

# Research on Space Transformation and Regeneration Design of Old Industrial Buildings

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**Abstract:** As the stock building of the city, the old industrial building has retained the traces of the industrial era and the memory of the city, so it has become the rational choice object of the sustainable utilization of contemporary urban renewal resources. It can be effectively protected and reused by giving it new functions. Whether this type of building is demolished, rebuilt, or renovated for reuse has become a focus of social attention. With the gradual development of urbanization, factories have been suspended and a large number of old buildings have been abandoned. This not only occupies land area, but also has a huge impact on the construction of urban modernization. The rational use of urban industrial building remnants has become the latest topic in urban construction. The old industrial buildings scattered in various corners of the city not only carry people's nostalgia, but also seriously affect the environment and development of modern cities. While renovating old buildings, perfectly interpreting the regeneration of texture will make the old buildings more interesting than those magnificent commercial spaces. This article summarizes the current situation of old industrial buildings and proposes strategic analysis on how to renovate and regenerate the space.

## 1. Introduction

With the continuous development of China's economy and the continuous improvement of urbanization level, the urban landscape is constantly changing. A large amount of capital is concentrated in urban development, and different types and levels of new development areas have emerged in various parts of the country, bringing new atmosphere to the country and cities. At the same time, the aging problem of old urban areas is becoming increasingly prominent [1]. Under the New Normal of economic development, China's industrial structure has been continuously optimized and upgraded, urban lifestyle and cultural patterns have undergone earth shaking changes, and a large number of old industrial buildings such as industrial plants and warehouses have gradually lost their original use value. The construction industry in China has entered a stage of rapid development, and the renovation and construction of old buildings in cities is also gradually underway [2].

With the progress of society and economy, cities have been able to expand rapidly and their industrial structure has been continuously optimized. The continuous innovation of new industrial technologies and increasingly strict environmental requirements have brought a fierce impact on traditional industrial civilization. Old industrial buildings are an inevitable product of industrial production transformation and upgrading in the process of urban development. Research and analysis have shown that developed countries abroad have generally experienced the urban development stage of the industrial era, while China's urban development process is shifting from industrial production development to high-tech industry development in the post industrial era [3]. Comfortable living conditions and beautiful environment cannot be separated from urban public spaces. In the rapid development process of the city, the functions and facilities of the city are gradually improving. As an important demand of the city, public spaces play a significant role in meeting people's communication, sports, leisure and other requirements. Public spaces that are people-oriented, focus on ecological protection and cultural construction are important guarantees for meeting people's high-quality urban life [4]. The upgrading of urban industrial structure, the

research and development of high-tech, and the introduction of industrial extensive processing and manufacturing production methods are gradually shifting towards "refined" manufacturing. Traditional industrial manufacturing production methods are gradually being phased out, leaving many old industrial buildings idle and abandoned, becoming a neglected area in the city. It is urgent to take measures to solve this problem [5]. With the construction of ecological civilization as an important measure of the overall layout of the "Five in One" and the enhancement of environmental protection awareness, people have begun to attach importance to the relationship between architecture and the environment. Therefore, the measures of "large-scale demolition and construction" that consume a large amount of resources and damage the ecology are no longer accepted.

Today, with the gradual transformation of urban development towards informatization and intelligence, the concept of green environmental protection is deeply rooted in people's hearts. In order to achieve sustainable urban development, the redesign and utilization of space under the renovation of old industrial buildings are increasingly valued. The renovation and reuse of old industrial buildings is a respect for industrial civilization and industrial development history. The renovation process is to find a balance between historical memory and contemporary development, while ensuring that the historical memory of industrial civilization is not erased, and to find new carriers for contemporary social development [6].

## **2. The Significance and Current Situation Analysis of the Renovation of Old Industrial Buildings**

### **2.1. The Significance of Renovating Old Industrial Buildings**

Old industrial buildings refer to industrial buildings whose structures are preserved intact but are not used due to functional or other factors. The extreme development of industry has promoted the development of human civilization. The Industrial Revolution has brought about tremendous changes in the world, creating countless material and spiritual wealth. After the rough growth of China's urbanization process, the industrial structure has been continuously optimized, the Urban morphology has undergone tremendous changes, and the abandoned factory buildings and warehouses have lost their original value. Existing building blocks generally face comprehensive problems such as incomplete infrastructure, aging building structures, decline in urban functions, and negative impacts on the urban environment after maintenance, which are not in line with the social and economic development of the new era. The revival of urban public spaces with the concept of renovating old buildings was widely carried out from the mid-1970s to the late 1980s. In recent years, China has undergone transformation and upgrading, resulting in a large number of industrial buildings being put on hold. With the advancement of urban development, many old industrial buildings have been renovated by designers and have regained their artistic and flexible spatial advantages, which have gradually been accepted and even welcomed by people [7].

