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A Study on the Walking Comfort of CITYWALK Routes in Historic Districts for the Elderly —Taking Beijing's Qianmen Dashilan Area as an Example

Tongbin Zhang, Yichen Gao, Yufei Gao, Lei Wang*

School of Architecture and Art, North China University of Technology, Beijing, China
*Correspondence Author, wlei@ncut.edu.cn

Abstract: ***As China's population ages rapidly, CITYWALK—a leisurely urban exploration method advocating slow-paced experiences—has increasingly become a vital pathway for the elderly to engage with historical spaces and cultural memories within cities. Historic districts, with their rich cultural heritage, emerge as preferred destinations for senior tourism and daily activities. However, their complex spatial environments and inadequate service configurations pose practical barriers to accessibility for older adults. This study examines Beijing's Qianmen Dashilan district, constructing a three-dimensional evaluation framework—"spatial accessibility, service adaptability, and technological friendliness." It employs multi-source data methods including field surveys, behavioral observations, in-depth interviews, and spatial coupling analysis of point data to systematically identify key constraints on elderly pedestrians' routes. Findings reveal shortcomings including discontinuous accessibility infrastructure, uneven distribution of rest facilities, insufficient service node coverage, and generational barriers in smart navigation systems. Guided by the "micro-renewal" concept, this study proposes a synergistic optimization strategy of "micro-renovation + soft services + lightweight technology": integrating community and commercial resources to strengthen emergency response and humanistic care; designing lightweight guidance systems to lower technological barriers. This research aims to provide an actionable theoretical framework and practical paradigm for age-friendly design in the context of historic district renewal, advancing the inclusivity and accessibility of urban public spaces.***

Keywords: Historic district, CITYWALK, Age-friendly design, Walking environment, Micro-renewal.

1. Introduction

1.1 Research Background

With growing health awareness and leisure time among the elderly, outdoor activities like walking have become vital for fulfilling social needs and maintaining physical and mental well-being. However, current urban public space designs predominantly cater to middle-aged and young adults, failing to accommodate seniors' behavioral patterns characterized by "slow walking pace, high rest requirements, and strong reliance on emergency response" – a situation particularly pronounced in historic districts.

CITYWALK, a leisure activity centered on "immersing in urban culture and exploring neighborhood textures through slow-paced exploration," has rapidly gained popularity in China in recent years. Historical districts, characterized by "intact street layouts and concentrated cultural resources," have become the primary venues for CITYWALK. The Qianmen Dashilan area, as one of Beijing's best-preserved Ming-Qing commercial districts, retains the traditional "two corridors and one main street" layout of Dashilan West Street. It clusters renowned time-honored brands and intangible cultural heritage workshops, combining historical, cultural, and practical value. Currently, both official and community-initiated CITYWALK routes have emerged in Dashilan. While this slow-paced exploration model revitalizes the district's spatial value and enhances accessibility for seniors, the prioritization of historical preservation in urban planning has led to spatial designs overlooking elderly needs, limiting their participation in CITYWALK routes. This highlights the need for higher standards in historical district revitalization: As both permanent residents and key participants in cultural experiences, seniors' needs directly impact the inclusivity and sustainability of public spaces. Therefore, Qianmen Dashilan is selected as the research area.

1.2 Research Purpose and Significance

This study examines the Dashilan area in Beijing's Qianmen district as a case study. By constructing a three-dimensional elderly-friendly evaluation framework, it systematically identifies pedestrian accessibility gaps in the CITYWALK routes. Combining micro-updating concepts, the research proposes actionable optimization strategies to balance historical preservation with senior citizens' needs. Building on this foundation, the study enhances the theoretical framework for elderly-friendly design in existing historic district renovations, introducing a spatial-service-technological tripartite assessment system. This approach breaks through current research limitations that prioritize single facility upgrades over systemic adaptation. The study provides concrete solutions for pedestrian accessibility improvements in Dashilan, while offering replicable models for similar historic districts like Nanluoguxiang and Yandai Xiejie in Beijing, ultimately enhancing the elderly-friendliness and inclusivity of urban public spaces [1][2].

2. Theoretical Basis and Site Status

2.1 Geropsychology

Geropsychology posits that aging leads to physiological decline in older adults, resulting in behavioral changes: walking speed and average 0.8—1.0m/s decrease to 60%-70%

of younger adults' levels; increased rest needs with 300-500-meter intervals; heightened sensitivity to environmental safety (e.g., avoiding slippery surfaces and steep slopes); and reduced technical acceptance, often leading to frustration with complex operations. This theory provides a direct foundation for evaluating walking path comfort and optimizing technical accessibility in this study.

