sustainability

MDPI

Article

Walkability in Riyadh: A Comprehensive Assessment and Implications for Sustainable Community—Al-Falah Case Study

Majd Homoud [1,2] and Ola M. Jarrar [1,*]

[1] Architecture Department, College of Architecture and Design, Prince Sultan University, Riyadh 11586, Saudi Arabia; mhomoud@psu.edu.sa or majd.alhomoud@gju.edu.jo or majdalhomoud@yahoo.com

[2] Department of Architecture, School of Architecture and Built Environment, German Jordanian University, Amman 11180, Jordan

* Correspondence: ojarrar@psu.edu.sa

Abstract: This paper focuses on studying the concept of walkability in Riyadh, Saudi Arabia, after the implementation of the Humanizing Neighborhoods Initiative. Al-Falah neighborhood was selected as a case study because it was one of the first neighborhoods to implement walkability strategies. By adopting a qualitative critical approach, this research collected data through a literature review and on-site observation to assess walkability in the neighborhood. Analysis of the observations highlighted the challenges and opportunities of walkability in Riyadh and the wider Gulf cities. Recommendations for promoting walkable communities in Riyadh include enhancing pedestrian infrastructure, incorporating mixed-use developments, integrating green infrastructure, implementing smart urban planning principles, and integrating public transportation systems. This paper emphasizes the importance of community engagement, preserving local identity, and involving various stakeholders to transform Riyadh into a pedestrian-friendly city that prioritizes public health and sustainability.

Keywords: humanization; walkability; community; urban; development; sustainability; neighborhood; Riyadh; Saudi Arabia

Citation: Homoud, M.; Jarrar, O.M. Walkability in Riyadh: A Comprehensive Assessment and Implications for Sustainable Community—Al-Falah Case Study. *Sustainability* **2024**, *16*, 8073. https://doi.org/10.3390/su16188073

Academic Editor: Ayyoob Sharifi

Received: 16 July 2024
Revised: 13 August 2024
Accepted: 12 September 2024
Published: 15 September 2024

1. Introduction

In recent years, there has been a global shift toward creating sustainable and livable urban environments. Central to this endeavor is the concept of walkable communities, where the design and infrastructure of cities prioritize and promote walking as a preferred mode of transportation. Walkable communities offer numerous benefits, including improved public health, reduced traffic congestion, increased social interactions, and enhanced environmental sustainability [1–10].

Riyadh, the capital city of Saudi Arabia, is witnessing rapid urbanization and population growth. As the city expands, it faces a range of challenges, including traffic congestion, air pollution, and sedentary lifestyles. Riyadh's existing urban fabric is predominantly car-oriented, characterized by sprawling developments, wide roads, and limited pedestrian infrastructure. Consequently, there is an urgent need to reimagine Riyadh's urban landscape and promote walkable communities as part of a sustainable urban development approach. To align with global trends and respond to these challenges, Saudi Vision 2030 is focusing on sustainability as a pivotal principle guiding its development schemes. Creating walkable communities is at the core of these schemes. This focus was emphasized by launching the "Humanizing Neighborhoods Initiative" in 2020 [11]. This research focuses on studying the concept of walkability in the city of Riyadh after the implementation of the Humanizing Neighborhoods Initiative. As one of the first neighborhoods in the city to adopt walkability strategies under the humanization initiative, the Al-Falah neighborhood was selected as a case study for this research.

This research adopts a qualitative critical approach that includes a theoretical investigation of walkability and observation to assess walkability. The next step includes interpretation and recommendations to fill the gap between theory and field assessment.

To contribute to the existing body of knowledge on sustainable urban development, this paper has three main overarching objectives. The first objective is to assess the applicability of walkability strategies implemented as part of the Humanizing the Neighborhoods Initiative, then to identify the key barriers and challenges to creating walkable communities in Riyadh, and finally, to provide recommendations that inform policymakers and urban planners on how to promote and implement walkable community initiatives in Riyadh.

2. The Current Urban Landscape in Riyadh

The capital city of Saudi Arabia has significantly evolved throughout its history. Initially a pedestrian-oriented compact settlement surrounded by mud walls, the city underwent a significant expansion after the 1950s, characterized by the adoption of orthogonal grid planning that is car-oriented. In addition to the automobile and new infrastructure technologies of electricity and water sewage, the introduction of new building typologies and the expansive nature of the grid planning patterns allowed for the city to expand sporadically [12]. Currently, the city is witnessing rapid urbanization and population growth. As the city expands, it faces a range of environmental, social, and economic challenges, including traffic congestion, air pollution, and sedentary lifestyles. Riyadh's existing urban fabric is car-oriented, characterized by sprawling monofunctional developments, wide roads, and limited pedestrian infrastructure [13]. This poses major challenges to sustaining the city and imposes an urgent need to reimagine Riyadh's urban landscape and promote walkable communities as part of a sustainable urban development approach.

A review of the current urban landscape in Riyadh highlights a range of salient characteristics. The first characteristic is land use patterns and zoning. Riyadh demonstrates a mixture of land uses, including residential, commercial, industrial, and governmental areas. The city has designated specific zones for different activities, aiming to create functional neighborhoods [14]. However, there are concerns about the lack of mixed-use developments and a fragmented urban fabric, leading to a dependence on cars for daily needs [15,16]. Additionally, the city is characterized by the dominance of low-density residential areas interspersed with commercial and industrial zones. According to Aina et al. [15], these low-density residential developments often lead to sprawling urban growth, promoting car dependency and impeding walkability [16].

The second characteristic of the city is urban growth and expansion. The urban growth of Riyadh has been remarkable, driven by population growth, economic development, and urban migration [17]. The city has witnessed significant expansions in its boundaries, with new residential, commercial, and industrial areas emerging on the outskirts [17]. This expansion has led to a sprawling urban form characterized by low-density development and a reliance on private vehicles [17].

The third characteristic is urban form and layout. Riyadh is characterized by a sprawling urban pattern with low-density residential areas, commercial districts, and industrial zones. The city is divided into various districts, with separate zones for business, residential, and recreational purposes. This fragmented and automobile-oriented urban layout presents challenges for creating walkable communities [16,18].

The fourth characteristic is transportation infrastructure. Riyadh is continuously developing and expanding its transportation infrastructure to accommodate its growing population. The city is renowned for its extensive road network, which includes major highways, arterial roads, and ring roads. However, the public transportation system is still lagging. According to Al Zohbi [19], one of the primary drawbacks of the urban transportation system in Riyadh is the limited availability of public transportation options. The existing public transportation system, primarily consisting of buses, is inadequate in meeting the needs of the growing population and covering the extensive geographic area of Riyadh [19]. Riyadh Metro is a significant public transportation project currently under de-

velopment to enhance connectivity and mitigate traffic congestion [20,21]. Nonetheless, the integration of the public transportation system, including buses and the forthcoming metro network, is not fully realized yet, which hampers seamless connectivity and accessibility within the city [16].

The fifth characteristic of the urban landscape is public spaces. The availability and quality of public spaces play a crucial role in promoting walkability and social interaction in urban areas. However, Riyadh faces challenges in terms of providing accessible and well-designed public spaces. Many existing public spaces suffer from poor maintenance and limited amenities, leading to underutilization and a lack of vibrant public life [22].

Finally, the last characteristic of the urban landscape is green spaces. The presence of green spaces is essential for enhancing livability and promoting health and well-being in urban areas. However, Riyadh has limited green spaces per capita compared to international standards [23]. This scarcity of green spaces hinders opportunities for recreational activities and outdoor exercise, affecting the walkability and quality of life in the city.

2.1. Challenges of Creating Walkable Communities in Riyadh

Based on the previous review, challenges to creating walkable communities in Riyadh can be identified. The first challenge is climate and weather. The extreme climate and weather conditions in Riyadh, characterized by hot summers and mild winters, present challenges for creating walkable communities. The scorching temperatures and elevated levels of solar radiation make it uncomfortable for pedestrians to walk long distances. Additionally, the lack of shade and excessive heat can have negative impacts on public health and well-being. The lack of shaded walkways, seating areas, and accessible water fountains further dissuades pedestrians from walking [15,24–26]. During the months of summer, the outdoor spaces experience extremely hot temperatures, reaching up to 50 degrees Celsius. These conditions discourage walking and limit the usability of outdoor spaces for pedestrians. Moreover, the significant urban heat island effect in Riyadh emphasizes the need for proper thermal planning and urban design considerations to mitigate the adverse effects of the climate on pedestrians [25]. The challenging climate conditions necessitate the implementation of innovative strategies to create walkable communities in Riyadh, including the provision of shaded walkways, green spaces, and the utilization of energy-efficient urban design techniques.

The second challenge to creating walkable communities in Riyadh is cultural and societal factors. Riyadh, being part of Saudi Arabia, has a unique cultural and societal context that can influence the development of walkable communities. Gender segregation, conservative cultural norms, and traditional transportation preferences are some of the challenges faced in creating walkable communities. In Saudi Arabia, gender segregation is a social norm that affects public spaces. This can impact the design and accessibility of walkable areas, as separate spaces may be required for men and women. For example, segregated sidewalks and public spaces may be necessary to accommodate cultural practices and norms of gender separation [27]. Additionally, conservative cultural norms may influence the acceptance and usage of walkable infrastructure. Traditional preferences for private vehicles and reliance on personal cars as symbols of status can undermine the adoption of more walkable modes of transportation [28]. Car ownership is deeply embedded in the culture of Riyadh. Driving is perceived as a symbol of status, convenience, and modernity. This mindset presents challenges in shifting toward a more walkable and sustainable transportation culture [29,30]. Furthermore, cultural perceptions of walking as a lower-status mode of transport may also pose a challenge. In some cultures, walking is associated with poverty or lack of access to private transportation. These attitudes need to be addressed to promote walking as a viable and desirable mode of transport [31]. To address these cultural and societal challenges, a combination of public education, community engagement, and inclusive urban planning strategies is crucial. By involving local communities, engaging with cultural and religious leaders, and promoting the benefits of walkability, it is possible to overcome these challenges and create more walkable communities in Riyadh.

The third challenge to creating walkable communities in Riyadh is the infrastructure and design of the city. Riyadh has historically evolved around car-centric transportation systems, with wide roads, sprawling developments, and limited pedestrian infrastructure. This poses significant challenges in promoting walkability and creating pedestrian-friendly environments. According to Katar [30] and Parashar and Bnayan [32], the lack of pedestrian infrastructure, such as sidewalks, crosswalks, and pedestrian-friendly intersections in Riyadh, hinders the ability of residents to walk and navigate the city efficiently. This study emphasizes the need for better pedestrian infrastructure planning and design to encourage walking and enhance the walkability of Riyadh. Also, the lack of attractive destinations at a walkable distance contributes to exacerbating the challenge. Another factor is the lack of efficient public transit integration. This enhances reliance on cars and discourages walking. Moreover, the lack of integration of green infrastructure is considered one of the main challenges that hinders walkability. The intense heat and sun exposure in Riyadh can make walking uncomfortable and unsafe, particularly during the summer months. This issue is highlighted in a study by Almayouf [24], which emphasizes the importance of providing shaded pathways and green spaces in urban areas to encourage outdoor activities like walking and enhance the livability of the city. Streetscapes that prioritize greenery and shade contribute to creating inviting walking environments and livable milieus that enhance biodiversity, improve air quality, and provide natural permeable surfaces and drainage systems that reduce urban heat islands and the risk of flash floods.

The last challenge to creating walkable communities in Riyadh is design challenges. One of the main design challenges is the lack of consideration for local identity and inventive continuation with the past. The walkability strategies implemented do not conjure a specific character for the neighborhood. Nor does it create a cultural identity that stems from an innovative consideration of traditional architecture and urban settings. Another factor is the lack of active and aesthetically attractive public spaces that integrate public art, community activities, and cultural events. A core factor in the design venue is community engagement and empowerment since the preliminary stages of the design. A bottom–up design approach that critically involves the community in design and decision-making processes fosters a sense of belonging and civic pride.

