

Common Safety Hazards and Regulation Strategies in the Renovation of Old Urban Residential Areas

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Abstract

Since the safety hazards in old urban residential areas are quite prominent in China, these persistent problems need to be addressed in the current renovation of old urban residential communities, which also have crucial impacts on the effectiveness of the renovation. This article categorizes common safety hazards in the renovation of old urban residential communities into six types: building safety, pipeline safety, environmental safety, fire safety, emergency avoidance, and biosafety hazards. It proposes remediation strategies from the aspects of hazard investigation, classification remediation, technical application, financial support, and long-term management, in order to provide reference for the entire process of safety hazard remediation in old urban residential communities in China.

Keywords

Renovation of Old Urban Residential Areas; Safety Hazards; Remediation Strategy; Long-Term Management.

1. Introduction

The general characteristics of the old town in China are large quantity and wide area, large population density and high aging degree. Due to the increasingly prominent problem of damage and aging of old urban communities, there are great deficiencies in residential safety, supporting functions and public services, especially the building body, municipal infrastructure in public areas, and public environment, there are many safety hazards. Due to the lack of effective safety plans and monitoring, safety accidents and behavioral accidents occur frequently in old residential communities. It has been difficult to meet the security and psychological needs of the people.

In July 2020, The General Office of the State Council issued the "Guiding Opinions on Comprehensively Promoting the Renovation of Old Urban Communities" (Guo Changfa (2020) No. 23), in principle, the content of "basic" transformation should be changed as much as possible, and the content of "perfect" transformation should be changed as much as possible, so as to promote the elimination of security risks existing in old communities [1]. In July 2023, the Ministry of Housing and Urban-Rural Development and other departments issued the Notice on Solidly Promoting the Renovation of Old Urban Communities in 2023, which clearly proposed that efforts should be made to eliminate safety hazards, adhere to the bottom line of safety, and run the concept of safe development through all links and the whole process of the renovation of old urban communities [2].

It can be seen that the rectification of common safety hazards in old urban communities has become an important task in urban construction and management, which is of great significance in ensuring the safety of residents' lives, improving the quality of life of residents, improving the comprehensive carrying capacity of cities, and promoting urban renewal.

2. Common Types of Security Risks in Old Urban Areas

Old urban communities generally have hidden dangers in many aspects such as architecture, environment, fire protection, emergency avoidance and biology. The root causes of these hidden dangers include the following points: first, due to the long construction, natural aging caused; Second, the original design and construction standards are relatively low, subject to the technical constraints at that time, the formation of historical reasons; The third is the lack of property management, maintenance and maintenance is not in place, man-made; Fourth, due to the lack of supervision and construction in the renovation process of the community, the above conditions have seriously affected the sense of security and satisfaction of the residents.

2.1. Building Safety Hazards

Table 1. Specific types of building safety hazards

Specific Types	Specific manifestation
Hidden dangers of building body and ancillary facilities	Cracking of external masonry, peeling of paint, peeling of finishes, aging of structural materials
	External wall insulation empty drum, shell, cracking, falling off
	Anti-theft Windows, air conditioners, flower shelves and other deformation, corrosion, loosening, aging
Platform protection hazards	Corridor platform, aisle platform, public terrace, both sides of basement ramp and presence field Platforms with ground height difference lack protective guardrail
	Guard rails are corroded, aged, loose, and high due to disrepair Degree does not meet the requirements and other conditions
Hidden dangers of lightning protection facilities	Lightning protection, anti-static facilities are not perfect, lightning rod for many years exposed to natural aging, easy to corrosion, rust, welding, and lack of regular inspection and maintenance, once broken Loss of lightning protection function
	There is no ground line to enter the household, or there is a flash line, lead down due to aging, damage and other phenomena
Hidden danger of falling from high altitude	Street balcony, platform edge and other debris accumulation, subject to weather, human and other factors, The event of falling objects
	The lack of high-altitude parabolic surveillance cameras makes it difficult to accurately locate and monitor

Building safety hazards in old residential areas are the most common and have the greatest impact on residents' safety. The old buildings in the community are in disrepair and aging seriously. The construction standard is low, the original design and construction of the building is unreasonable, the earthquake prevention and disaster prevention facilities of the building are not perfect, and the subsequent reconstruction, expansion and decoration may have different degrees of impact on its structural safety. Environmental erosion, excavation and reconstruction of surrounding roads, and massive construction of new buildings will also cause uneven settlement and cracking of buildings in old residential areas [3]. Some residents have a weak sense of safety, and the distance between the road and the building is too short, and the situation of building falling objects and man-made falling is also very easy to cause personal injury. According to the analysis of 751 cases of high-altitude fall from 2011 to 2020 by Renmin University of China, 29.83% of them are falling off walls and bricks, external wall appendages, roof appendages, etc., accounting for the highest proportion [4], and such hidden dangers are more common in old residential buildings due to lack of investigation and supervision.