2.2 Walking Environment Planning Theory

The pedestrian environment planning theory centers on three core principles: continuity, safety, and comfort. It emphasizes barrier-free connectivity, environmental friendliness, and multi-functionality of walking paths. Specifically, continuity requires uninterrupted access to tactile paving, ramps, and other accessibility features; safety demands slip-resistant surfaces and user-friendly crosswalks; comfort necessitates well-placed rest areas and shelter from sun and rain. Guided by this theory, the spatial evaluation of the CITYWALK route in this study examines alley widths and pavement materials.

2.3 Status Analysis

2.3.1 Location and spatial range

The Qianmen Dashilan area, located in the southwestern part of Beijing's Dongcheng District, sits approximately 1.5 kilometers from Tiananmen Square. This cultural hub spans about 0.8 square kilometers, stretching from Qianmen Street in the east to Meishi Street in the west, and from Xihexian Street in the north to Zhushikou West Street in the south. With convenient transportation links—including Metro Line 2's Qianmen Station, Line 5's Ciqikou Station, and multiple bus routes like 17 and 20—the area serves as a vibrant hub where visitors can experience authentic old Beijing culture while locals enjoy their daily routines.

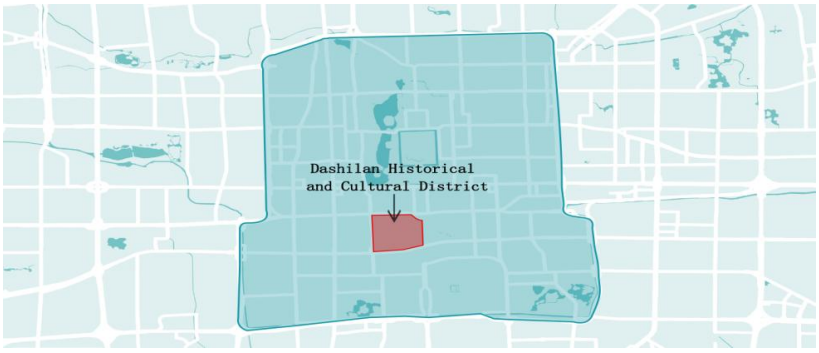

Figure 1: Location Map of Dashilan

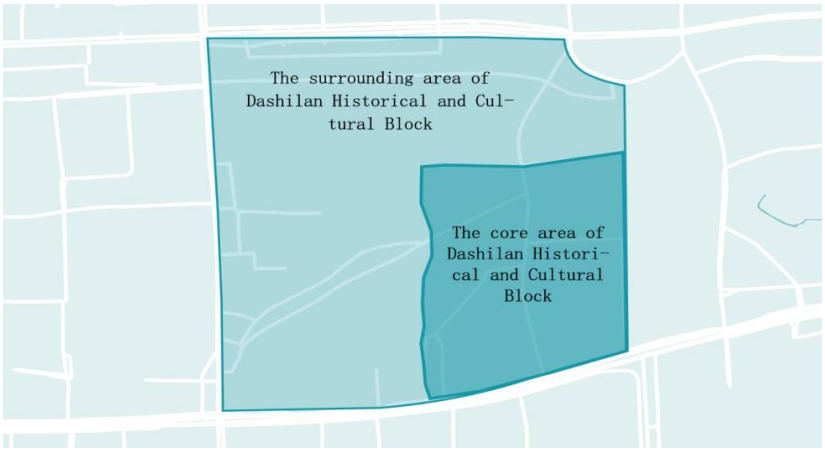

Figure 2: Core Research Area

2.3.2 Historical evolution and cultural characteristics

The commercial legacy of Beijing's Qianmen Dashilan area dates back to the Ming Dynasty. From the Qing Dynasty through the Republican era, this district flourished as Beijing's most vibrant commercial hub, hosting silk shops, tea houses, and footwear stores that formed the iconic "front store, back factory" layout. Today, the area preserves 12 municipal-level cultural heritage sites, 23 time-honored Chinese brands, and 15 intangible cultural heritage crafts. Its distinctive checkerboard-patterned streetscapes, gray walls with black-tiled roofs, traditional gable-and-hip roofs, and the living legacy of these time-honored businesses collectively define its cultural identity. As a vital component of Beijing's historic preservation efforts, this area stands as a living testament to the city's rich cultural heritage.

