged along the main streets in the neighborhood to form the main core. | |
| The services that should be available | The services should be considered significant enough to be accessible to everyone within 20min:<br>- Social facilities: groceries, daily needs shops (Local retail: like supermarkets and small retail shops), clothes shops, furniture shops, and parking.<br>- Health Services: Pharmacies, medical clinics (obstetrics and gynecology clinic, pediatric clinic, dental clinic….), Laboratories, and health centers.<br>- Education services: (require less walking time than other services, less than 10 minutes):<br>1. Preschool facilities (Nursery schools and kindergarten facilities<br>2. Primary schools<br>- Recreation services: Sports facilities (gym), Restaurants, coffee shops beauty, and barber salons, wedding hall, public parks, and playgrounds.<br>- Religious Services: Mosques and churches are the most important religious services that must be provided within the neighborhood. | |
| Typology | Semi-compact and the circular 20MN is the best typology, as shown in Figure 5.45. | |
| The ratio of land use categories to the total land area | Commercial- mixed-used area | 20-30% |
| | Residence area | 30-50%<br>detached and affordable houses (50% for each type) |
| | Streets | 25-30% |
| | Public services zones | 0-10% |
| | Green open spaces and recreation zones | 10-20% |

## 5.3 Apply the Model to Study Area 2: Future Expansion Zones in Halhul

### 5.3.1 Location and Areas

Halhul is a Palestinian town located in the southern part of the West Bank, 5 kilometers north of Hebron in Hebron Governorate. The town, encircled by Sa'ir and al-Shuyukh towns to the east, Beit Ummar town and al-Arroub refugee camp to the north, and Kharas and Nuba to the west, is 916 meters above sea level(T. A. R. I.-J. (ARIJ), 2009).

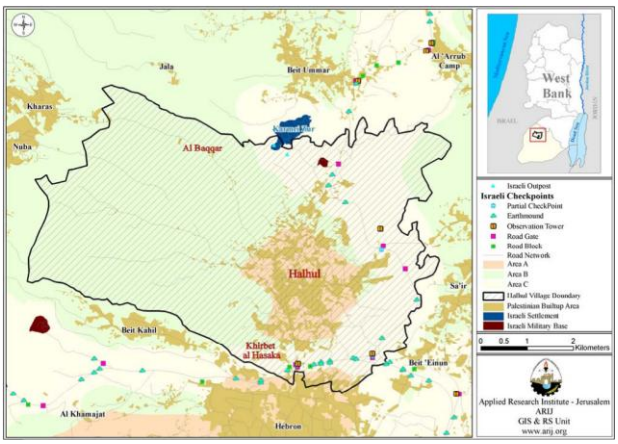




Figure 5.56: Location of Halhul in Palestine, source: (Wikipedia, 2024), Figure 5.57: Halhul location and borders, source:(T. A. R. I.-J. (ARIJ), 2009).

### 5.3.2 Study Area Analysis

Study area 2 was chosen in the higher part of one of Halhul Mountains, on the western sides of the town in the area considered future expansion zones. It offers views of a forested area known as Al-Safa Forest. with an area of 800 m in diameter and a total area of 502400.0 $m^2$(Figure 5.58). The neighborhood will be examined for 20 minutes; however, 25 minutes isn't practicable due to the high slope (Figure 5.59). Figure 5.60Figure 5.61Figure 5.62and Figure 5.63 shows images from the site.


Figure 5.58: Border of the study area 2 (Arc GIS Pro 3).

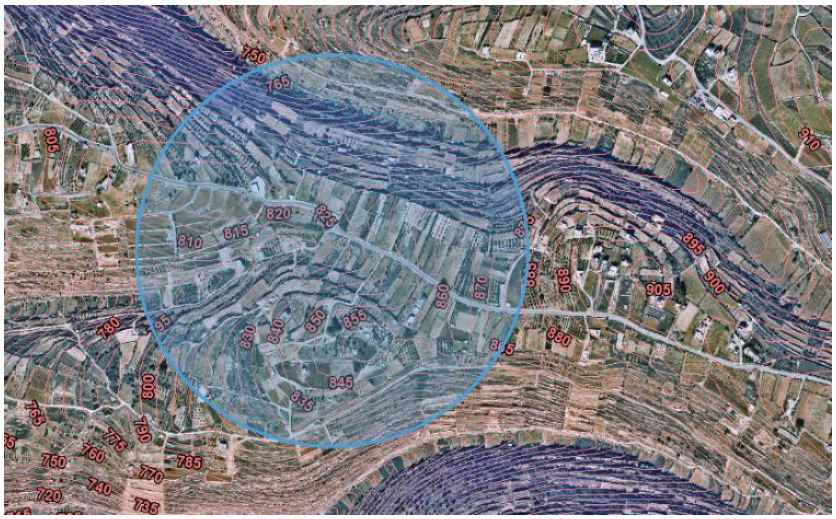



Figure 5.59: Topography of case study 2 (Geomolg).

Figure 5.60: Images inside the study area.

Figure 5.61: Images inside the research area represent the view of the forest regions.

Figure 5.62: Images inside the research area from the paved streets show the west side of the area.

Figure 5.63: Images show the north side of the study region.

#### 5.3.2.1 Current Master Plan

According to a master plan of Halhul displayed in Figure 5.64, which shows the distribution area into multiple parts. The study area was divided into zones according to building and organization rules, as the following:

- Commercial area.
- Residence area: is planned for residential, divided into residences A, B, C, Villa residences, and Agricultural housing.
- Areas planned for other uses include: a historical area, an archaeological area, public parks, a green area, an industrial and tourist area, and an area belonging to endowments.

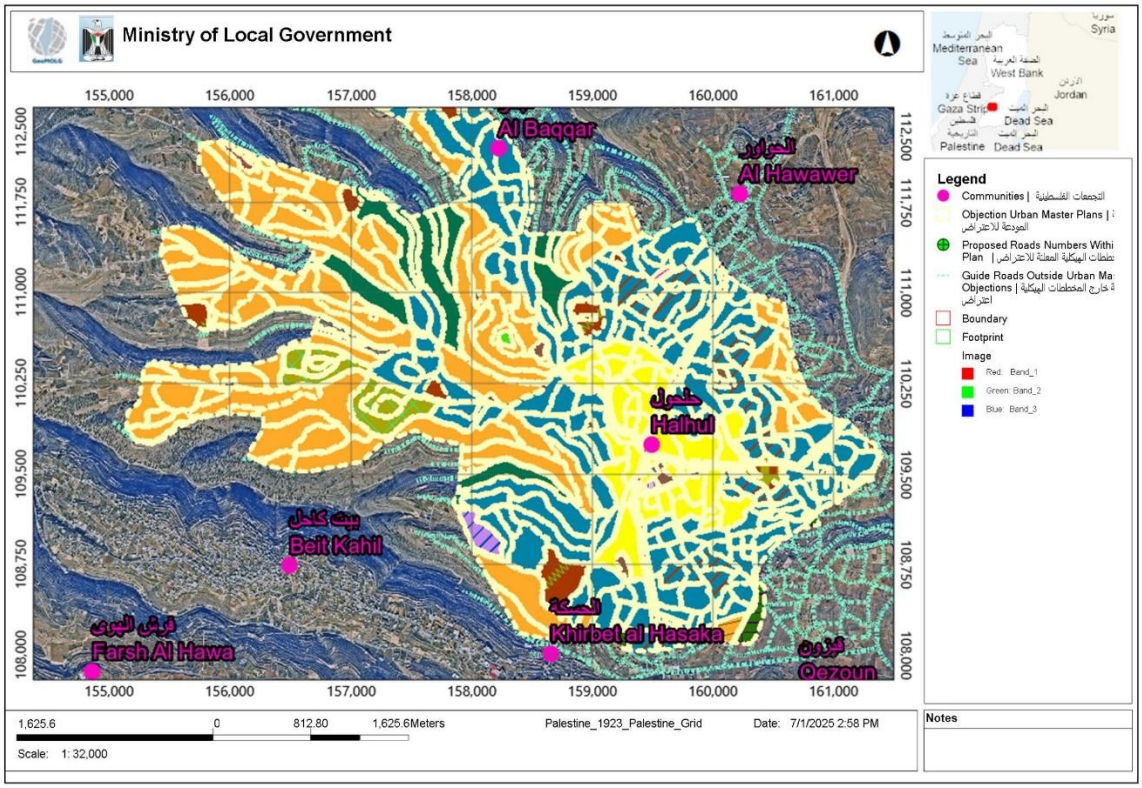



Figure 5.64: Master plan of Halhul, (Geomolg).

### 5.3.2.2 Urban Survey Campaign

- Streets

The study area is served by one paved street (Figure 5.65) and many unpaved minor roads (Figure 5.67). The paved streets called Halhul Bait Ula Road, The Directorate of Transport and Communications building, and the vehicle inspection station (Halhul Municipality Dynamo) are located at the beginning of this street, (Figure 5.66).