The basic methods for protecting old industrial buildings include protection, restoration, repair, and renovation. The renovation of old industrial buildings has historical and cultural significance, economic development, ecological construction, and other aspects. In order to promote the sustainable development of the urban economy, improve the urban environment and facilities, and enhance the land use efficiency of the city, it is of great significance to study the comprehensive transformation and utilization of existing buildings and their neighborhoods in the context of rapid urban development. Ancient old industrial buildings record a brief history of human industrial civilization, reflecting the historical style and cultural accumulation of a city. They still exist in our daily lives and are an indispensable part of urban life. They contain great historical and cultural values that cannot be replaced by other types of buildings, and are one of the city's profound spiritual and cultural heritage [8].

### **2.2. The Current Situation of Renovation of Old Industrial Buildings**

At present, the renovation of old industrial buildings in China has entered a period of vigorous

development, but the renovation of old industrial buildings is only an imitation and replication of existing buildings, or in its renovation, only the exterior facade of the building is retained, and the interior adopts an emotionless structure. China is currently experiencing a combination of internal structural updates, external enclosure renovations, and local renovation and expansion, from a model of uniform demolition and reconstruction. A large number of demolition and renovation projects have emerged, and dilapidated and abandoned industrial factories have been demolished and replaced by the emergence of high-rise and large-scale buildings, greatly changing the spatial structure and image characteristics of the city. A large number of historical industrial buildings have been demolished, and regional cultural characteristics are gradually disappearing. However, the overall proportion of existing building renovations in the current urban renewal, demolition, and reconstruction is still quite large, which will lead to the disappearance of the unique cultural texture of the city and the uniformity of its appearance. The renovation of old industrial buildings lacks a high standard overall development plan, a rigorous and comprehensive planning system, and a series of constraint mechanisms that complement it. In the process of renovation of old industrial buildings, it cannot be strictly implemented according to the design plan, and there is a lack of effective guarantee for the implementation of planning and design. It does not possess the scientific and sustainable nature of the renovation of old industrial buildings [9].

### **3. Principles and Strategies for the Renovation of Old Industrial Buildings**

#### **3.1. Principles for the Renovation of Old Industrial Buildings**

The old industrial buildings themselves are historical protected buildings, and in the process of renovation, it is necessary to preserve their original style and features, as much as possible to preserve their structure and materials, especially the parts with historical memories. We should respect the essence of old industrial buildings and strive to preserve their architectural style, layout, and structure to the greatest extent possible. This is respect for old industrial buildings, and it also preserves the imprint of a generation's youth, accumulating the historical and cultural connotations of a city. The removal of old cultural elements should respect historical and cultural characteristics, otherwise the imprint of the original culture will be lost; Due to cultural differences, the injection of new elements should not be too one-sided, causing it to lose its vitality. Under the principle of mutual respect and matching, the new maker culture should coexist harmoniously with the old industrial culture. The structural reconstruction of the internal space of the building has caused many unstable factors in the old industrial building due to its disrepair. On the one hand, it is necessary to reinforce the original building structure, and on the other hand, new structures should be adopted to improve the stability of the space. In the regeneration and utilization of old industrial buildings, it is necessary to understand their predecessors, and then analyze and design the utilization methods after regeneration based on historical inference, in order to maximize the performance matching of old industrial buildings and unleash their higher usable value [10]. Figure 1 shows the dynamic management and control logic of the old industrial building reconstruction project.

The size of old industrial buildings is large, and they consume a lot of resources and energy during construction. If they are demolished and rebuilt, it will cause high cost waste. Therefore, renovation and adaptive transformation can be adopted for reuse, which will minimize costs and comply with the sustainable development principle of low-carbon and environmental protection. Against the backdrop of global low-carbon environmental protection and sustainable development, industrial buildings, as the type of building that consumes the most energy and resources, should actively promote ecological concepts. In the renovation of old industrial buildings, we need to do our best to save resources and reduce energy consumption to the greatest extent possible.

