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## Research on Reconstruction Design of Exterior Wall Materials and Structures of Industrial Architectural Heritage

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### Abstract

With the advent of the post-industrial era, China's traditional industrial industry has gradually declined or transformed, leaving a large number of industrial buildings abandoned and idle. A majority of these existing industrial building heritages were built with original facade design, which cannot meet the requirements of the time and no longer fits into the new urban interface. From the perspective of language relationship in architecture, building skin and building space are two vital interdependent elements, and the study of building materials as a carrier has a significant impetus to the exploration of building skin. Therefore, the external wall material has naturally become an important factor directly related to the design and performance of the renovation of the industrial building heritages. Its performance and form largely influence or determine the possible ways and means of the transformation of the heritage facades. How should material performance be used to preserve the historical imprint of industrial heritage while conforming to contemporary aesthetics? What are the rules of material performance in the renovation of industrial buildings? These are the issues that need to be considered and studied in the transformation of industrial building heritage.

This paper studies the exterior wall materials and structures in the renovation of industrial building heritage facades, and uses reconstruction theory as a methodology to sort out effective strategies and methods for the material performance of industrial building heritage facade renovation. First it summarizes and elaborates the classification and performance characteristics of the materials of heritage facades as well as the principles and methods of facades transformation. Later it focuses on the practice and development of the renovation of facades in China's industrial building heritages, taking the reform practice of Nanjing Hutchison Factory as an example. Combining the analysis and summary of the practical project with the theory, this paper helps improve the theoretical system of architectural skin materials within the scope of architectural design theory, summarizes the design concepts consistent with the current view, and concludes the corresponding architectural skin design strategy and methods.

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### Keywords

Industrial architectural heritage; Exterior wall materials and structure; Hutchison factory; Design research.

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## 1. Introduction

In the 21st century, under the combined effects of energy crisis, environmental protection, resource recycling and urban cultural construction, the Chinese government has vigorously advocated sustainable development, and the construction activities have gradually formed a process of combining large-scale demolition and renovation. Most of the architectural heritage, the original façade design and style have not adapted to the requirements of the times, nor to create a good city image or create a distinctive urban mood. For example, This can be referred to Figure. 1.



Figure 1. Abandoned factory in the city (Source: [www.quanjing.com](http://www.quanjing.com))

Therefore, the updated design of the building heritage façade has become the focus of the current construction work. With the development of new materials and new technologies, and the development of diversified architectural theories, the renovation of architectural heritage is no longer limited to simple traditional methods. Using similar materials and performing re-interpretation has become the main way today. At the Shanghai World Expo, many of Shanghai's old factory buildings were functionally replaced as needed and the facade was remodeled.

As the basic material carrier that can be implemented in the transformation of the entire architectural heritage, the material is the first medium to carry the architectural form, shape the spatial form and transmit the architectural emotion. Therefore, the material is an important factor directly related to the design and performance of the architectural facade. Its performance and form largely influence or determine the possible ways and means of architectural facade renovation. In this paper, the research focuses on the material research of industrial building heritage's façade renovation. The material reconstruction method in the renovation of industrial building heritage's façade is discussed. The reconstruction theory is used to study and analyze the material of the facade and the existing typical examples. The author explores the method of material reconstruction and the possibility of existence in the renewal of industrial building heritage façade, in order to provide the representation method and solution

strategy of material in façade renovation.

Nanjing Hutchison Factory is the largest industrial heritage buildings in modern China. It is located at No. 168 West Street in Baota Bridge, Xia'guan District. It was founded in 1912 and is the first foreign-invested food processing factory in Nanjing. As one of the modern factories built by its British investor William Vestey Edmund brothers in the UK, Hutchison is a model of Western modern technology and production technology combined with local technology and craftsmanship, as well as a sample of fusion between architectural style and technology. Therefore, it is of great significance to select such an industrial building heritage as the research object of this paper. In September 2015, the demolition of Hutchison's original site was basically completed, and there were more than ten historical and architectural buildings built in the 1920s and 1930s retained, including office buildings, laboratory buildings, workshops, slaughterhouses, and cold storage. The total construction area was about 70 thousand square meters. I was fortunate to be one of the assistants of the project leader in the autumn of 2017 to participate in the renovation design of Hutchison, and to consider and summarize the experience of the reconstruction of the exterior wall of industrial building heritage during the transformation design process of the whole project.

## **2. Research theory perspective: reconstruction theory**

“Reconstruction”, as its name implies, is the process of parsing the composition of things and then reorganizing them. The architectural theorist Li Min'quan described the reconstruction in the “reconstruction consciousness and technique of architectural design”: “Reconstruction refers to breaking up or dispersing the old between the original systems or between the original forms within a system. The relationship between the elements, according to the objective needs of the society and the subjective ideas of the creators, reorganize within the system or between the systems to form a new order.”<sup>1</sup> (Li, 1988) “Break the old relationship, reorganize the new order” is the most notable feature of reconstruction. The relationship between the original components is reorganized and broken, which changes the inherent order relationship of the components in the prototype system, and re-groups with other system components to form a new relationship, thus obtaining a new expression order.

The reason why the reconstruction is used is because the expression method of the material of the industrial building heritage facade is actually the reorganization of materials. In this process, we can use new materials and new technologies to reconstruct new forms. The theory of construction coincides. In the research of material reconstruction performance in the transformation of industrial building heritage, the introduction of reconstruction theory as the entry point of research is the intrinsic need to meet the combination of old and new, and is the inevitable choice after continuous examination. This paper also uses reconstruction theory as a methodology to conduct a preliminary exploration of material representation methods.

## **3. Classification and Performance Characteristics of Exterior Wall Materials for Industrial Building Heritage**

The choice of building exterior wall material is the result of redesigning after considering various factors. It is visually determined by the architect's subjective thoughts. Before analyzing the industrial building heritage facade material reconstruction performance method, we can classify the corresponding Material and understand the properties of different materials or the performance characteristics of the material, such as shape features, color features, texture and texture features, regional characteristics. By doing these, we can pave the way for the following to explore the industrial building heritage façade material reconstruction performance method.

