

# Research on Modern Design and Functional Renovation of Industrial Heritage Buildings

---Based on Wuhan Ancient Gu Tianfang as an Example

Yuyi Yang, Jiawen Wang and Zhewen Zhu

School of Wuhan textile University, Wuhan 430073, China

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**Abstract:** When the People's Republic of China was founded in 1949, the poor and weak new China regarded building a complete industrialization system as its top priority. Therefore, the country quickly selected a large number of cities with advantages in location, economy, and resources to build various factories. These large-scale and rapid production factories have played a pivotal role in the development history of New China. They are not only the promoters and witnesses of the growth of New China, but also the memory of the times and the urban style of each city. Entering the 21st century, the process of urbanization has been accelerated. At the same time, along with industrial upgrading, a large number of old industrial buildings that have lost their functionality have been left idle or demolished. We are faced with the problem of how to deal with the development to meet the needs of social development in the new era. The main research object of this paper is the old industrial buildings left over from the upgrading and development of various cities in my country. Focusing on the many difficulties they are currently facing, the renovation design is carried out from the aspects of overall planning, building structure, building function, building shape, and ecological design.

**Keywords:** Industrial Heritage Buildings; Renovation; Exhibition Design; History and Culture.

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## 1. Introduction

1949. The impoverished and weak New China regarded building a complete industrialization system as its top priority. Therefore, the country quickly selected a large number of cities with advantages in location, economy, and resources to build various factories. These large-scale and rapid production factories have played a pivotal role in the development history of New China. They are not only the promoters and witnesses of the growth of New China, but also the memory of the times and the urban style of each city. After the reform and opening up, China's urbanization process has been accelerated, and the number of cities has increased from 216 in 1979.

The number soared to 452 in 1997, and the population also shifted from rural areas to cities, exacerbating the shortage of urban land. Along with industrial upgrading, a large number of old industrial buildings that have lost their functionality have been idled or demolished, and they are faced with the problem of how to deal with the development to meet the needs of social development in the new era. As material carriers, these industrial heritage buildings have witnessed the rapid development of human civilization and the development of urban industrial technology. At the same time, they also have rich historical and cultural significance, carrying the glorious history of the struggle of a new generation of Chinese proletariat. Therefore, the reasonable transformation of old industrial buildings for sustainable development can make the buildings meet the ecological, environmental protection, energy-saving, and environment-friendly needs of modern cities, meet the needs of urban residents for people-friendly and practical buildings, and preserve the hearts of a generation. The spiritual sustenance of the company continues to inherit the spirit of the era of hard work, endows it with the value of the new era, and assumes a new social function.

## 2. General Situation of Industrial Heritage Buildings after the Reform and Opening up Literature References

Re Most of the industrial heritage buildings left after the reform and opening up are factories built after the founding of New China in 1949, and most of them are heavy industrial types such as steel factories, automobile factories, and arsenals. Most of the buildings in such factories are production workshops or factory buildings, which bear the heavy responsibility of producing products in the factory. A small number of buildings are public functional spaces such as dormitories, canteens, and office buildings for employees in the factory area. All buildings are dominated by functionality, reducing or ignoring the ornamental value of the building itself.

### 2.1. Analysis on the Architecture of Industrial Sites after the Reform and Opening Up

Due to functional requirements, most of these industrial heritage buildings are huge in size, occupy a large area of site space, and have a towering vertical space. The interior of the building is open and transparent, allowing for the replacement of site facilities at any time according to production needs. The building has an open and clear large-scale traffic entrance and exit, which is convenient for the transportation of production equipment and the entry and exit of workers. The top of the building is mostly a sloping roof with double slopes, which is supported by the internal steel frame structure column network. More windows are opened in the high-rise area of the building facade to achieve the ventilation effect of the building interior. Industrial buildings themselves are in contradiction with "ecological". Industrial production will

inevitably produce industrial pollutants. In modern factories, polluted gases or polluted water sources can be properly treated and discharged or reused through scientific treatment methods. In the production environment of that year, environmental issues were insignificant in front of production efficiency, not to mention the integration of buildings with the surrounding environment during design and construction. These remaining problems are placed in the present, making a large number of industrial heritage buildings extremely mismatched with the surrounding environment of the site without transformation, and unable to form a natural ecological urban building complex. The limitations of the times when the building was constructed also led to the lack of ecological features of the building.