Figure 5.65: Paved Street inside the study area.

(A) (B)

Figure 5.66: (A)The Directorate of Transport and Communications building, (B)The vehicle inspection station (Halhul Municipality Dynamo).

Figure 5.67: Minor streets in the study area.

- Services and facilities

The study area has been allocated for future expansion, and as such, it currently lacks buildings and services both within its boundaries and in the surrounding areas, with no nearby amenities.

### 5.3.2.3 Mapping the Residential Building Distribution

There are just a few existing buildings inside the study area, all of which are detached residences, around seventeen in number, and distributed randomly. As Figure 5.68 illustrates.


Figure 5.68: Distribution of existing dwellings in study area 2.

### 5.3.3 Apply The Theoretical Part Of 20 Minutes Neighborhood Model to Study Area 2

#### 5.3.3.1 Zoning

The first step in using the theoretical part of the 20MN model to study Area 2 is zoning to distribute services, amenities, and residential areas and calculate their optimal proportions. This was done based on the results of previous studies and analyses of case studies from around the world, as well as the results of the previous analysis of the case study in Hebron area, which was used to determine how to create a model that is compatible with the nature of the area and the Palestinian individuals. Zoning is necessary to regulate land use and provide the proper balance of residential, commercial, public services, and green areas. Zoning defines how land is used in various portions of a community and controls the spatial distribution of buildings, facilities, and services to fulfill the 20MN goals. Where work was done to unify the land and re-secrete it. The region was split up into numerous neighborhoods by zoning.

#### 5.3.3.2 Determine Land Use Categories

- Residential zones: 34% of the overall study area has been allocated for residential use. Of this, 50% has been set aside for detached houses, with the higher-level regions reserved for these residences, while the remaining 50% are planned for multi-story residential complexes. This is designated as "Residential B" which, as previously mentioned, is one of the greatest residence classifications in Palestine.
- Commercial and mixed-used zones: Spaces were allocated for stores, offices, restaurants, and multi-use buildings, with the ground and first floors reserved for different services, such as

commercial, medical, and entertainment, and the above levels for residential use. Approximately 25% of the study area was set aside for these services.

- Public services zones: Some of the land was allocated for schools, health care, mosques, kindergartens, and other essential amenities. These facilities will take approximately 6% of the land.
- Green and recreation zones: An open green area was designated, representing 10% of the total area of the district for parks, playgrounds, and recreational spaces to enhance community livability.
- Public transport hubs: Transit stops were positioned no more than 400 meters from each other, encouraging residents to use public transport and assuring they could walk or cycle to one within 20 minutes.
- Streets: 25% of the total land area was dedicated to streets. Where should it be built to accommodate walkers, bikes, public transport, and cars. Implementing whole streets concepts such as bike lanes, wide walkways, and traffic calming measures contributes to safe and active areas for all users. Green infrastructure, such as trees and parks along roadways, benefits the environment, yet including public transport terminals within a 5–10-minute walk promotes efficient mobility. Streets function as dynamic public areas that encourage active transport and reduce automobile dependency. Figure 5.69and Figure 5.70 represents a proposed design for the major and minor streets.

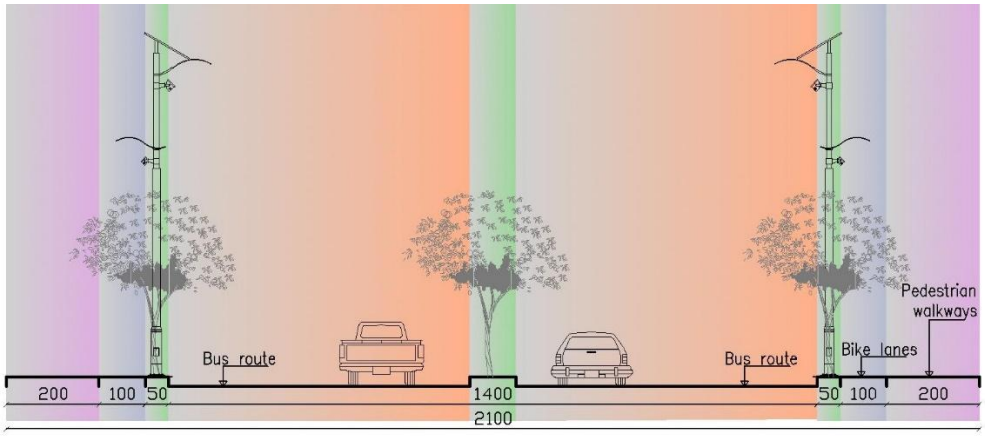



Figure 5.69: Proposed design for main streets.

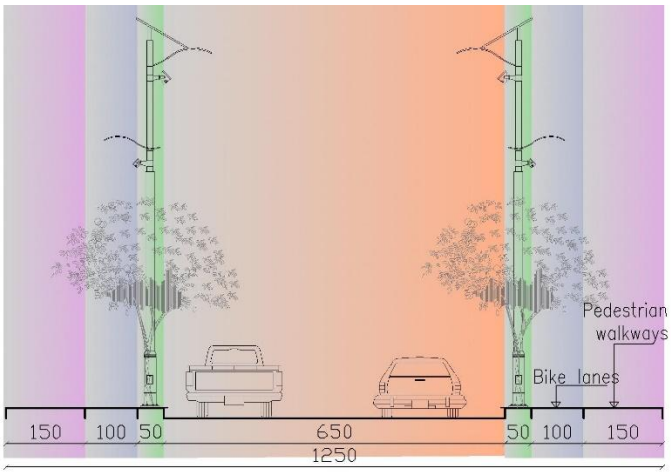



Figure 5.70: Proposed design for minor streets.

Table 5.21 below illustrates the ratio and area of land use categories in the zoning of the study area.

Table 5.21: land use categories.

| **Land use components** | **Ratio to a total area %** | **Area ($m^2$)** |
|---|---|---|
| Residential zones | 34% | 170816.00 |
| Commercial-Mixed used buildings | 25% | 125600.00 |
| Public services zones:<br>- Religious services,<br>- schools, nursery baby daycare, and kindergartens,<br>- Health center | 6% | 30144.00 |
| Green and recreation zones | 10% | 50240.00 |
| Streets | 25% | 125600.00 |

### 5.3.3.3 Determine Density

Based on the theoretical part of the model, the optimal density range is between 6500-9500 dwellings/ $km^2$, and at least 15000 persons/$km^2$, Accordingly, the distribution of population across the study area is determined to ensure that areas with high population density are well planned to maximize accessibility. .

Table 5.22 presents the number of residential floors suitable to the 20MN model, and Table 5.23 shows the ideal population and dwelling density for the research region.

Table 5.22: Suitable standards for residential areas within a 20-minute neighborhood

| Type of residential buildings | Area of Residential zones ($m^2$) | Ratio to the total area of the district | Permissible building ratio per dunam | Maximum number of floors | Number of dwellings | Number of residents |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| Apartments in mixed-used buildings | 125600.00 | 25% | 70% | 6 | 2176 | 10227 |
| Residence B | 85408.00 | 17% | 42% | 5 | 1110 | 5217 |
| Residence villa | 85408.00 | 17% | 30% | 3 | 135 | 635 |

Table 5.23: The optimal population and dwelling density for the 20MNs model in the expansion zones in Palestine.

| Total number of dwellings (dwelling units) | Total number of residents (peoples) | Density of dwellings (dwelling units/km$^2$) | Density of residents (Peoples/ km$^2$) |
|---|---|---|---|
| 3421 | 16079.00 | 6809 | 32333 |

The Table 5.23 above illustrate the required density for 20MN in Palestine's future expansion zones. They provide the number of stories needed to achieve that density and the building's percentage per dunum.

Figure 5.71 shows the zoning map in study area 2 which is an important tool for implementing the 20MN model since it depicts the designated land uses inside the study area. It designates separate districts for residential, recreational, and public services, ensuring that all necessary services are within a 20-minute walk or cycle ride. The plan also emphasizes mixed-use communities that combine residential and commercial purposes to promote walkability and community vibrancy. Streets, transit hubs, and natural areas are all meticulously planned to enhance connection, accessibility, and sustainable land use. This zoning plan promotes compact, livable community development while avoiding urban sprawl.

