



Urban Old Community Space Renewal Design Guided by Pedestrian Network Repair: A Case Study of Jianshe Road Community in Chengdu's Chenghua District

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Abstract. This paper takes Jianshe Road Community in Chenghua District, Chengdu as an example to explore the application of pedestrian network repair in the spatial renewal of old urban communities. By analyzing the problems of fragmented community pedestrian networks and unreasonable road space, a dual strategy with pedestrian network repair as the core is proposed: first, repair broken roads, optimize road density and connectivity, and improve the integrity and accessibility of the pedestrian network; second, integrate commercial and ecological spaces with the pedestrian network as the context to optimize the functional layout. The study significantly improved the community walking environment by opening up dead-end roads, widening sidewalks, and adding pedestrian-only roads. At the same time, the combination of commercial space reorganization and green space ecological space connection has improved community vitality and residents' quality of life. The results show that the pedestrian network repair not only reflects the humanistic care of the concept of "urban dual repair", but also provides a systematic solution for the renewal of old communities, which has important practical reference value.

Keywords: Pedestrian network repair; Community renewal; Spatial reshaping

1 Introduction

In the context of sustainable urban development, the spatial renewal of old urban communities has become a prominent issue in both academic and planning domains. These communities, formed during earlier phases of urbanization, often suffer from outdated infrastructure, chaotic traffic systems, and fragmented pedestrian environments ^[1]. With the promotion of low-carbon living, aging population dynamics, and a renewed emphasis on healthy lifestyles, pedestrian-friendly environments are increasingly recognized as key elements for enhancing the livability and social vitality of cities ^[2,3]. However, in many urban cores, the early mixed-planning model, insufficient coordination among departments, and decades of spontaneous urban growth have left pedestrian

systems disconnected and inefficient, creating serious safety and accessibility concerns for residents^[4,5].

Scholars have extensively examined the role of pedestrian infrastructure in shaping livable and sustainable cities. Pedestrian networks not only promote energy efficiency and public health but also serve as social and ecological connectors across diverse urban functions^[6,7]. High connectivity and walkability are positively correlated with active transportation behaviors and reduced dependence on motorized vehicles^[8]. Moreover, studies have emphasized that pedestrian-oriented design enhances the attractiveness of commercial spaces, supports inclusive public spaces, and contributes to environmental justice, particularly in dense urban settings^[9,10]. International practices in cities like Copenhagen, Tokyo, and Melbourne have demonstrated that a well-planned pedestrian network can lead to the revival of old neighborhoods, through enhanced spatial integration and improved resident experience^[11,12].

Despite these insights, the integration of pedestrian network repair into urban regeneration strategies remains underexplored in many Chinese contexts. This study takes the Jianshe Road Community in Chengdu's Chenghua District as a case to investigate how pedestrian network repair can serve as a framework for comprehensive spatial renewal. By analyzing issues such as broken road continuity, insufficient network density, mixed pedestrian-vehicle conflicts, and inadequate functional integration, this paper proposes a dual strategy: (1) repair and reconnect the pedestrian road system to enhance accessibility and safety; (2) reshape spatial functions—particularly commercial and green open spaces—around the improved pedestrian network. Through targeted interventions such as the opening of dead-end roads, widening of sidewalks, pedestrian-only zones, and green corridor integration, the study demonstrates a practical and human-centered approach to revitalizing old communities.

Jianshe Road Community in Chengdu's Chenghua District was the core area of the old eastern industrial base and now serves as a key zone for the city's "Northern Redevelopment" strategy, part of Chengdu's comprehensive urban plan featuring central optimization, northern renewal, western control, southern expansion and eastern advancement. As is shown in figure 1, this 0.89 km² rectangular area has developed into a popular university neighborhood benefiting from its proximity to a top-tier university. However, it currently faces challenges including high building density, outdated infrastructure, traffic congestion and fragmented urban functions.

