



Sustainable Renovation and Revitalization of Old Urban Communities for Infrastructure and Public Service Improvement in Chengdu

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Abstract. With the continuous development of society and economy, the idea of urban renewal planning is also undergoing significant changes, and people's quality of life is gradually improving. In addition, old communities have accumulated deep historical and cultural deposits in the course of time, and the revitalization and transformation of old communities located in urban centers has gradually become an important social issue. Taking the old community of Caojia Alley in Jinniu District of Chengdu City as an example, this study analyzes and concludes that some of the buildings with characteristic features have been destroyed, the residents have built indiscriminately, the urban memory has been lost, and the transportation system has been mixed up, and then proposes that the three major aspects of renovation should be strengthened to protect the buildings with characteristic features, improve the community environment, and optimize the transportation system.

Keywords: Urban regeneration, Community activation, Traffic optimization, Old residential buildings, Green design.

1 Introduction

Out of the demand for upgrading the image of the cityscape and improving the appearance of the city, the external space of the old city, which is rich in life flavor and does not conform to the so-called aesthetics of orderly streets, is constantly being remodeled or even demolished, and the order of the lives of the original residents of the old city is being disrupted, and the characteristic culture of the old city is gradually being lost. [1] As the bearer of urban memory, the protection and adaptive use of old urban neighborhoods has become an important issue that requires general attention in the process of urban planning and renewal in China. In August 2021, the Ministry of Housing and Urban-Rural Development (MOHURD) issued a Notice on Preventing the Problem of Large-scale Demolition and Large-Scale Construction in Implementing Urban Renewal Actions, which puts forward that urban renewal actions should be carried out in a manner that "prevents large-scale demolition and large-scaled construction, and promotes small-scaled, gradual organic renewal and micro-

remodeling".[2] Chengdu is one of the first batch of national famous historical and cultural cities, and the birthplace of ancient Shu civilization. [3]At present, Chengdu has established a relatively perfect system for urban renewal, but there are still many deficiencies and problems in the process of protection and adaptive utilization. This paper summarizes the problems and countermeasures in the protection, utilization and revitalization of old neighborhoods in Chengdu through field research, text analysis and other methods, in an attempt to provide an experience reference for China to strengthen the transformation and revitalization of old neighborhoods.

2 Method and Case Study

2.1 Current Issues

Misuse of Neighbourhood Buildings

Damage to the Style of the Building Facade. Caojia Alley was built in the early 1950s, and after years of use, the exterior wall finishing materials have deteriorated, and most of the door and window components of the exterior wall have been rusted and corroded seriously. In addition, some residents have installed air-conditioners, security nets and closed their balconies; and they have built storage spaces on the exterior walls in a variety of ways and with strange materials, which seriously affects the aesthetics of the residences. Moreover, almost all of the one-storey houses in the area have been turned into commercial houses with the development of the society and the demand of the residents' life, and many of the residents have used colorful and mixed billboards to destroy the original architectural style.[4]



Fig. 1. Destruction of Soviet-style red-brick buildings in Caojia Alley Lane.

Private Additions and Environmental Damage. In order to increase the area of use, some residents of Caojia Alley have privately added non-compliant buildings on the roofs and between units and sold or rented them to the public, which not only occupies the green space, but also diminishes the privacy and quality of living of the original inhabitants, and neglects the harmony and unity of the environment and style. With the continuous development of the city, for the purpose of cheap price and convenient transaction, residents spontaneously transform and utilize public space, forming informal bazaars. On the one hand, informal bazaars satisfy market demand, provide employment opportunities and even become cultural symbols of the community, but on the other hand, they affect the community environment to a certain extent, with vendors occupying sidewalks, alleys and other public spaces in a

Moreover, there is a serious lack of road lighting and a scarcity of street lamps in the Caojia Alley Workers' Village community, posing a safety hazard to residents in the community (Fig. 5). These behaviors lead to the compression of residents' activity space and green space, and they spend less and less time outdoors. There is also very little green space in the old neighborhoods, which is contrary to the "park city" concept practiced in Chengdu.