**Figure 1.** Internal structure of Gutianfang workshop

References The shops inside the Gutianfang workshop occupy a large amount of corridor area, which weakens the sense of transparency of the long-span corridor. The abandonment rate of shops is high, a large number of shops are abandoned, and no merchants have settled in. The traffic flow in the shop is unclear, which is easy to cause safety hazards. The internal lighting effect is extremely poor, there are no lighting facilities, and it is necessary to rely on artificial equipment to provide lighting. The supporting columns of the roof steel frame structure have not been overhauled for a long time, and they are rusted and damaged, which is dangerous. The top corrugated heat insulation board has poor durability, and the perennial wind and rain will easily reduce the service life. The facade of the factory building has been in disrepair for a long time, and some of the facades are dilapidated. The red bricks are falling, the concrete is damaged, and the rain stains are obvious, which leads to a strong sense of aging and affects the overall appearance of the façade.

## 2.2. Business Module and Positioning Problem Analysis

The commercial elements in the building are simple, the value network process is imperfect, and the degree of industrial correlation is low. Multiple business models of catering, movies, reading, fitness, and film are mixed in one area, resulting in the inability to effectively integrate and improve the consumption level of businesses. At the same time, the positioning of its business model is not clear, and the specific target group has not been determined, resulting in failure to attract a fixed consumer group, and there are hidden dangers in the long-term profit effect. The commercial style is chaotic and fails to clearly reflect the theme style of the entire creative park. The commercial decoration style is inconsistent with the original architectural form, resulting in confusion in visual and personal experience.

## 3. Overview of the Design of the Architectural Renewal of Industrial Sites

The method of "preservation", as one of the methods often followed in the design of industrial heritage building renovation, is of great significance to the preservation of the overall style of the building. Retention can be subdivided into "overall retention", "partial retention",

"reserving key nodes". There are several methods of "reserving key nodes". Among them, in the Gutianfang industrial plant, the method of partial reservation is chosen to retain the steel frame pillars with strong industrial elements. Due to the column network layout of the original building structure, the pillars are regularly arranged on both sides of the gallery. At the same time, the tops of the pillars on both sides are also connected by steel frame structure support columns, and the steel frame structure bears the force of the ceiling at the same time. Function. The ceiling retains the non-direct lighting function during design, and the light that enters the interior of the building obliquely needs to pass through the supporting columns of the steel frame structure of the ceiling to enter the indoor space. The space presents a mottled texture, and the light is divided again by the thickness of the columns on both sides. After two divisions and refraction of the structural components of the building itself, the light will show an irregular and fragmented feeling indoors. In the case of natural light sources during the day, the interior space can be decorated colorfully; when there is no natural light at night, the indoor artificial the light source produced by the light source can also create an indoor atmosphere through split refraction.

Architecture is a model of the fusion of the past and the future. The old industrial style is combined with modern building materials, electronic and electrical equipment. With the blessing of future technology, the technology of the past will be revived again in the new era. As an industrial heritage building, the Gutianfang Industrial Plant is a witness to the development of the times and a carrier of Wuhan's automobile culture. It has the attribute of inheriting the past and ushering in the future. The combination of old industrial style red bricks, steel frames, and concrete, combined with transformed transparent glass, plywood and other emerging materials is not only the progress and development of technology in the era, but also the product of the intersection of time and space between the past and the future. In the internal display space, the corridor runs from west to east as the main display axis, which includes the past and present of the automobile factory, and the end of the transparent corridor also shows the infinite possibilities of the future.

### 3.1. Design Principles for Architectural Renewal of Industrial Sites

Based on the purpose of maximizing the permeability of the corridors in the site, we did not set up too many devices in the layout, but placed the exhibition content underground, and used the columns on both sides for display design. A central light strip is set in the center of the corridor as a visual guide. The underground exhibition space is a rectangular space that sinks one meter underground. Physical display items are placed inside it, and the top is closed by movable tempered glass. Arranged from left to right; using the staggered method of plane composition, the exhibition space is staggered up and down around the central light strip, and

the central light strip will be offset and dislocated according to the position of the exhibition space. The columns on both sides are adjusted in length, presenting a wave-like curve effect on the plane.