2 Repair and Improvement of Jianshe Road Community Pedestrian Network

2.1 Repair of Pedestrian Network

Pedestrian roads in Jianshe Road Community vary greatly in scale. Due to poor functional layout, many dead-end and blocked roads exist. The density and width of pedestrian paths do not match pedestrian flow, leading to congestion and space being occupied. Overall, pedestrian routes are fragmented, seriously impacting residents' mobility. Roads in the community are mainly of two types: main roads, where pedestrians and

vehicles are separated, and living roads, where they share space. The original road list is shown in Table 1.

Table 1. List of original roads in Jianshe Road Community.

Road Type	Measurement results
Main road (road for separating pedestrians and vehicles)	7598.34m
Lifestyle roads (people and vehicles traveling together)	13397.87m
Total road length	20996.21m
Planning area	1195296.59 m ²
Density (km/ km ²)	17.57

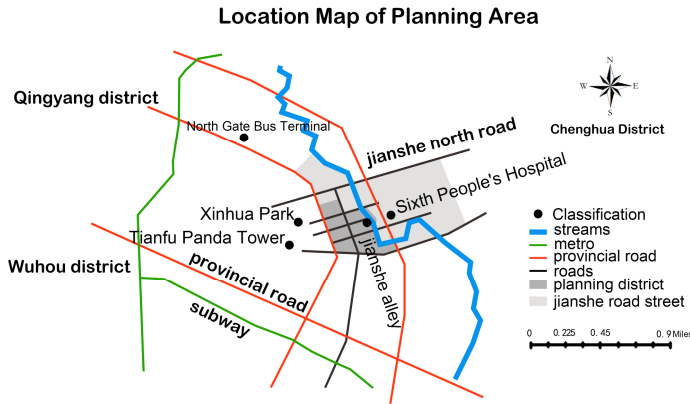


Fig. 1. Planning location map of Jianshe Road.

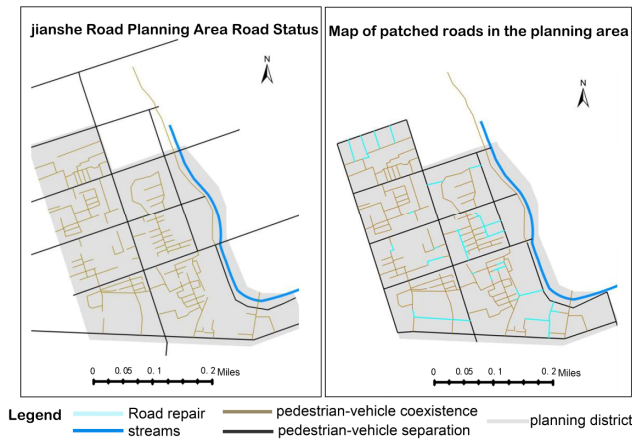


Fig. 2. Comparison of roads before and after the Jianshe Road community planning.

Based on the above description of the current situation, this paper adopts the following steps: (1) straighten out the original pedestrian roads and divide the roads in the planning area into two categories: pedestrian and vehicle co-travel and pedestrian and vehicle separation. (2) open up the pedestrian roads at the end of the planning area according to the current situation. (3) in response to the fragmentation of pedestrian roads and based on the living needs of community residents, plan new connecting roads, increase the density of the pedestrian network, and repair the Jianshe Road community pedestrian network. In the Jianshe Road community planning project, the original road length was 20,996.210 meters, and an additional 2,702.16 meters were added after the repairs. The total length reached 23,698.370 meters. The road density after the repairs was 19.830 km/km².

There is a river about 1,000 meters long in the east of the planning area. As is showed in Figure 2, there are about 275 meters of walking paths in the north and south of this section of the river, but there is a lack of proper walking paths in the middle, which has caused road interruption and seriously affected the comfort of people walking by the river. Therefore, based on theoretical methods and discussions, we plan to open up this section of walking paths, make it a pedestrian-only road, and improve the quality of the open space of the river.