Based on different performance characteristics, building safety hazards can be specifically divided into: building body and ancillary facilities hazards, platform protection hazards, lightning protection facilities hazards and high-altitude throwing hazards, as shown in Table 1.

2.2. Pipeline Safety Hazards

The municipal infrastructure of the old community, especially the pipeline, has a high frequency of use, and many belong to the management of the franchised unit, and the community lacks the ability to transform and manage alone; The municipal infrastructure of the old community has greatly exceeded its service life, such as aging lines, pipe network bursts, etc. The municipal foundation is relatively backward, the configuration is low, and with the improvement of residents' living standards, its carrying capacity is difficult to meet the daily needs of residents, which artificially causes some non-compliance problems, such as charging pile, wire layout problems leading to flying line problems, gas pipeline private transformation, etc., which is very easy to cause accidents.

According to the differences in pipeline types, it can be divided into power hazards, gas hazards, heat hazards and biogas hazards, as shown in Table 2.

Table 2. Specific types of pipeline safety hazards

Specific Types	Concrete performance
Electrical hazards	Electrical wiring has aging, exposed wiring, and multiple flying wires
	Transformer capacity is insufficient, lack of intelligent monitoring
Hidden danger of gas	Gas pipeline damage, aging; And aging and unqualified rubber hoses
	Existing or additional pipelines are not equipped with crash guardrails, are not fixed, etc
	There is leakage, poor water flow or pressure change in heating and water supply pipes
	Improper use and management of gas tanks
Heat hazards	Heating pipe network components, such as valves, brackets, meters, etc., cause heating equipment due to lack of maintenance
	Apply varying degrees of corrosion and damage
Hidden danger of methane gas	The pipe diameter, heat load and design parameters of heating pipe network do not match
	Sewer pipes, inspection Wells, cellar Wells, septic tanks, biogas tanks are relatively closed and not cleaned in time, resulting in excessive concentration of biogas, and then biogas spillover, biogas poisoning, Explosion accident

2.3. Environmental Safety Hazards

The road space of old residential areas is generally narrow, and the green belt on both sides of some roads is thick and high in height, or there are vehicle occlusion, disorderly parking and other conditions, which easily affect the sight of vehicles entering and leaving. Moreover, many roads lack protective measures such as anti-fall nets, affecting the daily travel of residents and vehicles. Some old residential areas are low-lying, and there are problems such as basement rainwater backpouring and poor drainage of rainwater. The lack of barrier-free facilities and landscape facilities has an impact on the travel safety and social communication of children, the elderly and the disabled, and also goes against the concept of building friendly communities for all ages, as shown in Table 3.

Table 3. Specific types and manifestations of environmental safety hazards

Concrete type	Specific manifestation
Hidden danger of lane blind area	In and out of the vehicle line of sight is easy to produce visual blind areas
	The safety material defense facilities such as speed belts and signs inside the community are missing or set unreasonable
	Lack of separation barriers between roads and public activity areas
Road paving and pipe well hazards	Potholes, bumps and collapses on public roads, and fallen trees on both sides of roads
	The aperture design of the road gutter cover plate is unreasonable, and the pavement is affected by paving materials, Weather, environment, long-term wear and tear and other factors, easy to cause slippery
	The manhole cover is damaged, displaced, loose, turned over, lack of anti-fall nets and so on Protective measures, lack of maintenance and safety warning reminders
Accessibility Hidden dangers	Lack of anti-slip design, barrier-free information tips, etc., in public places
Hidden danger of basement backfilling	There are defects in the layout, design and construction of drainage pipelines in residential areas
	There are problems such as lack of rain and pollution diversion, aging of sewer pipes and poor discharge of sewage
	Water leakage and seepage exist in the basement all the year round, and extreme weather is easy to cause underground Room water, back irrigation
Hidden dangers of landscape facilities	The water system landscape lacks guardrail, warning signs and other facilities
	Public facilities and landscapes have rigid vertical right angles and sharp corners
	Fitness equipment hole design is unreasonable, lack of maintenance management

2.4. Fire Safety Hazards

At the beginning of the construction of the old community, due to the low design standards, there are widespread problems such as narrow fire passage, not reserved enough fire spacing and fire climbing surface, and not clearly delineated fire passage marking lines. In the later use, as the number of private cars continues to rise, the occupation and blocking of fire channels caused by the shortage of parking Spaces are more common, which seriously affects the normal passage of fire trucks when accidents occur.