2.2. Future Development Plans and Initiatives

Recognizing the need for sustainable urban development and aligning with the global shift toward sustainable neighborhoods and community living, Riyadh has implemented several strategy frameworks and plans. The Riyadh Comprehensive Development Plan 2030 aims to improve urban livability, enhance public transport, and promote walkability [33]. Additionally, the Riyadh Metro Project is an ambitious transit-oriented development initiative to improve accessibility and reduce reliance on private vehicles [20].

Humanizing Neighborhoods Initiative, another ambitious plan, was introduced by the Saudi Ministry of Housing in 2020 [11]. The initiative focuses on enhancing the quality of life in the city through creating pedestrian-oriented neighborhoods. This approach aims to foster a healthy lifestyle through design by providing spaces that encourage walking and cycling as alternative modes of mobility in a predominantly car-oriented city. Al-Falah neighborhood was selected as a pilot project to apply this initiative.

3. Methodology of Investigation

As mentioned earlier, the Al-Falah neighborhood was selected as a case study for this research because it is one of the first neighborhoods in Riyadh to implement the Humanizing Neighborhoods Initiative. This investigation adopts a qualitative critical approach consisting of the following steps (Figure 1):

(a) Theoretical investigation: Data are collected from the relevant literature on walkability in residential neighborhoods. The literature is used to identify the theoretical frameworks, conceptual models, and key constructs related to walkability. In turn, walkability themes are mapped along with their criteria. Walkability themes identify

the main conceptual constructs of walkability. Criteria, on the other hand, are the requirements for achieving a theme [34];

(b) Observation—Criteria assessment: Through field reconnaissance survey and theoretical investigation, this research identified several indicators related to each criterion. Indicators are the measures that evaluate the subject in terms of its compatibility with the criteria and themes [34]. A field reconnaissance survey is a method that offers unique insights into the lived experiences of the neighborhood's residents. It captures the wide range and design-dependent aspects of walkability that are inherently subjective. Moreover, it enables a comprehensive understanding of the physical infrastructure, social dynamics, and sensory perceptions that influence walkability, much of which is subtle yet crucial;

(c) Interpretation: The process of criteria assessment is interpreted through explaining the relationship between the indicators implemented and the consequent effects of the overall walkability experience. This culminated in identifying the gaps in the criteria implementation, which affect peoples' behavioral choices when it comes to modes of mobility;

(d) Recommendations for criteria: Finally, the investigation is concluded with recommendations related to the gaps identified in criteria implementation as a means to enhance the walking environment and the overall well-being of the neighborhood inhabitants.

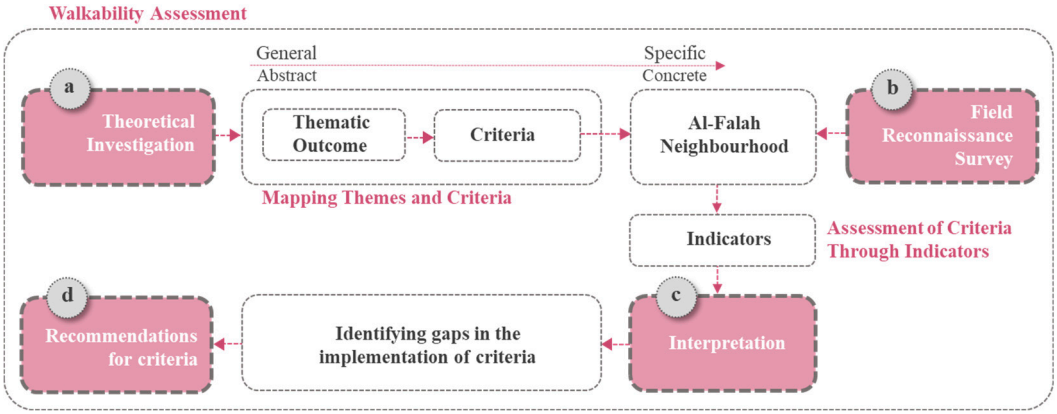


Figure 1. Methodology of investigation. Source: Authors.

3.1. Theoretical Investigation—Walkability as a Sustainable Urban Development

Walkability is a key concept in sustainable urban development, promoting health, social interaction, and environmental sustainability [35,36]. Walkable communities are characterized by a high degree of connectivity, mixed land uses, pedestrian-friendly infrastructure, and a range of amenities within walking distance [8,37,38]. Research has consistently shown that walkable neighborhoods encourage physical activity, reduce reliance on private vehicles, and improve overall quality of life [35,36,39]. Additionally, walkability is associated with numerous health benefits, such as lower risk of obesity, diabetes, and cardiovascular diseases [2,36]. Thus, promoting walkable communities aligns with the principles of sustainable urban development, fostering healthy lifestyles, minimizing carbon emissions, and enhancing social cohesion.

3.1.1. Walkability Defined

The concept of walkability covers a range of factors related to the built environment, design, and transportation infrastructure. Its objective is to encourage and support walking as a means of transportation.

Researchers and urban planners have defined walkability in different ways and have identified key elements that enhance the walkability of a neighborhood or urban area. Handy et al. [37] describe walkability as the extent to which the built environment is friendly

to walking, highlighting the role of physical characteristics in enabling or discouraging walking. The Project for Public Spaces [40] defines walkability as the degree to which the built environment is friendly to the presence of people walking, emphasizing the need to prioritize pedestrians and make walking an appealing and practical mode of transportation. Another definition by Frank et al. [41] states that walkability measures how friendly an area is for walking, considering factors like land use patterns, street design, connectivity, safety, and comfort. This definition recognizes that walkability is influenced by multiple elements and highlights the importance of considering factors beyond the built environment. Overall, these definitions emphasize the relationship between the built environment and walkability, emphasizing that numerous factors play a crucial role in creating a pedestrian-friendly atmosphere.

One of the key factors is the presence of well-connected and pedestrian-friendly infrastructure. Pedestrian-friendly infrastructure includes elements such as well-maintained sidewalks, crosswalks, pedestrian bridges, and street lighting. These features not only provide safety to pedestrians but also encourage walking as a means of transportation. Another key factor of walkability is the availability of destinations within a reasonable walking distance. These destinations can include amenities such as grocery stores, schools, parks, public transportation stops, and commercial areas. The presence of these destinations ensures that residents have a purpose to walk and encourages active, healthy lifestyles.

The concept of walkability also implies considerations for safety and comfort. Walkable communities prioritize the safety of pedestrians through measures such as traffic calming techniques, reduced vehicle speeds, and proper signage. Additionally, aspects such as attractive urban design, green spaces, and the presence of seating areas contribute to the comfort and enjoyment of walking within a community. In conclusion, walkability encompasses various elements that contribute to creating pedestrian-friendly environments. These components include pedestrian-friendly infrastructure, the presence of diverse destinations within walking distance, safety measures, and considerations for comfort and aesthetics. Understanding the definition and components of walkability is crucial for urban planners and policymakers to create sustainable and livable communities that promote walking as a viable mode of transportation.

3.1.2. Benefits of Walkability toward Sustainable Urban Development

Walkability, as a key component of sustainable urban development, plays a crucial role in promoting sustainable and livable cities. The relationship between walkability and sustainable urban development is deeply interconnected, as walkable communities can contribute to various aspects of sustainability, including social, environmental, and economic dimensions and the overall well-being of a city. The following section highlights the key benefits associated with walkable communities:

A. Health Benefits

Research has demonstrated that walkable communities play a crucial role in promoting physical activity, thus contributing to better cardiovascular health and a reduced risk of chronic diseases like obesity, diabetes, and heart disease. McCormack [1] conducted a comprehensive review of fourteen studies and concluded that living in a walkable neighborhood was associated with a lower body mass index (BMI) and a decreased likelihood of being overweight or obese. Additionally, Giles-Corti et al. [2] indicated that residents of walkable neighborhoods had significantly higher odds of meeting recommended physical activity levels.

Walkable communities play a crucial role in improving public health in many ways. Increased physical activity is one evident effect of walkability. A study conducted by Frank et al. [3] found that individuals living in walkable neighborhoods were almost twice as likely to meet the recommended level of physical activity compared to those in car-dependent neighborhoods. The presence of sidewalks, pedestrian-friendly infrastructure, and proximity to destinations contribute to increased walking and overall physical activity levels [42,43]. Another health benefit of walkability is reducing the risk of chronic diseases.

Regular physical activity, such as walking, has been associated with a reduced risk of chronic diseases. Kelly et al. [44] found that higher levels of walking were significantly associated with a lower incidence of cardiovascular diseases, obesity, hypertension, and type 2 diabetes. Walkable communities make it easier for residents to incorporate walking into their daily routines, contributing to better overall health outcomes. Lastly, walkable communities not only promote physical health but also contribute to improved mental well-being. Guite et al. [45] found that individuals living in walkable neighborhoods were less likely to experience symptoms of depression. The opportunity for social interaction, reduced traffic-related stress, and improved aesthetics in walkable areas contribute to better mental health outcomes [46,47].

In conclusion, walkable communities have significant health benefits, including increased physical activity levels, reduced risk of chronic diseases, and improved mental well-being. These findings demonstrate the importance of designing neighborhoods that encourage walking and active lifestyles;

B. Environmental Benefits

Walkable communities offer several environmental benefits that contribute to sustainability and a reduced ecological footprint. Reduced Vehicle Emissions is one of the main environmental benefits of walkable communities. Encouraging walking instead of driving leads to a decrease in vehicular emissions and air pollution [3,4]. For instance, a study in Portland, Oregon, revealed that residents of walkable neighborhoods produced 4.8% less automobile emissions compared to those in less walkable areas [48]. Du et al. [49] posit that individuals living in walkable neighborhoods generate 6 to 14% fewer CO_2 emissions from driving compared to those in car-dependent areas. Another environmental benefit of walkability is the preservation of green spaces. Walkable communities often prioritize the preservation of green spaces and encourage the development of parks and pedestrian-friendly areas [50]. This contributes to maintaining biodiversity, enhancing air quality, and reducing urban heat island effects. Cohen et al. [51] emphasize the importance of access to green spaces for physical and mental health benefits. Walkable neighborhoods also preserve natural resources by minimizing the need for excessive land consumption and supporting compact, mixed-use development patterns [52]. Reduced Energy Consumption is another key environmental benefit of walkable communities. The proximity of amenities and services in walkable neighborhoods reduces the need for long-distance travel, thereby minimizing energy consumption. Shephard [53] and Henriques-Neto [54] found that individuals living in highly walkable neighborhoods had significantly lower transportation energy consumption compared to those in low walkability areas.

These studies highlight the positive impact of walkable communities on reducing carbon emissions, preserving green spaces, and minimizing energy consumption. By fostering a walkable environment, communities can contribute to sustainable and environmentally friendly practices;

C. Economic Benefits

Walkable communities provide substantial economic benefits for both individuals and the community. On the one hand, it contributes to increasing property values. Studies have consistently shown that walkability is positively associated with property values [3,5–7]. Yameqani and Alesheikh [55] and Leinberger and Alfonzo [56] examined property values in walkable neighborhoods in the Washington, D.C. metropolitan area and found that homes in highly walkable areas had higher values compared to homes in less walkable areas. On the other hand, walkable communities witness increased retail sales as they tend to attract more foot traffic [5]. A study by Cortright [57] found that retail sales in central business districts with higher walkability had higher sales per square foot compared to areas with lower walkability. Another economic benefit of walkability is cost savings. Walkable communities can reduce transportation costs for individuals. According to Litman [58] and Burchell et al. [59], households in walkable neighborhoods have lower transportation costs, as they rely less on private vehicles and can make use of alternative modes of

transportation such as walking, biking, or public transit. McCann [60] found that households in automobile-dependent areas devote more than 20% of household expenditures to transport (over USD 8500 annually), while those in smart growth communities spend less than 17% (under USD 5500 annually). Job creation is another key economic benefit of walkability. The development of walkable communities often involves the construction and maintenance of pedestrian infrastructure, which can create job opportunities in the construction and transportation sectors. A study by Litman [61] estimated that investments in walkable infrastructure and transportation projects can create local jobs and stimulate local businesses and economic growth. Finally, walkability is associated with reduced healthcare costs: walkable communities encourage active modes of transportation and physical activity, which can contribute to improved health outcomes and a reduction in healthcare costs associated with chronic diseases. Besser and Dannenberg [9] found that communities with higher walkability tend to have lower rates of obesity and related health issues.