### **3.1. Category of exterior wall materials**

Usually, the exterior walls of a building are constructed from a variety of different materials. Understanding the basics of building exterior materials is the basis for the analysis of material reconstruction techniques. The exterior

wall materials used in the transformation of industrial building heritage in China mainly include real stone paint, cement mortar, water brush stone, integrated board and stone particle facing mortar (Figure. 2). These materials have not been used in the development of China's buildings. The decline has been favored by the majority of architects. Of course, with the advancement of technology, there are other materials that have also played a major role. These materials have become common building materials for the restoration of modern architectural heritage in China.

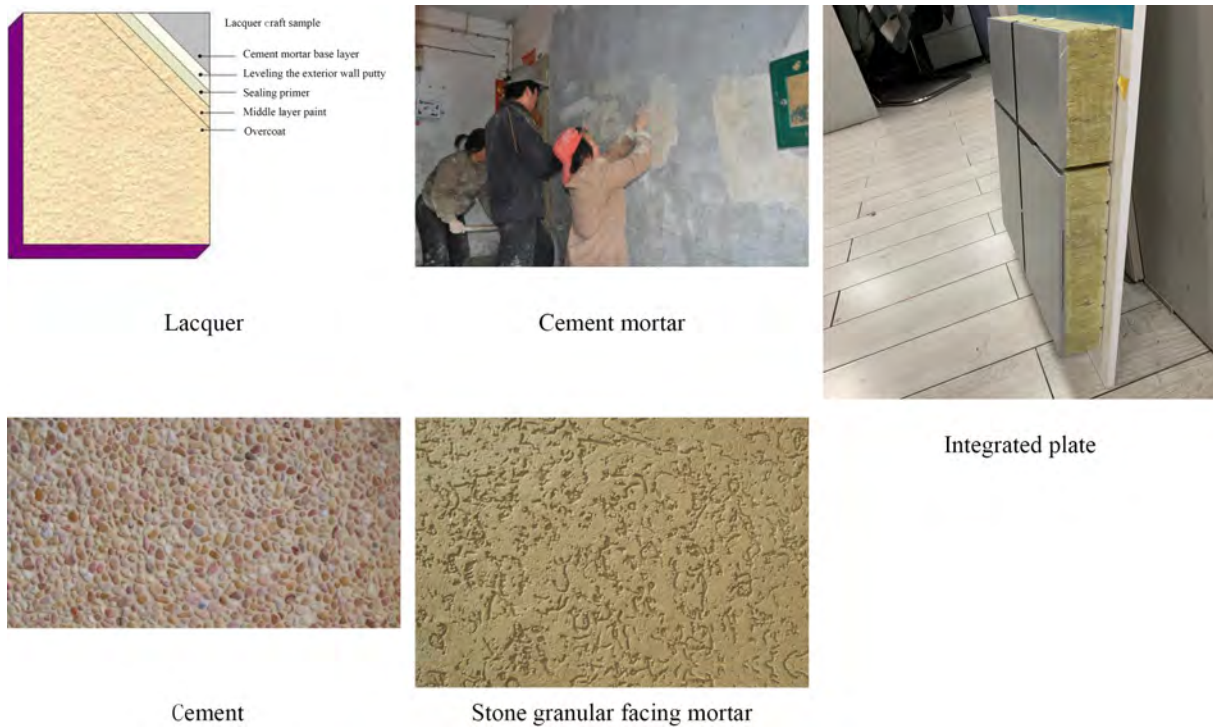


Figure 2. Five main materials for the renovation of industrial building heritage facades(Source: Self-painted)

- First choice: real stone paint

Real stone paint is a kind of imitation marble and granite paint. It mainly has the imitation stone effect on the building's exterior wall. It has the characteristics of fireproof, waterproof, acid and alkali resistant, pollution resistant, non-toxic, tasteless, strong adhesive and never fade. Replacing the stone hanging with real stone paint not only reduces the cost, but also reduces the safety hazard, and the layout can be freely designed and planned, which is convenient and quick, and accelerates the construction progress while improving the overall aesthetic appearance of the building.

- Second choice: cement mortar

The mortar, cement, stone, and sand are artificially constructed by the original process according to a certain mixing ratio.

- Third choice: water brush stone

The cement is a traditional construction process. It can make the wall have a natural texture, and the color is solemn and beautiful. The finish is strong and durable, does not fade, and is more resistant to pollution.

- Fourth choice: the integrated board



The integrated board is composed of a bonding layer, a heat-insulating decorative board, an anchor, a sealing material and the like. The one-piece board is also called composite heat-insulation decorative board (outer wall composite decorative board). It is not only suitable for exterior wall insulation and decoration of new buildings, but also for energy saving and decoration modification of old buildings; it is applicable to all kinds of public buildings as well as exterior insulation of residential buildings.

- Fifth choice: stone particle facing mortar

It is a decorative mortar with colorful decorative functions. Its color is soft and durable with cement-based materials. The stone grain facing mortar is a finishing material composed of a mixture of natural stone particles of different particle sizes.

### 3.2. Performance characteristics of building exterior wall materials

The purpose of material expression is to produce beautiful architectural forms by using the characteristics of different materials in shape, color and texture, and the careful organization of the designer. As a result, different building materials can bring a revolutionary form change to the building, and this beautiful architectural form has been perfectly extended in the old building renovation (Zhu, Wang, 2012). The performance characteristics of the exterior wall material generally include the color, shape, texture and texture of the material.

- First point: color of exterior wall material

In contemporary architecture, as technology advances and new materials continue to emerge, colors and materials are no longer “separated”. Colors rarely appear in separate, abstract “finished” forms, but are reintegrated into materials. Their combination has become more primitive and more “natural”. Color is no longer an add-on to the day after tomorrow, nor is it a cover or coat that masks the true image of the material. Color becomes a natural attribute of contemporary materials and becomes part of the material’s “authenticity” (Zheng, 2012). It can be referred to Figure 3.