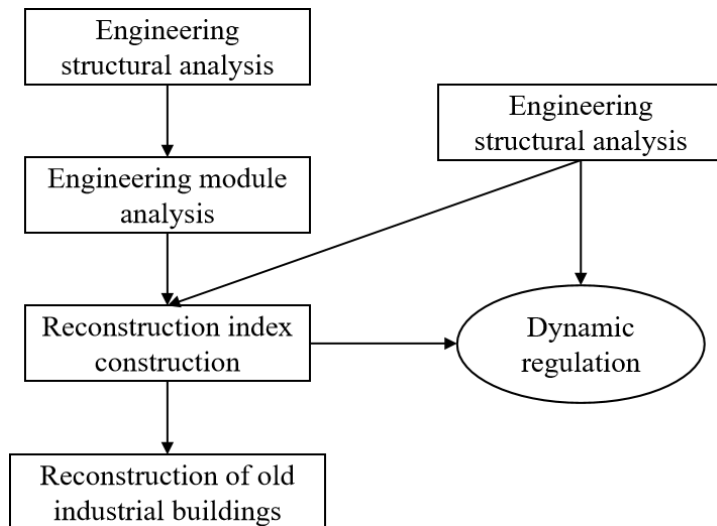


Figure 1 Dynamic control logic of old industrial building reconstruction project

### 3.2. Strategies for the Renovation of Old Industrial Buildings

By adding new elements or materials to old industrial buildings, new elements can be added to them, giving them new functions or appearances. Not only can some excess or overlooked spaces be reused, but it can also enhance the inherent style of the original building. Let the elements of the renovation exist independently of the original industrial building, and the two are simply in contact. Simply allowing new elements to come into contact with old industrial buildings, this collision between old and new materials can also regenerate the space. One method in the renovation of old industrial buildings is to maintain the original wall in its original state when it was discovered, only adjusting it for structural repairs. Another method is to replicate the original wall using different materials. Figure 2 is an idea of rebuilding an old industrial building with computer technology.



Figure 2 Reconstruction of old industrial buildings

In the process of renovation, the simple volume of old industrial buildings can be reasonably reduced and reorganized, which is conducive to the development of new building volume and physical relationships in the new creative space, meeting the aesthetic and spatial cognitive abilities of the contemporary public. In addition, the lighting environment of buildings is the foundation for ensuring their normal use. Old industrial buildings, as production sites, often adopt high windows and roof lighting methods. In the renovation of old industrial buildings, natural light can be fully utilized, and lighting can be achieved through the original vertical interface windows of the building, or through the ceiling interface. The original window design style of the building can be preserved or new design elements can be used to create lighting and shadow effects.

#### 4. Conclusions

With the development of technology and economy and the progress of social culture, people have realized that the urban renewal model of random demolition is contrary to the concept of sustainable development. Therefore, the protection and reuse of old industrial buildings have gradually become an important content of stock transformation in urban organic renewal. The renovation and reuse of old industrial buildings is an inevitable issue in current social development. The old industrial buildings themselves have valuable value in urban context and modernity, and their diverse internal spaces have the potential to create diverse spaces, making them easy to become building sites with agglomeration and activity, with broad prospects and value. At the same time, the regeneration and utilization of old industrial buildings have high research value, providing guidance for the subsequent regeneration of the exterior form and internal space remodeling of old buildings. Suitable renovation of old industrial buildings to meet the current needs of people. In the renovation, interventions, embeddings, and devices were mainly used to integrate the old and new, while the same needs were to redesign the interface and lighting to regenerate the space. With the emphasis on regional cultural characteristics in future urban development, the development of cities will increasingly highlight the characteristics of urban culture. Therefore, studying the protection and reuse of these abandoned industrial building remains has practical significance in economic, social, environmental, and urban cultural aspects. It is conducive to the strong inheritance and regeneration of industrial building relics, thereby sublimating the cultural connotation of regional architecture, creating urban characteristics, and reasonably utilizing old industrial building clusters to maximize the economic utilization value of old industrial buildings.

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Research on the reconstruction strategy of old industrial buildings——Take the western region as an example(2022-KYYWF-0492)

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