Overall, these economic benefits demonstrate that investing in walkable communities can yield positive returns for individuals, businesses, and the local economy;

D. Social Benefits

Walkable communities have many positive social impacts. Social cohesion and neighborhood interaction are two key benefits of walkability. Walkable communities encourage pedestrian-friendly zones where people can interact and engage with their surroundings and neighbors more easily. This leads to increased social cohesion and a stronger sense of community [8,10,62]. Leyden [63] found that walkable neighborhoods were associated with higher levels of social interaction and a greater sense of community among residents. Another key social benefit is improving the mental health and well-being of residents. Living in a walkable community can have positive effects on mental health and overall well-being. It promotes improved public health outcomes, including reduced rates of obesity, cardiovascular diseases, and mental health issues [41]. Saelens et al. [10] found that individuals living in walkable neighborhoods reported lower levels of stress and depression compared to those in less walkable areas. The presence of walkable streets, sidewalks, and public spaces in communities has been shown to encourage outdoor activities, increase opportunities for social interactions, and cultivate a stronger sense of community. These benefits manifest in improved mental well-being and social support systems, as well as enhanced social cohesion, stronger neighborhood ties, and increased personal safety perceptions [63–66]. Accessibility and inclusivity are other core benefits of walkability. Walkable communities prioritize accessibility, allowing people of all ages and abilities to move around easily. This promotes inclusivity by reducing reliance on private vehicles and providing equal access to essential amenities and services. Wasfi et al. [67] found that walkability positively influenced social equity and reduced transportation-related barriers for marginalized groups. In another vein, walkability significantly contributes to safety and crime reduction. Walkable communities with well-designed and well-maintained sidewalks, street lighting, and active streetscapes can enhance feelings of safety and reduce crime rates [68,69]. Wang et al. [70] revealed that neighborhoods with increased levels of walkability had lower rates of certain types of crime. Finally, through enhancing economic vitality and supporting local businesses, walkability promotes social solidarity and cohesion. Walkable communities often support local businesses and create vibrant commercial areas. A study by Cervero and Duncan [71] demonstrated that walkability was positively associated with higher retail sales, as pedestrian-friendly environments attract more foot traffic and create opportunities for local businesses to thrive. In turn, this enhances the sense of community and belonging.

4. Thematic Outcome of the Theoretical Investigation—Criteria Definition

The spatial components of walkability associated with the built environment may vary slightly across different studies. However, most definitions can be grouped under three main overarching key themes: quality of the journey; urban form; and pedestrian

infrastructure (Figure 2). Each of these themes entails spatial considerations and specific indicators of implementation that better define its characteristics.

Figure 2. Themes of walkability. Source: Authors.

4.1. Quality of the Journey

Several criteria mark the implementation of the "quality of the journey" theme. The first criterion is safety and security. Safety refers to pedestrians' real and perceived threats. Indicators related to this criterion include tripping, the intersection of pedestrian–vehicle routes, street speed, and lighting and visibility. Security, on the other hand, is improved through population density, window placement and transparency, and street connectivity [72]. The larger the population of a neighborhood, the more secure it is. As for window placement, the more windows overlooking the roads, the more surveillance is guaranteed. This, in turn, enhances a sense of security and reduces crime rates. The second criterion of "quality of the journey" is comfort. This criterion is enhanced through the provision of indicators like street furniture to rest, wind and shading devices to protect pedestrians from the elements, and public restrooms. These are especially important to seniors, children, and people with special needs [72]. Finally, the third criterion of "quality of the journey" is aesthetics and pleasantness. This criterion focuses on the visual appeal and quality of the built environment. Walkability is enhanced when neighborhoods feature indicators, including attractive streetscapes, landscaping, lighting, and amenities like benches and public art, which contribute to a comfortable and enjoyable walking experience [73]. It also contributes to place identity and memorability of the experience.

4.2. Urban Form

The theme "Urban Form" has five criteria that measure its implementation. The first criterion is the scale and block size. The concentration of different land uses within about 400 m with a block size of 350 to 500 m in circumference enhances walkability as a viable and easier mode of mobility [72]. The second criterion is street connectivity. The layout and design of the street network can significantly affect walkability. A well-connected street grid with shorter blocks and a higher number of intersections promotes easy and direct pedestrian movement [73]. Land Use Mix is the third criterion of the "Urban Form" theme. It plays a crucial role in enhancing walkability within a neighborhood. The availability of a diverse mix of land uses, including residential, commercial, recreational, and institutional areas, provides residents with a wider range of destinations that can be reached on foot. This reduces the need for car travel and promotes a more sustainable and active lifestyle. The integration of different land uses within a compact area also helps create a vibrant and dynamic community by encouraging interaction and accessibility to services and amenities [37,41,74]. The fourth criterion of "Urban Form" is density. This criterion refers to the compactness of the neighborhood, including its residential, commercial, and mixed-use developments. Higher levels of density are associated with shorter walking distances and increased access to amenities [73]. Lastly, the fifth criterion is the provision of a comprehensive and efficient transit service. Proximity to public transport routes with well-placed and attractive stops and shelters provides an alternative to private vehicles [72].

4.3. Pedestrian Infrastructure

Three criteria monitor the implementation of the third "Pedestrian Infrastructure" walkability theme. The first criterion is the provision of adequate and well-maintained pedestrian infrastructure. This includes well-maintained sidewalks with a minimum width of 1.5 m, crosswalks, and traffic calming measures (i.e., signage, road bumps, etc.). These are essential for creating a safe and inviting walking environment [73]. The second criterion of the "Pedestrian Infrastructure" is inclusive accessibility. Indicators related to this criterion include vigilant consideration for seniors, people with special needs, and other vulnerable groups through the provision of curb ramps, level sidewalks, restrooms, and direct accessibility to buildings [72]. Finally, a third criterion of this theme is the provision of street amenities, including benches, outdoor cafés, signs, lighting, off-street parking, and minimal parkade entrances on main streets [72].

Careful consideration of the three walkability themes' criteria contributes to mitigating the challenges of creating walkable communities in Riyadh. For example, the first challenge of "climate and weather" can be effectively tackled by enhancing design strategies associated with the criteria "comfort" and "aesthetics and pleasantness" of the "quality of the journey" theme. This challenge can also be mitigated through the criterion "adequate and well-maintained pedestrian infrastructure" of the "Pedestrian Infrastructure" theme. By providing sufficient street furniture, natural and human-made wind and shading devices, and public restrooms can significantly promote walkability as a viable and attractive mode of mobility. For the challenge of "cultural and societal factors", consideration of the "safety and security" and "aesthetics and pleasantness" criteria of the "quality of the journey" theme and thoughtful consideration of the "density" criterion of the "urban form" theme and the "adequate and well-maintained pedestrian infrastructure" and "inclusive accessibility" criteria of the "pedestrian infrastructure" theme significantly contribute to enhancing walkability in Riyadh. As for the "infrastructure and design of the city" challenge, the "safety and security" and "aesthetics and pleasantness" criteria of the "quality of the journey" theme, and the "scale and block size" criteria, "street connectivity", "land use mix", "density", and "efficient transit service" criteria of the "Urban Form" theme can address this challenge. The last design challenge to creating walkable communities in Riyadh can be addressed through the considerate incorporation of the "aesthetics and pleasantness" criterion of the "quality of the journey" theme. It is through the collective critical consideration of the themes and their associated criteria that an informative mitigation of challenges to transforming Riyadh into a walkable city can be achieved. Figure 3 illustrates the relationship between the criteria of the different themes of walkability and their contribution to addressing challenges to creating walkable communities in Riyadh.

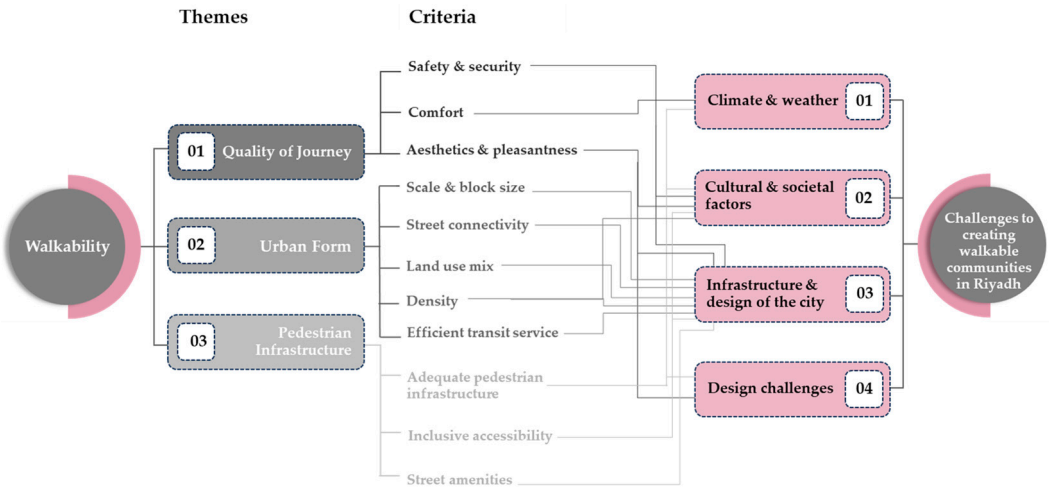
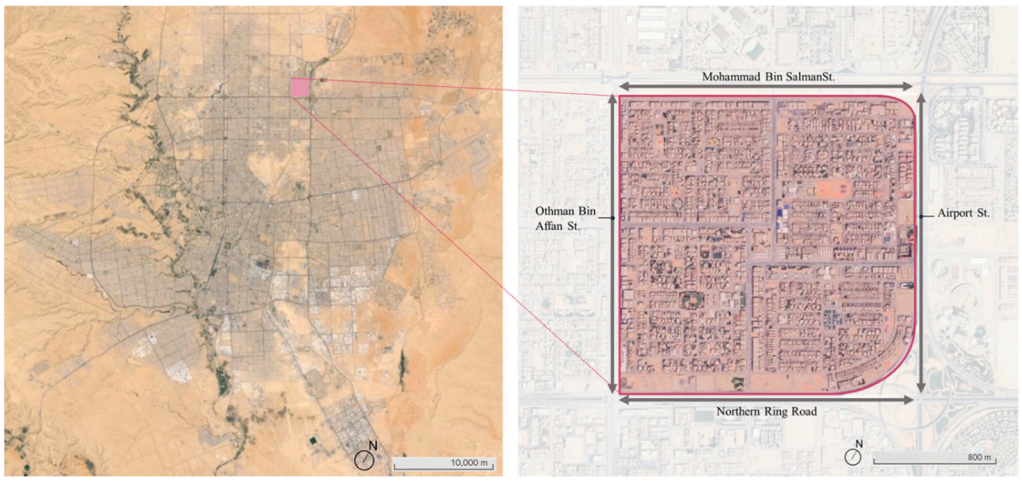


Figure 3. The relationship between criteria of the themes of walkability and their contribution to mitigating challenges to creating walkable communities in Riyadh. Source: Authors.

