International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

Evaluating Pedestrian Infrastructure within the Framework of Sustainable Land Use Planning in the Central Area of Jeddah City

Aseel AlQurashi, Ibrahim Zakaria, and Ayman Imam
Architectural Engineering Department, College of Engineering, King Abdulaziz University,
Jeddah 21589, Saudi Arabia

Abstract - Historic centers in hot–humid cities face the dual challenge of safeguarding heritage while delivering safe, comfortable walking conditions. Focusing on Al-Balad (a UNESCO World Heritage Site) in Jeddah, this study evaluates pedestrian infrastructure and its climatic performance on Al-Dahab (Gold) Street and Bata Ashour Street—two commercial corridors central to ongoing revitalization. A mixed-methods design integrates (i) a climate-sensitive Quantitative Performance Indicator (QPI) audit of 17 indicators, weighted through a modified Delphi exercise with 11 local experts; (ii) structured field observations and pedestrian counts at six monitoring points across morning, midday, and evening periods (n = 6,828); and (iii) informal stakeholder interviews, supported by comparative benchmarking against other hot-climate heritage districts in Saudi Arabia and the wider region. Results show pronounced spatial inequality in infrastructure quality: the busiest segment (Station A, Gold Street) records the lowest overall score (2.1/5), characterized by substandard sidewalk width and continuity, absent pedestrian signals and limited seating, and very restricted shading. Pedestrian activity is strongly time-dependent, with 70.7% of movements occurring in the evening, indicating thermal avoidance during peak heat hours; shading coverage in much of Al-Balad remains poor (<20%), undermining comfort, safety, and inclusivity for women, older adults, and people with disabilities. Comparative cases indicate that continuous shading (>60%), cooler paving materials, and frequent rest points are decisive for daytime usability. The paper concludes with heritage-compatible, policy-ready interventions and governance recommendations aligned with Saudi Vision 2030, the Historic Jeddah Development Program, and the Saudi Green Initiative..

Keywords: Al-Balad District, pedestrian safety, urban design, Saudi Vision 2030

1. INTRODUCTION

1.1 Background, Rationale, and Problem Statement

Walkability is a critical element of modern urban design, and it brings various benefits to the urban quality of life. It encourages better local health, stimulates local economies, and helps in maintaining the sustainability of the environment by reducing the use of private vehicles (AlQahtany et al., 2021). Although there are these advantages, there is often little attention to the infrastructure of pedestrians, especially in the Middle East and Saudi Arabia, where auto-centric city planning and harsh climatic conditions dominate.

The Al Balad devotional zone of Jeddah, a UNESCO heritage site, is an example of these issues. It is a dynamic business district as well as a significant cultural landmark whose progress closely corresponds to the Saudi Vision 2030, the goals of which are to enhance the quality of life, preserve cultural heritage, and attain sustainable growth. The knowledge and assessment of the pedestrian infrastructure in this location are critical towards the realization of such ambitious goals. Summer temperatures in the city frequently exceed the global average, with daytime maximums often ranging between 40°C and 52°C (104°F – 125.6°F) during extreme events (Almazroui et al., 2014). When combined with the high relative humidity typical of the coastal location, the 'apparent temperature' or heat index often rises to dangerous levels, creating extreme physiological stress by hindering the body's ability to cool itself through evaporative heat loss (Dasari et al., 2021; Almazroui et al., 2020)

Although there have been continuous revitalization efforts, the pedestrian infrastructure in Al-Balad has been the least researched and most importantly, it is not fit to suit the climatic conditions in the region. Historical studies have reported unrelenting gaps such as compressed and interrupted sidewalks, scarce and unsafe pedestrian crossings, insufficient lighting equipment, and paltry areas of shade, especially in major business areas, such as Al-Dahaba Street and Barahat Ashour (Aljoufie, 2022; AlQahtany et al., 2021; AlShareef and Aljoufie, 2020). Such weaknesses pose significant safety and comfort concerns that are disproportionately represented by such groups as women, the elderly, and persons with disabilities.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

In addition, intense cases of heat significantly limit movement among people. Initial observations and data from the field suggest a decrease of more than 60 percent in pedestrian flows at the necessary midday (AlGhamdi et al., 2022; Litman, 2020). The objective of an ambition to create walkable heritage hot districts, studying environments may remain infeasible, absent a broad perennial arrangement of adapting it through shading, microclimatic planning, and high-heat resistant materials and materials.

1.2 Research Objectives and Questions

Based on the problem statement, this study aims to achieve the following objectives:

- To assess the quality of the existing pedestrian infrastructure in Al-Dahab Street and Bata Ashour in Jeddah's Al-Balad district.
- To identify key urban challenges related to walkability, safety, and accessibility in the area.
- To compare the findings from Al-Balad district with other historic urban centers in Saudi Arabia, such as Downtown Riyadh and Al-Turaif in Diriyah, to draw lessons learned.
- To propose innovative and practical urban planning solutions that enhance walkability and align with international standards for pedestrian safety and the goals of Saudi Vision 2030.

To achieve these objectives, the study seeks to answer the following research questions:

- What is the functional, experiential, and climatic performance of pedestrian environments across different micro-contexts in Al-Balad?
- How does the pedestrian infrastructure in Jeddah's Al-Balad district compare with that in Downtown Riyadh and Al-Turaif in Diriyah?
- Which heritage-compatible interventions measured in comfort and safety gains per unit length or cost offer the most effective pathways to walkability (climatic)?
- How strongly do shading adequacy and climatic exposure (inferred from time-of-day variations) predict pedestrian activity levels?

1.3 Contribution of the Study

This study enhances sustainable urban planning in that it provides context-specific evaluation of pedestrian infrastructure in historic global South urban settings. In contrast to papers about modern or temperate cities, this paper is based on a combination of climatic adaptation and heritage preservation based on an analytical framework. Methodologically, it takes a mixed-methods strategy that involves field observations, quantitative pedestrian counts, and spatial analysis to establish design gaps that have context-driven motives. In practice, the research offers a prescriptive paradigm of improving the walkability in hot-arid heritage areas, and it is consistent with the aims of Saudi Vision 2030 and the Quality-of-Life Program. The projected results will feed the local policies on urban design and the future revitalization planning in the Al-Balad of Jeddah and other situations.

1.4 Article Structure

The article has a systematic format. Section 2 is an overview of the literature and theoretical grounds on walkability. Section 3 talks about the methodology, which covered research design, area of study, data collection and analysis. The primary research findings are displayed in Section 4. In section 5, a comparative analysis is made with the other historic areas. Section 6 addresses the outcomes and implications of the findings on the city planning and Saudi Vision 2030. Lastly, Section 7 provides conclusions and policy recommendations.

2. LITERATURE REVIEW

2.1 Theoretical Foundations of Walkability

Walkability has shifted from being a concept rather than a limited scope to the infrastructure to a comprehensive vision that includes experiential and cultural aspects of walking. Scholarship nowadays differentiates between two complementary dimensions, i.e., functional and experiential walkability (Carmona et al., 2010; Speck, 2013). Functional walkability is the infrastructure-based aspects, which can be specified as the width and continuity of sidewalks, street connectivity, density of crossings, accessibility, and surface quality. This aspect makes walking a useful dimension that efficiently links the destination and origin (Speck, 2013). Although it is required, functional walkability does not suffice as a means of producing appealing walking domains. Experiential walkability, in its turn, refers to qualitative, sensory, and cultural attributes of the walking experience, such as thermal comfort, visual beauty, sense of place, cultural identity, and social prominence. All these make walking comfortable and interesting

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

(Speck, 2013). In the case of a UNESCO World Heritage Site like Al-Balad, the experiential dimension, including cultural experience and historical identity, is among the requirements of the value of the site.

