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Case Analysis and Strategic Recommendations for Age-Friendly Renovation of Outdoor Public Spaces in Aging Residential Areas: A Case Study of Jiangsu Province

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Abstract:
This paper proposes that the goal of age-friendly design is to provide a safe, comfortable, and convenient residential environment for people of all ages, supporting the independence and autonomy of older adults while promoting the development of livable communities. Using aging residential areas in Jiangsu Province as a case study, the paper analyzes the causes of environmental issues in these areas. Through an examination of successful renovation projects, it presents design principles and strategies for age-friendly renovation, focusing on safety, accessibility, and adaptability. Additionally, the paper explores future directions for the age-friendly transformation of public spaces in aging residential areas.

Keywords:
Aging Residential Areas, Outdoor Public Spaces, Age-Friendly Renovation, Regional Culture, Accessibility Facilities

1.Introduction

Urban development in China has entered a crucial period of urban renewal, shifting from large-scale incremental construction in the past to the revitalization and restructuring of existing structures. On July 10, 2020, the State Council issued the "Guiding Opinions on Comprehensively Promoting the Renovation of Old Residential Areas in Urban Areas," which calls for comprehensive promotion of the renovation of old residential areas in urban areas to meet the needs of the people for a better life, promote livelihood improvement, expand domestic demand, transform urban renewal and development methods, and promote high-quality economic development. By the end of 2023, Jiangsu had renovated 14,000 old residential areas, and the scale of renovation will continue to be significant during the 14th Five-Year Plan period.[1] Accumulated experiences from the renovated old residential areas are worth learning from. With the rapid aging process in China, age-friendliness has become an important principle in residential area construction. This paper will focus on the age-friendly transformation strategies for public spaces in old residential areas in Jiangsu.

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2. Environmental Characteristics of Public Spaces in Old Residential Areas

The formation of the environment in old residential areas is complex, but it generally exhibits the following characteristics:

2.1 Insufficient Public Activity Space

There are mainly two forms: scattered and decentralized public spaces, presenting severe fragmentation and scattered distribution, with numerous group spaces and small central squares that cannot meet the collective activities of the residential areas.[2] Additionally, public activity spaces are illegally occupied, mainly in two situations: inadequate parking spaces leading to disorderly and arbitrary parking of motor vehicles, occupying activity squares or roads, and illegal constructions or enclosures further compressing the already inadequate public activity spaces.

2.2 Aging of Transportation and Activity Facilities

The aging of activity facilities in old residential areas is severe, not only resulting in the dilapidation of the appearance of old residential areas but also making it difficult for residents to use these facilities normally. This is mainly manifested in the wear and tear of road surfaces, damage at highly utilized locations, and the aging or damage of materials in sports, entertainment, and relaxation facilities in public activity squares. The growth of plants causes spatial congestion, leading to damage to flower beds or roads, and human occupation results in damage to lawns. The lack of management in some areas gives the space a sense of disorder.

2.3 Severe Lack of Age-Friendly Environments and Facilities

There is a severe shortage of age-friendly environments and facilities in old residential areas. The elderly spend a considerable amount of time in these areas, engaging in various activities. They constitute the primary users of public spaces. However, the activity spaces in old residential areas are often small and monotonous in type. The design, materials, and distribution of guiding, exercise, and rest facilities in public spaces do not meet the needs of the elderly. The limited green space, coupled with its low quality, fails to satisfy the outdoor activity and nature-appreciation needs of the elderly.

2.4 Lack of Barrier-Free Environments and Facilities

Although efforts to improve barrier-free environments in urban construction have been ongoing, there are still issues with the non-standard, non-systematic, and impractical implementation of barrier-free environments and facilities in old residential areas. This is primarily evident in road accessibility and environmental signage. Firstly, roads lack comprehensive barrier-free designs. For visually impaired individuals, there is a lack of coherent and unobstructed tactile paving, and for those with mobility issues, the barrier-free roads lack systematic elevation connections. Additionally, there is a shortage of barrier-free facilities, such as designated parking spaces for people with disabilities. Secondly, the environmental signage system lacks barrier-free design, including signage designs that are not easily understood and unreasonable positioning and height settings.