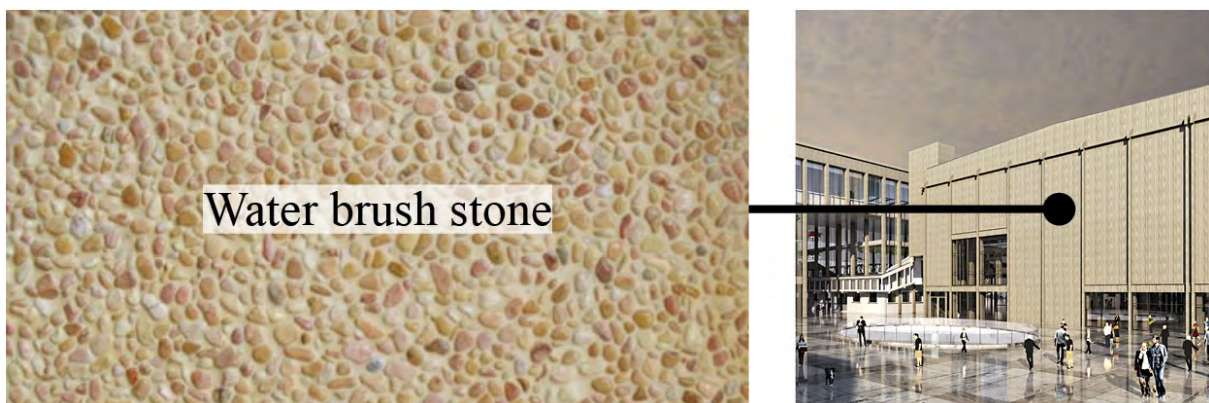


Figure 3. The materials used in the restoration of Hutchison’s façade (Source: Self-painted)

Le Corbusier once said, “Color is a huge building force that has been forgotten.”(Schindler, Corbusier, 2006) Among all the visual factors, color is the most expressive expression, and it has a great influence on people’s physiology and psychology, which can evoke people’s association with various emotions. (Wang, 2004)

- Second Point: the shape of the exterior wall material

The shape of the material has two main meanings: one is the initial shape of the material, and the other is the shape presented on the building. Different materials generally have different initial shapes, and the same material will

have different initial shapes. The second shape in the building is a new round of processing for the material, such as masonry, which can be used with natural uncut masonry, milled masonry, or sawed differently. The stone of the specification is made of various prefabricated slate. For instance, This can be referred to Figure. 4.

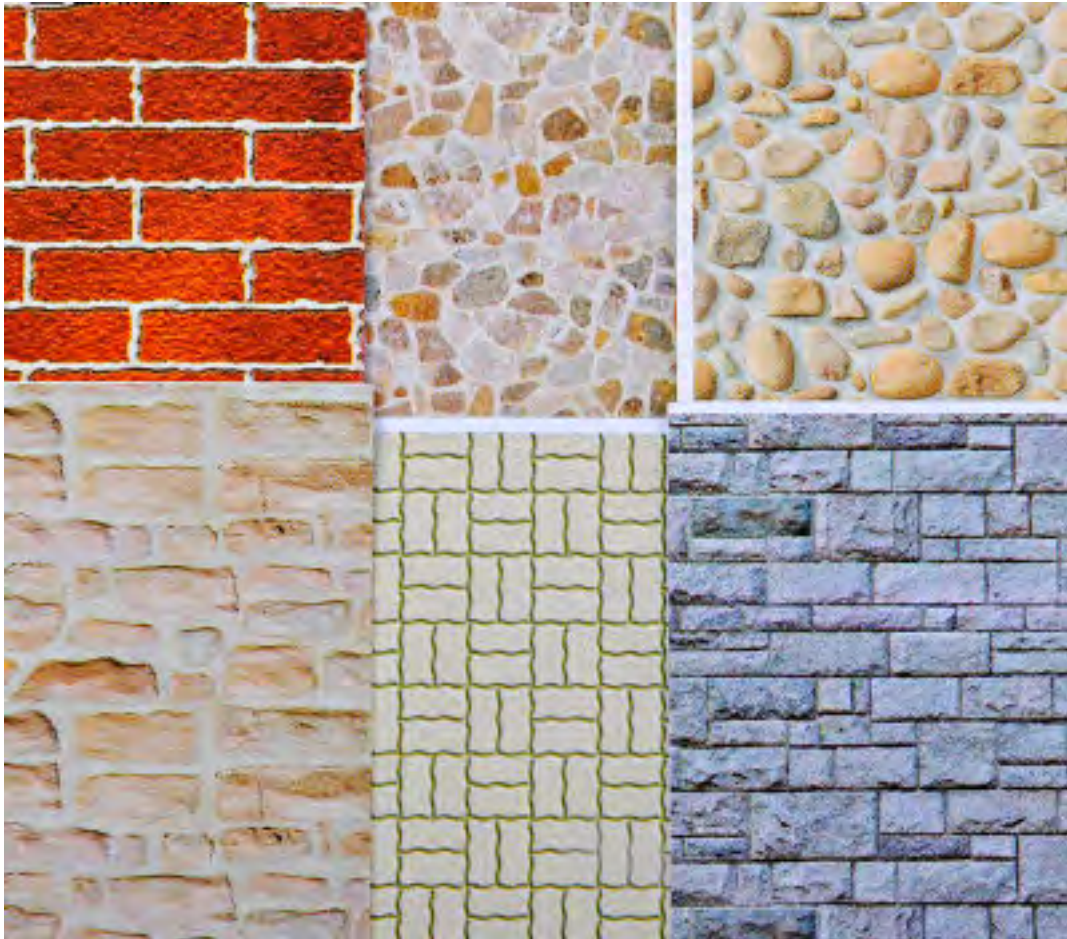


Figure 4. The initial shape of the masonry and the subsequent interpretation of the material(Source: <https://image.baidu.com/search>)

The designer can recreate the shape of the material according to the design needs to form a new material shape with performance characteristics.