The work of Gehl (2011), whose influential framework on the quality of public spaces and human-scale design is based on the idea of walkability, has influenced the development of modern walkability literature. However, use in other places outside its native Europe indicates deficiencies. Represented by the work of Gehl, which began in the urban centers of the temperate climates, with urban centers being the leading cause of climate and geography influences, the work of Gehl underemphasizes the climatic conditions, mainly extreme temperatures and humidity in cities such as Jeddah, that significantly define the behavior of pedestrians. In addition, it does not give adequate consideration to the role of religious practices and social practices in shaping the space in Arab-Islamic society. Implementation of the principles of Gehl in Jeddah is thus a necessity that one has to adapt towards, particularly concerning shading and configurations in space that are desirable culturally.

The standards of the World Health Organization (2018) offer quantitative criteria, including the minimum widths of sidewalks (2.5 m wide in a high-density setting and inclusive design). Nevertheless, they are generic, thus they do not explain climatic variations. A 2.5-metre sidewalk with no proper shading can be left to go to waste during midday in Jeddah. Excellent guidelines on hot-arid climates should include shading ratios and surface temperature, and comfortable rest areas.

Scholarships in the region have started to address such shortcomings. Al-Hathloul (2004) records the impact of auto-centric and fast urbanization in Saudi Arabia, whereby the urban forms adopted by the people were designed to facilitate walking, yet the present cities are not conducive to it. As observed by Al-Naim (2008), the classical Hijazi buildings created the features of climatic design, such as straight streets, towers of wind, which facilitated the life of pedestrians. Salama (2020) shows how the traditional souqs produced social and road-friendly spaces in the responding climate and culture. According to these scholars, the solutions should be based on regional traditions and not blind copying of foreign models.

Quantitative Performance Indicators (QPI) can offer a methodological way of assessing infrastructure quality in its various dimensions (sidewalk width, lighting, and crossing efficiency) (Creswell, 2014). Although strong on generating objective measures of evidence-based planning, the QPI assessment measures are usually functionally oriented toward walkability. This means that the evaluation of Al-Balad needs to be wholly completed by supplementing QPI with the qualitative evaluation of thermal comfort, aesthetic quality, and cultural suitability.

2.2 Climatic Urbanism and Thermal Comfort in Arid Cities

The emerging science of climatic urbanism appreciates the fact that pedestrian behavior is defined by the nature of thermal comfort, especially in hot climates. In Jeddah, where the summer temperatures are regularly over 40 °C, and the heat is exacerbated by the high humidity, thermal comfort appears to be one of the key factors defining the walkability.

The outdoor thermal comfort is influenced by the temperature of the air and sunlight, surface temperature, speed of wind, and humidity. Quantification is usually used with indices like the Physiological Equivalent Temperature (PET) or the Universal Thermal Climate Index (UTCI). Empirical experiments point to the comfortable PET range of around 18-26 °C, and a temperature exceeding 35 °C as extreme heat stress (Jia et al., 2022). By field observations, it is found that the situation of midday in Jeddah often exceeds such thresholds, leading to significant depressions of pedestrian behavior and movement behavioral patterns, including the tendency towards long, shaded paths.

Litman (2023) lists shading as the most effective of the shown interventions of enhancing walkability at extreme temperatures and has the potential to lower the PET by 10-15 °C. However, street widening and tree cutting are systematic efforts by many modern-day cities to do away with shade. Also, the physiological discomfort experienced in these urban canyons is not merely a product of high air temperature (tangible heat). Still, it is significantly exacerbated by the elevated Mean Radiant Temperature (MRT) resulting from a lack of vegetation. In the absence of tree canopies to intercept direct shortwave solar radiation, pedestrians are subjected to intense radiant heat flux from both the sun and the re-radiation of stored heat from paved surfaces (Lai et al., 2019). This creates a 'thermal sandwich' effect that physically overwhelms the body's thermoregulatory mechanisms, often pushing the Physiological Equivalent Temperature (PET) well beyond the threshold of extreme heat stress (PET > 41°C) (Matzarakis et al., 2009). Therefore, the discomfort is physically tangible and directly linked to the absence of green infrastructure, which would otherwise act as a critical thermal buffer

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

Passive cooling methods provide a variety of methods. The shading by trees is really effective; a forested canopy can reduce the surface temperatures of the ground by 15-20 °C and offers evaporative cooling (UNESCO, 2019). Drought-resistant acacia, ziziphus, and prosopis are the best native drought species that can survive the climate of Jeddah. Tensile structures and fabric canopies, which are typical of the traditional souq, offer flexible solutions near restrictions in tree planting, with a PET reduction of 12-14 °C (Chen et al., 2020).

The choice of materials is of paramount importance. Dark asphalt paving may reach above 70 o C, therefore radiates heat. The traditional Hijazi architecture used light green limestones and coral stones, which have the ability to reflect the sunlight. Research findings also support that light-colored paved surfaces can lower the temperatures of the surface by 15-20 °C as compared to asphalt (Arriyadh Development Authority, 2021). Water features like traditional fountains (sabil) are applied in evaporative cooling with thermal and psychological benefits, and misting systems are capable of reducing the temperature by 3-5 °C (Chen et al., 2020) with the good news being that water conservation is vital.

At the ground level, the speed of the wind can be increased (Venturi effects) by means of natural ventilation, e.g., the narrow streets (35 cm), which is a distinctive feature of the traditional Hijazi urban design. The architectural features, such as wind towers (malqaf) and projecting wooden screens (rawashin) make the ventilation even greater and offer the shade.

Such advanced climatic reactions were reflected in the conventional urban model of Al-Balad. The 20th-century evolution, however, left these tenets behind to embrace the automobile-oriented planning. Broad avenues, black tarmac, and the elimination of old-style formed walking patterns that at most times are unbearably hot during most of the year, have outranked walking as a means of transportation. The need to revitalize walkability in Al-Balad thus implies that climatic urbanism principles should be incorporated and focused on shading, the use of reflective materials, and natural ventilation.

2.3 Research Gaps

There are still considerable gaps in the knowledge about the infrastructure of pedestrians in Saudi historic areas. The prevailing theoretical models that control the discussion of walkability were developed in temperate climates and need extreme modification to suit hot-arid climates. These frameworks do not pay enough attention to climatic factors, which essentially define the city behaviors of pedestrians in cities such as Jeddah. There is limited empirical research that tries to test and adapt these frameworks to Saudi settings. Besides, macro-based indices like Walk Score, which are made of proxy variables, do not tend to represent micro-scale design and climatic factors, which tend to restrict their validity in non-temperate contexts (Aljoufie, 2022; Chen et al., 2020). Although field-audit tools (e.g., PEDS, PEQI) offer better granularity, the majority of them capture climatic parameters too covertly. The conditions of overexposure to the sun and the lack of shading, as the most serious limitations to walking in the Gulf area, are uncommonly included in the concept of global audits (AlQahtany et al., 2021; Litman, 2020). The paper will fill these gaps by utilizing a hot arid heritage environment that uses a climate-sensitive evaluation model.