After planning the road as pedestrian-only, it was found that one vehicle road still merged into it, affecting pedestrian comfort and safety. A survey showed that the road is near a major hospital and a community square, with high foot traffic (mainly from the hospital) and low vehicle flow. It is one of three roads connecting to the riverside green space; the other two are main roads, while this is a smaller residential street. Currently, vehicle traffic from both ends conflicts with hospital vehicles and pedestrians at the intersection. The road has a width of 11 meters and spans 129 meters in length, with a traffic flow of 4 cars per minute and 16 pedestrians per minute. Despite low vehicle flow, the high number of pedestrians highlights safety concerns. Therefore, the road is planned to become pedestrian-only, serving as a key link from the square to the river for residents and offering a safe, car-free route for hospital patients accessing the riverside area.

2.2 Spatial Transformation of Pedestrian Network

There are many problems with the Jianshe Road community road, the most prominent of which are:

(1) The pedestrian and motorway lanes at the intersections have not been separated by reasonable means. The pedestrian and vehicle spaces are seriously intertwined, the vehicle traffic is not smooth, and the walking experience is poor. At the same time, the interweaving of pedestrian and vehicle spaces poses a major safety hazard, affecting the traffic order and posing a threat to the personal safety of pedestrians and car owners.

(2) Due to unreasonable planning, pedestrian roads and non-motorized vehicle roads are irrationally intertwined in space. The road is parallel to the phenomenon of "people-cars-people-cars", and the blind path is planned between the road and the parking lane, which brings great inconvenience to the blind. At the same time, the spatial utilization

rate of this mode of road layout is low, and it is easy to have people and vehicles (non-motorized vehicles) mixed, as is showed in Figure 3.

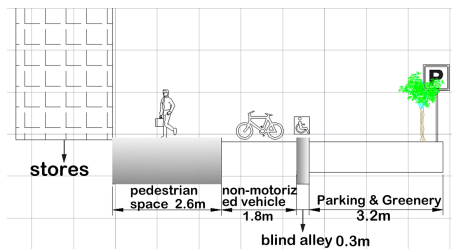


Fig. 3. Before road space reconstruction.

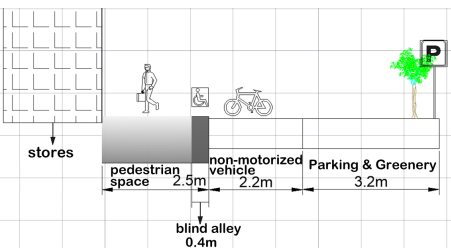


Fig. 4. After road space reconstruction.

(3) The sidewalk is a section of the road that is divided by curbstones, guardrails and other similar facilities for people to pass. During the field investigation, it was found that the block had serious encroachment on the sidewalk, such as the parking of shared bicycles and the planting of green plants on the road. The encroachment on the sidewalk not only affects the comfort of citizens' travel and the appearance of the city, but also poses a major safety hazard.

(4) Because the sidewalks of some streets in the old alleys of Jianshe Road were originally designed to be too narrow, and the surrounding commercial stores piled up goods and public facilities (shared bicycles, electric poles, surveillance camera poles) occupied most of the sidewalks, pedestrians had to be very careful when passing by, and some pedestrians had to walk on the motor vehicle lane to pass. The narrow roads and heavy traffic caused these roads to be frequently congested, which easily led to safety hazards.

These problems stem from disjointed infrastructure management, lack of departmental cooperation, and merchant encroachment on roads, blocking pedestrian access. The pedestrian walkways in the Jianshe Road community have a width of 2.2 meters, while the adjacent main road spans 16 meters in width. The observed pedestrian traffic flow is 41 people per minute, and vehicle traffic measures 12 cars per minute. The total length of pedestrian roads in this area is 800 meters. Urban roads define a city's identity, yet crowded sidewalks force conflicts between shoppers and pedestrians. Optimizing road space by widening walkways would align with Jianshe Road's development needs, ensuring safer, smoother foot traffic in the old district. This upgrade would improve living conditions and stimulate local commerce by better serving both pedestrians and businesses.