– Third Point: the texture of the exterior wall material

Texture usually refers to the structural characteristics of the material. Texture is a unique form of material that directly affects people's psychological feelings and experiences. Different types or materials of the same type have many different appeals and artistic expressions. Texture is the psychological feeling brought by the characteristics of the material. When people see a well-known material, the understanding-dependent memory mechanism triggers the corresponding tactile memory, which produces psychological feelings. For example, when people see a pitted surface or a mottled surface, they may think of the sense of time.

At this point, the exterior wall finish design of Nanjing Hutchison has fully reflected the original material texture. We designed the water brush stone construction method similar to the traditional architecture. Through the mixing ratio and color modulation of different materials, the exterior wall materials of the historical building were re-formed to form a texture, and the historic building was revitalized. (Figure. 5-6)





Figure 5. Hutchison history photos (drawing source: Take pictures of myself)



Figure 6. Nanjing Hutchison factory historical building exterior wall repair effect (drawing source: Zhou Qi studio design)

– Fourth Point: the texture of the material

“Texture” means the surface of matter and the texture feature. Wang Huabin’s commentary on texture in “Black and White Plane Composition” is: “Texture is the surface form of the objective material, which represents the texture of the material surface and reflects the shape of the material properties.” (Wang, 2004) That is to say, the texture is the material presented on the building skin. (Figure. 7) In general, there are two forms of texture, one is visual texture and the other is tactile texture. (Deng, 2013)

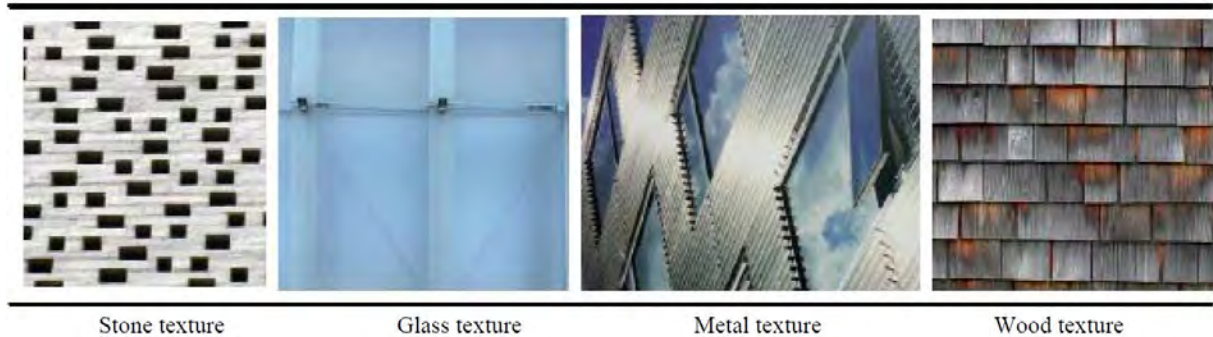


Figure 7. Texture of different materials (Source: Take pictures of myself)

If classified according to the cause of formation, the texture can be divided into natural texture and artificial texture. Natural texture refers to the texture of the surface of an object under natural conditions. Artificial texture refers to the texture exhibited by the surface of an object after artificial processing.

The exterior wall material and its performance characteristics are the most basic language elements for designers or a design. The key is how to construct these elements reasonably.

#### **4. Principles for Reconstruction Design of Exterior Wall Materials for Industrial Building Heritage**

This chapter firstly interprets the material reconstruction design of industrial building heritage exterior wall, and mainly discusses the principles of structural reconstruction of industrial building heritage exterior wall, including the principle of functional personality matching, visual aesthetic principle, durability principle, etc. When reconstructing the design of exterior materials of architectural heritage, we should pay attention to the principle of influencing the design, so as to carry out the research on the design strategy of the external wall material reconstruction of industrial building heritage.

##### **4.1. Interpretation of Reconstruction Design of Exterior Wall Materials for Industrial Building Heritage**

In the renovation of the exterior wall of industrial building heritage, most of the transformations have always followed the law of pursuing the history of the city. However, some industrial buildings have been demolished in the transformation to separate the historical context and collective memory, so that the city has lost its own distinctive neighborhoods and buildings. Architects must also think about the role of the façade material between the demolition and protection when they ask to stop the big demolition and construction, because the fragments of the building facade are still the emotional destination of people living in the same environment. (Gong, Xu, 2016) The material in the transformation of industrial building heritage carries collective memory, which is the direct medium for the connection between human and architecture. It plays a decisive role, and the new performance of the facade material of industrial architectural heritage is a reconstruction design.

Reconstruction design is a form-generating method in the field of culture. Associate Professor Zhao Jianbo explained in the article “Design Analysis of Form Reconstruction and Psychological Reconstruction”: “Destroying the old between the original systems or the original form within a system. The combination relationship is reorga-



nized within the system or between the systems according to the objective needs of the society and the subjective ideas of the creators, forming a new order.” (Zhao, Zhang, 2009) In the process of reconstructing the performance of industrial building heritage façade, the most important thing is the process of dismantling and reorganizing. It is the process of breaking the old order and establishing new rules. Figure 8 explains this process in detail. The author focuses on the level of façade material performance.

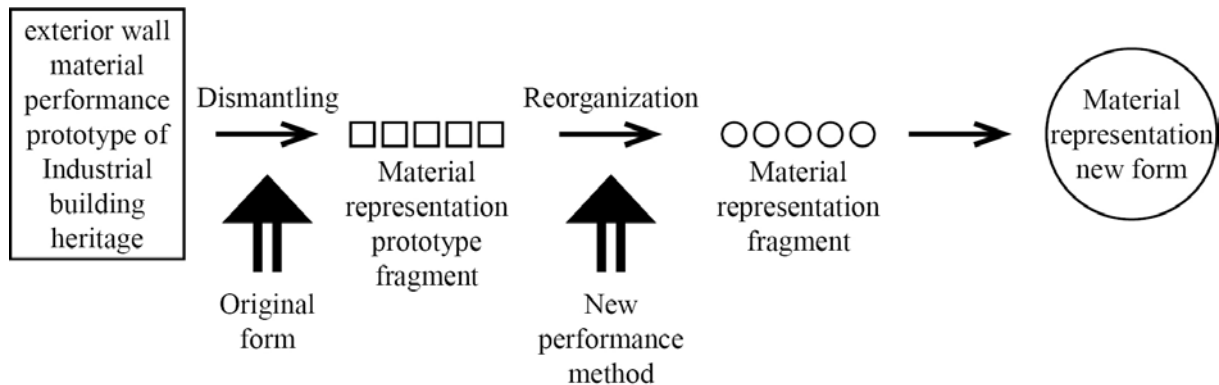


Figure 8. Industrial building heritage exterior wall material reconstruction design icon (Source: self-painting)