3. METHODOLOGY

3.1 Research Design and Approach

The research design used in the current study is a mixed-methods design, which was adopted to provide comprehensive knowledge of the pedestrian infrastructure quality at the Al Balad district of Jeddah (Creswell, 2014). The quantitative part included the accurate statistics of pedestrian movements and systematization of infrastructure evaluation, and the quantitative one in the qualitative part included the detailed urban field observations, the spatial analysis, and informal interviewing of stakeholders. Data triangulation is possible through integration, thus making the findings more reliable and valid.

3.2 Study Area and Observation Stations

The research targets the historic Al -Balad quarter of Jeddah, which is a UNESCO world heritage site due to a small and irregular street network, narrow lanes (harat), and high-density and multi-story coral -stone construction. Such a morphology creates a microclimatic type of effect, which cools temperatures by providing shade. Al A Dahab Street and Bata Asher are the two major streets that were explored but have continued to remain difficult to walk upon. The Al-Dahab Street is the central business road, which is where the huge pedestrian and car traffic is concentrated. Bata Ashour still has a more refined system of traditional alleys.

Both areas are treated with poor crossing, improperly concrete sidewalks, and visual pollution. The small right-of-way slims down

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

the general movement of human beings, and lack of universal accessibility has a negative impact on disabled users. The shading conditions are quite different; whereas some areas in the historic core have the advantage of self-shading of near-developed constructions, the major commercial streets have limited shading resulting to overexposure of people to intense sun radiation, and to further aggravation of thermal distress.

A purposive sampling approach was used in order to gain the entire range of pedestrian behavior and infrastructure. In these two places, four observation points were made in the most appropriate areas depending on pedestrian flow, the type of streets, and functional differences (see Figure 1 and Table 1). The spatial distribution had made a comparative evaluation of walkability among various micro-contexts, such as high-traffic commercial areas, the slimmer traditional lanes, and major intersections.

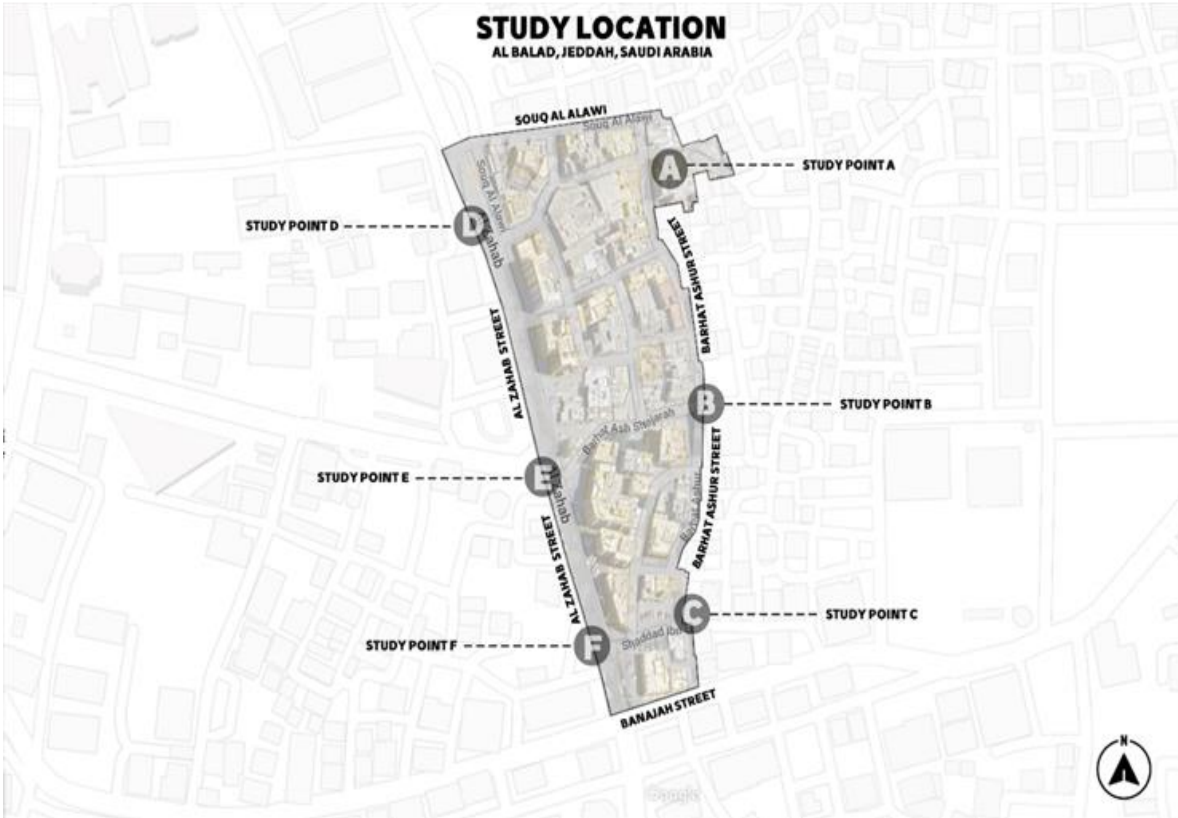

Figure 1. Spatial Distribution of Observation Points in Al-Balad, Jeddah

Table 1. Location and Functional Description of the six Pedestrian Observation Points.

Observation Point	Street Name	Approx. Coordinates (Lat–Long)	Functional Typology	Pedestrian Density (Observation)
P1	Al-Dahab Street	21.4872° N, 39.1903° E	High-traffic commercial	Very High
P2	Al-Dahab Street	21.4878° N, 39.1911° E	Retail frontage	High
P3	Al-Dahab Street	21.4884° N, 39.1918° E	Intersection node	Moderate
P4	Bata Ashour Street	21.4869° N, 39.1892° E	Narrow heritage alley	Low
P5	Bata Ashour Street	21.4875° N, 39.1898° E	Mixed-use corridor	Moderate
P6	Bata Ashour Street	21.4880° N, 39.1905° E	Transitional connector	High

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

3.3 Data Collection Methods

3.3.1 Expert Weighting and Validation Survey

To determine the relative importance of each infrastructure indicator in the QPI framework, this study employed a Structured Expert Interview process utilising a modified Delphi method (Linstone & Turoff, 2002). This consensus-based approach was selected to leverage the specialised knowledge of urban planning professionals rather than relying on a generic public survey. The Delphi technique is particularly effective in resolving complex urban design priorities where standard criteria may be insufficient for the local context (Hsu & Sandford, 2007).

The panel consisted of 11 experts who participated in iterative rounds to weight the indicators based on safety and climatic necessities, answering questions with a five-point Likert scale (1= least important to 5= most important). The structured interview questionnaire was finally completed by the participants, comprising academics from King Abdulaziz University and working engineers from the Historic Jeddah Development Program. This panel was a guarantee of a mix between theoretical knowledge and experience. Respondents rated the importance of 34 indicators across six categories (e.g., Sidewalk Quality, Crossings, Safety and Comfort Metrics).