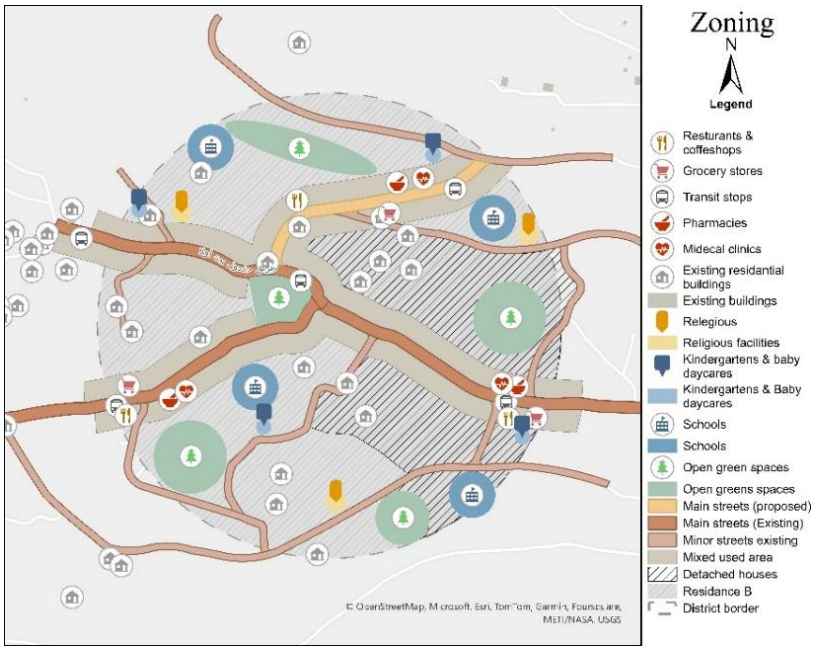



Figure 5.71: Zoning map of land use categories.

### 5.3.3.4 Buffer Zone Analysis

The buffer zone study is critical for determining the accessibility of vital facilities and services inside the 20MN. It has been conducted by creating buffer zones around critical facilities such as education facilities, grocery stores, parks and green open spaces, religious and health services, restaurants and coffee shops, and public transport stops, within a value of 20 minutes in around trip on walking or cycling for each service, except educational services that were analyzed within 15 minutes of walking or cycling, the analysis was done on the Arc GIS pro 3 software, using Buffer analyst tool. Figures below show maps showing the results of buffer zone analysis.

The buffer zone analysis findings show that zoning of land use categories effectively accomplishes access to vital services within 10 minutes on foot or by bike. This illustrates that the distribution of residential, commercial, recreational, and public service sectors was thoughtfully planned, allowing residents to conveniently access almost all of their everyday needs. The analysis indicates that the zoning layout responds to the principles of the 20MN, which improves walkability and decreases reliance on automobiles for short trips, leading to a more sustainable and connected community.

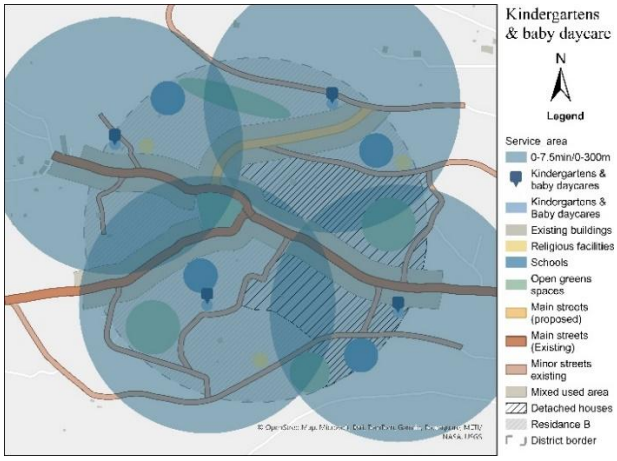



Figure 5.72: Buffer zone map concerning preschool facilities.

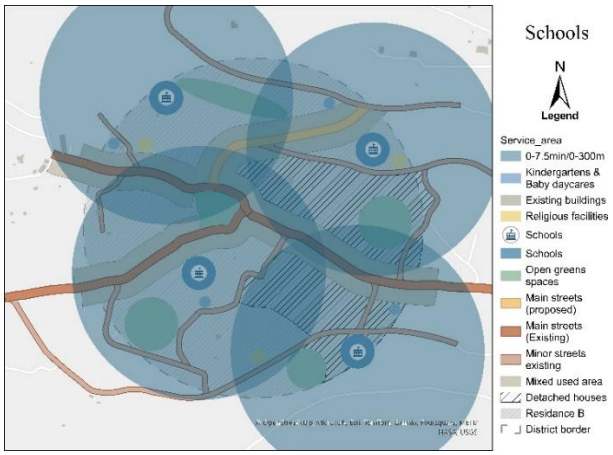



Figure 5.73: Buffer zone map concerning school facilities.

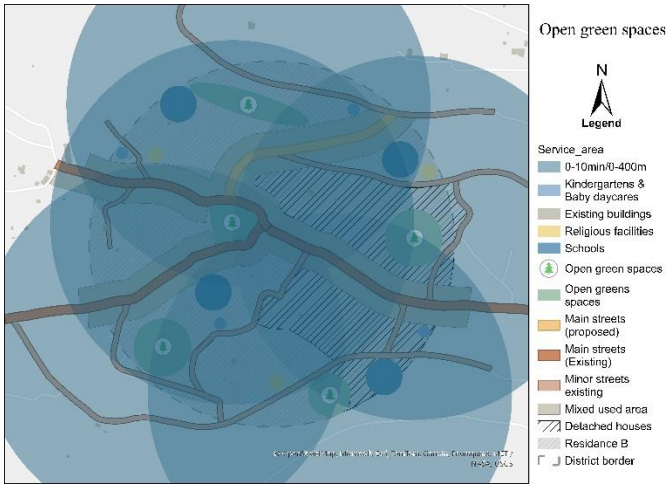



Figure 5.74: Buffer zone map concerning open green spaces.

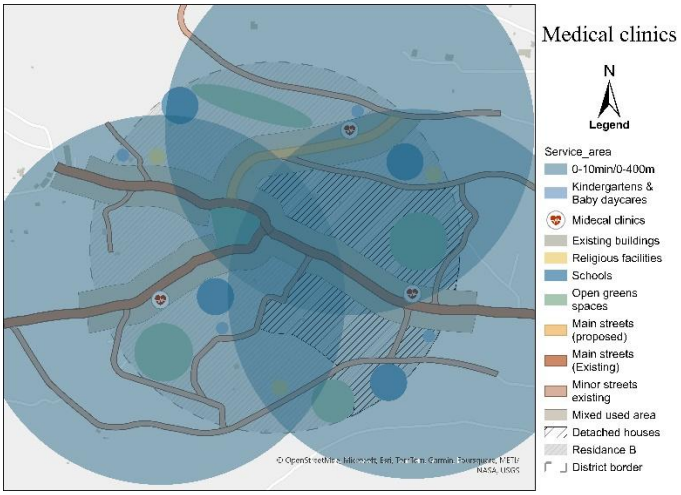



Figure 5.75: Buffer zone map concerning medical clinics.

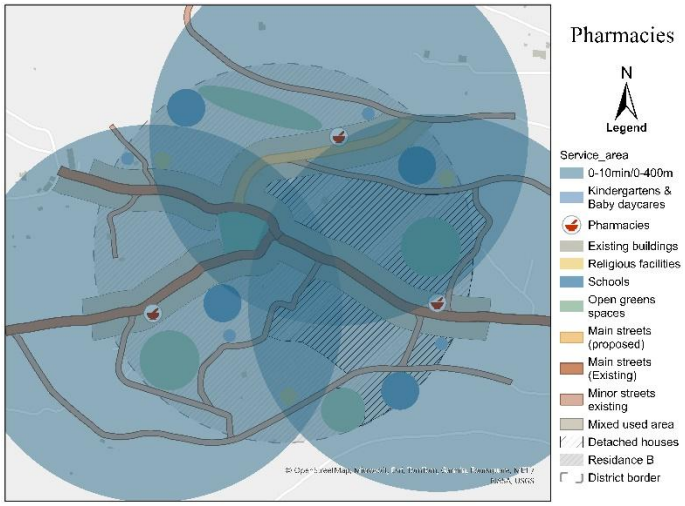



Figure 5.76: Buffer zone map concerning pharmacies.

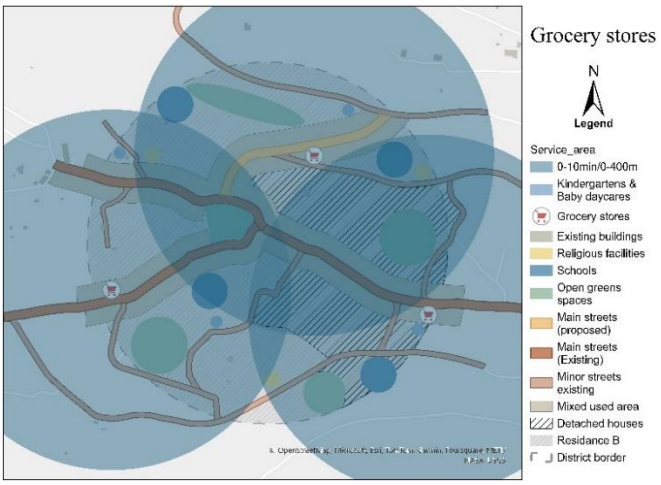



Figure 5.77: Buffer zone map concerning grocery stores.