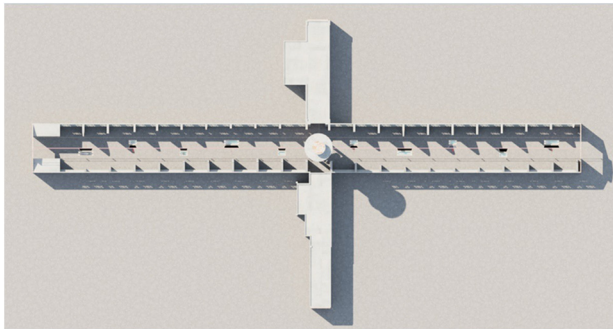


Figure 2. General Plan of Gutianfang Building

### 3.2. Designing Process

At The functional divisions in the flat site are mainly divided into underground display space, vertical display space and corridor space. The underground exhibition space is the main exhibition part of the entire exhibition area, which is mainly responsible for displaying the physical exhibits in the development process of the automobile factory, such as automobile engines, manufacturing production lines, auto parts, etc.; the vertical exhibition space is used as an auxiliary exhibition area; the empty corridor as a traffic area, the space is not arranged for display functions, but the permeability of the space is emphasized. The structural transformation of the Gutianfang factory is mainly on the lighting structure of the roof. The original double-slope roof structure of the sloping roof was broken, the central axis of the roof was opened, and a layer of daylighting layer was added. Glass materials are used on both sides of the lighting layer to ensure the transparency of light. The height of the lighting layer itself also ensures that natural light cannot directly enter the room, so that the room remains bright without being affected by ultraviolet rays and temperature problems caused by direct sunlight. On the original sloping roof pavement, part of the area was transformed into glass pavement, and the original plastic heat insulation board was placed on the glass pavement in an oblique manner to increase the lighting effect while taking into account the integrity of the architectural shape. The functional transformation of the Gutianfang factory is mainly to remove the original commercial functions of the corridors in the factory and replace them with display function areas. Due to multiple reasons such as positioning and design, the original commercial area was unsustainable at the commercial level. At the design level, it occupied corridor space, had traffic safety hazards, poor lighting effects, and the facade shape did not match the factory area, so it needed to be replaced. In the process of replacing, it with a display area, the width on both sides of the corridor was restored to ensure its permeability, and the remaining industrial elements such as columns, bricks, and frames were fully utilized to expand them into display carriers, and Wuhan was displayed in the industrial heritage building Gutianfang The history of the General Light Vehicle Manufacturing Plant has completed the transformation from a commercial function to a display function. The transformation of the shape of the Gutianfang factory is mainly to set up a tall tower in the center of the factory building. The tall tower is like a towering chimney in an old factory, breaking the inherent height limit of the factory

building and becoming a school of its own, becoming the visual center of the Jiangcheng No. 1 building complex and even the surrounding buildings. The shape of the tower is round and the top is round, which corresponds to the "round sky and earth" in the traditional Chinese theory of yin and yang. The square tower base gradually wears off its edges and corners in the process of rising upwards, forming a circular tower top. The pavement around the tower is consistent with the pavement of the facade of Gutianfang, which is paved with red bricks. There is an elevator inside the tower, which can go directly to the top of the tower. There are glass viewing windows at the front and back of the tower body that is higher than Gutianfang. You can enjoy the surrounding city scenery while taking the elevator. There is a viewing platform on the top of the tower, and there is a solar irradiation device on the top, which absorbs solar energy during the day and uses the solar energy accumulated during the day to project light and shadow at night.