The average importance rating $(\bar{X_i})$ for each sub-element i was calculated using the following Equation 1 as indicated by Creswell (2014):

$$\bar{X_i} = \frac{\sum_{j=1}^{n} R_{ij}}{n} \qquad (1)$$

Where R_{ij} : represents the rating assigned by expert j to element i, and n denotes the number of experts participating in the structured interview panel (n=11).

To ensure comparability across elements, the resulting average scores were normalized to obtain proportional weights (W_i) that sum to 1, using the normalization equation, Equation 2, as indicated by AlQahtany et al. (2021):

$$W_i = \frac{\bar{X_i}}{\sum_{k=1}^{m} \bar{X_k}} \qquad (2)$$

These normalized weights were subsequently used to compute the Weighted Quality Index (WQI) for each observation station, integrating both field-assessed performance scores and expert-derived importance values. The final QPI for each station (IPQ_s) was derived using the weighted summation formula shown in Equation 3 as indicated by Saaty (2008):

$$IPQ_s = \sum_{i=1}^{m} (S_{is} \times W_i) \qquad (3)$$

Where S_{is} : denotes the standardized score of sub-element i for station s. This mixed quantitative–qualitative weighting approach ensures that the evaluation reflects not only observed physical conditions but also the expert consensus regarding the contextual priorities of walkability in Jeddah's heritage core (AlQahtany et al., 2021; Creswell, 2014).

3.3.2 Field Observations and Pedestrian Counts

The field observations were undertaken on six predetermined observation points. There was a purposive temporal stratification plan so as to record the diurnal fluctuations, and each site was attended on a different day. The data was collected at three intervals, including morning (9:00 AM-11:00 AM), midday (1:00 PM-3:00 PM), which are the peak thermal hours, and evening (6:00 PM-8:00 PM).

Such a structure, where ten days were dedicated to observing individual stations, offered more robust and careful observation, and thus produced richer and more profound data on behavioral patterns and approaches to coping than did a condensed schedule. The total accumulated time on direct observation was 18 hours (6 days x 3 periods and 1 hour per period).

The number of pedestrians was counted systematically, and actors were classified according to apparent demographics (gender, visible age, visible mobility impairment). The behavioral trends, such as walking pace, the preference of the route, especially shade, rest, and interaction of the pedestrians and the vehicles, were also recorded. Environmental factors (temperature, humidity) were also recorded simultaneously, in order to place the behavior in context.

In all the observation points, 6,828 pedestrians were counted. As shown in Table 2, the data demonstrates that the number of pedestrians significantly differs dramatically between the reduction of the mornings and evenings, and thus, gives a concise representation of the impact of thermal comfort. The demographic analysis shows the following distribution: about 70% male, 15% female, 10% elderly (estimated age 65+), and 5% people with visible mobility impairment or disabilities.

Table 2. Pedestrian Counts by Time Period

Time Period	Total Pedestrians Counted	Percentage of Daily Total	Average per Hour
Morning (9:00-11:00 AM)	492	7.2%	246
Midday (1:00-3:00 PM)	1,512	22.1%	756
Evening (6:00-8:00 PM)	4,824	70.7%	2,412
Total	**6,828**	**100%**	**1,138**

3.3.3 Infrastructure Assessment Using QPI Framework

An elaborate evaluation checklist through Quantitative Performance Indicators (QPI) was used. The model was made based on existing instruments, bringing alterations to it depending on the context of the hot-arid heritage (see Table 3). The addition of Shading Coverage as a separate component of the QPI is one of the essential modifications, as the traditional instruments that deal with the temperate climate often exclude the aspect of thermal comfort, but in Jeddah, the significance of Shading is highly evident. The 50 percent shade contrast is equivalent to the latest trends of designing urban areas in the hot climate (Litman, 2020). The infrastructural elements were compared at various points with ratings done as per references, field testing (tape, light meter), and the known visual estimation.

Table 3. Customized QPI Assessment Framework

Infrastructure Element	Assessment Criterion	Reference Standard	Rating Scale (1-5)
Sidewalk Width	Minimum clear width	≥ 2.5 m (World Health Organization, 2018).	1 = Very Poor, 5 = Excellent
Surface Quality	Level, obstruction-free	(Al-Hathloul, 2004).	1 = Very Poor, 5 = Excellent
Lighting	Illumination level	≥ 10 lux (International safety standards)	1 = Very Poor, 5 = Excellent
Pedestrian Crossings	Frequency and quality	Every 100-150 m	1 = Very Poor, 5 = Excellent
Shading Coverage	Percentage of path shaded	≥ 50% (Litman, 2020).	1 = Very Poor, 5 = Excellent
Seating Availability	Frequency of rest points	Every 50-100 m	1 = Very Poor, 5 = Excellent
Cleanliness	Absence of litter/debris	Local standards	1 = Very Poor, 5 = Excellent
Safety	Lighting + visibility		1 = Very Poor, 5 = Excellent

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

3.3.4 Informal Stakeholder Interviews

Approximately 25-30 stakeholders, such as residents, the shop owners, visitors, and workers who were met during field visits, were interviewed informally. These discussions covered perceived obstacles to walking, thermal comfort, adequacy of infrastructures, the perceptions of safety, and suggestions for improvements. The issue of thermal discomfort and insufficient shading became one of the most prevalent, with an estimated 80–85% Fine has been mentioned by at least 80-85 percent of the respondents. The clientele observed the contravention that old structures, despite their narrow streets and crowded places, can in many cases offer more casual walking-friendly circumstances than newly refurbished districts.

3.4 Data Analysis Techniques

The analysis of data was conducted with the help of complementary methods. Data on pedestrian counts have been tabulated with the help of descriptive statistics (means, percentages) in order to determine the density, movement patterns, and demographic distributions. The strong temporal change was measured and determined within the context of thermal comfort.

A comparison table was created to compare the infrastructure that has been observed in Al-Dahab Street and Bata Ashour and international requirements (e.g., WHO, 2018; Gehl, 2011; Speck, 2013; Carmona et al., 2010). This was done systematically through the identification of shortcomings that occurred through the comparison of the observed conditions (e.g., sidewalk width, crossing frequency) with the specification thresholds in the system, and as such, gaps existed in significant numbers.

3.5 Limitations and Biases

Several restrictions have been recognized. Although the observation time was enough to determine the trend, it failed to cover seasonal fluctuation; circumstances during summer or winter would probably bring different outcomes. Although the rich qualitative data were obtained through the informal interview methodology, it was opportunistic compared to systematic, which may have created a selection bias. The fact that the study is based on two streets, although comparative analysis is contextualized, may reduce its generalizability. Field observation and QPI ratings were based on subjective judgments, which were countered by clear criteria and photographic verification. Last, the purposeful omission of Fridays (weekly holiday) also implies that no records of the behavior of pedestrians on weekends exist. These constraints indicate how future research should be done.

4. RESULTS

4.1 Pedestrian Density and Temporal Patterns

A field survey was conducted to monitor 6,828 pedestrian movements, and it showed considerable spatial and time differences. As demonstrated earlier in Table 2, the evening (6:00 PM -8:00 PM) hours had the highest activity as they represented 70.7% of all the observations, which means that people were more active during colder hours. On the other hand, the activity was significantly lower in the midday (1:00 PM - 3:00 PM) despite peak heat hours. The quietest time was the morning (9:00 AM - 11:00 AM), which brought 7.2% of the total number. This sudden drop in the volume of pedestrian walks at midday, compared with the evening, furnishes quantitative evidence that the discomfort of an overheated body prevents walking. Regarding space, Station A (Gold Street) displayed the largest number of patrons, including 37.5 percent of the entire pedestrian movement, which highlights its centrality as a pedestrian street. Stations E and F, which are at the edges, in contrast, reported significantly lower counts.