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2.5 Inadequate Display of Regional Culture and Customs

Jiangsu has a rich regional culture; however, this uniqueness is not fully reflected in the landscape design of old residential areas. This is mainly manifested in two aspects: Firstly, the lack of exploration and expression of local characteristics in the architectural appearance and landscape design. There is a lack of landscape elements or materials with cultural display functions, such as buildings with regional features or mural walls, leading to a trend of homogeneity in the appearance of old residences and the inability to highlight the unique charm of the residential areas. Secondly, old residential areas fail to provide residents with sufficient outdoor activity spaces for conducting local customs and cultural heritage activities. This not only affects the overall appearance of the residential areas but also makes it difficult for residents to experience and appreciate the profound cultural heritage of Jiangsu.

3. Environmental Characteristics and Causes of Formation of Public Spaces in Old Residential Areas in Jiangsu

The current state of public spaces in old residential areas is primarily attributed to the age of these areas, with many facilities aging or damaged due to wear and tear. Additionally, societal and cognitive developments have contributed to the formation of the current environmental conditions in public spaces within old residential areas.

3.1 Influenced by the Layout and Design of Residential Communities in the Previous Century

Many old residential areas were constructed before the year 2000, and the layout and design concepts of residential communities during that period differed from contemporary living demands. The planning at that time prioritized functionality and economy over environmental comfort and humanistic care. With the advancement of society and improvements in living standards, the requirements for living environments have been evolving. The planning standards of residential areas at that time struggled to meet current living habits.[①] In terms of spatial layout, public activity spaces were scattered and lacked concentration, each serving its own function, which made it difficult to meet the needs of residents for centralized social activities. Regarding transportation, around the year 2000, the average private car ownership rate in cities was low, and the parking rate for multi-story residential areas was regulated to not exceed 10%. This failed to meet the demand for parking spaces by residents. Additionally, the adoption of mixed pedestrian and vehicular traffic patterns in residential areas led to common issues of mixed pedestrian and vehicular traffic and chaotic parking, adding extra pressure to already narrow public spaces. Furthermore, the layout of spaces and people's cognitive understanding of culture did not fully consider cultural elements in landscape decoration. People tended to prefer simplistic and "modern" styles without distinct cultural characteristics.

① The standard used for old residential areas before 2000 was the 1993 edition of the "Urban Residential Area Planning and Design Standards," which was one of the earliest urban planning standards promulgated and implemented in China, and also one of the most widely used. It underwent several revisions, with the latest edition being the 2018 version.

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3.2 Insufficient Management System in Old Residential Areas

Due to the early development of old residential areas, the management systems in place during the initial stages were not sufficiently robust. Many weathered and damaged facilities lacked timely maintenance and management, leading to a gradual deterioration of the environment and a decline in the quality of public spaces. Unclear responsibilities and passing the buck among management entities resulted in phenomena such as unauthorized occupation of public spaces and construction of illegal structures, encroaching upon public spaces, affecting the appearance of residential areas, and causing adverse impacts on residents' travel and activities. The improper allocation of parking spaces and the increasing number of private cars led to chaotic parking within residential areas. The inadequate management system allowed vehicles to occupy public activity spaces and roads, posing a prominent and fundamental problem in old residential areas that must be addressed as a prerequisite for resolving many other issues.

3.3 Increased Vehicles Leading to Parking Difficulties

After 2000, the number of privately owned cars in China gradually increased, exacerbating the parking problem in old residential areas. The absolute increase in the number of private cars is the fundamental reason for parking difficulties, which also includes factors such as neighborhood planning and management. The latter requires strengthened management in the renovation of old residential areas, as the increasing number of vehicles is challenging to address and will only worsen over time. This issue serves as a prerequisite for the adaptation and renovation of public spaces in old residential areas to cater to elderly residents.