2.3.3 Characteristics of the elderly population in the region

According to the 2023 statistics of Qianmen Subdistrict Office, the total permanent resident population of the area is about 12,000, among which 4,200 are elderly people aged 60 or above, accounting for 35%, higher than the average level of Beijing (18.7%), which belongs to the "deep aging community".

2.4 Current CITYWALK Line Status

2.4.1 Line review

Through field surveys and interviews, the area has developed three core CITYWALK routes, covering three themes:

cultural experiences, food exploration, and historical architecture check-ins, as shown in Table 1 below.

2.4.2 Investigation on the elderly's walking environment in historical blocks

Survey findings reveal multiple challenges in pedestrian environments for senior citizens in Qianmen Dashilan area. Infrastructure issues include narrow alleys causing congestion, slippery stone-paved roads during rain, and uneven slopes that compromise safety and mobility. Staircases and steep inclines lack proper design, creating major barriers for elderly users. Accessibility gaps manifest in inadequate ramps and handrails, poorly marked restrooms, insufficient seating, and lack of ergonomic designs—all failing to meet seniors' basic needs. Service deficiencies include scarce medical facilities and inadequate commercial services in side streets, leaving elderly residents vulnerable to sudden health emergencies and daily convenience needs. To address these issues, seniors primarily demand improvements in barrier-free infrastructure, more user-friendly rest areas, optimized service facilities, and traffic infrastructure adaptations.

Table 1: Route Checklist

Line name	Enthesis	Length	Core themes and nodes	Generation type
Culture experience line	Dashilan West Street (West Entrance) -Langfang 2nd Street	800m	Intangible Cultural Heritage Experience (Jingtailan Workshop) and Time-honored Brand (Ruifuxiang)	Official recommendation (Culture and Tourism Bureau)
Food Trail	Qianmen Street (North end) -Xianyukou Street	650m	Traditional food (Tianxingju fried liver, Jinfang snacks)	Voluntary
Historic Sites	Xihe Street — Qianshi Hutong — Keshi Street	750m	Salt Industry Bank Old Site, Qianshi Hutong (Narrow Lane Landscape)	Voluntary

Table 2: Self-designed Questionnaire for Dashilan Historical and Cultural Block Survey

Category	Question	Answer (Elderly)
Basic Conditions for Walking	How would you rate the ease of access to roads within the neighborhood? Does the condition of the road surface affect your travel?	1. The main street is passable, but the side alleys are too narrow—when crowded with tourists, you can't even squeeze past each other. 2. The stone paths look charming, but they get extremely slippery when it rains; I nearly fell last time. 3. Some sections have gentle slopes that are quite strenuous to climb, requiring several breaks along the way.
Basic Conditions for Walking	Do the steps and steep slopes within the neighborhood pose obstacles to your mobility?	1. The steps at many old shops are too high, making it impossible to even enter and browse; 2. The steep slope near Qianshi Hutong is too dangerous to walk alone; 3. Without a gentle transition platform, climbing consecutive steps makes my legs feel weak.
Accessibility facilities	Are you satisfied with the accessibility features in your neighborhood, such as ramps and handrails? Are they easy to use?	1. Most places lack ramps, making wheelchair access impossible; 2. The handrails on overpasses are too low, offering no secure grip; 3. Ramps are scarce and hard to find, and some have excessively steep inclines.
Accessibility facilities	Can you easily locate accessible restrooms and seating areas? Do these facilities meet your needs?	1. Accessible restroom signage is inconspicuous; it took asking several people to locate it. 2. There are too few seating areas for rest; after walking for a short while, there's nowhere to sit down. 3. Seats lack backrests, causing back pain after prolonged sitting. Additionally, they are exposed to intense sunlight in summer and drafty in winter.
Supporting Services	Do you feel that the neighborhood's medical emergency services, commercial services, and other amenities meet your needs?	1. There's nowhere to get my blood pressure checked, and I worry about what would happen if I suddenly felt unwell; 2. There are no convenience stores in the side alleys, so I have to walk a long way just to buy a bottle of water; 3. There's no emergency call station, and as I get older, I fear no one will be there to help if something happens.
Optimization Requirements	What do you think is the most critical aspect of the current pedestrian environment that needs improvement? What specific suggestions do you have?	1. Install more handrails and gentle slopes; add simple ramps where steps are too high. 2. Increase the number of backrest-equipped rest benches, preferably with sunshades. 3. Clearly mark the locations of accessible facilities and establish additional medical emergency stations. 4. Extend traffic light durations—crossing the street always feels rushed.