The field survey data reveals a massive temporal disparity in pedestrian activity, with evening volumes (4,886 pedestrians) nearly ten times higher than morning volumes (492 pedestrians). This drastic fluctuation establishes a strong negative correlation between high thermal stress and pedestrian activity. The low morning and midday figures confirm a behavioral phenomenon of 'thermal avoidance,' where the physical intensity of the heat during daylight hours acts as a barrier to walkability, effectively suppressing necessary and optional activities until the ambient temperature and solar radiation levels drop after sunset (AlGhamdi et al., 2022).

To statistically validate this relationship, the data points were analyzed to determine the correlation between thermal conditions (represented by time-of-day heat intensity) and pedestrian volume. As shown in Table 4, the results indicate a location-dependent relationship. While specific locations like Point C exhibited a strong inverse relationship $r \approx -0.99$—implying that rising heat levels correspond to a sharp decline in pedestrian traffic—other points such as Point F ($r \approx 0.75$) deviated significantly from this trend. This positive correlation at Point F suggests that local microclimatic factors, such as extensive shading, or functional imperatives

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

like proximity to transit hubs, may mitigate the impact of heat on pedestrian behavior. Nevertheless, the strong negative correlation at Point C aligns with similar studies in hot-arid climates utilizing Pearson correlation analyses. These have demonstrated strong negative coefficients ($r > -0.7$) between air temperature and walking frequency, confirming that where environmental mitigation is absent, thermal comfort remains the primary independent variable dictating the usage of outdoor spaces (Shaaban & Muley, 2016).

Table 4. Pearson correlation coefficients (r) representing the relationship between air temperature and pedestrian volume at monitoring points A–F.

Point	Assessment Criterion
A	-0.262094326
B	-0.046030756
C	-0.987357603
D	-0.366057343
E	0.099945139
F	0.746208304

4.2 Comparative QPI Assessment of Observation Stations

The QPI evaluation indicated that there was a great difference in the quality of infrastructure in the six stations. General scores in Table 5 started with a high 4.3/5 at Station E to a low 2.1/5 at Station A, meaning that there is an uneven and uncoordinated management of pedestrian infrastructure in Al-Balad.

Station E (Renovated Street) turned out to be one of the optimal examples with high scores in such indicators as the width of the sidewalks (4.8/5), the quality of the surfaces (5/5), and shading (4/5). At the same station, Station A (Gold Street Commercial), with the most pedestrian traffic, recorded low scores on items like essential amenities (shading 1/5) and seating (0/5), and its sidewalk width received a low score at only 2.1/5. The highest total score in Station D (Major Intersection) was moderate (3.2/5) due to formal crossing infrastructure, which was compromised by concerns about heavy traffic that resulted in high levels of safety concerns. The overwhelming absence of shading and seating in the majority of stations demonstrates a structural inefficiency in dealing with the issue of pedestrian comfort in a hot environment.

Table 5. Comparative QPI Assessment Results Across the Six Stations

QPI Indicator	Station A	Station B	Station C	Station D	Station E	Station F	WHO Standard
Sidewalk Width	2.1	3.2	3.8	4.1	4.8	3.5	≥ 2.5m
Surface Quality	3	4	3	3	5	4	Good/Excellent
Crosswalk Markings	2	3	2	4	4	3	Clearly Visible
Pedestrian Signals	0	0	1	3	2	1	Present
Lighting	4	3	2	3	4	3	Adequate
Shading	1	1	3	1	4	2	Essential

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

QPI Indicator	Station A	Station B	Station C	Station D	Station E	Station F	WHO Standard
Seating	0	0	1	0	3	3	Available
Overall Score	**2.1**	**2.6**	**2.8**	**3.2**	**4.3**	**3.1**	**≥ 3.5**

*** Note: Scores (1-5) reflect a weighted average of all 17 QPI indicators.*

4.3 User Profile Analysis

The fact that 10% of the pedestrians were aged 65 and above and 5% were people with disabilities underscores the extreme importance of barrier-free and accessible infrastructure. The field analysis proved that these people are hindered by the fact that the sidewalks are narrow and uneven, there are no suitable ramps, and there are no auditory or tactile acquisition signals, which restrict the movement of these groups and their independence. This highlights the fact that the development of infrastructure should observe the principle of universal design, where the population spaces should be accessible and comfortable to every person (Al-Hathloul, 2004).

4.4 Expert Validation Results

The validation interview questionnaire of the 11 experts gave a high level of consensus toward the important aspects of walkability in Historic Jeddah (see Table 6). The highest priority was Safety and Comfort Metrics, 90.9% of experts rated it as an Extremely important or a Very important one (72.7% chose the highest rating). This agreement highlights the high importance of night lights, colored pavements, and low speed limits. The particular focus on shaded sidewalks directly corresponds to the observations of the field, which proved that the presence of heat in the middle of the day significantly decreased the number of people walking around. Also high in the list of priorities was Pedestrian Crossings and Intersections (54.5 percent Extremely important), which is rightful, given the recommendations provided by the WHO, and confirms results of insufficient width in high-traffic Station A.

Vegetation & Greenery was rated (63.6% Very important), yet experienced professionals preferred to think of core infrastructure at the beginning of their agenda. Nevertheless, the detailed feature of a rating, which was rated high and constant, is the shaded areas in this category, which support the context-specific value of thermal comfort. These findings give good independent evidence of the QPI framework, and affirm the importance of safety, comfort, and shading over the secondary importance of walkability in this hot-arid environment.

Table 6. Expert Consensus on QPI Category Importance (N=11)

QPI Category	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not Important (1)
Safety & Comfort	**72.7%**	**18.2%**	9.1%	0.0%	0.0%
Pedestrian Crossings	**54.5%**	36.4%	9.1%	0.0%	0.0%
Sidewalk Quality	45.5%	27.3%	18.2%	9.1%	0.0%
Vegetation & Greenery	18.2%	**63.6%**	18.2%	0.0%	0.0%
Amenities & Behavior	36.4%	27.3%	18.2%	9.1%	9.1%

4.5 Photographic Documentation of Field Conditions

The quantitative results are supported by visual evidence of the field survey. The tables below capture the conditions in five observation stations, which showcase some of the major walkability issues and opportunities.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