To this end, this research focuses on the "quality of the journey" walkability theme for different reasons. Enhancing the quality of the walking environment motivates individuals to walk more frequently. This contributes to improving physical and mental health and overall well-being. Improving pedestrian journey experience can reduce reliance on private vehicles. This, in turn, mitigates air pollution and carbon emissions and, on the other hand, reduces traffic congestion. Efficiently designed pedestrian environments enhance a sense of community through encouraging social interaction. Moreover, well-designed pedestrian spaces increase the likelihood of social encounters and community engagement. Enhancing pedestrian experience improves the livability of urban spaces, attracting more foot traffic and nurturing local businesses and the vibrancy of the neighborhood. Focusing on the quality of the pedestrian experience ensures easy accessibility to all public spaces by contributing to the inclusivity of the urban space. An environmentally and culturally significant pedestrian experience enriches cultural sensibility and promotes a deeper connection with the local context.

5. Al-Falah Neighborhood: Demonstrating the Assessment of Sustainable Community

Al-Falah neighborhood is one of the residential neighborhoods of Riyadh, which is located in the northern part of the city. The neighborhood is designed according to the Doxiadis orthogonal grid planning scheme with an area of approximately 2 × 2 km^2 [11]. This planning scheme was introduced to Riyadh during the second half of the twentieth century. Al-Hathloul [12] explains that the planner believed that a 2 × 2 km^2 was the optimum area for a neighborhood and designed his grid scheme accordingly. The neighborhood is bordered by main city arteries: Mohammad Bin Salman Road with Riyadh Sports Boulevard to the north, Airport Road to the east, Northern Ring Road to the south, and Othman Bin Affan Road to the west (see Figure 4).



(**a**) (**b**)

Figure 4. (**a**) Al-Falah neighborhood location in the City of Riyadh; (**b**) Al-Falah neighborhood's urban features. Source: Authors' modification from Google Earth.

Four main streets (Al-Barakah, Al-Mizan, Al-Mouzannab, and Shaikh Abdullah Al-Makhdub) divide the neighborhood into four quarters with the district congregation mosque, Dar Al-Oloom Mosque, located in the core at the intersection of the four streets (Figure 5). Walkability strategies have been applied in quarters 1 and 2 of the neighborhood, while quarters 3 and 4 are still in the process of applying these strategies. Therefore, this research will focus on quarters 1 and 2 to critically analyze the effectiveness of applying the Humanizing Neighborhoods Initiative.

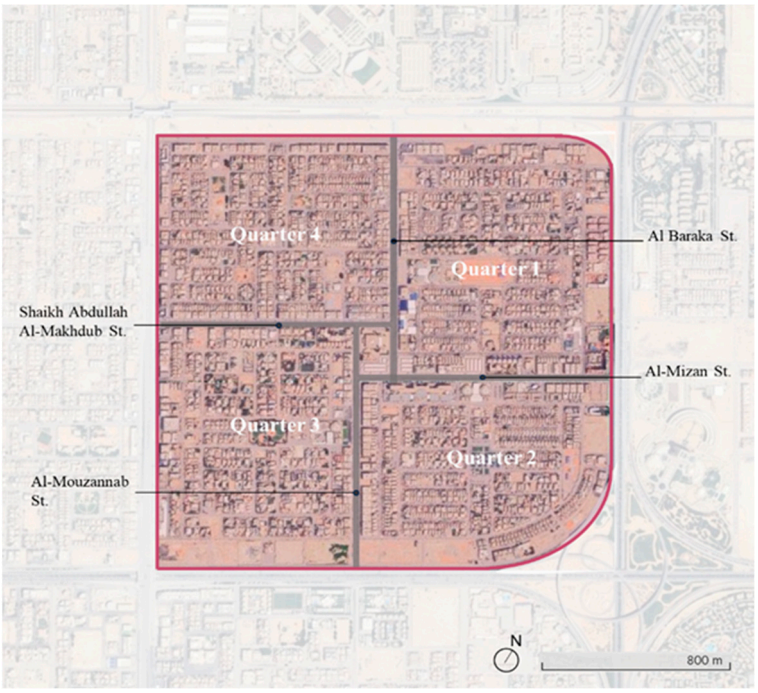


Figure 5. Quarters and main streets of Al-Falah neighborhood. Source: Authors' modification from Google Earth.

5.1. Implementing the Criteria and Indicators of the Quality of the Journey

Based on reconnaissance field observation and investigation with the literature-based sources on these observations, the implementation of indicators related to the criteria of the "quality of the journey" theme has been monitored. Concerning safety and security, as has been mentioned before, safety refers to pedestrians' real and perceived threats. Indicators associated with this criterion include avoiding the hazard of tripping, minimizing the intersection of pedestrian–vehicle routes, the provision of measures to mitigate vehicles' speed, and sufficient lighting and visibility of the streets. Indicators related to security, on the other hand, include population density, window placement, and transparency that allows for the efficient surveillance of the streets throughout the different times of the day and street connectivity, facilitating easier accessibility and wayfinding [72].

Indicators related to comfort, on the other hand, include the provision of sufficient and attractive street furniture to rest and socialize, wind and shading devices as means to protect from the elements, and the provision of public restrooms in multiple locations of the neighborhood. These are especially important to seniors, children, and people with special needs [72].

Finally, the criterion of aesthetics and pleasantness focuses on the visual appeal and quality of the built environment. Walkability is enhanced when neighborhoods feature attractive streetscapes, landscaping, lighting, and amenities like benches and public art, which contribute to a comfortable and enjoyable walking experience [73]. It also contributes to place identity and memorability of the experience. This enhances the sense of ownership, belonging, and place attachment among the inhabitants.

Collectively, these criteria contribute to the overall walkability of a neighborhood or urban area, and their presence or absence can significantly influence walking behaviors and patterns. Understanding these criteria is essential for designing and planning walkable communities that promote active and healthy lifestyles. Table 1 summarizes the criteria and indicators of the "quality of the journey" theme.

Table 1. Criteria and Indicators of Quality of the Journey Walkability Theme *.

Theme of Walkability	Criteria	Indicators
1. Quality of the Journey	a. Safety and security	Vehicle speed, tripping, intersection of vehicular and pedestrian routes, lighting and visibility, population density, window placement and transparency, and street connectivity
	b. Comfort	Street furniture, shading devices, public restrooms
	c. Aesthetics and pleasantness	Attractive streetscapes, landscaping, street furniture, public art

* Source: Authors.

5.2. Exploring the Indicators of the "Quality of the Journey" Walkability Theme—Visual and Field Analysis—The Applicability of the Walkability Theme in Quarters 1 & 2 of Al-Falah Neighborhood

The reconnaissance field observation was systematically conducted, going through every street of quarters 1 and 2 of the Al-Falah neighborhood. Given the similarity, representative shots were included. The outcomes of the field observation comprehensively describing the spatial and urban features of quarters 1 and 2 of the Al-Falah neighborhood in terms of implementing the "quality of the journey" walkability theme are presented as follows:

A. Observed Criterion 1: Safety and security at Al-Falah Neighborhood

a.1. Observed Indicator 1: Vehicle speed.

The observation showed that signage for speed limits is installed in every street (Figure 6a). This ensures the efficient mitigation of vehicle speed throughout the neighborhood. The observation also showed that pavement was used in secondary roads, indicating shared access and slowing the vehicles down (Figure 6a). Moreover, signs of pedestrian crosswalks and the extensive use of raised crossings ensure the pedestrian right of way as a measure of safe crossing of the roads and calming traffic down (Figure 6b,c).

(**a**) (**b**) (**c**)

Figure 6. Measures to mitigate vehicle speed: (**a**) Signage of speed limits and paved roads; (**b**) Pedestrian crossing; (**c**) Raised pedestrian crosswalks in Al-Falah neighborhood. Source: Authors.

a.2. Observed Indicator 2: Tripping.

The survey of the neighborhood revealed that sidewalks were efficiently paved and leveled (Figure 7a). This ensures a safe walking experience for all pedestrians. Also, efficient finishing of sidewalks guarantees inclusivity, especially for seniors and pedestrians with special needs. The survey also revealed the use of curb ramps as a design measure to ensure safe walking for all and access for wheelchairs, the elderly, strollers, etc. (Figure 7b). Finally, the observation showed the use of raised crossing throughout quarters 1 and 2 of the neighborhood. However, the raised crossings are not smoothly connected to the sidewalks, having a small gap between the two (Figure 7c). This poses a risk of tripping for the vulnerable population (i.e., seniors, people in wheelchairs, pedestrians with luggage or baby strollers, etc.).

Figure 7. (**a**) Paved sidewalks; (**b**) Curb ramps that facilitate and encourage walking; (**c**) Gaps between the raised crossings and the sidewalk. Source: Authors.

a.3. Observed Indicator 3: Intersection of vehicular and pedestrian routes.

To distinguish pedestrian crossings, clear pedestrian crossings are utilized across the two-quarters of the neighborhood with raised crossings and extensive use of a signage system (Figure 8a). However, due to insufficient parking spaces off the streets, residents park their cars on the sidewalks (Figure 8b,c). This poses a risk for people walking on the sidewalks, especially during the afternoon and early morning. The survey also revealed that entrances of underground car parking of apartment buildings intersect with the pedestrian paths on the sidewalks (Figure 8d). Also, entrances of single-family houses' garages intersect with pedestrian paths on the sidewalks, and most of the time, cars block the sidewalks (Figure 8e,f). Such design of the buildings' entrances hinders the continuity of the pedestrian circulation and poses significant risks to pedestrians, especially seniors, people with special needs, and children.

Figure 8. (**a**) Clearly identified and extensive pedestrian crossings; (**b**,**c**) Cars using the sidewalks for parking; (**d**) Intersecting routes of vehicles and pedestrians interrupting the pedestrian movement; (**e**,**f**) Private houses use the sidewalks for parking. Source: Authors.

a.4. Observed Indicator 4: Lighting and visibility.

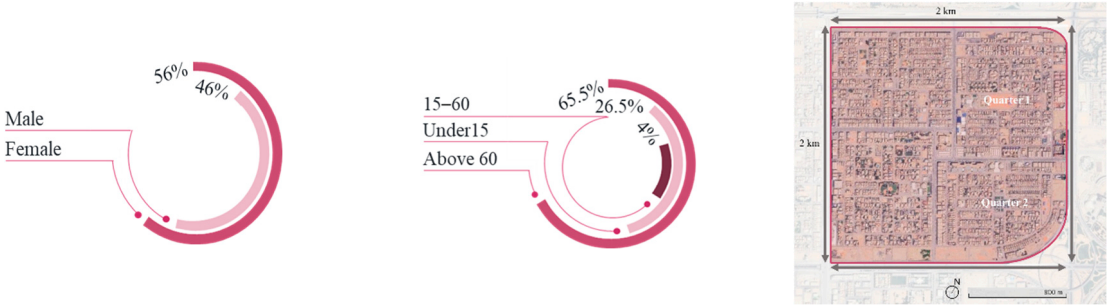
All main and secondary streets are very well-lit. This facilitates visibility during the night (Figure 9a–c). Overall, ensuring good visibility encourages walkability at all times of the day, especially in such a climatic zone where temperatures drop during the night and, as a result, most of the population opts for walking after sunset.

(**a**) (**b**) (**c**)

Figure 9. Lighting of (**a**) main street, (**b**) neighborhood core, and (**c**) a secondary street. Source: Authors.

a.5. Observed Indicator 5: Population density.

The estimated population of the neighborhood is 38,308P, comprising 0.81% of the Capital's population. The demographic structure of the neighborhood consists of 56% male and 46% female (Figure 10a), with 65.5% being between 15 and 60 years of age (Figure 10b), 26.5% under 15, and 4% above 60 [11]. This population is distributed over an area of 4 km^2 (Figure 10c). This is to say that the neighborhood is not compact in nature. This distribution of population density over such an area minimizes street surveillance and, as a result, reduces the sense of security, dissuading people from walking, especially after dark.



(**a**) (**b**) (**c**)

Figure 10. Demographic and urban features of Al-Falah neighborhood: (**a**) gender; (**b**) age; (**c**) neighborhood dimensions. Source for (**a**,**b**): Authors, for (**c**): Authors' modification from Google Earth.

a.6. Observed Indicator 6: Window placement and transparency.