Residents pile up debris at will in the corridor, park the battery car, and some also pull the flying wire to charge the battery car, which is easy to cause a fire, but also hinder the evacuation and fire rescue in the event of a fire. In addition, due to the lack of professional property management, the fire fighting facilities in the old community are mostly in a state of unmanaged maintenance, fire equipment, fire hydrants, etc., can not be used normally, and the evacuation channel lacks the necessary emergency lighting, evacuation indication signs, etc., which has greater security risks. See Table 4.

Table 4. Specific types and manifestations of fire safety hazards

Concrete type	Specific manifestation
Fire escape hazards	The fire channel is narrow, blocked, occupied, etc., affecting the normal passage of the fire engine; The fire passage marking line is not delimited or not clearly delimited Insufficient fire spacing and fire climbing surfaces are reserved
Evacuation access Hazards	Corridor debris accumulation, parking electric vehicles, private pull flying line
	The evacuation distance is not enough, the safety exit is closed, the enclosed cage and other evacuation channels lack the necessary emergency lighting and evacuation indication signs
Hidden dangers of fire protection facilities	Fire protection equipment is damaged, missing or not functioning properly
	No outdoor fire hydrant is installed, or the fire hydrant has no water source, insufficient water pressure, and insufficient extinguishing distance

2.5. Emergency Risk Avoidance

On the one hand, the public Spaces such as green Spaces, squares and parks in old residential areas are small, which are often difficult to be used as safe refuge places for residents to avoid major public emergencies such as floods, earthquakes, epidemics and explosions, and the emergency facilities in the residential areas are not fully equipped, such as the lack of emergency water supply, power supply, sandbags, ropes and other emergency materials. On the other hand, the setting of disaster avoidance signs in old residential areas also has different degrees of deficiencies. Disaster avoidance signs have the function of guiding residents to the disaster avoidance places quickly, and should be standardized, as shown in Table 5.

Table 5. Specific types and manifestations of emergency risk aversion

Specific Types	Specific manifestation
Avoid hidden dangers in disaster sites	Lack of safe refuge places to deal with major public emergencies emergency facilities are not fully equipped, and emergency materials are not configured
Avoid hidden hazards of disaster indication	Emergency evacuation roadmap, emergency evacuation place identification plate is missing

2.6. Potential Biosafety Hazards

Some old residential areas lack of design and management of greening, planting oleandrum, Nantian bamboo, water Guanyin and other toxic plants or some plants with unclear toxicity, strong smell, a large number of flying catkins, pollen concentration of plants lack control; Most of the trees have been planted for a long time, and there are many big trees, which have unstable roots and inclined trunks. The old community generally lacks regular weeding and killing of flowers and trees, and the public space environment is poorly cleaned, the garbage is not cleaned in time, and it is very easy to attract snake bees and rats ants. These conditions are prone to biosafety hazards, as shown in Table 6.

Table 6. Specific types and manifestations of biosafety hazards

Specific Types	Specific manifestation
Plant safety hazards	The tree's crown and root system can easily affect power lines and underground pipes
	There is a tipping hazard, easy to affect the low-rise residential lighting
	Pollen and floc plants cause harm to people with allergies during the flowering season, affecting residents' travel and outdoor activities
Animal safety hazards	It is easy to attract snake bees and rat ants, and harmful insects and animals are easy to enter the house along the branches
	There are hidden dangers such as termites corroding walls, hornets nesting on balconies, and rats flooding