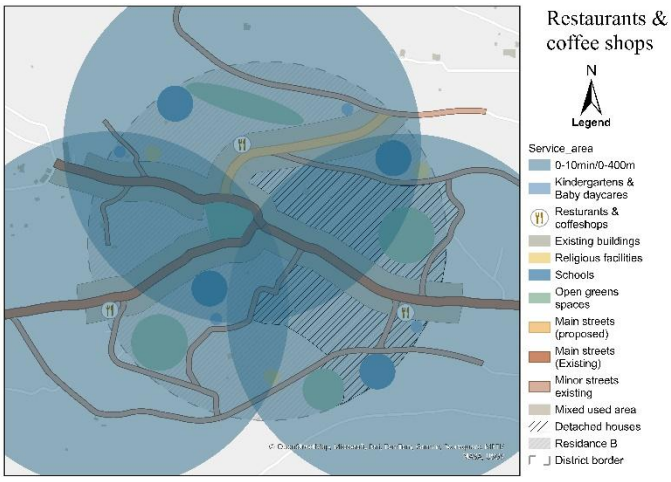



Figure 5.78: Buffer zone map concerning restaurants and coffee shops.

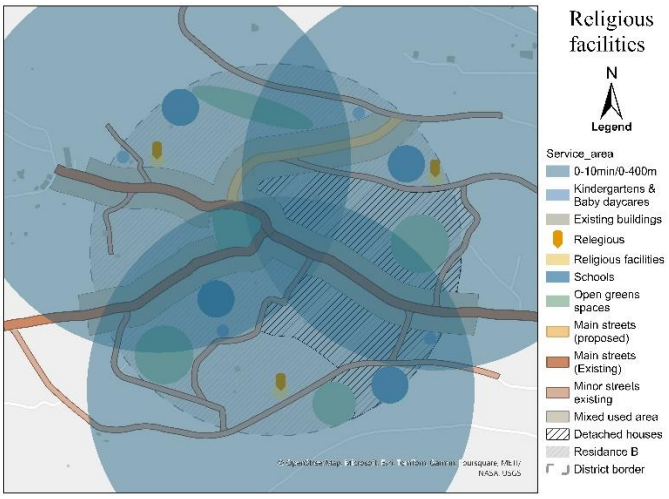



Figure 5.79: Buffer zone map concerning religious facilities.

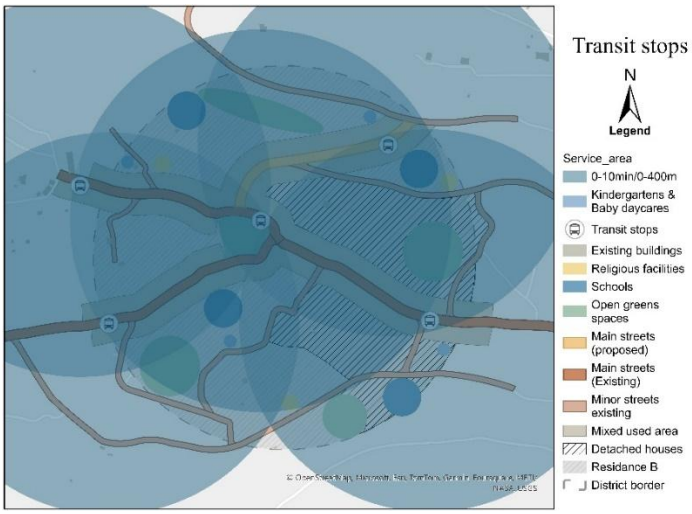



Figure 5.80: Buffer zone map concerning transit stops.

The analysis helps to visualize coverage and detect gaps in service delivery. This strategy guarantees that individuals can meet the majority of their daily needs within the time range indicated, while also emphasizing areas where accessibility is strong and adjustments are needed. Buffer zone analysis is vital for optimizing land use and providing fair access to key services throughout the community

Chapter 6

# Conclusion and Recommendations

## 6.1 Introduction

One of the primary topics raised in this study is the problem of urban sprawl and inefficient land use in Palestine, particularly in expansion zones. Urban expansion in Palestine is generally unplanned, resulting in a sprawling landscape that encourages automobile reliance and poor access to essential amenities. The purpose of this thesis was to provide a new planning model that tackles these issues, based on the 20MN concept. The concept aimed to create sustainable, accessible neighborhoods in which inhabitants could satisfy the majority of their everyday needs within a short walking or biking distance.

## 6.2 Research Findings and Conclusion

In response to the research objective, this study offers a new framework for planning sustainable neighborhoods that could mitigate the effects of sprawl, enhance local accessibility, and promote active, community-oriented living in Palestinian cities.

This research evaluated how the 20MN may be adapted to Palestine and utilized as a technique for improving the quality of life in urban areas, particularly in expansion zones and future extensions. By examining the extent to which the existing urban fabric in Palestinian cities is compatible with the principles of the 20MN, assessing the feasibility of implementing this model, identifying areas where improvements can be made to improve accessibility and sustainability, and developing a model for this concept to be used in the future expansion zones, through analysis study area in Hebron City.

- Case study 1:

The findings of an examination of a residential neighborhood in Hebron showed the following:

- The study area contained several services distributed in many places in the district.
- The results of the buffer zone analysis of the master plan show that the distribution of educational, commercial, and religious facilities allows all residents to access it in 20-25 minutes a round trip. However, the analysis of hospital accessibility within 25 minutes covers 50% of the study area.

- Buffer zone analysis of the built-up area was clear and more precise, as maps were produced indicating accessibility to all services in the area.
- The findings indicate that all households can get all services within 25 minutes on round trips, except kindergartens, nursery schools, and transit stops.
- The analysis results reveal that to establish a 20MN within the research region, the following interventions were proposed:

a- Distributing public transit stops along main streets in such a way that all residents have access to them, with no more than 400 meters between them, so four transit stops have been proposed, increasing the total to six.

b- At least 10% of the study area should be planned for green and recreational spaces, conveniently located within 10 minutes of all people's homes. There must be at least three locations selected for these parks and gardens.

c- It was concluded that seven kindergartens and six nursery schools should be there and distributed across the area such that they are within 7.5 minutes of each other.

d- It is assumed that pedestrian and bike routes will be established to provide safety and encourage walking and cycling, necessitating an increase in street space of at least 25% of the total area.

- After these interventions, the ratio of land use categories is changed to be suitable to achieve 20 MNs. This will minimize the density of people and dwellings, resulting in a dwelling unit density of 9420 units per $km^2$.

According to these findings, despite the suggested built-up area interventions, the density of dwellings and people is much higher compared to the previous studies. In reality, high density, along with past interventions in the analytical model, allows for the effective achievement of the 20MN criteria.

The analytical model's urban structure, characterized by unequal service distribution and automobile reliance, highlighted the challenges in applying the 20MN concept in existing urban contexts. The study identified strategic zoning, residential density, and improved facilities for walking and cycling to create walkable, accessible neighborhoods. Enhancing proximity to services and encouraging mixed-use buildings were crucial for reducing automobile reliance. These insights were crucial to developing the theoretical 20MN model for an expansion zone.

- Study area 2

The theoretical model was applied to the expansion region, ensuring residential, commercial, and public facilities were within a 20-minute walk or bicycle ride. The model's insights helped in locating key services, balancing density and open space, and creating infrastructure that encourages active travel, highlighting its potential for long-term urban growth in Palestine's expansion zones.

The 20MNs concept was effectively implemented in the specified expansion region (Study Area 2) to address land use inefficiencies. The land use zoning procedure achieved a balanced distribution of vital services and created a 20MN model by categorizing land into mixed-use, residential, commercial, and public service sectors. This development strategy guaranteed that inhabitants could reach amenities such as schools, stores, recreational areas, and healthcare within 10 minutes by foot or bicycle. This design has proven beneficial in decreasing the need for lengthy automobile trips, hence promoting a more integrated and sustainable development model.

The buffer zone analysis revealed that the model was successful. It offered an easily understood visual representation of the area's accessibility levels, proving that the land use distribution achieves the proximity criteria established in the 20MN concept. This research verified that the design improved walkability while also ensuring fair access to vital services throughout the community. The analysis identified the potential for zoning and spatial planning techniques to promote accessibility, leading to a more livable and inclusive urban environment.

According to this zoning, the optimal density for the 20-MN model is 6,809 dwelling units / $km^2$ and 32,333 persons/$km^2$. These findings are consistent with previous studies, which confirm that this density is appropriate for meeting the aims of the 20MN. Furthermore, this density may be expanded by adding more floors to buildings through vertical extension, ensuring access to all essential services and keeping to this concept. The study determined the final ratio of land use categories on which the zoning of the study area was based and the fewer numbers of services to achieve 20 MN. From it the results show that the number of some services is less than what is in the analytical model in Hebron city, the reason for this is that the zoning used in the 20MN model distributed service locations equitably, ensuring accessibility for every resident within ten minutes.

