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Investigating pedestrian-based environmental quality in Andisheh Alley, Dezful City, with the 15-minute city approach

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Abstract

Background and Objective: With the rapid pace of urbanization and emerging challenges such as air pollution, traffic congestion, and declining quality of life, walkability has gained attention as a sustainable strategy in urban planning. This study aims to assess the environmental quality of the Andisheh neighborhood in Dezful, Iran, based on walkability indicators and within the framework of the 15-minute city approach.

Methodology: The research is applied and follows a descriptive-analytical method. Seven key indicators were identified: land-use mix, environmental safety, public transportation, sidewalk design, intersection improvements, parking management, and bicycle lane development. The Analytic Hierarchy Process (AHP) was used to determine the relative weight of each criterion, while a SWOT analysis was employed to identify the strengths, weaknesses, opportunities, and threats affecting walkability in the area.

Findings and Conclusion: According to the AHP results, "land-use mix" (0.348) and "environmental safety" (0.222) were the most critical indicators for enhancing walkability. The SWOT analysis highlighted significant opportunities such as increased property values and access to public services, along with threats including resistance to car-use restrictions and insufficient safety measures for pedestrians, especially at night. Despite existing urban challenges, the Andisheh neighborhood demonstrates strong potential for implementing the 15-minute city model due to its spatial characteristics and community structure. However, the success of this approach relies on improving pedestrian infrastructure, strengthening public transportation, enhancing safety, and raising public awareness. This research provides a practical framework for promoting walkable environments and sustainable urban living in similar neighborhoods.

Keywords: Walkability, Andisheh Neighborhood, Dezful, 15-Minute City SWOT Matrix, Analytical Hierarchy Process (AHP).

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Extended Abstract

Introduction

The rapid pace of global urbanization has profoundly transformed the spatial, environmental, and social structure of cities. As urban areas expand and densify, challenges such as traffic congestion, environmental degradation, air pollution, and the declining quality of life have intensified. In response to these issues, urban planning has increasingly turned its attention toward human-centric strategies that promote sustainable development, with walkability emerging as a central theme. Walkable environments not only reduce reliance on motorized transportation but also encourage physical activity, foster social interaction, and enhance environmental quality. Within this paradigm, the 15-minute city model—proposed by Carlos Moreno—has gained significant international attention. This concept envisions a city where all essential services and facilities, including work, education, shopping, healthcare, and recreation, are accessible within a 15-minute walk or bike ride from one's residence. The model aims to decentralize urban life, reduce travel times, lower carbon emissions, and improve access and equity across diverse social groups. This approach presents a fundamental shift in urban planning toward a more localized, compact, and people-oriented urban form.

In the Iranian context, especially in cities like Dezful in Khuzestan Province, car-dependency and automobile-oriented development have led to severe environmental, social, and infrastructural issues. Many neighborhoods suffer from poor pedestrian infrastructure, limited public transportation networks, and a lack of safety in pedestrian zones. The Andisheh neighborhood in Dezful stands out due to its strategic location, population density, and mixed-use urban fabric, making it an ideal case study for applying and evaluating the principles of walkability within the 15-minute city framework.

The objective of this study is to assess the environmental quality of the Andisheh neighborhood based on a comprehensive set of walkability indicators and to determine its readiness for transformation into a 15-minute city zone. Through the use of the Analytic Hierarchy Process (AHP) and SWOT analysis, this research identifies key strengths, weaknesses, opportunities, and threats while prioritizing indicators that can inform future planning interventions.

Methodology

This research follows an applied and descriptive-analytical methodology. The approach combines quantitative analysis—through AHP for indicator weighting—and qualitative insights—gained from SWOT analysis, field observations, and stakeholder interviews.

Seven key walkability indicators were selected based on a comprehensive literature review and contextual relevance:

1. Land-use mix
2. Environmental safety
3. Public transportation access
4. Sidewalk design
5. Intersection improvement
6. Parking management
7. Bicycle lane development

These indicators encompass physical, social, and functional dimensions of walkability and provide a multi-faceted lens through which urban environmental quality can be assessed.

The AHP method was employed to determine the relative weight of each indicator. A structured questionnaire was distributed to 38 local experts and residents, who were asked to perform pairwise comparisons using a 9-point Saaty scale. The results were used to compute normalized weights and assess consistency in judgments.