3.4 Rapid Aging Population Development

Compared to newer residential communities, old residential areas have a larger proportion of elderly residents. In China, the proportion of elderly people living in urban old residential areas is significantly higher, by 9.9%, compared to younger age groups.[3] This is due to several reasons: firstly, elderly residents tend to have lived in these areas for a longer period and are less likely to move. Among all age groups, the elderly have the lowest relocation rate, with 67% of them strongly preferring to stay in their original neighborhoods.[4] Secondly, old residential areas are often located in urban areas with well-established surrounding facilities and services, making them convenient places for elderly people to live. This has led to the phenomenon of "old people, old houses." Aging in place has become an important principle and focus of old residential area renovation.

Most of China's old residential areas were built before the year 2000. According to reports from the National Bureau of Statistics, China entered an aging society in 1999. Universal design for aging started to be widely promoted in residential construction in China in 2013. Therefore, when old residential areas were built, aging in place was not yet a fundamental principle of construction. Rapid economic development and a large population base have accelerated China's aging process. As a result, there is a significant lack of aging-friendly environments and facilities in old residential areas, creating a major contradiction with the growing demand.

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3.5 Inadequate Awareness of Accessibility Facilities

Accessibility design was not given sufficient attention in the early planning and construction of neighborhoods. This reflects society's inadequate attention to people with disabilities and the elderly, as well as limitations in technology and economic conditions. Many people regarded accessibility facilities as only serving people with disabilities, overlooking the needs of the elderly, pregnant women, and parents with young children. The "Accessibility Design Code" was officially promulgated and implemented in 2012, but before that, there was inconsistency in design and construction standards across different regions. Moreover, after construction, the lack of effective maintenance and management led to inconvenience in use, severely affecting their effectiveness. Insufficient funding has also hindered the construction of accessibility facilities. Low social awareness, inconsistent design and construction standards, inadequate maintenance and management, and insufficient funding are the main reasons for the imperfect accessibility facilities in old residential areas. With increased social awareness and improved regulatory standards, accessibility design has gradually become a focus of attention, but implementing renovations in old residential areas still faces many challenges.

4. Case Studies of Age-Friendly Renovation in Old Residential Public Spaces in Jiangsu

Jiangsu Province has seen many successful cases of renovation in old residential areas since 2015, which are worth learning from.

4.1 Tian Shun Yuan Community in Nanjing

The Tian Shun Yuan community is located in the Jianye District of Nanjing City and was built in 1999. It comprises 168 households with a total building area of 14,700 square meters. The residential area underwent renovation in 2019 and was selected as a "city-level pilot demonstration project for age-friendly renovation." During the renovation, more than ten elevators were installed in the community, and supporting facilities were repaired and replaced. While retaining the original road system, the road surface was repaired, and the original leisure square was transformed into a public activity space. The existing trees were preserved, and the height of the square was reduced to match that of the community roads, maximizing accessibility. Additionally, the square was equipped with handrails, seating areas, and fitness facilities to meet the leisure and exercise needs of residents. Unused green spaces between houses were transformed into leisure squares for the elderly, providing convenient places for relaxation and socialization. Wooden rest seats and shading pergolas were installed, and low shrubs were used for landscaping to create a sense of place.

4.2 Zhongying Community in Zhenjiang

The Zhongying Community is located in the city center of Zhenjiang. Built in the 1990s, it covers a total area of approximately 186,000 square meters and is home to 4,410 residents, with those aged 60 and above accounting for 27% of the population. Renovation began in 2018, during which 1,600 square meters of activity space were added, over 100 parking spaces were designated, and two non-motorized vehicle sheds were installed. The community was selected as a case study in the "Practice Cases of Renovation of Old Residential Areas in Jiangsu (Creation of Livable Residential Areas)."

