

Architectural Skin Design in the Context of Sustainable Development

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Abstract: Under the background of the concept of sustainable development, the design of architectural skins has also shown an unprecedented development status. This paper analyzes the problems hidden in the current situation of architectural skin design, and points out that the design of today's architectural skin should aim at sustainable development. Based on the openness and developmental variability of the regional environment, the design orientation of the architectural skin design integrated into the overall design of the building and the environment is proposed. Several examples of architectural skin design were selected, and the design methods and techniques used to conform to the local physical environment and regional culture were summarized. Based on the example analysis, the article aims to explore a design path in order to solve how to realize the organic combination of the form, technology and meaning of the architectural skin through the construction of the skin design. The design path of this architectural skin is of positive significance for achieving sustainable development of the physical and human environment through the architectural design.

Keywords: Architectural Skin Design, Regionalism, Sustainable Development, Path

1. Introduction

Since the industrial revolution, the development of science and technology has promoted the global cultural exchange, and brought about the convergence of the urban features and architectural styles of different parts of the world. The sense of loss caused by the loss of traditional culture has prompted people to reflect on how to preserve the characteristics of regional culture and maintain the coexistence of multiculturalism. Since the 70s of last century, the energy and environmental crisis has caused people to think highly of sustainable development. Nowadays, the trend of architectural design is manifold and integrated, showing the general trend of sustainable development of physical environment and humanistic environment. Among the factors affecting architectural design, regional characteristic is becoming the dominant factor [1]. Paying attention to regional ecological balance and inheriting regional culture become the trend of architectural development.

2. Development Status of Architectural Skin Design

The evolution of architectural skin is always closely related to regional economic and technological factors. With the rapid development of building materials and technology, the creation of architectural skin has gained unprecedented freedom. "Heavy architectural skin, light architectural skin", "real architectural skin, false architectural skin", "static architectural skin, dynamic architectural skin" appear one after another, breaking people's traditional cognition of the architectural skin [2]. For example, the MIT-designed Digital Water Pavilion challenged many traditional ideas about architectural skin. The water walls can be programmed to take varying shapes, to display patterns, images and text, and to respond dynamically to input from sensors [12].

The architectural skin is no longer regarded simply as a part of enclosure structure but also a medium connecting the interior and exterior space of the building, or even the integration of information and architectural skin [3]. The appearance of architectural skin presents a tendency of

diversification, which has become the focus of architectural design.

However, in the Image Reading Era, which has been created by electronic and digital media technology, people's interest in the skin is generally concentrated in the pursuit of formal beauty and the information features of the image.

An overemphasis on the visual effects of architectural skin will inevitably bring deficiencies to the skin design, mainly in two aspects.

(1) Separation of form and technology

Today digital design and manufacturing technology can create almost any form of architectural skin that breaks through traditional Euclidean geometry. Using digital and manufacturing technologies, appropriate or needed materials can be used to shape these unusual forms. At present, more and more design techniques have been explored for use in architectural skin design, such as hollowing, bionic, white, rust, crease, bionic, louver, and wrinkles [4]. At present, we have more materials to choose from on the building skin, such as transparent wood, artificial leaves, ETFE, PTFE and so on.

In the information age, architectural skin has lost the strict correspondence with architectural function, structure and space. The corresponding result is that the forms Shaping of architectural skin lacks the logic from construction, and lacks the overall thinking with material, construction and structure [5].

(2) Separation of form and artistic conception

Under the direction of the mass consumption culture, the goal of building skin is more likely to remain in visual patterns and symbolization. While seeking for fast spread in a simple way, the lack of deep research on the "source" of the architectural modeling will make the relationship between the architectural connotation and environment neglected.

As the architectural skin is the result of building materials and technology, it is also an explicit material carrier of architectural culture and has the function of expressing the significance of architecture. The separation of form, technology and artistic conception is undoubtedly contrary to the sustainable development of ecological environment and regional culture [3].

3. Fusion with the Concept of Sustainable Development

Through the complex development status of architectural skin design, it can be seen that today's architecture skin design should be integrated with the concept of sustainable development. This can be confirmed by the development trend of integrated skin design [1].

First of all, from the perspective of ecological technology, it is more instructive to design the architectural skin, so that the architectural skin design can effectively realize the sustainable development of the regional physical environment. Second, from the perspective of visual form and space experience, it emphasizes the individuality and visual impact of architecture, and recurs or translates and interprets the regional culture.