Reflecting local cultural traditions that cherish the value of privacy, single-family houses in the quarters have high external walls as a privacy mechanism. Also, most of the houses use trees (Figure 11a,c), raise party walls by using metal screens (Figure 11b), and add aluminum shutters on windows as a privacy mechanism as well. The ratio of solid is relatively larger than the ratio of void in the elevations (Figure 11d). This is attributed to climatic as well as to privacy reasons. Windows are generally small, with a few windows overlooking the street. But even when windows are large, other privacy mechanisms are usually used to block visual flow (i.e., the use of tinted or frosted glass and the use of curtains and shutters). These mechanisms allow for little surveillance of the streets and, hence, reduced sense of security and safety. However, most houses use CCTV security cameras that monitor the premises (Figure 11e). Apartment buildings are located on the four main streets that divide the neighborhood. These buildings have openings overlooking the streets. However, most of these openings are small, with either aluminum shutters or curtains closed most of the day as a privacy mechanism (Figure 11f). This allows for some surveillance of the streets.

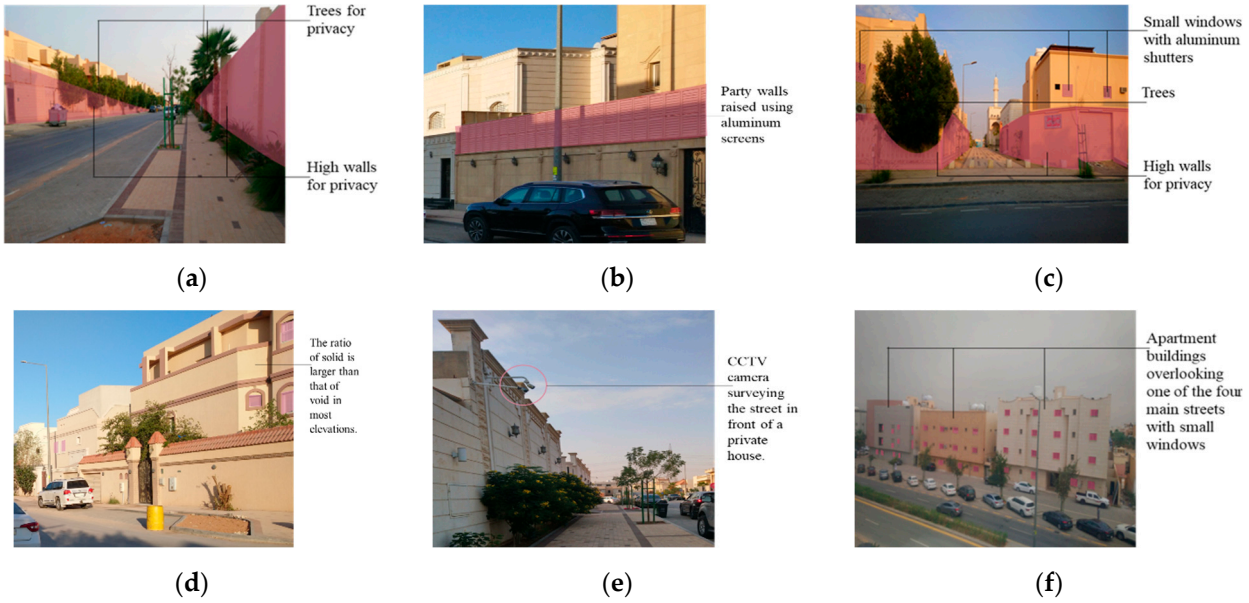


Figure 11. Window placements and transparency scenarios to reduce visual flow between inside and outside in private houses and apartment buildings: (**a**,**c**) using high walls and landscaping; (**b**) raising party walls; (**c**) covering windows with aluminum shutters; (**d**,**f**) reducing the ratio of void compared to the solid; (**e**) CCTV cameras to monitor the street. Source: Authors.

a.7. Observed Indicator 7: Street connectivity.

The neighborhood follows the orthogonal grid system (Figure 12a). This system of planning allows for a high level of connectivity and accessibility between different zones of the neighborhood (Figure 12b,c). Such facilitation of accessibility encourages walkability. As for connectivity with adjacent neighborhoods, the periphery of the neighborhood is defined by four highways creating strong edges separating the neighborhoods with no pedestrian bridges (Figure 12a). As a result, it is challenging to walk beyond the peripheries of the neighborhood to destinations in adjacent neighborhoods.

Figure 12. (**a**) Orthogonal grid system of Al-Falah neighborhood and highways at its edges; (**b**,**c**) High connectivity within the neighborhood. Source: Authors.

B. Observed Criterion 2: Comfort at Al-Falah Neighborhood

b.1. Observed Indicator 1: Street furniture.

The survey showed that there are no setting areas along all four main streets of the neighborhood. However, concrete benches are installed in the central core around the mosque (Figure 13a,b), which is a designated walking area. Moreover, electric bikes and scooters are provided in this core area to encourage people to use them for mobility within the neighborhood vicinity as a substitute for cars (Figure 13c).

Figure 13. Street furniture in Al-Falah neighborhood: (**a**) Concrete benches in the neighborhood core; (**b**) No setting areas on streets; (**c**) Electric bikes and scooters at the neighborhood core. Source: Authors.

b.2. Observed Indicator 2: Shading devices.

All streets in quarters 1 and 2 do not have any wind or shading devices. However, along main streets and in public spaces, trees, and shrubs are planted to provide shade, enhance air quality, reduce traffic noise, regulate urban heat, physically separate pedestrians from traffic, and for psychological and aesthetic purposes (Figure 14a,b). As for private houses, trees are planted on the sidewalks as a privacy mechanism to enhance air quality and for aesthetic purposes (Figure 14c). The trees planted on the main streets are still young, and as a result, their advantages have not been reaped yet. The lack of shading devices limits walkability, especially during daytime, given the hot weather.

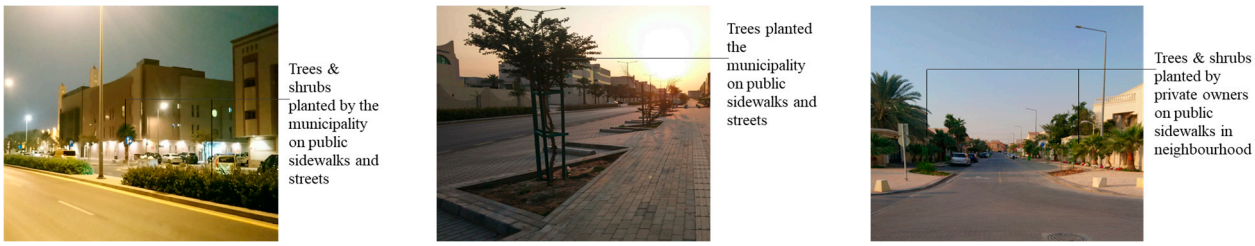


Figure 14. (**a**,**b**) The use of trees in main streets of Al-Falah neighborhood; (**c**) Soft landscaping planted by private house owners on secondary streets. Source: Authors.

b.3. Observed Indicator 3: Public restrooms.

No provision of public restrooms in any location of the neighborhood. This is mainly a challenge for seniors, children, and people with special needs. Hence, the lack of these public services is more likely to discourage these segments of the population from walking and resorting to using vehicles for trips within the neighborhoods.

C. Observed Criterion 3: Aesthetics and Pleasantness at Al-Falah Neighborhood

c.1. Observed Indicator 1: Attractive streetscapes.

The neighborhood exhibits human-scale environments that offer a sense of psychological comfort (Figure 15a–d). All streets are clean and well-maintained (Figure 15b), with easy wayfinding and efficient use of signs (Figure 15c). However, the neighborhood does not have a distinct identity as all walkability measures are generic and in the process of being applied in other neighborhoods in Riyadh (Figure 15d). Moreover, streetscapes are unattractive, and most street facades and storefronts are inactive, offering no vibrant connection between private and public realms (Figure 15f).

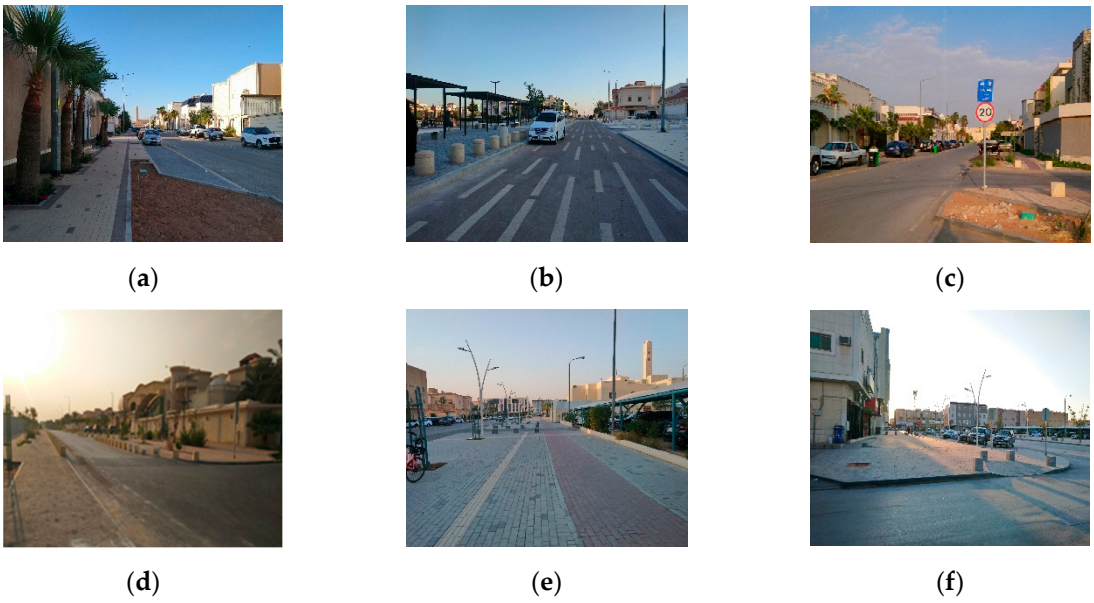


Figure 15. (**a**) Human scale environment; (**b**) Well-maintained streets; (**c**) Efficient use of signs; (**d**,**e**) No distinct identity of the neighborhood; (**f**) Unattractive streetscapes of Al-Falah neighborhood. Source: Authors.

Except for mosques, minimum attractive destinations are provided within the neighborhood (basic amenities and commercial functions are parks (Figure 16b,d,e), cafés, supermarkets (Figure 16c), laundromats, restaurants, pharmacies, butchery, bakery, bank, gas stations, bookstores, stationery, gym, alterations, barber shops, health centers. Bus stops and a metro station are located on two edges of the neighborhood (edges of quarters 3 and 4) (Figure 16a). The neighborhood does not have public schools but has two private schools (primaries for boys and girls) and some nurseries. In addition, the neighborhood has one private university. One distinct destination currently under construction is the Sports Boulevard, an entertainment spine that cuts through the Capital from east to west. It borders the neighborhood at the northern edge (Figure 16a,d). This attractive destination will be accessible by walking from quarters 1 and 4. However, it will be beyond walking distance of the other two quarters.

Figure 16. (**d**) Al-Falah neighborhood attractive destinations; (**a**) The Sports Boulevard and metro station; (**b**) Park in quarter 1; (**e**) Park in quarter 2; (**c**) Supermarkets, café, and laundry at the neighborhood core. Source: Map: Authors' modification from Google Earth; photos: Authors.

Soft landscaping is being planted on main streets and within neighborhoods around the parks by the municipality (Figure 17a) and on public sidewalks in front of private houses by owners (Figure 17b). However, the trees are still insufficient in providing shade and shelter from the elements. The neighborhood does not have any water features. Though this element is useful in this climate as it tends to enhance air quality and mitigate temperature, especially during the long months of summer, water is completely ignored as an essential feature of the humanization scheme. Hard landscaping is provided in the form of paths, electrics, driveways, drainage systems, fences, walls, steps, and ramps (Figure 17c). The efficient provision of these features allows for the distinction of different surfaces and spaces and provides an inviting environment for walking.