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Within the community, a certain area of dilapidated houses was demolished, and the Dajia Mountain Square was constructed as the core public space for activities. It also serves as a cultural display area, showcasing the rich historical and cultural heritage of Zhongying Street. Through relief walls, historical figures such as Emperor Wu of Southern Qi, the great scientists Shen Kuo and Su Song of the Northern Song Dynasty, and the scholar Diaoyue of the Northern Song Dynasty are depicted. The north side, with the best accessibility, was designed as a senior fitness area, while the south side, close to primary schools and kindergartens, was designed as a children's activity area and a tree-lined small square, with a blank cultural wall to stimulate interactive activities. The central square is at the same elevation as the outside world, and the walking paths are made of anti-skid, waterproof, anti-glare, and reflective materials. Soft materials are used as much as possible for the ground of the fitness facilities. Additionally, centralized drying spaces are provided, taking into account the age-friendly and daily needs of the community residents.

4.3 Zhonghuayuan North Village in Kunshan

As a provincial-level "Livability Demonstration Residential Area" in Jiangsu Province, the renovation and transformation of Zhonghuayuan North Village hold typical significance in exploring the path of building livable cities in Jiangsu, promoting the urbanization of immigrants, and driving the transformation of urban governance. Established in 2000 as a resettlement community, Zhonghuayuan North Village covers a total area of 6.8 hectares and comprises 980 households. The community has a large proportion of immigrant residents and a relatively high degree of aging. After nearly 20 years of use, the housing structures became dilapidated, roads were damaged, parking was chaotic, greenery was disorderly, and supporting facilities were lacking.

Through consultations with residents, the transformation was conducted under the theme of "Jiangnan New Language, Enjoying the Home," aiming to create a "one axis, one ring, five nodes" all-age shared public activity space. The "one axis" is the central garden, serving as the community's public living room. The "one ring" consists of a circular fitness trail along the main road of the community and its eastern and western boundaries, with a width of 1.2 meters and enhanced functionality through colored permeable paving. The "five nodes" utilize spaces within and around the residential units to create areas for children's games, elderly communication, forest leisure, sports and fitness, and entrance imagery, meeting diverse activity needs and promoting interaction among different groups and generations to enhance neighborly relations. Accessibility improvements were made at the unit entrances, optimizing ramp slopes and providing leisure seating on one side for the convenience of elderly and disabled individuals for temporary rest. The sign system of Zhonghuayuan North Village in Kunshan was systematically designed to resonate with the overall aesthetics and color environment of the community, becoming an organic part of the community environment.

5. Principles and Strategies of Age-Friendly Transformation in Public Spaces of Old Residential Areas

As age advances, various bodily functions of the elderly experience a certain degree of decline, which manifests in aspects such as motor function, sensory perception, cognitive function, and immune function. Apart from significant risks posed by safety hazards in spatial environments, there are situations where normal living facilities cannot be used due to bodily decline. Age-friendly design of spatial environments supports in-

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dependent living. Accessible design elements and the easy identification of transportation and environmental information in an age-friendly environment encourage elderly individuals to take autonomous action, leading to psychological well-being. The safety of the environment enables elderly individuals to fully utilize their remaining physical functions, autonomously carry out daily activities, and increase their sense of psychological security. The adaptability of the environment prompts elderly individuals to increase their use of outdoor environments, leading to social interaction and physical activity, extending the scope of their lives, and promoting physical and psychological health. Based on the successful renovation demonstrations mentioned above, age-friendly transformation designs for old residential areas should be based on the principles of safety, accessibility, and adaptability, which are the core of successful redesigns for old residential areas.

5.1 Safety

The safety dimension of public spaces in old residential areas includes site safety and facility safety. The age-friendly transformation of public spaces in old residential areas must first address parking issues because the main contradiction in spatial layout in old residential areas lies between parking space and leisure space. Clear determination of parking areas ensures the safety of leisure activity spaces. In cases of insufficient parking spaces in old residential areas, solutions such as borrowing space externally or expanding internally can be employed. This can be achieved by demolishing illegal constructions, integrating idle land, and constructing new multi-story parking facilities to upgrade and revitalize parking facilities. Additionally, there should be clear boundaries between activity spaces and pathway spaces. The traffic system in old residential areas often involves mixed pedestrian and vehicular traffic, necessitating the delineation of pedestrian safety areas through changes in pavement materials or the use of warning yellow lines. Smooth and slightly rough pavements can prevent slips, and color and pattern designs on pavements can differentiate main roads, secondary roads, and activity squares for easy spatial identification.