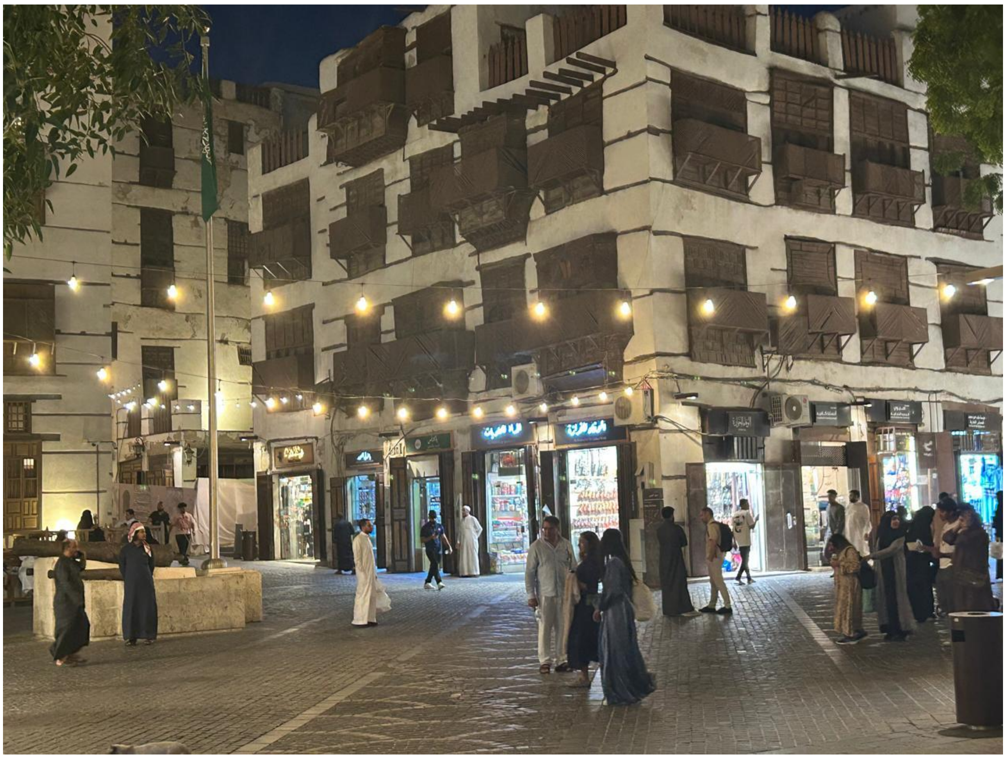

Figure 2. Station A - Evening Pedestrian Activity in Gold Street. Despite high footfall and cultural vitality, this station scored lowest on the QPI (2.1/5) due to narrow sidewalks and a total lack of seating and daytime shade.

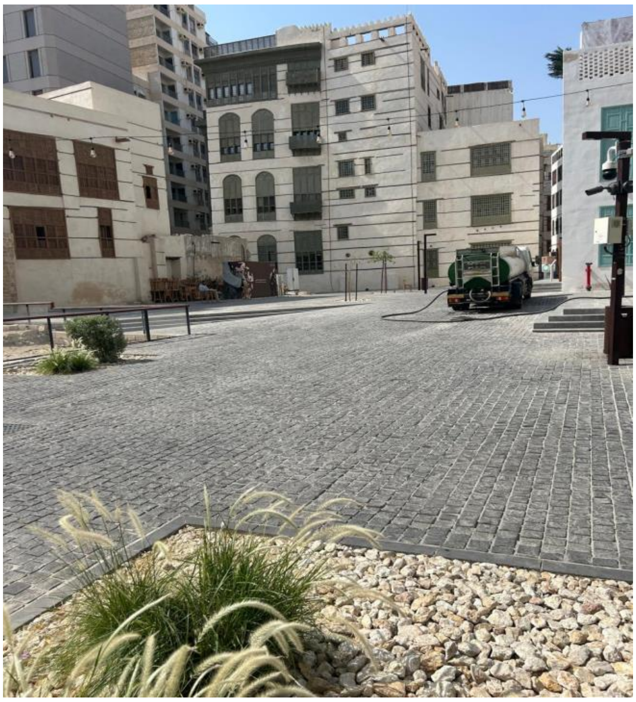

Figure 3. Station B - Daytime Conditions in a Renovated Section. While the infrastructure features wide, high-quality paving, the critical lack of shade (QPI score: 1/5) contributes to the sharp drop in pedestrian activity during peak heat.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

Figure 4. Station C - Mixed Conditions in Barahat Ashur Square. The plaza serves as a public space but suffers from a lack of seating (QPI score: 1/5) and uneven shade distribution, restricting daytime use.

Figure 5. Station D - Vehicle-Pedestrian Conflict at a Major Intersection. Although formal crosswalks are present (QPI score: 4/5), the high volume of vehicular traffic creates a hazardous environment.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

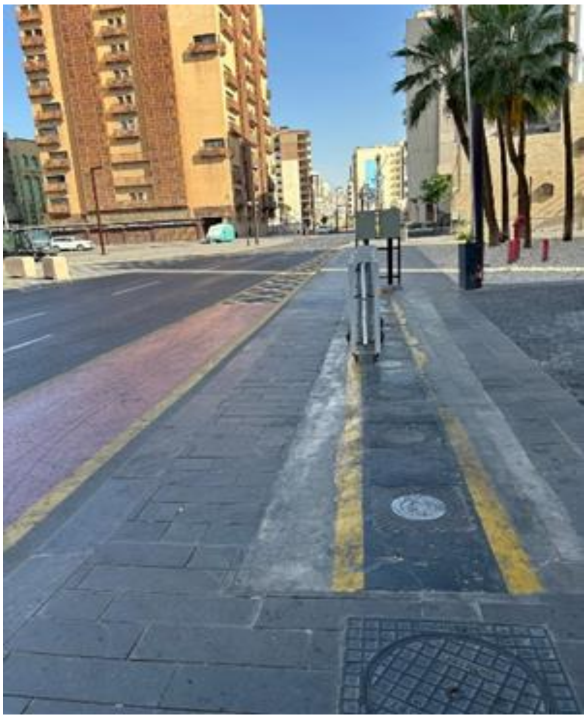

Figure 6. Station E - A Best-Practice Model for Pedestrian Infrastructure. The image displays wide, accessible sidewalks, shade from palm trees, and clear separation from traffic, demonstrating successful integration.

5. COMPARATIVE ANALYSIS

In order to contextualize the results obtained in Al-Balad, it was systematically compared in the findings with other historic districts in Saudi Arabia and in countries with a hot climate. This discussion determines the lessons and benchmarks that can be transferred and the performance of Al-Balad.

5.1 Local Comparative Cases (Saudi Arabia)

Riyadh's central area has been heavily invested in its pedestrian infrastructure improvement, which is in the form of improved crossings, modern street furniture, and broadened sidewalks (see Figure 7). Technically, it has a high level of infrastructure. However, the utilization is not adequate, especially in hot months. The first weakness is the lack of adequate shading coverage (approached <30%), and the continued prioritization of automotive movement. Large streets maximizing the amount of sunshine make the high-quality infrastructure thermally intolerable. Riyadh is a warning example: even high-quality infrastructure, according to the standards of the temperate climate, cannot be used in hot weather without organized consideration of thermal comfort.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

Figure 7. Pedestrian Walkway in Downtown Riyadh.

By comparison, a better example is At-Turaif, a UNESCO World Heritage Site (see Figure 8). The project combines heritage preservation and pedestrian requirements, including broadened walks, massive canopies of fabric and plants (>70%) shading, and traditional materials (adobe, light-colored stone) with low heat absorption. The outcome is an evidently pleasant physical space to walk around in that can lure guests even in hot weather. Although questions of scalability arise due to the nature of a tourism destination and not a living neighborhood, At-Turaif demonstrates that it is possible to combine the use of traditional climatic thinking with modern infrastructure and thus open heritage walks in the challenging climate of Saudi Arabia.