(**a**) (**b**) (**c**)

Figure 17. (**a**) Soft landscaping on main street; (**b**) Soft landscaping in neighborhoods; (**c**) Hard landscaping in Al-Falah neighborhood. Source: Authors.

c.2. Observed Indicator 3: Street furniture.

This indicator has been discussed in detail in indicator 1 of criterion 2, "Comfort at Al-Falah neighborhood".

c.3. Observed Indicator 4: Public art.

Al-Falah neighborhood does not have any display of public art. Public art substantially contributes to the creation of place identity and locale-specific related art displays. This fosters a sense of ownership, especially when art is produced by local community, belonging, and place attachment.

6. Results and Interpretative Discussion

This phase of this research interprets the results presented in the previous section. A comprehensive analysis of the previously described observations is presented in Figure 18. It summarizes the wide range of implementing walkability criteria related to the "quality of the journey" theme. Four scales of implementation are devised to validate the applicability of the three criteria of the theme. Strongly implemented implies a comprehensive integration and effective operationalization of the criterion. Moderately implemented, on the other hand, indicates a partial incorporation of the criterion and opportunity for improvement. Weakly implemented stipulates minimal integration and effectiveness of the criterion with significant inconsistencies and gaps in its implementation. Finally, poorly implemented suggests an inadequate integration of the criterion with significant deficiencies and substantial room for improvement.

As seen in Figure 18, the implementation of the "quality of the journey" theme criteria in quarters 1 and 2 of the Al-Falah neighborhood lacks consistency. This leads to a suboptimal pedestrian experience.

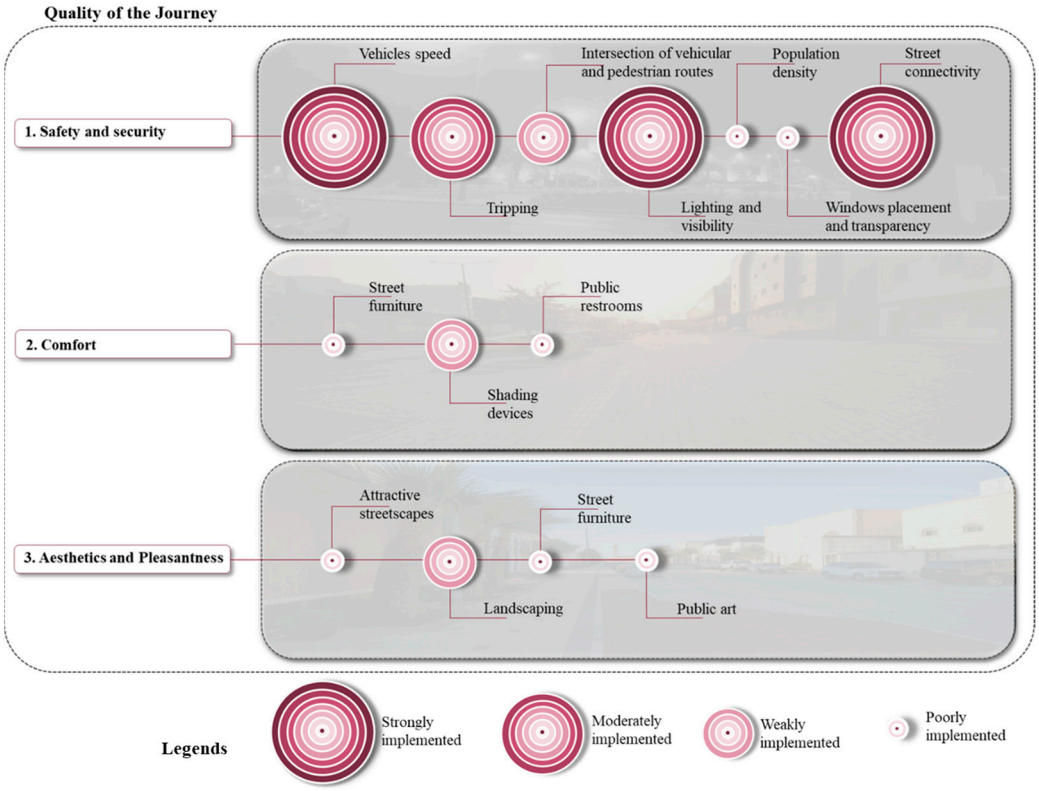


Figure 18. Implementation of the criteria of walkability "quality of the journey" theme in Quarters 1 and 2 of Al-Falah neighborhood. Source: Authors.

6.1. Criterion 1 Interpretation: Safety and Security

There are three indicators that are strongly implemented. The first one is the speed control mechanisms in which measures of calming traffic down are efficiently applied. These include signage, leveled and paved sidewalks, paved shared access roads, raised crossings, and the extensive use of curb ramps. The other indicators strongly applied are lighting and visibility, in which sufficient streetlights are used in all main and secondary streets, enhancing visibility and, hence, a sense of security. The third indicator in this category is street connectivity, which is strongly enhanced through the orthogonal planning of the neighborhood with small block sizes, encouraging walkability as a mode of mobility for short distances.

One indicator is moderately applied for this criterion. This indicator is tripping. This research observed a gap between the raised crossings and the sidewalks, which poses a risk for vulnerable populations like those in wheelchairs, the elderly, and pedestrians with luggage or strollers.

One indicator is weakly applied, and that indicator is the intersection of vehicular and pedestrian routes. The analysis of this indicator shows that despite all measures previously discussed to ensure pedestrian security and safety, there is still more to be made in this regard. Entrances of parkades and garages present a significant obstacle for pedestrians, forcing them to share the streets with cars when the sidewalks are occupied by cars. Also, due to insufficient provision of car parking off the street, drivers use the sidewalks to park their cars, posing a risk for pedestrians.

Finally, two indicators of security and safety are poorly considered: population density and window placement and transparency. As population density is a spatial phenomenon, its relationship with walkability is twofold. On the one hand, the denser a neighborhood is, the more sense of security its inhabitants will have and, hence, be encouraged to walk. On the other hand, when it comes to walkability, density is also associated with destinations. For the Al-Falah neighborhood, due to the expansive nature of the orthogonal planning, the neighborhood is not compact, stretching 2 × 2 km, with the location of most of the

available destinations being beyond a 5-minute walk. Moreover, the district is bordered by four main city arteries that resemble strong edges separating the neighborhoods with no consideration for pedestrian links. This increases reliance on cars and makes walking a non-viable option. As for window placement and transparency, this research shows that due to cultural factors associated with the conservative nature of society, consideration of privacy is of prime importance. In addition, environmental factors also play a pivotal role in the choice of building materials and ratio and design of openings. This is reflected in a relatively low ratio of openings compared to the solid construction of high walls, the use of trees, raising party walls by using metal screens, and adding aluminum shutters on windows [75]. These measures limit the visibility and surveillance of streets, compromising the sense of security, especially during the night.

6.2. Criterion 2 Interpretation: Comfort

This research shows substantial inadequacies in urban design and infrastructure. Street furniture is not critically considered both in terms of design and provision. In terms of setting areas, a limited number of concrete benches are installed at the neighborhood core around the congregation mosque. Also, in the core area, electric bikes and scooters are provided to encourage using them for mobility within the neighborhood. All main streets and roads have no wind or shading devices. This lack of shading devices makes it very challenging to do any kind of recreational or destination walking, especially during the long, hot months of summer. This makes the use of vehicles a viable choice of mobility. Concerning soft landscaping, special attention to it is considered as part of the "Greening the City" initiative. In addition, private house owners use the public sidewalk to plant trees. This imposes restrictions on pedestrian mobility in the neighborhoods, especially when the sidewalk is narrow. As for the provision of public restrooms, no consideration of this vital service is made. This is particularly challenging for the elderly, children, and people with special needs.

All these factors discourage walkability and force the population to resort to private vehicles as viable means of transport both for destinations within and outside the neighborhood. As such, special attention should be given to restudy the current humanization strategies and enhance the provision of comfort-related interventions.

6.3. Criterion 3 Interpretation: Aesthetic Appreciation

This research shows a significant discrepancy in aesthetic appreciation. This is attributed to several reasons. Firstly, despite the evident consideration for human scale in the neighborhood and the clean and well-maintained streets, which offer a sense of psychological comfort and easy wayfinding; nonetheless, the neighborhood is not inviting when it comes to visual appeal and spatial experience. For example, streetscapes and public facades are not activated, offering no incentive for pedestrians to engage with public spaces. Secondly, the neighborhood has no distinct visual and spatial character that uniquely differentiates it from other neighborhoods, with no consideration for public art. Thirdly, and most importantly, there is no continuity of local identity of Najdi architecture and urban planning and design schemes that are deeply rooted in history and rich with typological and spatial scenarios and styles. Hence, this lack of identity and design aesthetics limits place attachment, belonging, and the creation of a unique sense of community and social cohesion. Moreover, except for mosques, the neighborhood lacks attractive destinations within a walkable distance (400 m). The absence of main amenities like public schools and entertainment activities discourages residents from walking and forces them to travel further by vehicle. It is worth mentioning here that a main entertainment destination, the Sports Boulevard, is underway to be constructed at the northern edge of the neighborhood. Planned to enhance greenery and a healthy lifestyle, once realized, this destination will substantially enhance walkability, at least for those living within the 400 m periphery. Finally, public transport is not efficiently provided, with only two bus stops at two edges of the neighborhood and one metro station at the northern edge. This lack of sufficient

attractive destinations and public transportation forces the use of private vehicles to travel further to other parts of the city where these services are provided.

7. Conclusive Recommendations and Guidelines

This study aims to critically reflect on the implementation of walkability themes in the City of Riyadh. It analyzed the implementation of the "quality of the journey" walkability theme in Al-Falah neighborhood. The results show the different ranges in implementing the three criteria of this theme, identifying areas of improvement that future revision can capitalize on and efficiently realize.

In conclusion, promoting walkable communities in Riyadh is an essential step toward building a sustainable and livable city. Despite all efforts to improve walkability, Riyadh still faces some challenges in creating a truly pedestrian-friendly city. By prioritizing pedestrians, enhancing infrastructure, and adopting smart urban planning strategies, Riyadh can achieve multiple benefits, including improved public health, enhanced social cohesion, reduced traffic congestion, and a more sustainable urban environment.

Future research on walkability could explore several trajectories that will further deepen our understanding of the intricate factors affecting walkability in Riyadh. Suggested research may include the following:

(a) Analyzing case studies that resemble emblems of walkability strategies. These will serve as benchmarks through which a walkability model for local context could be constructed;
(b) Understanding cultural factors that influence walkability. This research can explore how cultural norms and historical legacies shape the design and perception of pedestrian infrastructure in successful case study communities. These will inspire local innovative solutions in the local context of Riyadh and other Gulf cities.

7.1. Recommendations for Future Action for Promoting Walkable Communities in Riyadh

The results of this research can potentially serve as a diagnostic tool that informs planners and decision-makers. It also highlights the importance of empowering and involving local communities at all design stages. Collaboration among policymakers, urban planners, and community stakeholders is crucial in transforming Riyadh into a model city that prioritizes the well-being and needs of pedestrians. By doing this, Riyadh can truly become a precedent for other Gulf cities and cities around the world.

Walkability is a collective endeavor that needs the collaboration of all stakeholders toward achieving vibrant, walkable communities that promote a healthy lifestyle and quality of life. To achieve all this, community engagement in decision-making is crucial. A bottom–up design approach that involves the local community caters to their needs and aspirations and ensures their input from the very beginning and throughout the design process, which is key to the success of any walkability initiative. This approach fosters the provision of creative design strategies tailored to the specificities of each neighborhood, enhancing its distinct identity and, in turn, a sense of ownership, pride, and belonging.