The safety of the elderly is an important consideration for outdoor activities. Auxiliary handrails should be installed at sloping roads and steps, with high and low rails to meet the different needs of self-reliant elderly individuals and wheelchair-bound elderly individuals, thereby enhancing safety. The installation of emergency call buttons in public spaces is essential to ensure the safety of the elderly.

5.2 Accessibility

Age-friendly transformation of public spaces in old residential areas should be characterized by accessibility, which includes the usability of the site selection for public spaces and the accessibility of the arrival paths.

5.2.1 Utilizing Existing Core Landscape Areas for Convenient Access by Residential Area Residents

The renovation of old residential areas generally maintains the original spatial structure of the residential area. Therefore, it is essential to make full use of the existing core landscape spaces and integrate fragmented spaces to achieve rational spatial layout transformations, thus preserving the original usage habits of pathways. By integrating fragmented spaces, the multifunctionality of public spaces can be activated. The elderly and children are frequent users of residential environment spaces. According to research, 47.28% of the elderly need help from their children to take care of grandchildren.[5] Therefore, in addition to considering the use

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by the elderly, leisure activity spaces also need to focus on children's use. Public spaces are complex spaces that need to consider multiple needs and elements. However, according to the needs of residents, they should be organically combined in the order of leisure seating, fitness equipment, central activity spaces, children's activity areas, and elderly activity areas. Where conditions permit, core landscapes such as water features and sculptures can be added. Additionally, auxiliary seating such as rocks and steps can be installed in activity squares to increase seating capacity.[6]

5.2.2 Barrier-Free System Design for Life Paths and Activity Spaces

The design of barrier-free systems should be based on the life paths and places where elderly individuals engage in activities, ensuring that they can independently lead their lives and engage in leisure activities. The key points are: first, it should be systematic, meaning comprehensive coverage, connecting various activity venues in the residential area, entrances to public facilities, entrances to residential units, parking lots, etc., and seamlessly connecting with the barrier-free walking systems in urban roads. Second, it should be designed according to the standards of barrier-free roads and spaces, ensuring smooth traffic for the elderly themselves or those using wheelchairs. Attention should be paid to the detailed treatment at the intersections of venues to ensure sufficient space, road width, and slope to meet the needs of self-reliant and assisted elderly individuals, provide clear spatial environmental information prompts, create a familiar living environment, and provide clear and understandable prompts to give the elderly a sense of psychological security. Tactile paths should be set up according to the standards of barrier-free environments, ensuring that the routes are continuous and free of obstacles, and connected to tactile paths on urban roads.

5.3 Adaptability

The core of age-friendliness is to establish an adaptive relationship between the elderly and space and facilities.[7] This includes two levels: acceptability and comfort of public spaces. Acceptability is the foundation of public space renovation, where residents can accept the new layout and appearance of the residential environment after renovation. The improved environmental quality after renovation stimulates people to participate in comfortable environments.

5.3.1 Achieving Cultural Identity by Preserving Residential Area Characteristics

Residential area renovations should preserve the cultural symbols of the area in appropriate ways, such as the architectural finishes, sculptures that have existed in the residential area for many years, and beautifully landscaped plants with seasonal changes. These symbols can be displayed in new ways, such as coordinating and unifying the finishes of new environmental facilities and building materials, using architectural decorative symbols, recoloring sculptures, and rearranging plant landscapes through changes in spatial layout. Alternatively, local cultural characteristics and architectural styles can be integrated into the renovation design to harmonize the new environment with the original culture. The distinctive style of the residential area is the foundation of its cultural identity, which can evoke residents' resonance and sense of belonging.