Fig. 5. Status of lighting within the Caojia Alley community

2.2 Retrofit Strategy

Ideas for Architectural Style and Environmental Renovation. Some old buildings should be firmly protected. "Protection" is not the same as "Retention" and "Preservation", only with a dynamic, developmental perspective to look at it, its remediation, to prevent its decline, and promote its development, in order to realize the true meaning of protection. Protection in the true sense of the word.[7] For the old buildings in Caojia Alley, in-depth analysis of its current situation, determine the construction age of each building in Caojia Alley Workers' Village Area, divide the buildings in the community into three time periods: 50s to 60s, 70s to 90s, and after the 90s, and carry out facade renovation of the buildings of each era based on the architectural style and historical characteristics of different time periods. However, old urban communities have been gradually formed over a long historical period and are bound to possess historical and cultural deposits of different periods and types. Therefore, its protection should not be a frozen, static protection of history, nor should it cut off its own development, but must ensure the integrity and continuity of the historical lineage.[8]

Demolition of private buildings and shantytowns in the area to release public space. Then, based on the analysis of the population structure, the location of each public node in the planning office and increase the green space at the public nodes. Formula (1) is used to calculate the increased greening rate after the renovation. σ denotes the greening rate, S_1 denotes the greening area (m^2), and S_2 the area of the planned construction land (m^2).

$$\sigma = \frac{S_1}{S_2} \times 100 \% \quad (1)$$

Ideas for Infrastructure Improvements. First, different motor vehicle lane widths are set according to the width of the roadway. Get the flow of people and vehicles on each traffic road in the old community through research. Based on the research data,

the main traffic roads were identified. An overhead walkway system is placed over the main roads to separate people and vehicles, and public nodes are combined through the walkways. Then, according to the shape of the overhead walkway, set up points, lines, surfaces, and systems of green space, and use Formula (1) to calculate the greening rate. Subsequently, parking spaces and recreational facilities are set up in combination with the walking frame.

3 Results and Discussion

3.1 Results of Architectural landscape and Environmental Transformation

Building facade renovation results. Firstly, the facade of the 1950's building on the site was transformed into a three-part skin structure by using different materials according to the Soviet style of architecture. Secondly, the large roofs that were prevalent throughout the country in the 1950s were mostly used as decorative structures without much functionality. The design restores the roof and reveals the wooden part of the roof.

The houses of the 1970s and 1990s were characterized by flat roofs, many windows, and little decoration.[4] Starting from the concave-convex relationship of the facade, balconies and air conditioning units are set up on the original "matchbox" facade to increase the use area of the residents, and discarded red bricks are used for the construction of the building.

For buildings built after the 1990s, a 3m wide concrete frame structure was extended on the north facade of the building. Vertical greenery was placed on the concrete frame and watered with air-conditioned water to increase the green space and enhance the interest of the landscape in the old neighborhood.



Fig. 6. Building facade remodeling effect.

Public Space and Environmental Transformation. The public spaces needed by residents as summarized from the population analysis are: parks, reading rooms, senior orchestras, senior care centers, and playgrounds. As shown (Fig. 7), the three entrances of the community, north, east and west, have a high flow of people and vehicles at the east entrance. Therefore, the nodes are inserted into the community based on these, and the distribution is shown in Fig. And, at the same time, a large amount of green space is also added (Fig. 8), the area of the increased green space is 7381.84 m²., increasing the 11.708% greening rate.

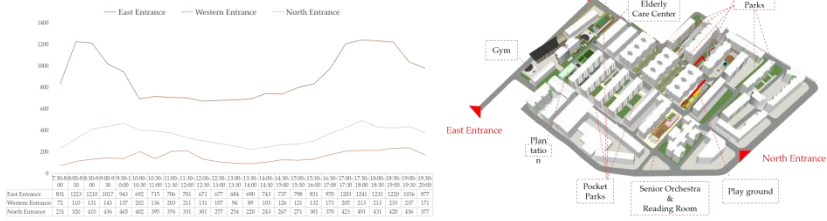


Fig. 7. Map of foot traffic data at different entrances and node setups.