Suggested criteria-specific recommendations to transform the Al-Falah neighborhood and, in turn, Riyadh into a more walkable urban setting include the following:

(a) Safety and security:
    - Reducing the risk of tripping on the raised crosswalks by minimizing the gaps between the sidewalks and the crosswalks;
    - The provision of sufficient parking spaces will reduce the instances of parking cars on the sidewalks. Another measure that could be implemented in this regard is limiting private car ownership to one or two per household;
    - Considering densification as a main urban strategy in which compact mixed-use neighborhoods and developments are realized. The developments that combine residential, commercial, and recreational spaces within walkable distances can contribute to a vibrant and active community. Consequently, this will mitigate

the need to travel by car and enhance a sense of community, belonging, and place attachment;
- Integrating public transportation systems, such as an efficient network of buses or a light-rail system, can also facilitate access to different parts of the city and reduce car dependency;
- Increasing connectivity with adjacent neighborhoods by providing safe crossings for pedestrians (i.e., bridges or underground tunnels);
- Considering neighborhood design that is inspired by traditional local neighborhoods in which safety measures are ingeniously achieved through hierarchical design strategies that filtrate pedestrian movement from the public to the private. Also, seeking inspiration from traditional local architecture, reinterpreting design strategies that enhance privacy but at the same time allow for the surveillance of adjacent paths;

(b) Comfort:
- The provision of street furniture that enhances the pedestrian experience (i.e., setting areas and benches along the main and secondary streets, more electric bikes and scooters in different locations in the neighborhood);
- The provision of wind and shading devices along the main and secondary streets;
- Enhancing the plantation of trees for shading along the main and secondary streets;
- The provision of public restrooms in multiple locations along the main and secondary streets;

(c) Aesthetic appreciation:
- Activating public facades will significantly enhance engaging the inhabitants with the public spaces and other inhabitants. This could be achieved through the provision of attractive translucent shopfronts and extending the public spaces to the sidewalks;
- Creating a distinct neighborhood identity inspired by the critical interpretation of traditional local neighborhoods and architecture. This critical design approach incorporates and ensures the continuity of the local identity of Najd, which is deeply rooted in history and rich in typological and spatial solutions. It critically analyzes and understands Najdi architecture and community planning as rich sources of inspiration for contemporary solutions and design propositions. The goal is not to emulate but to ingeniously translate these sources in a critical, innovative, and contemporary manner. This critical continuity with the past is crucial for place attachment and sense of belonging, community building, and social cohesion.

7.2. Potential Strategies Guides for Promoting Walkable Communities in Riyadh

This research suggests several potential strategies that can transform Riyadh into a pedestrian-centered city. Enhancing pedestrian infrastructure is key to any city that strives to be walkable. This entails constructing safe and connected sidewalks to encourage walking, installing pedestrian crossings at strategic locations to facilitate safe road crossings, and establishing dedicated pedestrian-only zones in high-traffic areas to prioritize pedestrians. Another core strategy is incorporating mixed-use developments by integrating residential, commercial, and recreational spaces within walkable distances to create a vibrant community, designing mixed-use developments that encourage walking and support local businesses, and ensuring that amenities and services are easily accessible by foot to reduce the need for car travel. Integrating green infrastructure is another strategy that significantly shapes mobility behaviors and choices. This can be achieved through implementing green spaces, parks, and trees along pedestrian pathways to enhance the quality of the walking environment, incorporating sustainable landscaping practices that improve air quality and create a visually appealing urban landscape, and promoting the use of green infrastructure to combat air pollution and reduce the urban heat island effect. Decisions

taken at the level of urban planning are paramount to creating walkable communities. As such, implementing Smart Urban Planning Principles is another core strategy. This entails prioritizing human-scale design in urban planning to create walkable streets and neighborhoods, enforcing zoning regulations that encourage mixed land use and pedestrian-friendly environments, and allocating public spaces for community gatherings, outdoor activities, and social interactions to promote walkability. The last strategy is the efficient integration of public transportation systems. This is achieved through developing an efficient network of buses or a light rail system to provide alternative modes of transportation, connecting different parts of the city through public transportation to reduce car dependency and encourage walking, and implementing integrated transportation systems that complement the walkable infrastructure and promote sustainable mobility options.

By incorporating these strategies and guidelines, Riyadh can transform into a more walkable city that prioritizes pedestrians, promotes public health, and fosters a sustainable urban environment. These efforts can lead to improved social cohesion, reduced traffic congestion, and enhanced quality of life for residents.

Author Contributions: Conceptualization, M.H. and O.M.J.; methodology, M.H. and O.M.J.; data curation, M.H. and O.M.J.; writing—original draft preparation, M.H. and O.M.J.; writing—review and editing, M.H. and O.M.J.; literature review, M.H. and O.M.J.; visualization, O.M.J. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in this study are included in this article. Further inquiries can be directed to the corresponding author.

Acknowledgments: The authors would like to acknowledge the support of Prince Sultan University for paying the Article Processing Charges (APC) of this publication. The authors would like to thank Prince Sultan University for their support.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. McCormack, G.R.; Blackstaffe, A.; Nettel-Aguirre, A.; Csizmadi, I.; Sandalack, B.; Uribe, F.A.; Rayes, A.; Friedenreich, C.; Potestio, M.L. The Independent Associations between Walk Score and Neighborhood Socioeconomic Status, Waist Circumference, Waist-To-Hip Ratio and Body Mass Index Among Urban Adults. *Int. J. Environ. Res. Public Health* **2018**, *15*, 1226. [CrossRef] [PubMed]
2. Giles-Corti, B.; Broomhall, M.H.; Knuiman, M.; Collins, C.; Douglas, K.; Ng, K.; Lange, A.; Donovan, R.J. Increasing walking: How important is distance to, attractiveness, and size of public open space? *Am. J. Prev. Med.* **2005**, *28* (Suppl. 2), 169–176. [CrossRef] [PubMed]
3. Frank, L.D.; Sallis, J.F.; Conway, T.L.; Chapman, J.E.; Saelens, B.E.; Bachman, W. Many Pathways from Land Use to Health: Associations between Neighborhood Walkability and Active Transportation, Body Mass Index, and Air Quality. *J. Am. Plan. Assoc.* **2006**, *72*, 75–87. [CrossRef]
4. Litman, T. *Transportation Cost and Benefit Analysis II—Travel Impacts and Value of Time Savings*; Victoria Transport Policy Institute: Victoria, BC, Canada, 2023. Available online: www.vtpi.org (accessed on 12 January 2024).
5. Jacobs, J. *The Death and Life of Great American Cities*; Vintage Books: New York, NY, USA, 1961.
6. Ewing, R.; Schmid, T.; Killingsworth, R.; Zlot, A.; Raudenbush, S. Relationship between urban sprawl and physical activity, obesity, and morbidity. *Am. J. Health Promot.* **2003**, *18*, 47–57. [CrossRef] [PubMed]
7. Cao, X.; Mokhtarian, P.L.; Handy, S.L. Do changes in neighborhood characteristics lead to changes in travel behavior? A structural equations modeling approach. *Transportation* **2007**, *34*, 535–556. [CrossRef]
8. Carr, L.J.; Dunsiger, S.I.; Marcus, B.H. Validation of Walk Score for estimating access to walkable amenities. *Br. J. Sports Med.* **2011**, *45*, 1144–1148. [CrossRef] [PubMed] [PubMed Central]
9. Besser, L.M.; Dannenberg, A.L. Walking to public transit: Steps to help meet physical activity recommendations. *Am. J. Prev. Med.* **2005**, *29*, 273–280. [CrossRef] [PubMed]
10. Saelens, B.E.; Sallis, J.F.; Black, J.B.; Chen, D. Neighborhood-based differences in physical activity: An environment scale evaluation. *Am. J. Public Health* **2003**, *93*, 1552–1558. [CrossRef]

11. Mostafa, L. Investigating the Impact of Saudi QoL Program on Neighborhoods Public Spaces: Riyadh neighborhoods. *Environ.-Behav. Proc. J.* **2021**, *6*, 293–303. [CrossRef]
12. Al-Hathloul, S.; Riyadh Architecture in One Hundred Years. A Public Lecture Curated by Center for the Study of the Built Environment at Darat Al-Funun, Amman, Jordan in 2002. Available online: https://www.csbe.org/riyadh-architecture-in-one-hundred-years-1 (accessed on 20 March 2022).
13. Ministry of Municipal and Rural Affairs (MOMRA). Riyadh City Profile 2019. UN Habitat. Available online: https://unhabitat.org/riyadh-city-profile (accessed on 19 June 2023).
14. Riyadh Municipality. (n.d.). Riyadh Traffic Safety. 2024. Available online: https://www.alriyadh.gov.sa/en/Divisions/Traffic/Riyadh%20Traffic%20Safety/Pages/default.aspx (accessed on 30 March 2024).
15. Aina, Y.A.; Merwe, J.H.V.; Alshuwaikhat, H.M. Urban spatial growth and land use change in Riyadh: Comparing spectral angle mapping and band ratioing techniques. In Proceedings of the Academic Track of the 2008 Free and Open-Source Software for Geospatial (FOSS4G) Conference, Incorporating the GISSA Conference, Cape Town, South Africa, 29 September–4 October 2008; pp. 51–57.
16. Almatar, K.M. Rehumanize the Streets and Make Them More Smart and Livable in Arab Cities: Case Study: Tahlia Street; Riyadh City, Saudi Arabia. *Sustainability* **2024**, *16*, 3376. [CrossRef]
17. Aina, Y.A.; Adam, E.M.I.; Ahmed, F.; Wafer, A.; Alshuwaikhat, H.B. Using multisource data and the V-I-S model in assessing the urban expansion of Riyadh city, Saudi Arabia. *Eur. J. Remote Sens.* **2019**, *52*, 557–571. [CrossRef]
18. Ledraa, T.A. An Examination of Riyadh Neighborhood Forms Using GIS Applications. *Emir. J. Eng. Res. (EJER)* **2015**, *20*, 15–31. [CrossRef]
19. Al Zohbi, G. Sustainable Transport Strategies: A Case Study of Riyad, Saudi Arabia. *E3S Web Conf.* **2021**, *259*, 02007. [CrossRef]
20. Riyadh Development Authority. Riyadh Metro. 2020. Available online: http://www.ada.gov.sa/ (accessed on 12 January 2024).
21. Youssef, Z.; Alshuwaikhat, H.; Reza, I. Modeling the Modal Shift towards a More Sustainable Transport by Stated Preference in Riyadh, Saudi Arabia. *Sustainability* **2021**, *13*, 337. [CrossRef]
22. Almughairy, A. Reinventing Urban Space in Riyadh's Neighborhoods. *J. Archit. Plan. Res.* **2017**, *34*, 295–308.
23. Alamri, S. Spatial Analysis and GIS Mapping of Public Parks Adequacy: A Case Study from Riyadh, Saudi Arabia. *Sustainability* **2024**, *16*, 3305. [CrossRef]
24. Almayouf, A. Preserving the Green in Hot-arid Desert Environments: The Case of Riyadh, Saudi Arabia. *J. King Saud. Univ. Archit. Plan.* **2013**, *25*, 39–49.
25. Alznafer, B.M. The Impact of Neighbourhood Geometries on Outdoor Thermal Comfort and Energy Consumption from Urban Dwellings: A Case Study of the Riyadh City, the Kingdom of Saudi Arabia. PhD Thesis, Cardiff University, Cardiff, UK, 2014.
26. Al-Mosaind, M. Applying complete streets concept in Riyadh, Saudi Arabia: Opportunities and challenges. *Urban. Plan. Transp. Res.* **2018**, *6*, 129–147. [CrossRef]
27. Al-Rashdi, N.A.S.; Abdelwahed, N.A.A. The Empowerment of Saudi Arabian Women through a Multidimensional Approach: The Mediating Roles of Self-Efficacy and Family Support. *Sustainability* **2022**, *14*, 16349. [CrossRef]
28. Hidayat, N.; Haryanto, I.; Isheka, R.P. Evaluation of Pedestrian Facilities Performance. *IOP Conf. Ser. Earth Environ. Sci.* **2022**, *1065*, 012061. [CrossRef]
29. Sultan, B.; Katar, I.N.; Al-Atrush, M.E. Towards sustainable pedestrian mobility in riyadh city, Saudi Arabia: A case study. *Sustain. Cities Soc.* **2021**, *69*, 102831. [CrossRef]
30. Katar, I. Promoting pedestrian ecomobility in Riyadh City for sustainable urban development. *Sci. Rep.* **2022**, *12*, 14808. [CrossRef]
31. Sreedhara, M.; Valentine Goins, K.; Frisard, C.; Rosal, M.C.; Lemon, S.C. Stepping Up Active Transportation in Community Health Improvement Plans: Findings from a National Probability Survey of Local Health Departments. *J. Phys. Act. Health* **2019**, *16*, 772–779. [CrossRef]
32. Parashar, A.; Bnayan, H. Studying walkability preferences using urban design qualities: A Case of Riyadh, Saudi Arabia. *IOP Conf. Ser. Earth Environ. Sci.* **2020**, *452*, 012140. [CrossRef]
33. The Royal Commission for Riyadh City. Riyadh Comprehensive Strategic Plan. 2030. 2017. Available online: https://www.rcrc.gov.sa/reports/Riyadh-Comprehensive-Development-Plan-2030_EN.pdf (accessed on 12 January 2024).
34. Al-Zoabi, A.; Jarrar, O.M. Sustainable City Paradigm: Criteria and Indicators of Efficiency. In *WIT Transactions on Ecology & Environment*; Garrigos, A., Brebbia, C., Eds.; WIT Press: Southampton, UK, 2016; Volume 204, pp. 143–159.
35. Frank, L.D.; Andresen, M.A.; Schmid, T.L. Obesity relationships with community design, physical activity, and time spent in cars. *Am. J. Prev. Med.* **2004**, *27*, 87–96. [CrossRef] [PubMed]
36. Saelens, B.E.; Handy, S.L. Built environment correlates of walking: A review. *Med. Sci. Sports Exerc.* **2008**, *40*, S550–S566. [CrossRef]
37. Handy, S.L.; Boarnet, M.G.; Ewing, R.; Killingsworth, R.E. How the built environment affects physical activity: Views from urban planning. *Am. J. Prev. Med.* **2002**, *23* (Suppl. 2), 64–73. [CrossRef]
38. Ledraa, T.A. Evaluating Walkability at The Neighborhood and Street Levels in Riyadh Using GIS and Environment Audit Tools. *Emir. J. Eng. Res.* **2015**, *20*, 1–13.
39. Ewing, R.; Cervero, R. Travel and the Built Environment: A Meta-Analysis. *J. Am. Plan. Assoc.* **2010**, *76*, 265–294. [CrossRef]
40. Project for Public Spaces (PPS). What Is Walkability? *How Do You Measure It?* Available online: https://www.pps.org/article/what-is-walkability-how-do-you-measure-it-take-aways-from-this-years-trb-meeting (accessed on 12 January 2024).