The process is mainly divided into two phases:

The first stage: the dismantling of the representation of the material of the industrial building heritage façade

Based on the performance of the industrial building heritage façade material, based on the understanding of the industrial building heritage, the original façade is analyzed, and the performance characteristics of the old façade material of the industrial building heritage are disassembled, including color, shape, texture and texture. And the material details are decomposed, and the prototype fragments are selected and restored to the smallest unit fragments. For example, the design team dismantled the structural form of the historic building’s façade in the preliminary design of the Hutchison’s parking façade to restore the original prototype. (Figure. 9)



Figure 9. Disassemble the original historical façade structure of Hutchison Factory (Source: Self-painting)

The second stage: the reorganization of the material representation of the industrial building heritage façade

After the decomposition of the material expression of the industrial building heritage façade, under the guidance of aesthetic ideas, the prototype fragments of the material representation are integrated and reorganized according to the new method to make the material color, shape, texture and texture become the material expression. A new form of fragmentation completes the reconstruction of the facade material of the industrial building heritage. In the preliminary design of the Hutchison Factory parking façade, the design team reorganized the prototype of the historical building exterior wall and applied it to the new building, which successfully echoed the historical buildings on both sides. (Figure. 10)

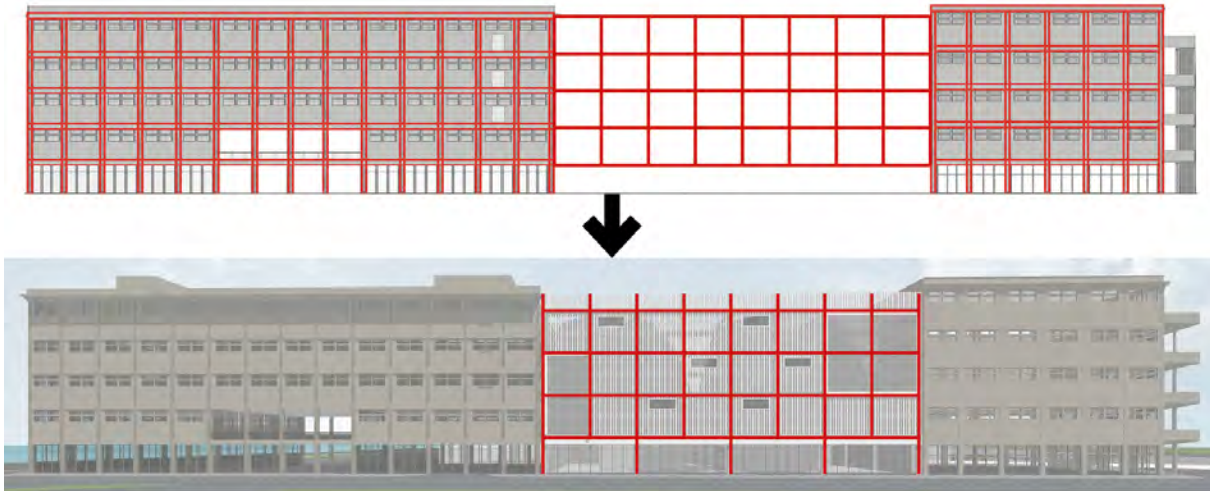


Figure 10. Restructuring and remembering the historical form of the historical facade of the foreign bank and applying it to new buildings (Source: Self-painting)

#### 4.2. Principles of Reconstruction Design of Industrial Building Heritage Facade Materials

It should be said that any industrial building heritage façade material reconstruction design is principled, but the degree of grasp or emphasis on the principle between each design scheme will be different, the focus or understanding is biased, the material weight The principles of structural design basically include four aspects: functional personality matching principle, visual aesthetic principle, durability and easy maintenance principle, environmental protection and sustainability principles. After careful analysis, it is not difficult to see that these four principles actually contain the requirements of the designer (the client) for the designer in the design practice, and also include an internal norm for the designer (the party) to create their own design. This paper wants to make some interpretations of the above four principles in combination with the design of the case of Nanjing Hutchison Factory.

The Hutchison is a foreign-invested food processing factory. In the process of urban renewal, the real function has been degraded, and the original building has been damaged for a long time. The exterior wall is seriously damaged, and the existing city is shaped. The style is not very consistent, but its architectural space is still of use value, so it needs to be redesigned. As a design side, in the design of the transformation design, the above four principles have been fully considered and applied in Hutchison factory, as follows:

- First point: Principle of functional personality

The reconstruction of the external wall material should conform to the principle of functional personality and consistency. The material reconstruction satisfies the use function of the industrial building heritage transformation and meets the requirements of people's use. It can neither be easily engaged nor deliberately pursued. Respect the industrial architectural heritage, ensure that the personality of the material is consistent with the function of the building, inspire the creative inspiration with rigorous analytical methods, and design the architectural works that meet the actual functional needs.(Zhang, Chen, Liang, 2006) If the transformation is carried out rudely, regardless of the coordination of the building function and the material personality, it will cause confusion in the current viewing and it is irresponsible for the transformation of the building heritage.