Parallel to AHP, a SWOT analysis was conducted to identify internal and external factors affecting walkability in the neighborhood. Strengths and weaknesses were derived from spatial analysis and field data, while opportunities and threats were shaped by broader socio-economic, environmental, and policy contexts.

The Andisheh neighborhood was selected as the study area due to its relatively high population density, proximity to essential services (e.g., schools, health centers, parks), and recent urban development trends. The neighborhood lies in southwestern Dezful and is surrounded by major streets, making it a critical node for mobility and accessibility in the city.

Data sources included:

1. Field surveys and observational checklists
2. Urban maps and satellite imagery analyzed in GIS
3. Stakeholder interviews
4. Literature and policy documents related to walkability and urban planning

Results and Findings

The AHP analysis revealed a clear hierarchy of priorities among the walkability indicators:

1. Land-use mix received the highest weight (0.348), indicating that diversity in land functions is central to pedestrian-friendly environments.
2. Environmental safety followed with a weight of 0.222, highlighting the critical role of secure, well-lit, and monitored public spaces.
3. Public transportation scored 0.135, emphasizing the need for reliable and accessible transit systems.
4. Sidewalk design received 0.110, reflecting the importance of adequate sidewalk width, shade, and amenities like benches.
5. Intersection improvements, parking management, and bicycle lane development scored lower (0.082, 0.056, and 0.041, respectively), though they still contribute to overall walkability.

The SWOT analysis offered nuanced insight into the local context:

1. Strengths (S):
    a. Abundant public space for sidewalk expansion.
    b. Access to diverse public services and commercial centers.
    c. Presence of security infrastructure, including police stations.
2. Weaknesses (W):
    a. Strong cultural resistance to limiting car usage.
    b. Lack of sufficient night-time lighting and surveillance.
    c. High cost of developing and maintaining pedestrian infrastructure.
3. Opportunities (O):
    a. Potential for increased property values through urban revitalization.
    b. Growing interest from investors and urban tourists.
    c. Community engagement and demand for safer, more attractive public spaces.
4. Threats (T):
    a. Rising temperatures and climate-related discomfort, especially in summer.
    b. Pressure from automobile-oriented developments seeking to expand parking.
    c. Safety concerns for women, children, and the elderly in certain zones.

A combined AHP-SWOT matrix was developed to match the most critical indicators with corresponding strategic actions. For example, the high ranking of land-use mix and environmental safety aligns with identified strengths such as spatial diversity and opportunities for public space enhancement.

The analysis suggested a proactive strategy (SO strategy) focused on capitalizing on local strengths (e.g., available public land and service diversity) while exploiting opportunities such as investment attraction and tourism development. Simultaneously, mitigation strategies (WT strategy) were proposed to address threats like poor safety at night and public opposition to car restrictions through educational campaigns and gradual infrastructure upgrades.
Mapping analyses in GIS confirmed spatial mismatches in sidewalk coverage, street connectivity, and distribution of transit nodes. The study proposed targeted interventions in critical intersections, retrofitting existing sidewalks, and introducing green corridors to link parks, schools, and marketplaces.

Conclusion

This study demonstrates that the 15-minute city model is not only conceptually applicable to a mid-sized Iranian city like Dezful but also operationally feasible when grounded in data-driven planning and community engagement. The Andisheh neighborhood shows strong potential for walkability enhancement due to its mixed land-use structure, relatively dense urban form, and proximity to key services.
The research concludes with the following strategic recommendations:

1. Enhance urban density through infill development and mixed-use zoning to reduce travel distances.
2. Improve accessibility by expanding pedestrian and cycling infrastructure, particularly in underserved zones.
3. Diversify public spaces to support multiple activities and foster inclusivity across demographic groups.
4. Strengthen public awareness and participation to build support for walkability and reduce car dependency.
5. Implement context-sensitive design to mitigate environmental challenges, such as heat exposure through shaded walkways, water features, and climate-responsive materials.
6. Invest in night-time safety infrastructure including lighting, surveillance systems, and active community policing.
7. Leverage digital tools (e.g., GIS, mobile apps) for real-time monitoring of walkability improvements and public feedback collection.

In conclusion, the walkability-oriented assessment of Andisheh within the framework of the 15-minute city provides a replicable model for similar neighborhoods across Iran and the wider region. It highlights the importance of integrating technical analysis, policy support, and social engagement in pursuit of more livable, equitable, and environmentally resilient cities.

Declarations

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