41. Frank, L.D.; Schmid, T.L.; Sallis, J.F.; Chapman, J.; Saelens, B.E. Linking objectively measured physical activity with objectively measured urban form: Findings from SMARTRAQ. *Am. J. Prev. Med.* **2005**, *28*, 117–125. [CrossRef] [PubMed]
42. Giles-Corti, B.; Vernez-Moudon, A.; Reis, R.; Turrell, G.; Dannenberg, A.L.; Badland, H.; Foster, S.; Lowe, M.; Sallis, J.F.; Stevenson, M.; et al. City planning and population health: A global challenge. *Lancet* **2016**, *388*, 2912–2924. [CrossRef] [PubMed]
43. Adkins, A.; Makarewicz, C.; Scanze, M.; Ingram, M.; Luhr, G. Contextualizing Walkability: Do Relationships Between Built Environments and Walking Vary by Socioeconomic Context? *J. Am. Plan. Assoc.* **2017**, *83*, 296–314. [CrossRef] [PubMed]
44. Kelly, C.M.; Lian, M.; Struthers, J.; Kammrath, A. Walking to Work: The Roles of Neighborhood Walkability and Socioeconomic Deprivation. *J. Phys. Act. Health* **2015**, *12* (Suppl. 1), S70–S75. [CrossRef] [PubMed]
45. Guite, H.F.; Clark, C.; Ackrill, G. The impact of the physical and urban environment on mental well-being. *Public Health* **2006**, *120*, 1117–1126. [CrossRef]
46. Mair, C.; Diez Roux, A.V.; Galea, S. Are Neighbourhood Characteristics Associated with Depressive Symptoms? A Review of Evidence. *J. Epidemiol. Community Health* **2008**, *62*, 940–946; 8p following 946. [CrossRef] [PubMed]
47. Van den Bosch, M.; Ode Sang, A. Urban natural environments as nature-based solutions for improved public health—A systematic review of reviews. *Environ. Res.* **2017**, *158*, 373–384. [CrossRef]
48. Board, T.R. National Academies of Sciences, Engineering and Medicine. In *Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects*; The National Academies Press: Washington, DC, USA, 2004. [CrossRef]
49. Du, X.; Kang, X.; Gao, Y.; Wang, X. Driving behavior characterization and traffic emission analysis considering the vehicle trajectory. *Front. Psychol.* **2024**, *14*, 1341611. [CrossRef]
50. Juul, V.; Nordbø, E.C.A. Examining activity-friendly neighborhoods in the Norwegian context: Green space and walkability in relation to physical activity and the moderating role of perceived safety. *BMC Public Health* **2023**, *23*, 259. [CrossRef]
51. Cohen, D.A.; Han, B.; Derose, K.P.; Williamson, S.; Marsh, T.; McKenzie, T.L. Physical activity in parks: A randomized controlled trial using community engagement. *Am. J. Prev. Med.* **2013**, *45*, 590–597. [CrossRef]
52. Ewing, R.; Bartholomew, K.; Winkelman, S.; Walters, J.; Chen, D. *Growing Cooler: The Evidence on Urban Development and Climate Change*; Urban Land Institute: Washington, DC, USA, 2008; ISBN 9780874201789.
53. Shephard, R.J. The Exercising Commuter: Is Commuting a Healthy Way to Be Active? *Curr. Cardiovasc. Risk Rep.* **2012**, *6*, 299–306. [CrossRef]
54. Henriques-Neto, D.; Peralta, M.; Garradas, S.; Pelegrini, A.; Pinto, A.A.; Sánchez-Miguel, P.A.; Marques, A. Active Commuting and Physical Fitness: A Systematic Review. *Int. J. Environ. Res. Public Health* **2020**, *17*, 2721. [CrossRef] [PubMed]
55. Yameqani, A.S.; Alesheikh, A.A. Development and evaluation of a walkability index (Case Study: Districts of the Ghom city). *JGST* **2015**, *5*, 159–174. Available online: http://jgst.issgeac.ir/article-1-236-en.html. (accessed on 12 January 2024).
56. Leinberger, C.; Alfonzo, M. *Walk This Way: The Economic Promise of Walkable Places in Metropolitan Washington, D.C.*; The Brookings Institution: Washington, DC, USA, 2012; Available online: https://www.brookings.edu/wp-content/uploads/2016/06/25-walkable-places-leinberger.pdf. (accessed on 12 January 2024).
57. Cortright, J. *Walking the Walk: How Walkability Raises Home Values in U.S. Cities*; CEOs for Cities; Impresa Inc.: Chicago, IL, USA, 2009. Available online: http://www.ceosforcities.org/pagefiles/WalkingTheWalk_CEOsforCities.pdf (accessed on 12 January 2024).
58. Litman, T. *Evaluating Public Transportation Health Benefits*; Victoria Transport Policy Institute: Victoria, BC, Canada, 2020; Available online: https://www.vtpi.org/tran_health.pdf (accessed on 12 January 2024).
59. Burchell, R.W.; Downs, A.; McCann, B.; Mukherji, S. *Sprawl Costs: Economic Impacts of Unchecked Development*; Island Press: Washington, DC, USA, 2005.
60. McCann, B. *Driven to Spend: The Impact of Sprawl on Household Transportation Expenses*; Surface Transportation Policy Project, Center for Neighborhood Technology: Chicago, IL, USA, 2000. Available online: https://www.walkboston.org/sites/default/files/DriventoSpend.pdf (accessed on 14 January 2024).
61. Litman, T.A. Economic value of walkability. *Transp. Res. Rec. J. Transp. Res. Board* **2003**, *1828*, 3–11. [CrossRef]
62. Southworth, M.F. Designing the walkable city. *J. Urban Plan. Dev.* **2005**, *131*, 246–257. [CrossRef]
63. Leyden, K.M. Social capital and the built environment: The importance of walkable neighborhoods. *Am. J. Public Health* **2003**, *93*, 1546–1551. [CrossRef]
64. Saelens, B.E.; Sallis, J.F.; Frank, L.D. Environmental correlates of walking and cycling findings from the transportation, urban design, and planning literatures. *Ann. Behav. Med. A Publ. Soc. Behav. Med.* **2003**, *25*, 80–91. [CrossRef]
65. Zhu, X.; Lu, Z.; Yu, C.Y.; Lee, C.; Mann, G. Walkable communities: Impacts on residents' physical and social health: Researchers from Texas A&M University studied residents in a newly developed 'walkable community' in Austin, Texas to see how it changed their habits for physical activity and whether it increased social interaction and cohesion in the community. *World Health Des.* **2013**, *6*, 68–75. [PubMed]
66. Jun, H.-J.; Hurr, M. The relationship between walkability and neighborhood social environment: The importance of physical and perceived walkability. *Appl. Geogr.* **2015**, *62*, 115–124. [CrossRef]
67. Wasfi, R.A.; Ross, N.A.; El-Geneidy, A.M. Achieving recommended daily physical activity levels through commuting by public transportation: Unpacking individual and contextual influences. *Health Place* **2013**, *23*, 18–25. [CrossRef]
68. Loukaitou-Sideris, A. Is it safe to walk here? Design and policy responses to women's fear of victimization in public places. Research on women's issues in transportation—Vol. 2: Technical papers. *Proceedings* **2005**, *35*, 102–112.

69. Loukaitou-Sideris, A. Fear and safety in transit environments from the 'women's perspective. *Secur. J.* **2014**, *27*, 242–256. [CrossRef]
70. Wang, Z.; Liu, L.; Haberman, C.; Lan, M.; Yang, B.; Zhou, H. Burglaries and entry controls in gated communities. *Urban Stud.* **2021**, *58*, 2920–2932. [CrossRef]
71. Cervero, R.; Duncan, M. Walking, bicycling, and urban landscapes: Evidence from the San Francisco Bay area. *Am. J. Public Health* **2003**, *93*, 1478–1483. [CrossRef] [PubMed]
72. Stantec. Proposed Walkability Strategy for Edmonton. Available online: https://www.edmonton.ca/public-files/assets/document?path=PDF/WalkabilityStrategy200909.pdf (accessed on 30 March 2024).
73. Owen, N.; Cerin, E.; Leslie, E.; duToit, L.; Coffee, N.; Frank, L.D.; Bauman, A.E.; Hugo, G.; Saelens, B.E.; Sallis, J.F. Neighborhood walkability and the walking behavior of Australian adults. *Am. J. Prev. Med.* **2007**, *33*, 387–395. [CrossRef] [PubMed]
74. Cervero, R.; Kockelman, K. Travel demand and the 3Ds: Density, diversity, and design. *Transp. Res. Part D Transp. Environ.* **1997**, *2*, 199–219. [CrossRef]
75. Almehrej, M.I. A Design Guide for Contemporary Saudi Arabian Homes in Riyadh. Ph.D. Thesis, Northumbria University, Newcastle upon Tyne, UK, 2015.