To address the second problem, the blind path is placed between the pedestrian space and the non-motorized vehicle space, and the width of the blind path is widened to 0.4 meters, with a total length of 793 meters, as is shown in figure 4. The total length of the widened sidewalk is 800 meters. According to the "Urban Road Design Code" (CJJ37-90), the smallest sidewalk in Chengdu, as a large city, is 3 meters, and the road to be widened is a commercial street, so the road widening range is 3-5 meters. The calculation is as follows:

$$W_{people} = Q_{people} / N_{people} \quad (1)$$

the sidewalk is calculated as follows:

$$N_{base} = \frac{3600 \cdot v}{h_{people} \cdot w_{people}} \quad (2)$$

During peak hours, the pedestrian volume on the sidewalk reaches 7,380 per hour. The pedestrian capacity per meter of sidewalk width is 2,400. According to formula (1) and (2), the Jianshe Road community widened the road to 3 meters.

3 Reshape the Functional Layout of Community Space with Walking Paths

3.1 Theoretical Overview

Pedestrian network repair enhances walkability, revitalizes old urban centers, and integrates functional, transportation, and ecological networks to rejuvenate both pedestrian infrastructure and urban space. Its flexibility improves the urban environment, revitalizes street life, and boosts city vitality. Connectivity varies by area: commercial zones adopt full openness for seamless pedestrian flow; residential areas use semi-open designs; and cultural/educational zones employ peripheral layouts to minimize noise disruption.

Open space is vital for neighborhood quality and aligns with growing demands for urban livability. Ecological space development is prioritized, ensuring harmony among living, production, and ecological zones. New communities focus on layered ecological spaces (public to private), while older ones maximize limited land by blending green areas with commercial, recreational, and daily activities—enhancing convenience and comfort.

3.2 Reshaping Commercial Space with Pedestrian Paths

This area's commercial spaces primarily consist of street-level shops in residential buildings, offering diverse but scattered food, clothing, and entertainment options. Area 1 features concentrated restaurants; Area 2 includes a 700 m² farmer's market; Area 3 is a comprehensive shopping mall. The northern zone caters to youth leisure, while the southern zone serves elderly grocery shopping. However, the north lacks elderly-friendly markets, and the south lacks scattered retail stores.

In the northeast, residential areas lack nearby shopping venues, leading vendors and residents to occupy sidewalks, creating unsafe mixed traffic, as is shown in figure 5. Our plan converts this street into a pedestrian-only zone, leveraging its parallel lane for minimal traffic impact. Adjacent riverside green space will be integrated, transforming the road into a multifunctional eco-street for recreation and shopping, enhancing land use efficiency and community ecology.



Fig. 5. Road maintenance location map.



Fig. 6. Map of Jianshe Road repair.

There are businesses set up along a 155-meter-long road near the river in the west of the planning area. Each store is narrow, and buyers need to stand outside to select goods, which conflicts with passers-by. There is also a bus stop on this 155-meter road, which conflicts with people waiting for the bus, forcing them to stand at the bus stop. As is showed in Figure 6, The pedestrian road is only about 1 meter wide, which has a certain impact on the safety of pedestrians on this commuter-type road, so the plan recommends closing this 155-meter-long commercial store, as is showed in Figure 7.

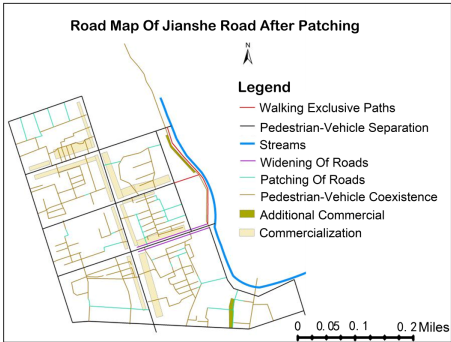


Fig. 7. Commercial distribution map of Jianshe Road community after planning.