It is noteworthy that the regional physical environment and intangible cultural environment are not antagonistic or fragmented. It should be realized that the regional environment will change along with people's values and ecological views, and be affected by the direct effects of technology, policy decision and else. The building skin design should respond to the impact of changes in the regional environment with open design thinking.

Combining the artistic and technical aspects of the architectural skin with the overall design ideas will help to achieve sustainable development of the regional ecological and human environment [7].

4. Path of Architectural Skin Construction

4.1. Realizing the Sustainable Development of Regional Physical Environment with the Combination of Technologies

The natural conditions of the region have relative stability. Respecting the particularity and objectivity of different regional environments, the development of architectural form has formed the characteristics of adapting to different regions. The concept of integration with sustainable development determines that renewable and pollution-free local building materials and energy should be adopted in accordance with the principle of low energy consumption and recyclability, and the relatively simple and applicable technology is adopted in accordance with the level of regional economy and technology.

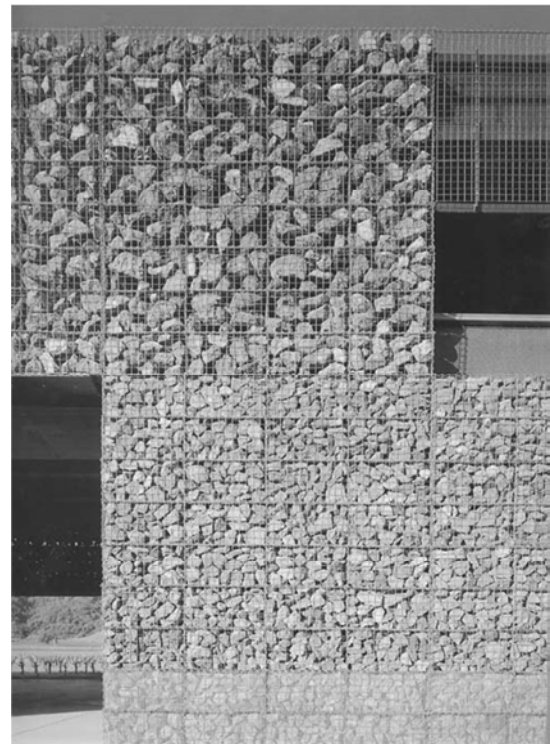


Figure 1. The Domingo les wineries.

The Domingo les wineries (Figure 1) designed by Jacques Herzog and Pierre de Meuron is located in Napa Valley, where the temperature difference between day and night is large. The climate is suitable for the growth of wine grapes, but it is not good for the storage and brewing of wine. The architects respected the natural conditions of the region and creatively used local materials to solve the architectural functional requirements with unique architectural skin-----gabion wall. In the gabion, stones are derived from the local basalt, which has different colors, such as dark green or black, and is integrated into the surrounding scenery.

Because the stones collected are relatively small and cannot be used directly, the architects set up metal wire woven cages to fill the stones and form a unique architectural structure, facade and skin.

According to different internal functions, large, medium and small, three sized stones are placed from top to bottom in cages, ranging from loose to tight and layered facades forming a hierarchical facade from loose to tight.

The upper part of the gabion cage wall is loose, allowing light and wind to enter the room and interact with the surrounding environment. The bottom of the walls are densely arranged in order to prevent rattlesnake from crawling through the crevice, and also to form a dense shelter for wine cellars and storeroom.

The gabion wall covers the interior space during the day and releases the heat absorbed in the day to the interior space at night, which can reduce the temperature difference between the day and night in the interior space and forms the thermal insulation layer subverting the tradition and realizes the sustainable development of the ecology [6].

4.2. Reconstructing Architectural Form - Promoting Sustainable Development of Regional Humanistic Environment

4.2.1. Restructuring the Traditional Elements

While focusing on the sustainable development of the physical environment, the source and power of promoting the growth and development of regional culture should not be neglected [7].

It is accompanied by cultural exchange, population mobility, social, political, economic and value forms. The characteristics of the opening and growth of regional culture determine that the design of the architectural skin cannot mechanically copy the traditional cultural form, but maintains a critical distance from the tradition to conduct morphological reconstruction.

The fundamental source of architectural form is the refinement and expression of the natural and humanistic characteristics of the region. The architectural skin is the language that conveys the most direct image of culture. People can intuitively feel the regional characteristics through the skin's explicit color, texture, pattern and other elements. The unique symbol system of the region makes people feel the characteristics of local history and culture.