- 20 MNs Model

The 20MN model is an urban planning concept that emphasizes the creation of compact, walkable communities in which inhabitants can access critical services such as stores, schools, healthcare, and recreation within a 20-minute walk or cycling to and from their houses. The approach encourages a balanced mix of land uses, including residential, commercial, recreational, and services for the public, to reduce dependency on cars and encourage active transport.

The 20MN model distinguishes itself by emphasizing walkability and accessibility. Facilities are situated within a 10-minute walk of residential areas thanks to effective zoning and layout, infrastructure is supported to encourage walking and cycling, and public transport is upgraded to increase accessibility. To maximize the usage of public services and transport networks, the model requires appropriate residential and population density. In this study, a density of 6,809 houses/$km^2$ and 32,333 persons/$km^2$ was determined to be the optimal density, with the possibility for vertical development to improve accessibility and efficiency in the usage of public services.

The results of this study show that the 20MN concept is a realistic strategy to guide sustainable growth in expanding Palestinian regions, as seen by its effective implementation in (study area 2). By deliberately zoning areas for mixed land use and assuring access to critical services such as schools, health facilities, and green open spaces within 20 minutes of walking or cycling, this concept improves walkability, decreases dependency on automobiles, and produces more livable communities. This model provides a framework for dealing with Palestine's developing urban sprawl and a long-term answer for new expansions in similarly expanding locations, Figure 6.1 shows the Factors that should be considered when planning a 20MN, and Table 6.1 is the final framework for the model of this concept in Palestine expansion zones.


Figure 6.1: Factors that should be considered when planning a 20-Minute Neighborhood.

Table 6.1: The framework for the 20MN's model in Palestine expansion zones.

<table>
<tr><th colspan="4">Density</th></tr>
<tr><td colspan="4">6800 dwelling units/ km$^2$</td></tr>
<tr><th colspan="4">Proximity</th></tr>
<tr><td colspan="4">Accessibility within a 20-minute stroll out and back to home</td></tr>
<tr><th colspan="4">Mixed land use</th></tr>
<tr><td colspan="4">- Mixed-used buildings 25% of the total land area.<br>- Residential buildings 34%, detached and affordable houses (50% for each type)</td></tr>
<tr><td>Type of residential buildings</td><td>Ratio to the total area of the district</td><td>Permissible building ratio per dunam</td><td>Number of floors</td></tr>
<tr><td>Apartments in mixed-used buildings</td><td>25%</td><td>70%</td><td>6</td></tr>
<tr><td>Residence B</td><td>17%</td><td>42%</td><td>5</td></tr>
<tr><td>Residence villa</td><td>17%</td><td>30%</td><td>3</td></tr>
<tr><th colspan="4">Diversity of transport options</th></tr>
<tr><td colspan="4">- Public transport (bus)<br>- Active transport (walking and cycling)<br>- Maximum distance between each transit stop is 400 m<br>- Fewer number of transit stops is 5</td></tr>
<tr><th colspan="4">Streets</th></tr>
<tr><td colspan="4">- 25% of the total land area<br>- Should availably bike and pedestrian lanes</td></tr>
<tr><th colspan="4">Public services zones</th></tr>
<tr><td colspan="4">- 5-10% of the total land area</td></tr>
</table>

| Type of services | Name of services | Number of services |
|---|---|---|
| Education services | Nursery schools | 4 |
| | Kindergartens | 4 |
| | Primary Schools | 4 |
| Health services | Medical clinics | 3 |
| | Pharmacies | 3 |
| Religious services | Mosques | 3 |

**Social facilities**

- Groceries, and daily needs shops, like supermarkets and small retail shops
- The number of these services is 3

**Recreation services**

- Restaurants and coffee shops: The number of these services is 3.
- Open green spaces: It should be 10% of the total area, which is 4-5 distributed in different neighborhood locations.

## 6.3 Recommendations

### A- Recommendations for future urban planning

Various recommendations may be offered for planners for future urban development, particularly in unorganized regions like Palestine, based on the findings of this study:

- Future constructions should prioritize sustainability by including green spaces and parks, promoting environmentally friendly building techniques, and designing renewable neighborhoods.
- Increasing dwelling density to sustain local services and public transport should strive for a minimum housing density of 6500 units/km$^2$. To improve density, vertical growth should be considered while retaining walkability and accessibility to services.
- City planners should create neighborhoods with a balanced mix of residential, commercial, and public services. This may be accomplished through mixed-use buildings, which guarantee that necessary services are within walking or cycling distance.
- Transport infrastructure should be easily incorporated into residential and commercial areas. Creating safe pedestrian and bicycle pathways will improve accessibility.

### B- Implementation Strategies

The following recommendations are intended for the Ministry of Local Government, municipalities, and relevant stakeholders. These organizations are encouraged to adopt and execute the recommended solutions for improving urban planning and ensuring sustainable development in the study regions.

- Policy Recommendations: should make policy ideas or modifications that promote mixed-use development and the 20MN concept in urban planning frameworks.
- Community Engagement: Engage local inhabitants, companies, and stakeholders in the planning process to meet their needs and concerns.
- Monitoring and Evaluation: Create measures to track the performance of the 20MN model, like improvements in the mode of travel, walking and cycling rates, and residents' satisfaction levels.

C- Recommendations for future research

Additionally, there are several recommendations for future and practical study such as:

- Future studies should look at the influence of vertical growth on 20MNs, especially the impact of high-rise buildings on accessibility and density since this will bring fresh insights for urban planning in highly populated locations.
- Extending this study to evaluate the 20MN model's applicability in other countries would provide a more comprehensive understanding of how the model can be adapted to different urban contexts, such as areas with varying population densities, uses of land, and infrastructure availability.
- Future studies might look into the benefits of smart city technologies in enhancing 20MN, such as real-time traffic and transit information apps that promote accessibility and walkability, which could lead to more sustainable urban development.
- Exploring how 20MNs may be combined with future innovations in sustainable mobility, such as electric automobiles, e-bikes, and self-driving public transit, might broaden the model's scope.

## References


(ARIJ), A. R. I. J. Hebron Governorate

(ARIJ), T. A. R. I.-J. (2009). Halhul Town Profile

(PCBS), P. C. B. o. S. (2023). Palestinian Central Bureau of Statistics (PCBS) Presents the Conditions of the Palestinian Population on the Occasion of the World Population Day, 11/07/2023.

Adams, D., & Tiesdell, S. (2012). *Shaping places: urban planning, design and development*: Routledge.

Akar, G., & Clifton, K. J. J. T. r. r. (2009). Influence of individual perceptions and bicycle infrastructure on decision to bike. *2140*(1), 165-172.

Al-Asta, S. K. A., Al-Dhubhani, B. R. A. J. U. o. S., Engineering, T. J. f., & Technology. (2023). Using Three-Dimensional Modeling Techniques in Digital Preservation of Urban Plans for the Old Walled City of Shibam Hadramawt. *1*(1), 1-27.

Al-Kodmany, K. J. B. (2018). Sustainability and the 21st century vertical city: A review of design approaches of tall buildings. *8*(8), 102.

Ali, M., Ali, T., Gawai, R., & Elaksher, A. J. S. (2023). Fifteen-, Ten-, or Five Minute City? Walkability to Services Assessment: Case of Dubai, UAE. *15*(20), 15176.

Alimi, E., & Gamson, W. (2007). *Israeli politics and the first Palestinian Intifada: Political opportunities, framing processes and contentious politics*: Routledge.

Aliqtisadi. (2016). تراخيص البناء التي تمنحها البلديات في فلسطين؟ ما أنواع.

AlWaer, H., & Cooper, I. J. O. H. I. (2023). Unpacking the concept of 20-minute neighbourhoods: disentangling “desired outcomes” from the “means” available for achieving them.

Authorities, C. R. N. o. o. t. B. a. O. S. f. L. (2011). Cabinet Resolution No. (6) of 2011 on the Buildings and Organization System for Local Authorities.

Ayala, A. M. C., Lamb, K. E., Loh, V., Daniel, M., Coffee, N. T., Oostenbach, L. H., . . . Place. (2022). Do residents with a 20-min neighbourhood walk more? Findings from ProjectPLAN. *76*, 102859.

Ayele, N., de Looze, B., Schouten, S., & Both, F. (2023). The Compact Garden City: Creating a Framework for a Comtemporary Garden City.

Badland, H., Whitzman, C., Lowe, M., Davern, M., Aye, L., Butterworth, I., . . . medicine. (2014). Urban liveability: emerging lessons from Australia for exploring the potential for indicators to measure the social determinants of health. *111*, 64-73.