3. Current Assessment of Age-Friendly Adaptation of CITYWALK Routes in Qianmen Dashilan Area

3.1 Selection and Setting of Evaluation Indicators

The selection of evaluation indicators should ensure scientific rigor and objectivity. This indicator screening process is grounded in the interpretation and synthesis of age-friendly policies, clarifying the objectives and development directions for age-friendly construction in urban spaces. Building on this foundation, we systematically identify the criterion-level factors of the pedestrian-friendly evaluation framework for historic districts, establishing the basic structure of the evaluation system. By synthesizing literature and international evaluation guidelines, we complete the initial selection of indicators. Subsequently, we integrate evaluation elements between historic districts and age-friendly development, extracting common assessment criteria to ensure relevance between indicator factors and the criterion level, thereby finalizing the evaluation indicator selection.

This study, based on relevant policies and literature reviews [4-9], employs statistical analysis to identify evaluation criteria layers with high frequency of occurrence, which serve as theoretical foundations for selecting applicable criteria in this research. At the spatial material environment level, road traffic dimensions (including pedestrian environments and transportation infrastructure) demonstrate the highest frequency, followed by spatial perception dimensions, then service facilities dimensions, and subsequently landscape greening, slow traffic networks, information exchange, usage effectiveness, creative enhancement, and management maintenance [8]. Regarding population subjective perception criteria, safety forms the foundation of evaluation as a fundamental need for elderly pedestrians, encompassing barrier-free facility configurations and other safety measures aimed at reducing walking accidents. Convenience serves as the primary objective, representing a core requirement for pedestrian mobility that applies not only to seniors but also to other demographics, focusing on crosswalk facility

installation rates and spatial accessibility through considerations of density of crosswalks, intersection density, and ease of access. Comfort represents a higher-level requirement for transportation, crucial for elderly physical and mental well-being and urban quality, including service function integration and spatial comfort, with particular emphasis on service experience and enjoyment during walking, such as accessibility and diversity of service facilities [9]. Building upon these theoretical foundations, three evaluation criteria layers—safety, convenience, and comfort—are established to assess the elderly-friendliness of historical districts. Subsequently, based on the behavioral psychology of the elderly and the theory of walking environment planning, combined with the characteristics of the 35% elderly population in the Qianmen Dashilan area and the core pain points of elderly users obtained from the field survey, the relative importance of each level of indicators was systematically judged.

When establishing evaluation coefficient indicators, the core consideration is integrating spatial accessibility as the fundamental prerequisite for elderly pedestrians. Service adaptability directly impacts user experience, while technical accessibility serves as a supplementary enhancement factor in the three-tier research framework. Under the three criterion levels, there are 7 secondary indicators and 18 specific evaluation items. Through questionnaire surveys and AHP (Analytic Hierarchy Process) analysis, the weight values were determined to construct an evaluation system for pedestrian suitability around rail transit stations from an age-friendly perspective (Table 1).

The priority framework is structured as: Spatial Accessibility (0.6 total weight)> Service Adaptability (0.25)> Technological Friendliness (0.15). Among these, Continuous Accessible Facilities (0.25) carries the highest weight, as accessibility gaps pose the primary barrier for elderly mobility. Given the relatively low technological dependency of seniors and the feasibility of cost-effective optimizations for existing issues, the sub-indicator “Technological Friendliness” carries a lower weight. For quantitative assessment of age-friendly development in urban areas, the scoring system combines indicator ratings (1-5 points, with 1 indicating poor performance and 5 excellent) multiplied by respective weight coefficients. Higher scores indicate better age-friendly adaptation.

3.2 Current Assessment of Age-Friendly Status

Spatial accessibility refers to the elderly’s ability to safely and conveniently reach CITYWALK routes and their nodes by walking. The core evaluation dimensions include barrier-free facility continuity, walking path comfort, and entrance adaptability. The specific evaluation indicators are as follows:

Table 3: Current Assessment of Age-friendly Status

Primary indicator	Secondary indicator	Specific assessment criteria	Data source / evaluation basis	Weight coefficient
Space accessibility	Accessibility Continuity	1. Is the tactile paving system intact, and has it been installed despite merchants occupying the road? 2.Ramp configuration: Are barrier-free ramps provided at the entrances and exits of historic buildings [10] 3.Handrail facilities: Are handrails installed on ramps, shop entrances, and pedestrian overpasses [11]	Field survey, “Code for Design of Barrier-Free Access” (GB 50763-2012)	0.25
	Walking comfort	1.Path slope: Whether the slope exceeds the elderly-appropriate threshold (5%) and the physical exertion feedback of the interviewed elderly when climbing the slope 2. Road anti-slip measures: Interview records on rainwater accumulation and slip hazards on stone-paved walkways, and the risk of elderly falls 3. Passage space: Whether the narrowest part of the hutong meets the needs of walking seniors and wheelchairs side by side, and whether there is congestion	Field measurement, in-depth interview	0.20
	Entrance Adaptability	1. Stair height: Verify whether the entrance/exit stairs of historical buildings meet the ≤15cm standard and whether warning signs are installed 2. Pedestrian facilities: Does the crosswalk duration at intersections match the walking speed of elderly pedestrians (0.8m/s)?	Field survey, Barrier-free Design Code (GB 50763-2012), speed calculation	0.15
Service Compatibility	Distribution of rest facilities	1.Spatial density: Calculate the difference in facility density and identify any rest areas without access 2. Design considerations: Does the seat have a backrest? Is the material hard stone? Is there a sunshade? Is it affected by foot traffic or cold wind?	POI data, field statistics, and in-depth interviews	0.12
	Service node coverage	1. Medical services: Number and location of medical facilities within a 15-minute walk (approximately 1200m), and whether side streets are covered 2. Age-friendly toilet facilities: The proportion and location of age-friendly toilet stalls in the restroom, and whether wheelchair access is convenient 3. Commercial services: Distribution of convenience stores and availability of drinking water and emergency supplies in side streets	Arcgis spatial analysis and field survey	0.13
Technical Friendliness	Smart navigation system is unavailable	1. Operation steps: Scan the QR code to learn if scanning is required — Follow the official account — Register — Select route 4 2. Interface design: Can the font on the electronic screen be enlarged? Is there a voice reading function? 3. Language Adaptation: Does it offer dialect explanations to meet the needs of elderly people who rely on dialects?	In-depth interviews and field operation tests	0.08
	Technology acceptance among the elderly	1. Usage frequency: The proportion of “occasionally used with children’s help” and “never used” indicates that users avoid it due to complex operation or concerns about data charges. 2. Functional requirements: Whether it meets the needs of one-click triggering voice tour, dialect explanation, and focusing on the history of time-honored brands	depth interview	0.05

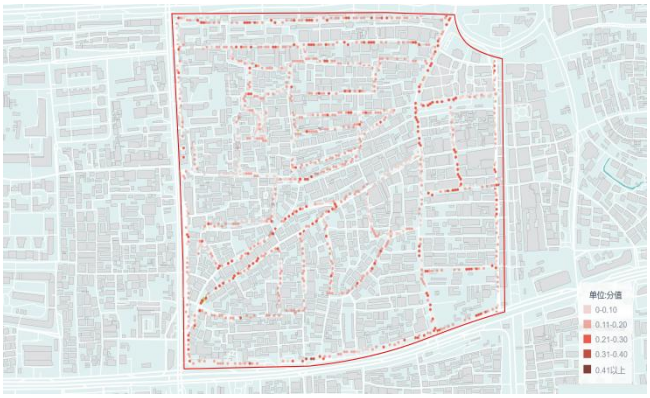

Figure 3: Continuous accessibility assessment

Figure 4: Pedestrian path comfort assessment

Figure 5: Distribution of rest facilities

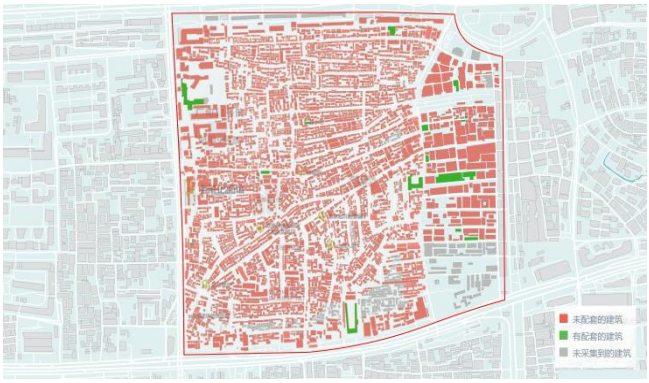

Figure 6: Analysis of barrier-free facilities at building

3.3 Evaluation Results and Summary of Issues

According to the evaluation coefficient, the evaluation is carried out from the three dimensions of space, service and technology, and the results are shown in Table 4:

Table 4: Age-appropriate evaluation results

Primary indicator	Secondary indicator	Weight coefficient	Evaluation score (1-5)	Weighted Score
Space accessibility	Accessibility Continuity	0.25	2	0.5
	Walking comfort	0.20	2	0.4
	Entrance Adaptability	0.15	2	0.3
Service Compatibility	Rest facilities distribution	0.12	2	0.24
	Service node coverage	0.13	2	0.26
Technical Friendliness	Smart navigation system is unavailable	0.08	1	0.08
	Technology acceptance among the elderly	0.05	1	0.05
Ensemble	-	1		1.83

The CITYWALK route in Beijing's Qianmen Dashilan area scored 1.83 (out of 5) in overall aging-friendly weighting, indicating a relatively low level of accessibility. Across all dimensions, the route showed poor performance: spatial accessibility scored 0.5+0.4+0.3=1.2, service adaptability 0.24+0.26=0.5, and technical friendliness 0.08+0.05=0.13, with technical friendliness being the most problematic aspect.

The analysis of specific issues from three dimensions is as follows: Spatial accessibility: Pedestrian pathways are obstructed by commercial vendors, historical buildings lack accessible ramps at entrances/exits, some road sections exceed elderly-friendly slope thresholds with slippery stone-paved surfaces during rain, stair heights in certain historical buildings fail to meet standards, and traffic light durations mismatch elderly walking speeds. Service adaptability: Uneven distribution of rest facilities creates blind spots, seating designs lack ergonomic features, insufficient medical facilities and senior-friendly restrooms exist within 15-minute walking ranges, and convenience stores are sparsely distributed in side alleys. Technological accessibility: The smart navigation system requires complex operation steps, its interface design is not elderly-friendly and lacks dialect interpretation, resulting in low usage frequency among seniors and system functionalities failing to meet their needs.

3.3.1 Spatial Contradiction between Historical Style Protection and Age-friendly Renovation

As a historic district, the Qianmen Dashilan area faces inherent challenges in balancing its narrow alleyways, dense architecture, and aging-friendly renovations. Three key issues emerge: First, alleyway constraints – subways like Qianshi Hutong can not accommodate pedestrian paths, tactile paving, and ramps simultaneously, and large-scale upgrades would disrupt the traditional street fabric. Second, heritage protection requirements – entrance modifications to historic sites require official approval from cultural authorities, and adding ramps might compromise architectural aesthetics, slowing renovation progress. Third, planning priorities – current plans prioritize preserving historical character and attracting tourists, relegating elderly-friendly renovations to a secondary role without being integrated into core development objectives.

3.3.2 Insufficient preliminary research and lack of main body for elderly-friendly needs

The preliminary research phase reveals two critical shortcomings. First, the regional demand survey demonstrated limited coverage, with the route planning phase primarily targeting young demographics while neglecting elderly residents and senior tourists. This oversight particularly failed to account for the needs of older adults with mobility challenges, resulting in facilities that don't meet actual requirements. Second, the planning process inadequately considered practical usage scenarios. While focusing on tourist check-in points, it overlooked seniors' daily activities like leisurely walks, grocery shopping, and social interactions. Consequently, rest areas and service nodes were strategically placed in ways that don't align with real-life usage patterns.

4. Age-friendly Optimization Strategy for CITYWALK in Qianmen Dashilan Area

In view of the core problem of diagnosis mentioned above, the "micro-renewal" concept and three-dimensional evaluation framework are combined to propose a collaborative optimization strategy of "micro-renewal + soft service + light technology" to improve the adaptability of the route to the elderly while protecting the historical features.

4.1 Micro-renovation: Improve Space Accessibility and Rest Comfort

To address the identified issues and promote the deep integration of age-friendly environment construction and cultural experience enhancement in Qianmen area, comprehensive measures have been implemented. In terms of barrier-free facility improvements, blind paths occupied by main streets have been cleared, while spot-type tactile paving has been installed in side alleys to ensure accessibility for visually impaired seniors. Invisible ramps have been added to entrances of historic buildings, and anti-slip wooden handrails have been installed on alleys' slopes, achieving a balance between functional improvements and architectural preservation.

The pedestrian environment optimization focuses on safety and comfort. Transparent anti-slip treatment is applied to the stone-paved roads to reduce risks during rainy weather. For steep slopes, a combination of steps and ramps is adopted with gentle platforms to alleviate walking fatigue. Crosswalk facilities at intersections are improved by extending signal timing and installing seat-equipped safety islands to accommodate the movement patterns of elderly pedestrians.

The upgraded rest facilities emphasize human-centered design and multi-functionality. In areas like the eastern section of Tieshu Xiejie, movable storage-style benches have been installed, while existing seating areas on the main street now feature antique-style sunshades. Additionally, rest spots integrate portable water dispensers and large-font cultural signage, which not only meet basic recreational needs but also enhance the dissemination of historical culture. This approach contributes to creating inclusive and culturally distinctive public spaces in the neighborhood [12].