Through retrospections, using for reference, extracting and transforming the traditional patterns and symbols, we can

shape the architectural skin. Even with the new materials and technology, it can still show the track of regional culture and historical development, and realize the growth of the regional traditional culture.

The John Lewis Department Store and Cineplex designed by FOA uses a "net curtain" as the skin to cover the surface, which looks like a fabric and reflects the local handicraft culture. The skin pattern originated from the translucent sari woven by Indians living in Leicester and the fabric produced by JOHN LEWIS. These patterns are rich in decoration and arouse people's traditional culture related to their memory [13]. The form of the skin not only reflects the development of modern materials and techniques, but also conveys the regional traditional culture it contains.



Figure 2. John Lewis Department Store and Cineplex.

4.2.2. Showing the Spirit of Place

Tadao Ando said, "what I am keen on is not the actual form of 'Sukiya' itself, but its spiritual and emotional connotation. It is the spirit of 'Sukiya', which plays an important role in promoting the evolution and development of traditional Japanese architecture." [8]

In addition to the reconstruction of the visual form itself, the construction of the architectural skin should also help to reveal the spirit of the place, to arouse the sense of identity and belonging, and to inherit the development of regional culture. This requires full respect for the external environment such as the geographical environment, nature and other conditions of the environment in which the building is situated, and focuses on the communication needs between people and the environment [9].

The "Z58" (Figure 3) was once a watch factory. Through the design of Kingo Kuma, it was converted into a modern building as a design center. Its surface facing the Panyu Road uses mirror stainless steel grooves for greenery arranged at equal intervals on the outside of the glass wall. The mirror stainless steel reflects the French parasol trees and low brick structures on both sides of the street. This scene is exactly the same as it was years ago. Its skin links the architecture to the context of historical sites. The decoration of the architectural skin does not deviate from the essence of building. Instead, it uses glass and stainless steel to absorb and reflect the

surrounding environment, creating a way to read and transmit the urban landscape [9].



Figure 3. Z58.

In the interior space of the building, people and objects outside can be observed through the transparent glass and stainless steel grille. This forms a dialogue between people, a dialogue between the building and the environment. It transcends the antagonism between the interior and exterior space. It reveals the introvert and intelligence of Oriental traditional culture [10].

4.3. Integrating the Form, Technology, Artistic Conception, Attention to Sustainable Development of Physical and Humanistic Environment

In the process of constructing the skins, modern technology and materials enable the building skin to play a role in demonstrating regional culture, thereby achieving the ultimate goal of sustainable development of the physical environment and the human environment.

Tjibaou Cultural Centre located in New Caledonia designed by Renzo Piano (Figure 4) has a very traditional form of "shanty" and is reinterpreted by modern means. Renzo Piano mainly adapts to the local climate by using the special form of "double skin system". The outer layer is made of wood, and the inner layer is glass. He replaced palm saplings with glulam and galvanized steel and "woven" these ribs with local construction techniques. He extended the architectural form design to the skin design, reflecting the form of the "shack" from the whole to the details. These ribbed materials can fade into bronze grey like palm tree trunks over time, blending with the natural environment and telling the historical evolution.

The gap between the ribs weakens the impact of the maritime monsoon on the building, making the building a huge container for capturing wind. There are many kinds of materials for building walls. The size of louvers can be

adjusted freely according to the direction of wind and the intensity of wind strength. In terms of energy conservation, it can make full use of air circulation to reduce the heat radiation of the sun in the tropics.



Figure 4. Tjibaou Cultural Centre.

In the design of Tjibaou Cultural Centre, Renzo Piano respects the local natural environment, draws on the local traditional architectural forms and techniques, and uses modern technology through architectural design (especially the architectural skin design) to achieve ecological energy conservation and protect and develop the native heritage culture of kana [6].

5. Conclusion

Wang Shu talked about the original intention of design Five Scattered Houses, which was awarded for the Holcim Award Sustainable construction projects. "First is how to reflect modern architecture with Chinese temperament; the second is not limited to building the house itself, but the special coordination with the site and environment. In addition, various construction methods and building types have been tried, such as the use of rammed earth, steel, precast concrete structure and other traditional Chinese construction methods." [11]

In addition, it is worth noting that the regional traditional culture is not closed and rigid, and it will continue to be influenced by factors such as technical level and social awareness. In architectural skin design, the overall consideration of architectural form, construction and structure is not to achieve the design goal of creating a new form or language, but to promote and realize the common

development of the regional physics and human environment.

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