Barker, G. J. F. (2020). How might buyer and seller priorities change in the post-COVID housing market.

Barton, H., Grant, M., & Guise, R. (2021). *Shaping neighbourhoods: for local health and global sustainability*: Routledge.

Beilin, Y. (2004). *The Path to Geneva: The Quest for a Permanent Solution, 1996-2003*: Akashic Books.

Bereitschaft, B., & Scheller, D. J. U. s. (2020). How might the COVID-19 pandemic affect 21st century urban design, planning, and development? *, 4*(4), 56.

Bereitschaft, B. J. A. G. (2020). Gentrification central: A change-based typology of the American urban core, 2000–2015. *118*, 102206.

Bianchi, G. (2018). Lo spazio aperto nella pianificazione locale, da standard a struttura. In *Costruire lo spazio pubblico tra storia, cultura e natura. Building the public space between history, culture and nature* (pp. 34-37): INU Edizioni.

Bibri, S. E., Krogstie, J., & Kärrholm, M. J. D. i. t. b. e. (2020). Compact city planning and development: Emerging practices and strategies for achieving the goals of sustainability. *4*, 100021.

Blazy, R., Hrehorowicz-Gaber, H., Sandu, I. G., & Hrehorowicz-Nowak, A. J. I. J. o. C. S. (2022). GARDEN CITIES AND HERITAGE OF THE HOWARD'S IDEA IN EUROPE WITH PARTICULAR CONSIDERATION OF POLAND. *13*(3), 805-822.

Bocca, A. J. T.-J. o. L. U., Mobility, & Environment. (2021). Public space and 15-minute city. *14*(3), 395-410.

Bradshaw, K. (16 March 2020). Coronavirus in Austin: Scooter app companies sanitizing rides. *Austin Statesman*. doi:Available online: https://www.statesman.com/news/20200316/coronavirus-in-austin-scooter-app-companiessanitizing-rides(accessed (accessed on 18 August 2024).

Briefings, O. A. J. E. E. (2018). Rising living costs will hasten 'high streets' decline. (oxan-db).

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. J. T. l. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *395*(10227), 912-920.

Bruyns, G. J., Higgins, C. D., & Nel, D. H. J. U. S. (2021). Urban volumetrics: From vertical to volumetric urbanisation and its extensions to empirical morphological analysis. *58*(5), 922-940.

Burton, E. J. E., Planning, p. B., & Design. (2002). Measuring urban compactness in UK towns and cities. *29*(2), 219-250.

Bush, J., & Doyon, A. J. C. (2019). Building urban resilience with nature-based solutions: How can urban planning contribute? *, 95*, 102483.

Calafiore, A., Dunning, R., Nurse, A., Singleton, A. J. T. R. P. D. T., & Environment. (2022). The 20-minute city: An equity analysis of Liverpool City Region. *102*, 103111.

Cangelli, E., Vettori, M. P. J. T.-J. o. T. f. A., & Environment. (2019). The architecture between horizontality and verticality. 16-21.

Capasso Da Silva, D., King, D. A., & Lemar, S. J. S. (2019). Accessibility in practice: 20-minute city as a sustainability planning goal. *12*(1), 129.

Carvajal, G. A., Sarmiento, O. L., Medaglia, A. L., Cabrales, S., Rodríguez, D. A., Quistberg, D. A., . . . Prevention. (2020). Bicycle safety in Bogotá: A seven-year analysis of bicyclists' collisions and fatalities. *144*, 105596.

Caselli, B., Carra, M., Rossetti, S., & Zazzi, M. J. E. T. T. E. (2021). From urban planning techniques to 15-minute neighbourhoods. A theoretical framework and GIS-based analysis of pedestrian accessibility to public services. (85), 1-15.

Challinger, D. J. I., Alexandria, VA. (2008). „CRISP Report: From the Ground Up: Security for Tall Buildings," ASIS Foundation.

Chau, H.-W., Gilzean, I., Jamei, E., Lesley, P., Preece, T., & Quirke, M. J. U. P. (2022). Comparative analysis of 20-minute neighbourhood policies and practices in Melbourne and Scotland. *7*(4), 13-24.

Cities, C. (2020). *C40 Mayors' Agenda for a Green and just recovery*. Retrieved from

Connolly, K. J. T. G. (2020). Cleaner and greener': Covid-19 prompts world's cities to free public space of cars. *18*.

Coskun, H. *Beginning of the 20 th. century two French architects and two different approaches to the urban morphology. Henri Prost in İstanbul and Le Corbusier in Paris.* Paper presented at the ISUF 2016 XXIII International Conference: Urban Morphology and Resilient Cities.

Council, E. L. J. M. C., WEST LOTHIAN COUNCIL. (1997). The City of Edinburgh Council.
COUNCIL, G. C. (2021). Glasgow's Liveable Neighbourhoods - Toolkit.
ctbuh.org, s. c. (2019). CTBUH Height Criteria for Measuring & Defining Tall Buildings. doi:https://www.coursehero.com/file/45686141/CTBUH-HeightCriteriapdf/
Da Silva, D. C., King, D. A., & Lemar, S. J. S. (2019). Accessibility in practice: 20-minute city as a sustainability planning goal. *12*(1), 1-20.
DELWP. (2017). Plan Melbourne 2017–2050 metropolitan planning strategy. Melbourne: State Government of Victoria.
Dodson, J., & Gleeson, B. (2007). *The use of density in Australian planning*.
Dolega, L., & Lord, A. J. C. (2020). Exploring the geography of retail success and decline: A case study of the Liverpool City Region. *96*, 102456.
Douglas, M., & Beautyman, I. J. T. I. S. (2020). Comparing the 20 Minute Neighbourhood and Traditional Scenarios in Edinburgh Local Development Plan: a Rapid Scoping Assessment.
Dovey, K., Jones, R., & Adams, R. J. P. N. (2018). Urban Choreography: Central Melbourne 1985. *44*(3), 26-27.
Dovey, K., & Pafka, E. J. U. s. (2020). What is walkability? The urban DMA. *57*(1), 93-108.
Dunning, R., Calafiore, A., Nurse, A. J. T., & planning, c. (2021). 20-minute neighbourhood or 15-minute city?
Dunning, R. J., Dolega, L., Nasuto, A., Nurse, A., & Calafiore, A. J. A. g. (2023). Age and the 20-min city: Accounting for variation in mobility. *156*, 103005.
Earth, G. Google Earth.
Euklidiadas, M. M. (2020). Paris Wants to Become a “15-Minute City”, Smart cityLab. In.
Europe, W. H. O. J. W. H. O. R. O. f. (2016). Urban green spaces and health (No. WHO/EURO: 2016-3352-43111-60341).
FHWA, H. S. P. Separated Bike Lane Planning and Design Guide. *United States Department of Transportation - Federal Highway Administration* Pg 89-101.
Gehl, J. (2013). *Cities for people*: Island press.
geverment, V. s. (2017). Plan Melbourne 2017-2050. doi:Available online: https://www.planning.vic.gov.au/guides-and-resources/strategies-and-initiatives/plan-melbourne. (access on 18 Aughest 2024)
GOVERNMENT, D.-G. C. T. S. (2021a). Fourth National Planning Framework - position statement: consultation analysis. The Scottish Government.
GOVERNMENT, D.-G. C. T. S. (2021b). Fourth National

Planning Framework - position statement: consultation analysis. *The Scottish Government*. doi:https://www.gov.scot/publications/scotlands-fourth-national-planning-framework-position-statement-analysis-responses-consultation/documents/
GOVERNMENT, S. (2020). Protecting Scotland, Renewing Scotland: The Government's

Programme for Scotland 2020-2021.
Government, V. S. (2013). Plan Melbourne metropolitan planning strategy [draft] (Melbourne: Victorian State Government).
Government, V. S. (2024). The 20 minutes nieghberhood.
Government, V. S. (2024

). 20-minute neighbourhoods. doi:https://www.planning.vic.gov.au/guides-and-resources/strategies-and-initiatives/20-minute-neighbourhoods