3. Regulation Strategies for Security Hazards in Old Urban Areas

3.1. Linkage City Physical Examination and Hidden Danger Investigation

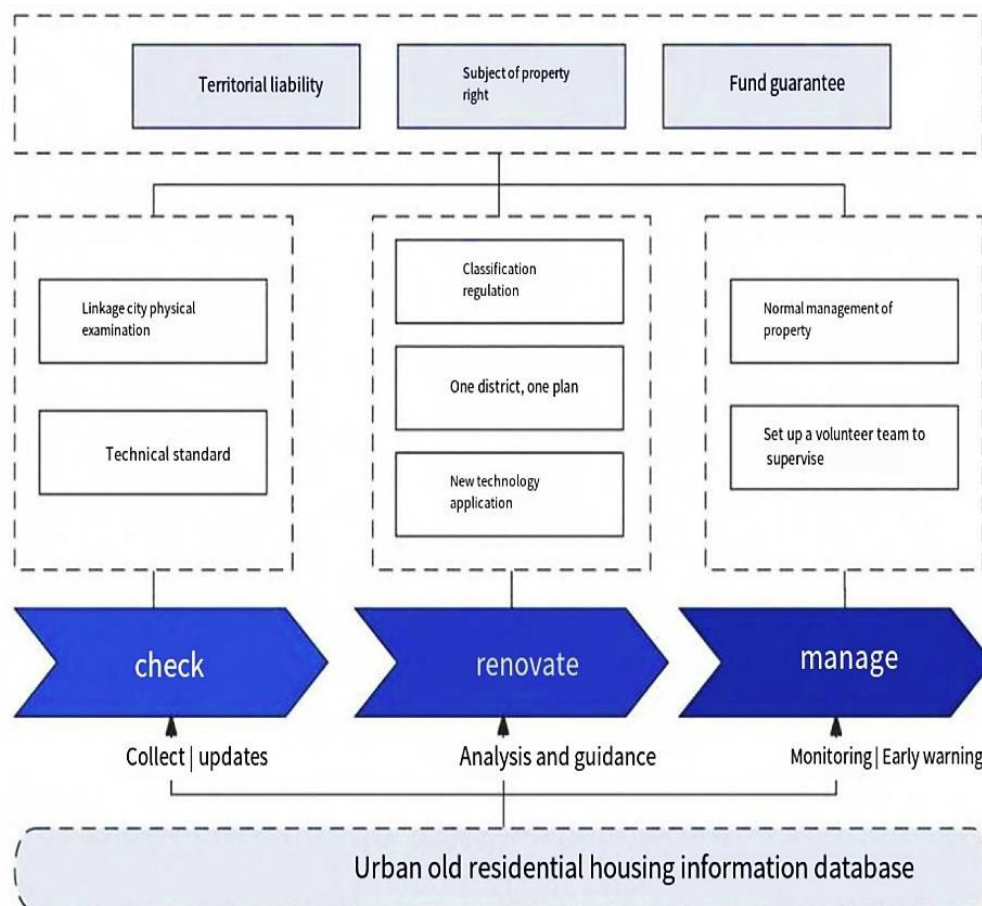


Figure 1. Housing information database of old residential areas in cities and towns.

In October 2023, the Guiding Opinions of the Ministry of Housing and Urban-Rural Development on Comprehensively carrying out Urban Physical Examination were issued, which clearly stated that "from housing to residential areas (communities), blocks, and urban

areas (cities), the difficulties, blocking points, and pain points that are strongly reflected by the masses are identified." Therefore, as a housing and community security risk investigation, should rely on the city physical examination action, by the local housing and construction department overall leadership, housing management, urban management, fire, public security, emergency management and other lines of competent departments responsible for coordinating and promoting the investigation of all old residential areas of the district security risk situation, through the property investigation, department and street town verification, professional institutions participation and other forms of combination. Complete the investigation and preliminary judgment according to the safety hazard investigation specification to ensure the source control.

The investigation content should include but not limited to common safety hazards such as buildings, pipelines, and the environment, and the old community that has completed the transformation should focus on the inspection of new facilities such as the installation of elevators, awnings, etc. For the old community that is being transformed, the safety supervision body should carry out regular inspection of project quality and safety, and urge the participating units to implement the main responsibility of project quality and safety.

In combination with the urban physical examination information platform, the housing information database of old urban residential areas is built, and the security hidden danger investigation information of the residential area is well preserved, dynamically updated and real-time monitoring, and the data analysis ability is used to implement regional regulation, type regulation and predictive supervision, as shown in Figure 1.