4.2 Soft Services: Building a "15-minute elderly-friendly service circle"

4.2.1 Resource integration and spatial coupling

To enhance public service efficiency for elderly residents in historical districts and promote deeper integration of service resources with public spaces, the Qianmen area has implemented multidimensional service resource optimization [13]. Regarding medical resource decentralization, collaboration with Qianmen Community Health Service Station enables the establishment of two mini medical stations along the route. Community doctors provide three weekly on-site visits, offering essential healthcare services including blood pressure monitoring and emergency medication pickup, effectively addressing residents' urgent health needs.

In terms of toilet configuration for the elderly, the existing toilets will be renovated to increase the proportion of toilet seats suitable for the elderly, and new toilet seats will be added. In addition, voice prompt function will be added at the entrance of the toilet to provide convenient guidance for the elderly with poor vision, so as to improve the safety and convenience of toilet use.

At the commercial service integration level, we collaborate with local convenience stores to launch elderly-friendly delivery services. Seniors can use the call button at rest areas to request deliveries of essentials like drinking water and medicines, ensuring swift service. This initiative precisely aligns commercial services with senior care needs, further enhancing the neighborhood's convenience system.

4.2.2 Strengthening emergency response capacity and humanistic care

To enhance safety and cultural warmth in Qianmen area while strengthening emergency response capabilities and promoting inter generational integration, emergency measures could include installing one-touch emergency call buttons with large-print signage in side streets, directly connecting to community first aid stations for 5-minute response. Core rest areas should be equipped with elderly-friendly first aid kits containing essential medications, maintained by local businesses and replenished by the community. Additionally, training programs could be conducted for merchants within the area to provide emergency assistance to seniors and issue identification badges, fostering proactive support awareness.

In terms of cultural integration across generations, we will enlarge existing signage fonts with high-contrast color schemes, and install simplified maps highlighting core nodes at alley entrances. The organization will arrange for young and middle-aged volunteers to provide "one-on-one" guided tours on weekends. Monthly cultural experience activities featuring time-honored brands will be held at the leisure square, attracting participants of all ages. This initiative not only enhances elderly-friendly experiences but also fosters inter generational communication.

4.3 Light Technology: Lower the Threshold of Technology Use and Achieve "technology-friendly"

To enhance the technological compatibility of elderly-friendly services in historic districts, the Dashilan Elderly-Friendly Navigation System was developed using mature low-cost technologies with core principles of simplified operation, sensory adaptation, and demand alignment. In terms of lightweight design, a streamlined navigation mini-program was created for seniors, featuring only two core functions: voice-guided commentary and route navigation. The interface includes two physical buttons for operation, with voice support for dialects and Mandarin switching, adjustable maximum volume, and default large fonts that can be expanded with one click. A black background with white text reduces visual fatigue. Additionally, users can pre-download commentary content, assisted by community volunteers, enabling offline usage without data consumption. The system integrates cultural heritage through narratives of time-honored brands and intangible cultural heritage, with controlled commentary duration at each node. A one-click like feature collects user preferences, providing data-driven insights for facility optimization. This approach not only strengthens cultural dissemination but also achieves precise alignment between technical services and practical needs.

5. Conclusion

Historic and cultural districts possess both profound historical value and practical daily functions. However, when relying on a single approach for renewal, many crucial yet overlooked details are often neglected [14]. This study transcends mere scene recreation, proposing adaptive cultural sustainability strategies tailored for local residents and senior tourists. It requires reconstructing the district through material, spiritual, and heritage dimensions to create a historic neighborhood that preserves Beijing's legacy while adapting to an aging society. Therefore, how to raise awareness of accessibility for people with disabilities in modern society and write a new chapter of universal inclusivity remains a pressing issue. This paper aims to provide a more comprehensive framework, which holds significant implications for tracing cultural roots and revitalizing contemporary historic districts.

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References

[1] Shen Lu. Evaluation and Optimization Strategies for Pedestrian-Friendly Design of Public Spaces for Visually Impaired Groups in Urban Blocks [D]. Beijing Jiaotong University, 2023. DOI:10.26944/d.cnki.gbfju.2023.003503.

[2] R. Caves, Multinational Enterprise and Economic Analysis, Cambridge University Press, Cambridge, 1982. (book style) Miao Dailai, An Wenqing. The Multifaceted Dimensions and Optimization Strategies of Urban Community Governance: An Analysis Based on the 'Human-Centered-Technological-Institutional' Three-Dimensional Framework [J]. Xinjiang Social Sciences, 2023(5):163-173.