Figure 8. At-Turaif Heritage District in Diriyah.

5.2 International Comparative Cases (Hot-Climate Cities)

The success of the Al Fahidi Historical District in Dubai (see Figure 9) proves the efficiency of maintaining the traditional urban structure as a passive cooling technique. Narrow streets (3- 4m) offer each other some shading; wind towers (barjeel) allow natural ventilation; the use of coral stone building (traditional) reflects the sunlight. Modern interventions are very sparse which gives regard to historic fabric. The point that must be remembered by Al-Balad, also with a similar climatic environment and housing experience, is that traditional city patterns are complex responses to climate that should be maintained and increased.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

Figure 9. Al Fahidi Historical District, Dubai.

Conversely, the rehabilitation of the Islamic Cairo Al-Muizz Street (see Figure 10) incorporated the use of pedestrianization together with the substitution of asphalt with light-colored natural stone paving. Although this helped to improve the situation, daytime thermal comfort is an issue. The moderateness of the street provides certain shadows, yet the extent of coverage in case (approximately 40 per cent) is insufficient, and the maintenance issues have influenced the quality of the infrastructure. The experience at Cairo implies that pedestrianization and relevant materials, although good, have to be supplemented with extra shading (canopies or trees), as well as regular maintenance.

Figure 10. Al-Muizz Street, Islamic Cairo.

Also, the lessons of the city of coastal, hot-humid Jeddah are very applicable to the city of Muscat in Figure 11. The classical souq has a traditional canopy cover (>80%) and provides a microclimate that is significantly cooler in comparison with the surroundings and has natural ventilation. The neighboring corniche is a successful combination of large plantings of native trees, vast praise walks, and rest spaces. The success of Muscat indicates that the most useful intervention to take the form of complete shading to provide pedestrian comfort in such a climate.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

Figure 11. Muttrah Souq, Muscat.

5.3 Comparative Analysis Summary

The comparative analysis shows consistent trends as it is synthesized in Table 7. To begin with, coverage of shade is the most relevant factor of thermal comfort and human activity in hot weather. Cases that have less shading (Jeddah, Riyadh, Cairo) experience less daytime action, as compared to those that have more than 60 per cent shading (Diriyah, Dubai, Muscat), which have active environments. Second, light materials that are conventional always perform better than dark asphalt in alleviating heat. Third, simple cases combine various cooling measures (shading, materials, water, ventilation). Lastly, the relevant models that can be used in Jeddah are the other hot and humid coastal areas like Muscat and Dubai.

Table 7. Comparative Analysis of Pedestrian Infrastructure in Hot-Climate Historic Districts

City/District	Shading Coverage	Paving Materials	Path Width	Thermal Comfort	Applicability to Jeddah
Jeddah - Al-Balad (Current)	**Poor (<20%)**	**Dark asphalt**	**2-4 m**	**Low**	**-**
Riyadh - Downtown	Moderate (30%)	Contemporary	3-5 m	Moderate	Moderate (Cautionary)
Diriyah - At-Turaif	Excellent (>70%)	Traditional	3-6 m	High	High (Model)
Dubai - Al Fahidi	Good (60%)	Traditional coral stone	3-4 m	Good	Very High
Cairo - Al-Muizz	Moderate (40%)	Light stone	5-7 m	Moderate	Moderate
Muscat - Muttrah	Excellent (>80%)	Mixed	4-6 m	Very High	Very High (Model)

6. DISCUSSION

6.1 Synthesis of Findings

The results validate that there has been a significant difference between the existing pedestrian infrastructure and the goal of a sustainable and walkable city in Al-Balad (Gehl, 2011; Speck, 2013; WHO, 2018). The apparent barriers, which comprise a modest half-meter-wide (mean) sidewalk, lack of crossings, and less than a quarter-meter-wide coverage of the shades, essentially inhibit the potential of the area. The quantitative evidence that supports the thesis that walkability is a key outcome of thermal comfort in this climate is pulse times of pedestrian traffic, where evening pedestrian volumes (4824) are ten times larger than morning pedestrian volumes (492). Moreover, the poor proportion of women (15 %), the elderly (10 %), and the disabled people (5 %) indicates that the existing infrastructure is unequal and does not have an inclusive nature.

6.2 Systemic Barriers and Policy Inertia

Rigid shortcomings are caused by deep-seated systemic impediments. The current car-driven urbanism that has characterized the cities of Saudi Arabia since the 1970s (Al-Hathloul, 2004) still favors automobile accessibility, despite the presence of historic areas, at the expense of pedestrian accessibility. This paradigm has been depicted in street widening, which places a preference on traffic, areas of parking that take the alternative space that should be used by people, and traffic lights, which give preference to the traffic flow.

Resource allocation patterns, which subordinate distributed, pedestrian-scaled interventions that are necessary to make walking easy to high-visibility, monumental projects (highways and flyovers), support the predominance of automobile-centricity. Pedestrian infrastructures are being given token percentages of funds, but not an all-around, systematic investment.

Lack of regulatory gaps worsens the situation. The contextual adaptation of existing building codes and standards, which are mostly borrowed from the temperate-climate models, is absent. They can become specified concerning the width of the sidewalk, but not concerning cover on shading, limits of surface temperature, or the number and location of rest areas, which are vital in ensuring thermal comfort in Jeddah.

The other factor is cultural issues. Much of the past 40-year history of automobile-based development has helped establish a cultural identity that activities involving automobile usage are linked to status, whereas walking, especially in extreme temperatures, is a stigmatized activity. This dynamic cycle will put off the walk along inadequate infrastructure, and consequently, the low rates of walking will kill the need to have their infrastructure improved.

Lastly, all these come together to produce policy inertia. However, the positive discourse of Vision 2030, institutional disintegration between various agencies, conflicting priorities, and the nature of the complexities involved in the intervention in a UNESCO site tend to stop transformative change. Therefore, the interventions are not comprehensive and proactive but episodic and reactive.

6.3 Implications and Contribution to Saudi Vision 2030

The study's implications align directly with the objectives of Saudi Vision 2030, highlighting pathways to bridge the gap between policy aspiration and current reality.

6.3.1 Aligning with the Quality-of-Life Program

The Quality-of-Life Programme in Vision 2030 aims to increase the livability and physical activities. Walkable environments are one of the rudimentary approaches to these goals. However, in hot-arid regions, quality of life depends on thermal comfort; implemented without adaptation, temperate-climate walkability criteria will be unsuccessful. The effectiveness of the programme in urban centers like Jeddah relies on the fact that climate-related strategy puts shading, passive cooling, and suitable materials as the inherent, but not optional, elements in the design of the public space.

6.3.2 Advancing the Historic Jeddah Development Program

The Historic Jeddah Development Programme is charged with the responsibility of conservation as well as revitalization. This paper has argued that these objectives are complementary to each other. The heritage district should be walkable; people cannot view a living heritage site through a car. Besides, conventional Hijazi urbanism with its narrow streets and rawashin can also be viewed as a climate-oriented and pedestrian-based design. Thus, proper revitalization will require not only the reconstruction of the facades

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

but also the perception and recreation of old design principles that made the area habitable and pedestrian. Improvement of infrastructure with pedestrian access is thus paramount as opposed to peripheral to heritage conservation.