Under normal circumstances, the modified façade used as a commercial building on the general façade does not need to consider the window opening problem, the use of materials is more flexible, and more metal wrapping, combined with glass curtain wall for material reconstruction. If the industrial building heritage transformation

function is office or residential, it is necessary to consider factors such as lighting, and the use of materials should be based on the environment in which the building is located. It should not be too exaggerated to satisfy the functional personality and ensure the construction. In the design of the façade of Hutchison, the design team analyzed the characteristics and values of the facades of each historical building in advance, and appropriate renovation and reconstruction of each historical building had been done to meet the requirements of internal functions based on the full preservation of the historical imprint. For example, the format of cinemas and auditoriums has low requirements for day lighting, mainly in closed exterior walls; commercial and catering, which has high demand for day lighting, has been designed with larger windows on the corresponding exterior walls. (Figure. 11)

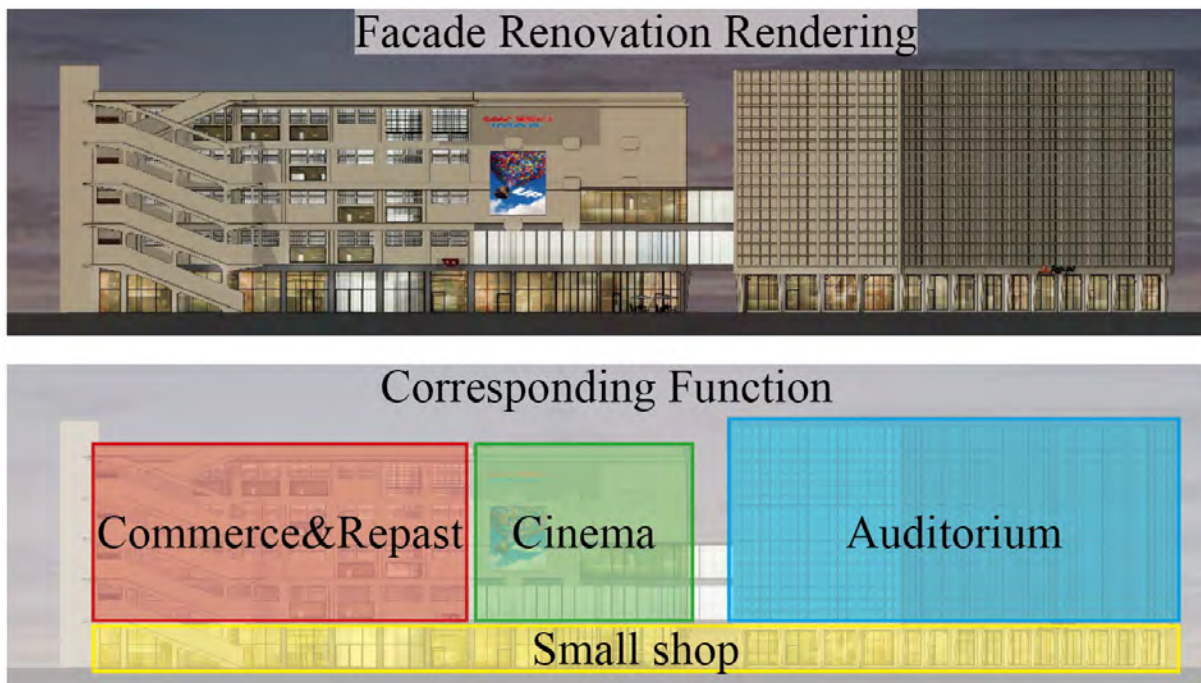


Figure 11. The personality of the Hutchison Factory façade needs to be consistent with the function (Source: Zhou Qi studio design)

– Second point: Principle of visual beauty

The reconstruction of the exterior wall material of the architectural heritage should conform to the principle of visual beauty. It mainly includes people's basic feelings about the visual elements such as shape, light, color and space of architectural visual form. The material performance is to conform to the aesthetic standards of architecture under the influence of consumer society and mass culture. The material reconstruction design according to the appropriate proportion, color and texture is not a subversive reconstruction and expression of opposite materials. Disregard the public aesthetic. In the design process, we should pay attention to the rebirth of the old building, take the essence to its dregs, preserve the charm of the industrial building heritage, and maintain the overall beauty of the building through the integration of new design techniques, or give it a new appearance according to its body structure.

– Third point: Durability and easy maintenance principle

Due to the accumulation of time, the external wall material of industrial building heritage has been corrupted and destroyed. Our transformation of the exterior wall of industrial building heritage is based on the practical and aesthetic economics, and the renovation of the material in the facade. In the selection and application of materials, we must consider the durability and easy maintenance of materials, reduce unnecessary waste of costs, and make the old buildings can reduce unnecessary economic expenditures under the premise of refreshing and satisfying practical functions. The role of saving resources and creating economic value has realistic social significance.



- Forth point: Environmental protection and sustainability principles

In the process of material reconstruction, in order to meet their own design requirements, designers no longer rely on natural materials, but use a large number of industrial materials that are not environmentally friendly and have short cycle times, resulting in more and more environmental problems. We are beginning to realize that getting rid of our dependence on natural materials has ironically turned into the foundation of losing our existing lifestyle. (Bergman, 2014)

As early as 1998, Mr. Wu Liang'zhu proposed in the “Vision of Architecture in the 21st Century”: “In the era of multiple technologies coexisting, high-tech, suitable technology, traditional technology, etc. should be developed in accordance with local conditions. We must see this direction and it is clearly recognized that the appropriate technology itself has a simple and sustainable development norm.” (Wu, 1998)

## **5. Research on Reconstruction Design Strategy of Exterior Wall Materials for Industrial Building Heritage**

Based on the reconstruction design theory, the author analyzes the material reconstruction strategy of industrial building heritage exterior wall. According to the material performance characteristics of the industrial building heritage exterior wall, the reconstruction design research is divided into material color reconstruction design, material shape reconstruction design, material texture reconstruction design, and material fragment reconstruction design four main aspects. Then, the author proposes several strategies for material refactoring design.

### **5.1. Material Color Reconstruction Design Strategy — reconcile technique for same color**

The color of the material can be the “binder” that connects the elements on the facade of the building, and it is also the “repulsive” that separates the elements.(Chin, 1998) When the color of the industrial building heritage façade material tends to be uniform in the proportion and brightness of the color, the overall effect is a harmonious fusion. The architect can shape the mutual harmonization between the original façade materials to achieve the overall color. So, this is the method called “reconcile technique for same color”.