[3] LAWRENCE D F, BRUCE S A, JARED M U. LAWRENCE D F, BRUCE S A, JARED M U. et al. Comparing walkability methods: creation of street smart walk score and efficaey of a code based 3D walkability index[J]. Journal of transport & health, 2021,21:101005.

[4] Xu Zehua. A Study on Age-Friendly Evaluation and Renovation of Public Spaces in Residential Historic Blocks: A Case Study of Suzhou's Pingjiang Historic Block [D]. Suzhou: School of Architecture, Soochow University, 2023.

[5] Long Ying, Li Li, Li Shuangjin, et al., Measurement of Street Pedestrian Environment Index in China's Urban Vitality Centers [Southern Architecture 2021(1): 114-120.

[6] Zhang Yi. Research on Age-Friendly Design in Urban Streets [D]. Chongqing: Chongqing University, 2016.

[7] Gao Qun, Kong Mingliang. Age-Friendly Adaptation of Public Spaces in Traditional Villages of West Chongqing from an Active Aging Perspective: A Case Study of Donghaituo Village, Jiangjin District [J]. Landscape Architecture, 2022, 39(08): 53-63.

[8] Wang Shan. Research on Barrier-Free Quality Assessment and Enhancement Strategies for Urban Slow Traffic Spaces with Travel-Friendly Features [D]. North China University of Technology, 2025. DOI:10.26926/d.cnki.gbfgu.2025.000881.

[9] Rao Chuan-kun, Tian Xue-qi, Zhai Duan-qiang. A Study on Pedestrian Suitability of Residential Rail Transit Station Areas from an Age-Friendly Perspective [J]. Modern Urban Research, 2024, (06):107-113.

[10] Zeng, X. (2019). Research on the Current Status of Barrier-Free Environment Design in Urban Cultural Architecture [D]. Guangdong University of Technology. DOI:10.27029/d.cnki.ggdgu.2019.001133.

[11] Liu Xiaona. A Study on the Revitalization of Public Spaces in Historical Blocks Based on Inclusive Development [D]. Henan University of Technology, 2020. DOI:10.27791/d.cnki.ghegy.2020.000096.

[12] Analysis of the '15-Minute Elderly Care Service Circle' from an Economic Efficiency Perspective [J]. Shi Xiaodan; Chen Youhua. Southeast Academic, 2022(04).

[13] Ministry of Housing and Urban-Rural Development of the People's Republic of China. Standard for the Protection Planning of Historic and Cultural Cities (GB/T 50357—2018) [S]. Beijing: China Architecture & Building Press, 2018.

[14] Peng Zhimou, Zhang Ruiying, Liang Zhihao. The Historical and Cultural Origins and Rejuvenation of Age-Friendly Neighborhoods: A Case Study of Daliqibei Mosque District, Liaocheng City [J]. Architecture and Culture, 2023, (09):181-183. DOI:10.19875/j.cnki.jzywh.2023.09.057.

[15] Wang Jianguo. Urban Design (3rd Edition). Nanjing: Southeast University Press, 2011.

[16] Ministry of Housing and Urban-Rural Development of the People's Republic of China. Code for Design of Accessible Buildings (GB 50763—2012) [S]. Beijing: China Architecture & Building Press, 2012.

[17] World Health Organization. Global Report on Aging and Health[R]. Geneva: WHO, 2015.

[18] Wei Jingxin. Research on Optimization Strategies for Fitness Spaces in Urban Comprehensive Parks under the National Fitness Initiative [D]. Southwest University of Science and Technology, 2024. DOI:10.27415/d.cnki.gxngc.2024.000486.
[19] Wu Tienan. Research on Optimal Strategies for Public Space Optimization in Changsha's Open-type Residential Areas with a Focus on Pedestrian Orientation [D]. Hunan University, 2020. DOI:10.27135/d.cnki.ghudu.2020.001238.
[20] Luo Yuxian. A Study on Evaluating the Quality of Urban Strolling Leisure Experiences Based on Tourist Perception [D]. Guizhou Normal University, 2025. DOI:10.27048/d.cnki.ggzsu.2025.001326.
[21] Wu Liangyong. Introduction to Human Settlements Science [M]. Beijing: China Architecture & Building Press, 2001.
[22] UN-Habitat. Inclusive Cities: Global Human Settlements Report 2008 [M]. Beijing: China Architecture & Building Press, 2009.