3.2. Classification and Rectification According to Priority and Urgency

According to the current situation of security risks, the territorial responsibility and departmental supervision responsibility should be implemented, and the rectification plan should be formulated according to the principle of "one community one plan" according to the investigation results. The economically and technically feasible rectification strategy should be selected according to the demands of residents. The rectification period, the source of rectification funds and the supervision department should be clearly defined in the plan, and the property right should be the main person responsible for safety. We should fully mobilize their enthusiasm for regulation. We should adhere to local conditions, make specific provisions from the aspects of safety hidden danger investigation and diagnosis evaluation, remediation plan design and formulation, construction quality control and acceptance, long-term management mechanism establishment and improvement, and determine the corresponding technical indicators.

For the old residential areas with property management, the property enterprises should be guided to perform their duties and strengthen the renovation, maintenance and management; Where there is no property management, the community under the leadership of the street town shall be responsible for renovation, maintenance and daily management. The closed-loop management of the rectification process should be strengthened, and for the safety hazards found in the inspection, the district street town should develop a special maintenance plan, select a strong and reputable third-party enterprise to participate in the safety hazards rectification work, and conduct acceptance in strict accordance with the quality acceptance standards and other provisions.

For the safety hazards found in the investigation, classification and rectification should be implemented according to the type of safety hazards and the principle of priority. For buildings with serious safety hazards, residents should be evacuated to stop using them, and warning lines should be drawn and obvious warning signs should be set up before regulation. General safety hazards such as occupied, blocked, closed fire truck passageway, non-normal water

supply from fire hydrants, and animal and plant infestation should be handled immediately to ensure the safety of residents' lives and property.

3.3. Guide the Safe and Stable Application of New Technologies

Relevant departments should guide and exert the effectiveness of new materials, new processes and new technologies in the rectification of safety hazards in old urban communities, by formulating a recommended catalogue of new processes, new materials and new technologies for the rectification of safety hazards in old residential areas, as well as a catalogue of restrictions and elimination of processes, materials and technologies that affect safety hazards. Improve the cognition level of design, construction, supervision and other units on new construction processes, materials and technology applications, reduce all kinds of safety hazards caused by design and construction problems, and achieve prevention.

In terms of new materials, such as the use of new materials to transform water supply and heating pipeline facilities, it is conducive to increasing the service life and reducing problems such as bursting. As far as the new process is concerned, through the analysis and optimization of the process flow, the potential safety risks can be found and reduced, while the production efficiency can be improved, the maintenance time can be reduced, and the impact on the daily life of residents can be minimized. In terms of new technologies, make full use of digital means such as the Internet of Things, cloud computing, and big data to strengthen intelligent sensing and intelligent monitoring, and effectively reduce early warning and prevent the occurrence of hidden security accidents through intelligent electricity monitoring and intelligent fire monitoring technologies in the residential distribution room. In the renovation and renovation of old residential areas, new technologies can also be adopted to reduce the hidden dangers of construction quality and safety. For example, the application and realization of BIM technology in the renovation of old residential areas can maximize the promotion efficiency of engineering projects. Through global and visual data analysis, the implementation of technical processes can be correctly applied to the renovation of residential projects. Improve project construction quality [5].

3.4. Multi-channel Strategy to Implement Financial Security

We will adhere to the combination of self- financing by responsible entities and financial subsidies. Safety hazards rectification and old residential renovation integration, should actively strive for subsidy funds; For local repairs or special rectification, the community that has paid maintenance funds shall, in accordance with the application procedure for maintenance funds, be maintained by the property, the owners committee or the territorial community organization, and further simplify the application process for maintenance funds and reduce the approval time limit; For the community that has not paid maintenance funds, the property, owners' committee or the territorial community organization and convening all the owners through raising special maintenance funds, drawing provident fund and other ways to raise money for maintenance.

To urge and guide specialized business units to fulfill their social responsibilities. The supporting facilities such as water, electricity, gas, heating and information that need to be renovated in the old community shall be prioritized into the annual renewal and renovation plan, and the relevant pipeline facilities in the old community shall be jointly funded and synchronically participated in the renovation and upgrading of the relevant pipeline facilities in the old community, and the subsequent management and protection responsibilities shall be implemented.

Set up a special emergency fund. Once there is a major safety hazard in the old community, in the case of lack of maintenance funds, the territorial government should apply for a special emergency disposal fund according to the size of the old community, and then return to the

fund after the special maintenance funds of the community, or in line with the principle of "who uses, who benefits, who contributes", the community raises funds to return the fund. The specific rules and conditions for use shall be formulated by the territorial government.