In the process of restructuring the industrial building heritage façade, it is inevitable that there will be problems of conflicts between new and old materials, that is, the problem of material language inconsistency. At this time, the “reconcile technique for same color” are effective. It can not only complete the new interpretation of the exterior wall material of industrial building heritage, but also fully consider the problem of the fusion of the new material color and the original color of the industrial building heritage. In the process of reorganization of the exterior wall materials of Hutchison’s historical buildings, according to the characteristics of industrial building heritage and the characteristics of the surrounding environment, the color of the industrial building heritage interface is imitated, highlighting the sense of the times, and also bringing the old and new styles to organic integration. (Figure. 12) The “reconcile technique for same color” unify the correspondence between the façade and the environment, and use the difference between the color and the color of the material to adjust the distance between the building and the surrounding environment to form a new coordination relationship. It won’t make a sudden feeling.

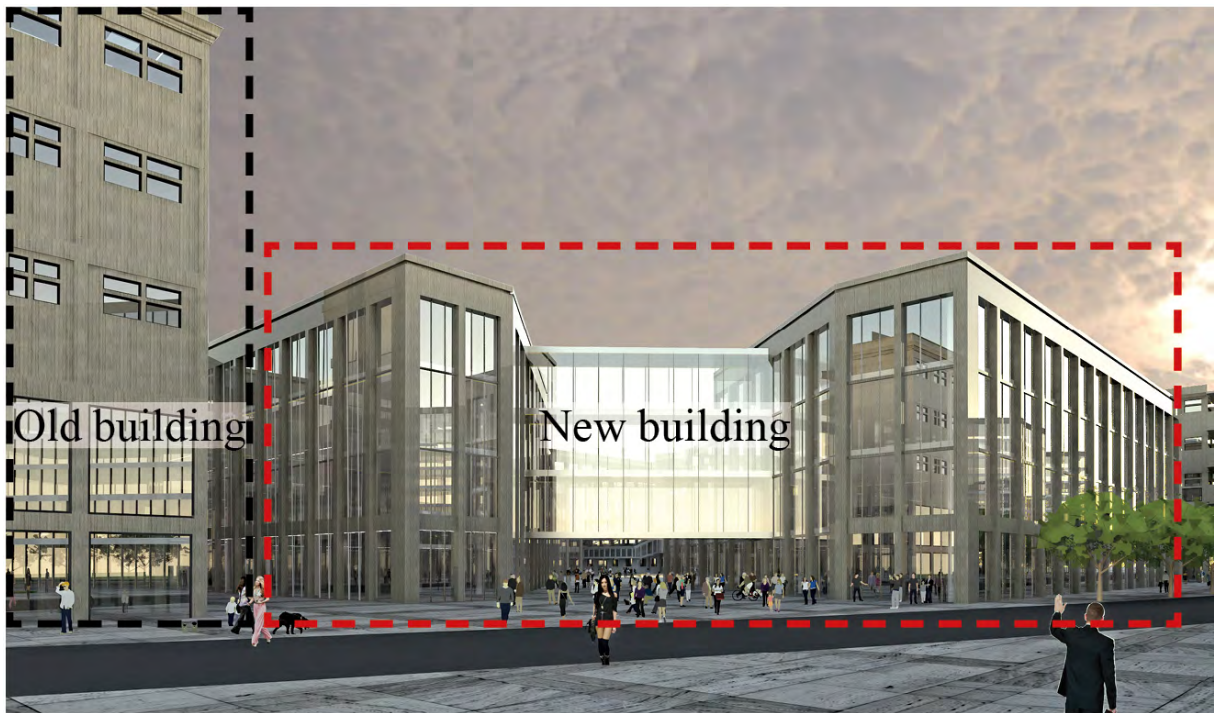


Figure 12. Reconstruction design of the exterior wall color of Nanjing Hutchison factory historical building (Source: Zhou Qi studio design)

## 5.2. Material shape and scale reconstruction design strategy

- First point: Classification of material shape and scale

The building has a grading of form and scale. The same material also has its shape and scale. In the reconstruction design of the shape of the industrial building heritage façade, the shape and scale are integrated for materials of different scales at different times, and the old and new elements are coordinated. The proportional relationship is the focus of the design.

The modern American architect Tobert Hamlin said: “In architecture, the sense of scale makes the building look out to the right size. This is a unique seemingly architectural instinct. The characteristics required.” (Hamlin, 1990) According to this, this proportional relationship should meet the requirements of both people’s psychological and visual aspects. Different proportions of materials give different feelings. The designer expresses the construction by processing the different shape scales of the materials. A lot of understanding.

For the material of the water brush stone, its shape scale can be cut by different scales according to the needs, and the prefabricated module is formed. In the renovation of the façade material of the old factory of Hutchison, we carried out the grading of new and old materials, according to the length, area, volume and specific structural details and decorative details, eliminating the obvious difference between the old and new materials; The scale transition gives a sense of coordination, making the scale expression clear and legible; at the same time, the long-shaped glass window is reserved to contrast with the small size of the brick, which is rich in rhythm and rhythm. (Figure. 13) This method is very common in the transformation of industrial building heritage.



Figure 13. Reconstruction design of the water brush stone module of Nanjing Hutchison office building (Source: Take pictures of myself)

– Second point: Reorganization of material shape scales — analog analogy

In the façade transformation of industrial building heritage, the logical relationship of a certain shape scale exists between the new material and the original material, so that after the transformation, the material fusion degree is very high, which is not only the analog analogy. What should be paid attention to in the application of the technique is to strictly distinguish the shape characteristics of the original material and eliminate the confusion; on the other hand, it is necessary to associate the shape scale of the new material with it to achieve the synergistic effect of the two.

During the renovation of the facade of Hutchison’s industrial complex, the glass curtain wall material of the new building part was divided into many groups on the X-axis by the analog-to-digital analog method. The width of each group is the same as that of the historical building. The width of the opening corresponds to the historical structure of the original building, and the reconstruction of the shape and scale is completed. (Figure. 14) The combination of different combinations of building facades can also evoke memories of the old factory.