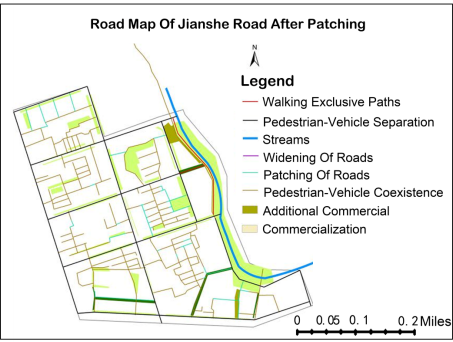


Fig. 8. Functional layout of Jianshe Road community after planning.

3.3 Reshaping Green Space with Walking Paths

In the core area of the old city we investigated, public open space is scarce, and large areas of green space are concentrated in relatively private areas such as the interior of newly built residential areas. There are few open spaces available to the public, and the existing open space environment is poor, which is not conducive to the long-term development of the area. In addition, due to the high construction density, the entire area cannot form a large area of open space.

When planning, we adopted the design method of "streets connected with green space", based on the pedestrian network, integrating various patchy open spaces, using scattered spaces to form small-scale open spaces, and expanding the radiation range of

open spaces. As is shown in figure 8, connecting open spaces with pedestrian networks improves the accessibility of open spaces, thereby improving the efficiency of space use and forming a networked urban open space system combining lines and surfaces.

Based on the repaired roads of the pedestrian network, new planar green space is added on the pedestrian exclusive road next to the hospital to connect the large strip of open green space along the river and increase the greening rate around the hospital. New road green space is added on the newly repaired road in the south to promote the continuity of the linear green space on the road. Landscape design methods are used in the planning area to beautify the environment and add infrastructure. As is showed in Figure 9, Green space spaces with relatively large original green areas and open to the community are formed into nodes at ①②③ for people to play, rest and exercise.

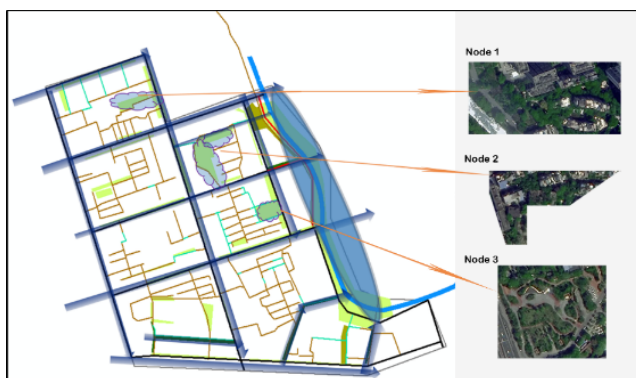


Fig. 9. Green space node diagram.

4 Conclusion

The repair of pedestrian network embodies the concept of "urban double repair". The repair of urban roads combined with the renovation of old cities will help change the previous destructive construction situation of large-scale demolition and reconstruction of old cities. The pedestrian network is mainly improved by pedestrian roads. Compared with the vehicle road as the skeleton, this method of giving way to pedestrians better reflects humanistic care. It not only allows people to return to a slow-moving life, but also increases the frequency of daily communication between people. Focusing on people's walking habits and rules, taking the entire pedestrian network as the skeleton, integrating various functional spaces in the community including commercial space and ecological space, not only optimizes the community configuration but also provides convenience for community residents. Therefore, this article uses a systematic perspective to repair the pedestrian network, and grasps the urban commercial and ecological space as a whole based on the pedestrian network, which promotes the improvement of the overall vitality of the old city center.

Disclosure of Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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