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5.3.2 Enhancing Outdoor Activity Comfort by Adding Effective Rest Facilities and Adjusting Plant Groupings

Creating comfortable spaces that promote the social needs of the elderly, combined with systematic configurations based on road layouts, placing an adequate number of comfortable seats along the paths of elderly people's daily lives, supports the continuation of outdoor activities through rest. The plants in old residential areas have reached a certain age, forming gradually mature landscapes. Building on this, flowering and fruit-bearing plants can be added, or densely planted areas can be thinned out to create open visual spaces. The positions of deciduous and shade plants can be adjusted to achieve physical and psychological comfort. Given Jiangsu's location in the East China region with a mild climate and mosquito prevalence in summer, open planting methods and double-layer planting should be used in areas where people gather, along with the addition of mosquito-repellent and health-promoting plants. At the boundaries of activity spaces, planting methods with three or more layers can be used to enclose and create vertical facades, enhancing the sense of space.

6. Future Development Directions for Age-Friendly Renovation of Public Spaces in Old Residential Areas

6.1 Fully Consider the Scale and Adaptability of Environments for Both Care-Receiving Elderly and Caregivers

China is the country with the fastest aging population development globally, presenting a situation of "aging before affluence." Aging in place is not only an intrinsic need of the elderly but also the primary way for elderly care in China, with research showing that over 90% of the elderly choose to age at home.[8] However, currently, only about 30% of the elderly utilize public spaces for caregiving purposes.[9] This is partly due to the lack of willingness of caregiving elderly to engage in activities in public spaces and, on the other hand, the lack of consideration for the needs of caregiving elderly in residential areas, let alone specific places and facilities for caregivers. Resting, socializing, walking [10]exercises, equipment fitness, strolling, gymnastics, and tai chi are the main outdoor activities for caregiving elderly. Based on the specific activity requirements of caregivers, public spaces need to consider providing benches suitable for both wheelchair-bound elderly and those assisted by caregivers, rehabilitation equipment suitable for use by assisted or caregiving elderly, as well as space for the storage of canes, walkers, wheelchairs, and dedicated rehabilitation exercise paths.[11]

6.2 Establish Special Fitness and Rehabilitation Areas

The renovation of old residential areas should also consider the future usage of the community. It is estimated that by around 2035, the population aged 60 and above will exceed 400 million in China, accounting for over 30% of the total population, entering a stage of severe aging.[12] Many elderly patients need to continue rehabilitation exercises after discharge from the hospital. Therefore, if conditions permit, residential areas can set up dedicated rehabilitation areas to meet the needs of residents. These areas should not occupy the core areas of the residential community but should be easily accessible and closely connected to the core areas. Following outdoor design standards for both ground and facades, rehabilitation equipment should be

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placed in suitable locations. In terms of facilities, in conjunction with landscape design, appropriate exercise slopes and handrails of various heights should be installed, along with a sufficient number of seats for resting after exercise.

6.3 Introduce Smart Facilities to Build the Future Community

Elderly people have regular activity patterns in residential environments. Therefore, the use of smart facilities can enhance their ability to predict risks and reduce the occurrence of accidents. Through facial recognition technology, basic information of elderly residents, including their identity and health status, can be quickly and accurately recorded, while their activity types and durations can be automatically identified. With the help of intelligent management systems, the movements of elderly residents can be tracked in real-time to promptly detect any abnormal situations, such as failure to return home on time or excessive activity. If any abnormality occurs, the system will immediately issue an alert to remind relevant personnel to take timely action. However, the widespread adoption of intelligent security measures in residential area renovations is currently limited due to budget constraints and the insufficient scale of the user population. As the aging process accelerates, with support from national policies and increased funding, it is believed that smart management facilities will be more widely used, providing safer and more convenient services for aging in place.

7.Conclusion

It is important to emphasize that aging in place does not mean designing specifically for aging; it is not merely about considering the needs of the elderly. The goal of aging-friendly design in residential areas is to provide a safe, comfortable, and convenient living environment for people of all ages, with a focus on helping the elderly maintain independence and autonomy while prioritizing their needs. Fair access to public spaces is also a recognition of the human worth of the elderly, with strong psychological implications that benefit their physical and mental health, and promote the development of livable residential areas.

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