Gower, A., Grodach, C. J. U. P., & Research. (2022). Planning Innovation or City Branding? Exploring How Cities Operationalise the 20-Minute Neighbourhood Concept. *40*(1), 36-52.
Graham, S. (2016). *Vertical: The City from Satellites to Bunkers*: Verso.
Griffiths, D. (2009). *Density targets: Measuring everything except that which makes life worthwhile.* Paper presented at the 10th International Cities Town Centres & Communities Society Conference. Deakin University Geelong.
Grodach, C., Kamruzzaman, L., & Harper, L. (2019). 20-Minute Neighbourhood: Living Locally Research.
Gunn, L. D., King, T. L., Mavoa, S., Lamb, K. E., Giles-Corti, B., Kavanagh, A. J. J. o. t., & health. (2017). Identifying destination distances that support walking trips in local neighborhoods. *5*, 133-141.
Haarstad, H., Kjærås, K., Røe, P. G., & Tveiten, K. J. D. i. H. G. (2023). Diversifying the compact city: A renewed agenda for geographical research. *13*(1), 5-24.
Habitat, U. J. N., Kenya: United Nations Human Settlements Programme. (2014). A new strategy of sustainable neighbourhood planning: Five principles.
Hachem-Vermette, C., Singh, K. J. E., & Buildings. (2019). Optimization of the mixture of building types in a neighborhood and their energy and environmental performance. *204*, 109499.
Hart, J. (2016). *Towns and Cities: Function in Form: Urban Structures, Economics and Society*: Routledge.
Heymans, A., Breadsell, J., Morrison, G. M., Byrne, J. J., & Eon, C. J. S. (2019). Ecological urban planning and design: A systematic literature review. *11*(13), 3723.
Hurtado, P. (2020). . A necessary paradigm shift in how we use urban space. *Am. Plan. Assoc. Knowl. Center*. doi:Available online: https://www.planning.org/blog/9200400/necessary-paradigm-shift-in-how-we-use-urbanspace/ (accessed on 18 August 2024).
Jacobs, J. J. B. U. r. (1961). The death and life of great american cities. Randoms house, New York.
Jafari, A., Singh, D., Giles-Corti, B. J. H., & Place. (2023). Residential density and 20-minute neighbourhoods: A multi-neighbourhood destination location optimisation approach. *83*, 103070.
Jamei, E., Ahmadi, K., Chau, H. W., Seyedmahmoudian, M., Horan, B., & Stojcevski, A. J. S. (2021). Urban design and walkability: Lessons learnt from Iranian traditional cities. *13*(10), 5731.
Jin, Y. J. U. P. (2022). Urban Verticality Shaped by a Vertical Terrain: Lessons From Chongqing, China. *7*(4), 364-376.
Kamruzzaman, L. J. F. (2022). Typologies of 20-Minute Neighbourhoods, Active Transport Use, and Spatial Spillovers.
Kang, M., Choi, Y., Kim, J., Lee, K. O., Lee, S., Park, I. K., . . . Seo, I. J. I. J. o. U. S. (2020). COVID-19 impact on city and region: what's next after lockdown? *, 24*(3), 297-315.
Lehmann, S. J. F. c., & environment. (2016). Sustainable urbanism: towards a framework for quality and optimal density? *, 2*, 1-13.
Lewis, M. B. (1999). *Suburban Backlash: The battle for the world's most liveable city*: Bloomings Books.
Lindner, A. Everything Within 20 Minutes: Travel Infrastructure & The 20-Minute Neighborhood. In.

Lopez, B., Kennedy, C., Field, C., McPhearson, T. J. U. f., & greening, u. (2021). Who benefits from urban green spaces during times of crisis? Perception and use of urban green spaces in New York City during the COVID-19 pandemic. *65*, 127354.

Lu, Y., Zhao, J., Wu, X., & Lo, S. M. J. C. f. O. S. (2020). Escaping to nature in pandemic: a natural experiment of COVID-19 in Asian cities.

Lynch, C. B. M. City of Portland.

Mackenzie, A. (2022). Creating sustainable and equitable communities in a post-Covid context: development of the Scottish 20-minute neighbourhood concept.

Maes, J., Zulian, G., Günther, S., Thijssen, M., & Raynal, J. J. P. O. o. t. E. U. L. (2019). Enhancing resilience of urban ecosystems through green infrastructure (EnRoute). 1-115.

March, L., & Lehrer, U. J. C. J. o. U. R. (2019). Verticality, public space and the role of resident participation in revitalizing suburban high-rise buildings. *28*(1), 65-85.

McNeill, D. J. E., Economy, P. A., & Space. (2019). Volumetric urbanism: The production and extraction of Singaporean territory. *51*(4), 849-868.

Mehaffy, M. (2014). 5 Key Themes Emerging From the 'New Science of Cities'. doi:Available online:

https://www.bloomberg.com/news/articles/2014-09-19/5-key-themes-emerging-from-the-new-science-of-cities (2014) (accessed

on 18 August 2024).

Ming, O. K., & Fong, J. J. P. I., February. (2016). The SUNWAY Bus Rapid Transit (BRT) Line: Lessons for The Future.

Moreno, C., Allam, Z., Chabaud, D., Gall, C., & Pratlong, F. (2021a). Introducing the" 15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities, Smart Cities 2021, 4, 93-111. In: s Note: MDPI stays neu-tral with regard to jurisdictional claims in ….

Moreno, C., Allam, Z., Chabaud, D., Gall, C., & Pratlong, F. J. S. c. (2021b). Introducing the "15-Minute City": Sustainability, resilience and place identity in future post-pandemic cities. *4*(1), 93-111.

Morley, M., Pafka, E. J. U. P., & Research. (2023). "Density Done Well" in the Pursuit of 20-Minute Neighbourhoods: Navigating Fluid Discourses in Melbourne. *41*(2), 148-163.

Mosha, L. H. Historical Paradigms of Architects Le Corbusier and Anthony Almeida on Modern Architecture and City Planning with an Overview of Dar es Salaam–Tanzania.

Municipality, H. Approved Master plan of Hebron

Nethercote, M. J. C. (2018). Theorising vertical urbanisation. *22*(5-6), 657-684.

O'Gorman, S., & Dillon-Robinson, R. (2021). *20 minute neighbourhoods in a scottish context*. Retrieved from

Olsen, J. R., Nicholls, N., Panter, J., Burnett, H., Tornow, M., & Mitchell, R. J. E. R. (2022). Trends and inequalities in distance to and use of nearest natural space in the context of the 20-min neighbourhood: A 4-wave national repeat cross-sectional study, 2013 to 2019. *213*, 113610.

Olsen, J. R., Thornton, L., Tregonning, G., Mitchell, R. J. S. S., & Medicine. (2022). Nationwide equity assessment of the 20-min neighbourhood in the scottish context: A socio-spatial proximity analysis of residential locations. *315*, 115502.

Pala, E. E. (2023). *A Critical Analysis of High-Rise Housing Blocks: The Case of South-Western Ankara.* Middle East Technical University,

Perry, C. A. J. N., Community Planning, C. o. R. P. o. N. Y., & Environs, I. (1929). the Neighborhood unit-a scheme of arrangement for the family-life community, regional survey of New York and its environments. *8*, 30.
Portland. (2021). Portland Plan
Pozoukidou, G., & Chatziyiannaki, Z. (2021). 15-Minute City: Decomposing the New Urban Planning Eutopia. *Sustainability, 13*(2). doi:10.3390/su13020928
Pozoukidou, G. J. E.-M. J. f. E. I. (2020). Designing a green infrastructure network for metropolitan areas: a spatial planning approach. *5*(2), 40.
Roast, A. J. U. S. (2022). Towards weird verticality: The spectacle of vertical spaces in Chongqing. 00420980221094465.
Roosli, R., Isa, M. I., Mohamad, D., & Othman, A. G. J. P. M. (2022). CRITERIA AND ATTRIBUTES FOR THE 20-MINUTE CITY CONCEPT (KP20M) IN BALIK PULAU, PULAU PINANG. *20*.
Ross, A. J. T. N. B. c. t. t. c. (2011). "Nothing Gained by Overcrowding": The History and Politics of Urban Population Control. 169-178.
Seong, E., Lee, N., & Choi, C. (2021). Relationship between land use mix and walking choice in high-density cities: a review of walking in Seoul, South Korea. Sustainability 13: 810. In.
Service, I. (2021). Place and Wellbeing Outcomes. doi:Available
from: https://www.improvementservice.org.uk/products-and-services/consultancy-andsupport/planning-for-place-programme/place-and-wellbeing-outcomes. (acsess on 18 Aughest 2024)
Shatu, F., & Kamruzzaman, M. J. F. (2021). Determining optimum design density for 20-minute neighbourhoods.
Shih, M., Chang, H.-t. B., Popper, F. J. J. P. T., & Practice. (2018). Development rights: Regulating vertical urbanism in Taiwan. *19*(5), 717-733.
Stanley, J., & Stanley, J. J. B. A. V. (2014). Achieving the 20-minute city for Melbourne: Turning our city upside down.
Statistics, P. C. B. o. (2021). Number and Area of Licensed Housing Units in Palestine and Governorate.
Thomas, R. J. (2003). Sustainable urban design: an environmental approach.
Thornton, L. E., Schroers, R.-D., Lamb, K. E., Daniel, M., Ball, K., Chaix, B., . . . Activity, P. (2022). Operationalising the 20-minute neighbourhood. *19*(1), 1-18.
Toderian, B. J. S. M., Store,, & Network, B. (2013). Toderian: density done well.
Trancik, R. (1991). *Finding lost space: theories of urban design*: John Wiley & Sons.
Unesco. Old Walled City of Shibam , https://whc.unesco.org/en/list/192/.
van der Horst, D., Lane, M., Creasy, M. A., Gillette, M. K., Jia, M. H., Soriano, M. P., & Smith, S. (2021). Edinburgh and the n-minute neighbourhood concept; an exploratory study.
Venter, Z. S., Barton, D. N., Gundersen, V., Figari, H., & Nowell, M. J. E. r. l. (2020). Urban nature in a time of crisis: recreational use of green space increases during the COVID-19 outbreak in Oslo, Norway. *15*(10), 104075.
Ware, J., Lobos, J., & Carrano, E. J. I. D. a. h. w. i. i. o. j.-p.-w. p.-c.-p. (2020). Una proposta per ripensare le nostre città.
Whitzman, C., Tucker, D., Bishop, A., Doyon, A., Jones, C., Lowen, T., & McMillan, E. (2013). *Plan Melbourne: can outer suburbs become 20 minute neighbourhoods?* Paper presented at the State of Australian Cities National Conference, 2013, Sydney, New South Wales, Australia.