Fig. 8. Part of the green space effect.

3.2 Infrastructure Optimization

As shown in the figure, it can be observed that the width of the roads in the community varies, with one-way lanes and two-way lanes, respectively, depending on the width setting (Fig. 9).



Fig. 9. Schematic of single and dual carriageways in the community.

During weekdays, pedestrian traffic is mainly concentrated on Road 2, Road 3, Road 4 and Road 5 (Fig. 10), which are set up as the main traffic roads, on top of which elevated walkways are set up to form a one-axis, one-ring elevated (Fig. 10). This adds 5687.13m² of traffic area and improves street accessibility. Between the unit courtyards, the space below the walkway is utilized to set up parking spaces and connect various public spaces to enhance the physical conditions within the community. The elevated walkway combines with the street below to form a space under the corridor, providing a sitting area for the elderly. Streetlights in the community are staggered on both sides of the street to maximize resource savings while maintaining basic lighting (Fig. 11). Then, interspersed with the arrangement of points, lines and surfaces type of green landscape, the area of the increased green space is 2112.44 m², increasing the 3.350% greening rate.

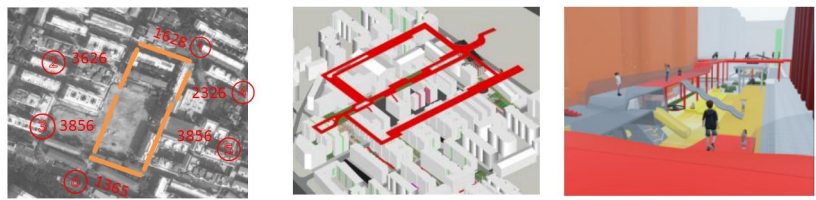


Fig. 10. Schematic diagram of overhead walkway modification.



Fig. 11. Photographs of open spaces, elevated greenery and street lighting installations.

3.3 Transformation value

This renovation design takes Caojia Alley as an example, in the case of protecting the original urban texture not to be destroyed, through the protection of architectural style, the use of discarded materials, the continuation of the city's memory on the basis of the old buildings, a total of additional green space area: 9493.28 m², a total increase in the greening rate: 15.508%. Through the addition of elevated walking frames to create a three-dimensional transportation space, not only to provide residents with a slow walking green way, while ensuring the privacy of the community aborigines, but also to create a new modern community of open sharing, and improve the community environment. These renovation measures have greatly increased the amount of time residents spend outdoors. According to research, people who spend just about 20 minutes in an environment such as a garden or park are about 64 per cent more satisfied with their lives.[9]

4 Conclusion

The protection, revitalization and renovation of old urban neighborhoods are related to people's well-being, whether it is to improve the urban space or to inherit the city's history and culture, which is the main way to enhance the sense of happiness and accessibility of the city. This paper investigates the history and current situation of Caojia Alley Workers' Village in Chengdu City, and through study, it explores the experiments on the transformation of Caojia Alley's old neighborhoods from the four levels of the protection of characteristic architectural style, environmental enhancement, greening rate enhancement and transportation system improvement, which are specifically divided into the following points:

1. Remodeling old building facades and utilizing discarded red bricks and other materials to continue the urban memory of Chengdu.

2. In the public environmental space, a total of additional green space area: 9493.28m², a total increase in the greening rate: 15.508%.

3. Increase the transportation area by 5687.13m², and greatly improve the accessibility and integration of the street.

The revitalization and utilization of old urban neighborhoods is conducive to the consolidation and enhancement of a city's status and the shaping of a global or local city with regional cultural characteristics.

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