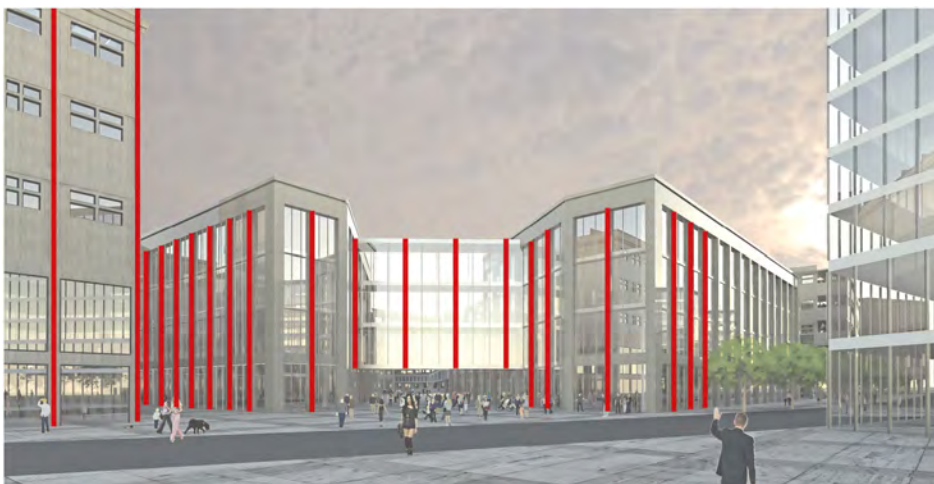


Figure 14. Reconstruction design of the glass curtain wall of the new building of Nanjing Hutchison factory (Source: Zhou Qi studio design)



### 5.3. Material fragment reconstruction design strategy

“Details are an indispensable part of aesthetics. It is fundamental to the basic activities of aesthetic choice and the complex process of reflecting comments. The meaning is ‘rooted’ in the feelings.” (Scruden, 2005) In the transformation of industrial architectural heritage, the color, shape, texture and texture of the original façade material are generally not reconstructed, but the material fragments are selectively retained or added for those who retain value high-rise buildings with heavy historical information. A material detailing component is used to enrich the form of industrial building heritage, to enhance the sense of existence and recognizability of the building. The relationship between the detail of the material and the building is complementary. The choice of the detail decoration depends on the volume of the building. The detailed reconstruction of the material will be relatively simple and elegant, while the smaller building will be suitable for delicate and delicate details.

We can further understand the reorganization of the fragments through the design of Hutchison’s transformation. Figure 15 shows the reconstruction of the “factory north” building of Nanjing Hutchison Factory. It is understood that the wall of the building body has been broken. In order to maintain the characteristics of the historical building and for the visual continuity of the building facade, the designer used the new steel to reinforce the original wall structure, replace the incomplete windows of the historic building with new steel windows, and retain the original water tower section of the roof. The preserved water tower looks more delicate and moving on the restored building. A symbol that seems to have not adapted to the development of the times, as long as it is slightly processed and squared, can still stimulate vitality and achieve a rational modeling effect. The water tower is placed in the roof garden, which has a direct dialogue with the visitors, records the passage of time, evokes the emotional and collective memory of the place.

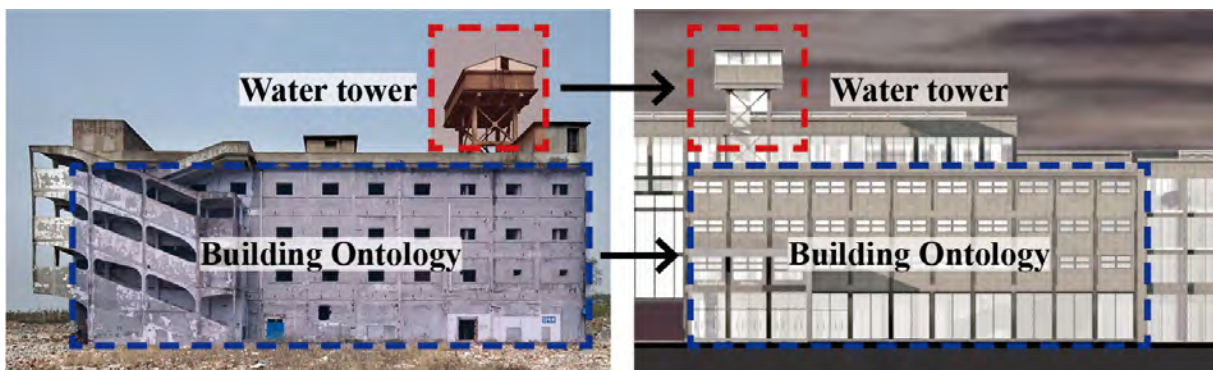


Figure 15. Fragment retention plan for Hutchison’s factory (Source: Zhou Qi studio design)

## 6. Conclusion

Reconstruction design of industrial building heritage façade, shouldering the important role of plastic building image, continuing its historical information and place spirit, inheriting its urban context. On the one hand, the material reconstruction design can repair or replace the aging material, and continued the aesthetic value of the building façade through reorganization. On the other hand, the material reconstruction design can construct a unique architectural façade expression in the process of the city.

For the construction unit, the reconstruction of the exterior wall material of the industrial building heritage brings a new vitality to the industrial building heritage. Those old houses, which have experienced storms and even incompleteness, can produce an inexplicable beauty that presents a cultural meaning and artistic value through new architectural vocabulary and materials.

In the past few decades, the reconstruction of various architectural heritage facade materials has emerged in an endless stream, such as the renovation of the Tate Modern Art Gallery and the Shanghai World Expo office building’s facade. The refurbishment of materials, etc., in these cases, the material injects new vitality into the architectural

heritage in the reconstruction contrast. The meaning of those cultures, the historical texture and temperament, closely intertwined with each other. It is like a bridge of time, connecting the past and leading to the future. They carry people's memories, convey the information of time and space, and re-establish a balance between old and new.

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