6.3.3 Supporting the Saudi Green Initiative

Pedestrian-based design focuses on the indoor should encourage walking instead of driving due to its direct access to the objectives of the Saudi Green Initiative, minimizing carbon emissions, and mitigating urban heat islands. This study has offered some recommendations (especially one of its full-scale native-tree planting, i.e., Acacia, Ziziphus), which have co-benefits, i.e., native shading, which is needed to promote thermal comfort; at the same time, carbon sequestration and the quality of air; and also in keeping with the landscaping goals of the Initiative.

6.4 Theoretical Implications

This research makes contributions to the body of research on urban planning in several ways. One, it questions mainstream automobile-focused paradigms by advancing heritage-based pedestrian city planning as an alternative, which restores and reinvents traditional, climate-responsive design ethics instead of adopting overseas models.

Secondly, it brings into perspective walkability frameworks on the international scale (Gehl, 2011; Speck, 2013; Carmona et al., 2010). It shows that thermal comfort, in hot-arid conditions, is not a secondary experience playing field but a defining factor of the functional walkability. As a result, there is a need for climate-specific frameworks with collaboration of shading, surface temperature, and cooling metrics as fundamental indicators.

Thirdly, the research works towards the literature on spatial justice. Under-representation of women, the aged, and individuals with disabilities that are documented upholds how ineffective infrastructure creates inequity, which in effect deprives some people of their rightful access to the public space. This puts the walkability not only as an amenity but also as a base of inclusive urban citizenship concept.

Lastly, the research enriches the research community in heritage conservation by promoting the idea of a living-heritage approach. It shows that conservation and modern-day habitation should not be two dissimilar ideas and that restoring design concepts that used to guarantee useful and comfortable spaces (shading and passive cooling) is the key to maintaining historic districts as dynamic and useful urban spaces, but not as passive relics.

7. Conclusions and Recommendations

This paper makes several critical inferences about pedestrian infrastructure in the Al-Balad district of Jeddah. To start with, the existing infrastructure is distinguished by a significant lack of it, covering not only the level of global functional mobility, including sidewalks and crossing density, but also, and most importantly, the level of experience. The almost complete lack of shading (less than 20% coverage) in a hot-arid climate is the only significant obstacle, as quantitatively demonstrated by a ten-time difference in the volumes of pedestrians during the morning and evening hours. Secondly, Al Balad lags significantly behind related heritage districts in Saudi Arabia; although Downtown Riyadh provides a bad example of implementing temperate-climate guidelines, At-turaif in Diriyah is a good example of the local one. The experience of Muscat and Dubai, among others, outside the country, confirms that such hot climates can be turned into comfortable pedestrian areas, with end-to-end shading and traditional climate-responsive design.

Thirdly, such shortcomings exist due to deep-rooted factors in the system such as an automobile-based planning paradigm, disjointed governance, resource distribution patterns that favor major projects, and the lack of regulation to enforce climate-specific adaptations. Fourthly, it is possible to bridge this gap. The combined offer made by Vision 2030, the Historic Jeddah Development Programme, and the Saudi Green Initiative is a powerful and consistent policy-making tool for transformative intervention. Fifthly, action is urgent. The current situation threatens the sustainability of the district as a heritage destination and limits its economic capacities, in addition to creating spatial injustices that exacerbate inequalities via vulnerabilities of people. Bringing back walkability will mean not making things a bit better, but an organized change led by priorities, coordination, and a historically based design approach that puts thermal comfort at the forefront.

Even though this paper provides a detailed evaluation, further investigation is required. Longitudinal measures of impact must be implemented to measure the effectiveness of interventions employed with time, the change in the volumes of pedestrians, user

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 12 , December - 2025

satisfaction, economic activity, and health outcomes. The study should also be based on methods of integrating the planning participations and thus making sure that the community input informs the design processes. Efforts to maximize the use of real-time data to manage traffic movement and provide thermal-comfort modelling of infrastructure will require studies with the implementation of smart infrastructure. Lastly, special studies on the obstacles faced by women, the elderly, and persons with disabilities should be conducted to make revitalization efforts enhance spatial justice and have a truly inclusive, urban, diverse environment.

REFERENCES

[1] AlGhamdi, A., AlQahtany, A., & AlOtaibi, M. (2022). Thermal comfort and pedestrian behavior in hot-arid cities: Implications for sustainable urban design. *Sustainable Cities and Society, 84*, 104034.

[2] Al-Hathloul, S. (2004). *The Arab-Muslim city: Tradition, continuity and change in the physical environment*. Dar Al Sahan.

[3] Aljoufie, M. (2022). Revisiting walkability indicators for Gulf cities: Challenges and prospects. *Journal of Urban Design, 27*(5), 621–639.

[4] Al-Naim, M. (2008). Identity in transitional context: Open-ended local architecture in Saudi Arabia. *International Journal of Architectural Research, 2*(2), 125-146.

[5] AlQahtany, A., Abdelhamid, H. T., Shinawi, A., AlQahtani, A., & Alshabibi, N. M. (2021). Evaluating walkability in Jeddah, Saudi Arabia: A case study of the historical district. *Journal of Urban Planning and Development, 147*(4), 05021001.(https://doi.org/10.1061/(ASCE)UP.1943-5444.0000745)

[6] AlShareef, F., & Aljoufie, M. (2020). Towards a walkable and sustainable Jeddah: Challenges and opportunities. *Journal of Urban Planning and Development, 146*(3), 05020019.(https://doi.org/10.1061/(ASCE)UP.1943-5444.0000588)

[7] Arriyadh Development Authority. (2021). *Downtown Riyadh pedestrian infrastructure enhancement project: Implementation report*. Royal Commission for Riyadh City.

[8] Carmona, M., Heath, T., Oc, T., & Tiesdell, S. (2010). *Public places, urban spaces: The dimensions of urban design* (2nd ed.). Architectural Press.

[9] Chen, Y., Ravulaparthy, S., Deutsch, K., Dalal, P., Yoon, S. Y., Lei, T., Goulias, K. G., Pendyala, R. M., Bhat, C. R., & Hu, H. H. (2020). Accessible pedestrian facilities: A review of design guidelines and research. *Journal of Transport and Land Use, 13*(1), 1-20. https://doi.org/10.5198/jtlu.2020.1588

[10] Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Sage Publications.

[11] Litman, T. (2020). *Evaluating accessibility for transport planning: Indicators and tools to support sustainable decision making*. Victoria Transport Policy Institute.

[12] Saaty, T. L. (2008). Decision making with the analytic hierarchy process. *International Journal of Services Sciences, 1*(1), 83-98.

[13] Salama, A. M. (2020). *Transformations of urban form in the Arab world: Architectural and urban heritage in the era of globalization*. Routledge.

[14] Saudi Vision 2030. (2016). *Kingdom of Saudi Arabia Vision 2030*. https://www.vision2030.gov.sa/

[15] Speck, J. (2013). *Walkable City: How downtown can save America, one step at a time*. Farrar, Straus and Giroux.

[16] UNESCO. (2019). *Historic Cairo rehabilitation: Al-Muizz Street pedestrianization project*. UNESCO World Heritage Centre.

[17] World Health Organization. (2018). *Global action plan on physical activity 2018-2030: More active people for a healthier world*. https://www.who.int/publications/i/item/9789241514187