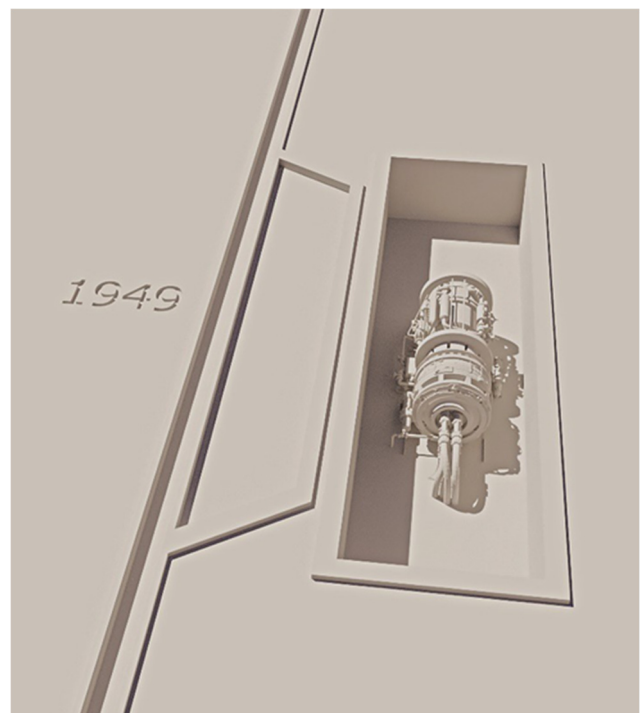


Figure 3. Underground showcase structure

The interior space of the Gutianfang factory is divided into three spaces: the lower floor display space, the middle corridor space and the upper tower space. The lower space is an underground display and furnishing space. This space is not an overall space, but an independent space with a single display space as a unit. The middle space is the interior space from the ground to the roof of the building. The most important thing in the design of this space is to ensure the transparency of the entire corridor and the sense of depth. Driven by the plane, the pillars on both sides have a fluctuating visual effect when viewed from the side, adding movement to the entire space. The steel frame support columns under the roof will separate the upper space of the interior, and keep in touch with the lower space without being isolated. The staggered support columns make the upper visual effect of the interior space seem chaotic but not chaotic, narrow but not narrow. The upper space is the part of the tower protruding from the roof. This space breaks away from the scope of the interior space and extends the scope of the space to the entire urban area around Jiangcheng No. 1.

Because of its height, the towering tower becomes the visual center of the area and the visual high point of the surrounding open space, re-attracting the perspective of the entire open space back to the Gutianfang factory building, forming the interaction between the small indoor space and the large open outdoor space connect.

## 4. Design Summary

This design starts with the analysis of the conditions of the creative park where the project is located, including location conditions and historical conditions, and then specific to the architectural issues and business model issues of the project itself, and gradually deduces the design principles and methods that the proposed renovation design needs to follow. The renovation of Gutianfang Factory is a design for the protection and reuse of industrial building sites. On the one hand, this design emphasizes the protection and inheritance of the original industrial building sites, and on the other hand, it also emphasizes the reuse and innovative development of the industrial building sites.

The design closely revolves around the requirement of displaying the history of the park where Gutianfang is located, that is, the history of Wuhan Light Vehicle Manufacturing General Factory, and closely follows the theme of "changing current events and circumstances", creating an exhibition space centered on the large transparent corridor of Gutianfang factory, using the remaining industrial elements in the site skillfully, without breaking the overall sense of depth, the display space is transferred to the underground and the facade, and the moving line span of the site is combined with the time axis to create a time corridor-like. The exhibition experience vividly shows the past and present of the automobile factory and its historical rise and fall. The tall tower that breaks through the constraints of the factory space has also become the visual center of the surrounding area, focusing the eyes of the site on Gutian Square again. The original light and shadow system makes the display space unique, and the interweaving of light and shadow adds a different charm to Gutianfang. Each design point has its own characteristics, with different functions and artistry, and finally merged into the Gutianfang Industrial Site Center Exhibition Space with both display and viewing functions.

## 5. Conclusion

At present, China's mainstream development and transformation models for industrial heritage buildings can be roughly divided into three types: building cultural and creative industrial parks, building themed museums, and designing places for leisure and entertainment. Different site construction plans need to be decided according to funds, but in general, cultural and creative industrial parks have the largest number of transformations and the most abundant cases. This article considers how to design a process that

better intervenes in the daily needs of users and how to meet the different needs of users of different age groups when the current industrial site renovation is limited to these single models. How to combine the regional cultural characteristics with the industrial heritage building itself can further explore more possibilities in the process of industrial heritage building renovation design.

The renovation design of industrial heritage buildings is a comprehensive research problem. The article combines the transformation of industrial sites with display design, and explores this issue under the condition of fully combining theory and practice. Wuhan Jiangcheng No. 1 Creative Park is a historical relic of modern industry, which has left valuable material wealth and spiritual connotation to Wuhan. How to design these legacy industrial heritage buildings in line with the times, so that they become brand-new buildings with the value of the current era, requires continuous study and discussion. This research and design combine on-site research and online data collection to analyze the concept of industrial site building renovation at home and abroad. Actively use the industrial elements in the Gutianfang site, apply the remaining industrial element symbols to the display design, and combine the characteristics of the site's unique large-scale transparent corridors, and innovatively propose a design with the theme of "changing events and circumstances" idea. Among them, "time" represents the docking of time axis and space, "thing" represents the presentation of epic and exhibition content, "environment" represents the colonnade structure and the shaping of light and shadow, and "movement" represents the blending of the past and the future. On the premise of grasping these four innovation points, the old Gutianfang factory building will be transformed into a comprehensive historical display space of Wuhan Light Automobile Manufacturing General Plant, and the transformation will be limited to a single model such as the creative industry park, to expand more possibilities for the transformation of industrial heritage buildings.

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