We will explore the establishment of urban housing construction safety insurance programs. By the local housing bureau to promote the implementation, try the "resident investment + government subsidy" model, that is, the government financial subsidy part, to guide the community owners committee to promote the maintenance liability insurance insurance. The insurance company is responsible for underwriting, once the phenomenon of payment in the community, the insurance company organizes professionals to investigate the scene and complete the claim settlement process according to the amount of loss and maintenance expenditure.

3.5. Establish a Long-Term Management Mechanism after Rectification

Do a good job of connecting the renovation of old residential areas and the rectification of security risks, and promote the organic combination of the two. For those who have not completed the transformation of old residential areas, those with more safety hazards should be prioritized into the recent transformation plan of old residential areas, and some hidden dangers and chronic diseases should be thoroughly solved in the transformation process to achieve "comprehensive transformation once and once in place"; For those who have recently completed the renovation of the old community, if there are safety hazards such as building exterior walls and road damage again, or safety hazards such as the installation of elevators, illegal construction and demolition due to the renovation, the responsibility for the problem should be clarified in accordance with the principle of "construction and management in one", and the rectification responsibility should be implemented by the construction, design and construction units of the old community transformation. The construction of the old residential area should improve the safety and quality management, and eliminate the safety risks in strict accordance with the existing norms and standards; Carry out civilized construction to avoid the formation of new safety hazards or construction accidents due to renovation.

The long-term operation and maintenance after the renovation of the old residential area is an important starting point to consolidate the regulation effect of safety hazards. Therefore, it is necessary to incorporate the regular investigation of security risks into the daily operation and maintenance of old residential areas, and implement the simultaneous improvement of transformation and management. The owners of the conditional community should select property service enterprises in a timely manner, strengthen the safety prevention work and inspection mechanism of the property management area, strengthen the normal management of fire protection, pipeline and other hidden dangers, and do a good job in monitoring and prevention; For those communities that do not have the conditions for the time being, the community will take the lead in soliciting the opinions of the owners, manage them through trusteeing, social organization hosting, and residents' self- management, launch the establishment of a volunteer team for the prevention and control of safety hazards and a mass supervision mechanism, and conduct regular inspections and supervision of safety hazards in the community.

4. Conclusion

The rectification of security risks in old residential areas will be a long-term task, which can be fully combined with the urban physical examination work, introduce the concept of physical examination in old residential areas, and take the investigation of security risks as a mandatory task. In accordance with the work flow of physical examination, diagnosis of hidden dangers, transformation and treatment, acceptance and evaluation, precise efforts will be made to comprehensively eliminate all kinds of security risks and ensure the life safety of residents in

old residential areas. At the same time, in accordance with the principle of reform and priority, multi-party efforts should be made to jointly manage, give full play to the leading role of grassroots party building, promote zero action in non-property communities, promote residents' autonomy, establish a dynamic investigation mechanism for security risks in old communities, timely discover and eliminate all kinds of security risks, and effectively build a safe, livable and resilient environment for residents. The old community will be built into a modern community in the new era.

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References

- [1] The General Office of the State Council. Guiding Opinions on Comprehensively Promoting the Renovation of Old Urban Residential Areas [EB/OL].[2020-07-20].https://www.gov.cn/zhengce/zhengceku/2020-07/20/content_5528320.htm.
- [2] The Central People's Government of the People's Republic of China. The Ministry of Housing and Urban-Rural Development and other departments issued the Notice on Steadily Promoting the Renovation of Old Urban Residential Areas in 2023 [EB/OL].[2023-07-19].https://www.gov.cn/lianbo/bumen/202307/content_6892957.htm?dzb=true.
- [3] LI Jing, Chen Longzhu, LONG Xiaomei. Old Building Safety Hazards and Fault tree Analysis Method [J]. Industrial Construction, 2005(S1):46-49.
- [4] RUC Newsroom. How to protect the overhead clearance? From 751 cases of high altitude falling objects in the search for answers | several [EB/OL]. [2021-02-23]. HTTP: // [https:// www.thepaper. cn/newsDetail_forward_11413233](https://www.thepaper.cn/newsDetail_forward_11413233).
- [5] XUE Bingyong, ZHANG Yun, JIANG Yue. Application of BIM in the reconstruction of old residential areas [J]. Science and Technology Information, 21,19(21):63-65.
- [6] Wang Guimei, Zhang Wenjie. Technical guide for the renovation of old urban areas [M]. Beijing: China Architecture and Construction Press, 2022.