Wikipedia, t. f. e. Hebron. *Wikipedia, the free encyclopedia*

*https://en.wikipedia.org/wiki/Hebron#cite_note-7*.
Wikipedia, t. f. e. West Street pedestrian bridges. doi:https://en.wikipedia.org/wiki/West_Street_pedestrian_bridges
Wikipedia, t. f. e. (2024). Halhul. *Wikipedia, the free encyclopedia*.

## Appendices

Appendix A: interview questions

| Questions |
|---|
| Gender (Male / Female) |
| Number of family members |
| What type of dwelling do you reside in? |
| What is the name of the neighborhood in which you live? |
| Is there a public transit stop nearby that is close to your residence? |
| Is it preferable to use a car or walk to meet daily needs? |
| Are there any activities, events, and facilities in the neighborhood that serve those with special needs? |
| Is the neighborhood safe for pedestrians? |
| Do people utilize bicycles for their everyday requirements? |
| Are there dedicated bicycle lanes? |
| Are there any stores, health clinics, or entertainment facilities nearby, such as restaurants and cafes? How far is it from your home on foot? |
| Are there public places like parks and gardens in the neighborhood and close to your house, and if so, how far away from it? |
| Are there relationships amongst the neighborhood's residents, and do they gather to organize recreational events such as walking groups? |
| Are there any nursery schools, kindergartens, or schools nearby, and how far are they from your house on foot? |
| Do school and kindergarten students prefer to walk to school or take a private automobile, school bus, or public transport? |
| What challenges do the people of the neighborhood face? |

Appendix B: Density calculation

**A- Calculation of density of study area 1 according to a master plan**

- Calculation of the number of dwellings and number of residences in various residence areas.

| Residential area type | Calculation results |
|---|---|
| Residence B | - Area= 116.380 Dunam<br>- Permissible building area<br>116.380 * 0.42= 48.8796 Dunam= 48880 $m^2$<br>- Number of apartments per floor<br>48880/161.7= 302 apartments/ floor<br>- Total number of apartments<br>302*5 floors = 1511 apartments<br>- Number of residences<br>1511 *4.7= 7102 peoples |
| Residence C | - Area = 249.745 Dunam<br>- Permissible building area<br>249.745 *0.48= 119.8776 Dunam= 119878.00 $m^2$<br>- Number of apartments per floor<br>119878.00 /161.7= 741 apartments/ floor<br>- Total number of apartments<br>741*5= 3705 apartments<br>- Number of residences<br>3705 *4.7= 17414 peoples |
| Residence D | - Area= 117.377 Dunam<br>- Permissible building area<br>- 117.377 *0.52= 61.03604 Dunam<br>- Number of apartments per floor<br>63400/161.7 = 377 apartments/ floor<br>- Total number of apartments<br>377*5= 1885 apartments<br>- Number of residences<br>1885 *4.7= 8860 peoples |
| Villa | - Area= 25.178 Dunam<br>- Permissible building area<br>25.178*0.30= 7.5534 Dunam= 7553.4 $m^2$ |

| | |
|---|---|
| | - Number of dwellings<br>7553.4/190= 40 units<br>- Number of residences<br>40*4.7= 188 peoples |
| Commercial area (mixed-used buildings) | - Area = 107.865 Dunam<br>- Permissible building area<br>107.865 *0.70= 75.5055 Dunam= 75505.5 $m^2$<br>- Number of apartments per floor<br>75505.5 /161.7= 467 apartments/ floor<br>- Total number of apartments<br>467*4= 1868 apartments<br>- Number of residences<br>1868 *4.7= 8780 peoples |

Note: The average area of housing units in Hebron (new and existing) is 161.7 $m^2$, source: (Statistics, 2021). The floor area of villa is larger than the apartments, so the area was taken as 190$m^2$.

- Total number of dwellings = 9009 dwelling units
- Total number of residents = 42344 people

**The density of the area is:**

- Density of people = 42344 people /0.785 m2= 53941.4 people/ $km^2$
- The density of dwellings = 9009/0.785 = 11476 units/ $km^2$

**B- Calculation of density of study area 1 to a built-up area after interventions**

New density was calculated after interventions in built-up area, as shown in the table below:

| Residential area type | Calculation results |
|---|---|
| Residence B | - Area= 50.454 Dunam<br>- Permissible building area<br>50.454 * 0.42= 21.19068 Dunam= 21191.0 $m^2$<br>- Number of apartments per floor<br>21191.0 /161.7= 131 apartments/ floor<br>- Total number of apartments<br>131*5 floors = 655 apartments<br>- Number of residences |

| | |
|---|---|
| | 655 *4.7= 3079 peoples |
| Residence C | - Area = 173.365 Dunam<br>- Permissible building area<br>173.365 *0.48= 83.2152 Dunam = 83215.2 $m^2$<br>- Number of apartments per floor<br>83215.2 /161.7= 515 apartments/ floor<br>- Total number of apartments<br>515*5= 2575 apartments<br>- Number of residences<br>2575 *4.7= 12103 peoples |
| Residence D | - Area= 76.034 Dunam<br>- Permissible building area<br>76.034 *0.52= 39.53768 Dunam<br>- Number of apartments per floor<br>39537.68/161.7 = 245 apartments/ floor<br>- Total number of apartments<br>245*5= 1225 apartments<br>- Number of residences<br>1225 *4.7= 5758 peoples |
| Villa | - Area= 25.178 Dunam<br>- Permissible building area<br>25.178*0.30= 7.5534 Dunam= 7553.4 $m^2$<br>- Number of dwellings<br>7553.4/190= 40 units<br>- Number of residences<br>40*4.7= 188 peoples |
| Commercial area | - Area = 167.485 Dunam<br>- Permissible building area<br>167.485 *0.70= 117.2395 Dunam = 117239.5 $m^2$<br>- Number of apartments per floor<br>117239.5 /161.7= 725 apartments/ floor<br>- Total number of apartments<br>725*4= 2900 apartments<br>- Number of residences<br>2900 *4.7= 13630 peoples |
| Total number of dwelling units | 7395 units |

| | |
|---|---|
| Total number of residents | 34,758 peoples |

**The density of the area is:**

- Density of people = 34,758 people /0.785 $m^2$= 44,278 people/ $km^2$
- The density of dwellings = 7395/0.785 = 9,420 units/ $km^2$

**C- Calculation of density for 20minutes neighborhood model**

| Residential area type | Calculation results |
|---|---|
| mixed-used buildings | Permissible building area<br>125.600 dunam * 70% = 87.92 dunam= 87920 $m^2$<br>Number of dwellings<br>Number of apartments per floor<br>87920/161.7 $m^2$ = 544 dwelling units/ floor<br>Total number of apartments<br>544 *4 floors = 2176 dwelling units<br>Number of residents<br>2176*4.7= 10227 peoples |
| Residence B | Permissible building area<br>85.408 dunam *42% = 35.87136 dunam = 35871.36 $m^2$<br>Number of dwellings<br>Number of apartments per floor<br>= 35871.36/161.7 $m^2$ = 222 dwelling units/ floor<br>Total number of apartments<br>222 * 5 = 1110 dwelling units<br>Number of residents<br>1110 * 4.7 = 5217 peoples |
| Villa | Permissible building area<br>85.408 dunam *30% = 25.6224 dunam = 25622.4 $m^2$<br>Number of dwellings<br>= 25622.4 /190 $m^2$ = 135 dwelling units<br>Number of residents<br>147 * 4.7 = 635 peoples |
| Total number of dwelling units | 3421 |
| Total number of residents | 16079 |

- Density of dwelling units

Total number of dwellings / total area of the district ($km^2$)

= 3421/0.5024= 6809 dwelling units/$km^2$

- Density of residents

Total number of residents / total area of the district ($km^2$)

= 16079.00/0.5024 = 32004 Peoples/ $km^2$