

LETTER TO THE EDITOR**Design Method of Green Ecological Building considering
Light Environmental Pollution**Haipeng Li¹, Yanlong Liu², Chujun Wu³, Long Jia^{4*}¹Academy of Fine Arts, Xuchang University, Xuchang 461000, China²School of Design and Art, Chongqing Technology and Business University, Chongqing 400067, China³Art College, Kunsan National University, Kunsan 54105, Korea⁴Academy of Fine Arts, Anyang Normal University, Anyang 455000, China

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In order to realize the main development goal of green and ecological building road, a green ecological building design method considering light environment pollution is put forward. From the point of view of energy, the natural lighting can be used to the greatest extent, and the light environment of green buildings can give full play to its functions in energy saving and environmental protection. Through the comprehensive design of architectural modeling, combined with three-dimensional greening, reduce light radiation, enrich the indoor landscape and spatial composition, to create a more comfortable working and living environment for people.

Light environmental pollution; Green ecology; Architectural design

1 Introduction

The green ecological design of architecture has become an important development direction of improving building quality and developing sustainable architecture in our country, and it is the main development goal of green and ecological building road that can continue to develop in our country. The development of green ecological architecture means that every important link should be scientifically controlled in all periods of the whole life of the building, such as site planning, architectural design, project construction and the completion of the project, and the control of each link should be coordinated with the environment and protect resources. Maintaining ecological balance as the main principle (Li et al. 2017). Therefore, more and more scholars or architects begin to invest in the research and exploration of green ecological architecture design strategy.

The color and quality of the building material is the eternal theme of the building color, and the color combination formed by the smooth glass curtain wall, the smooth ceramic tile and the fine metal panel has created a prosperous urban atmosphere. However, these highly reflective exterior wall materials, because of their thermal insulation defects, not only consume a lot of conventional energy, but also reflect the available solar energy, especially the light pollution caused by their reflectivity. It even destroys the living environment of people, there are countless traffic accidents caused by strong glare on the outer wall of the building every year. Thus it can be seen that the ability to make good use of solar energy in architectural design depends to a large extent on the ecological consciousness of the architect and the owner (He et al. 2017). The new concept of ecological architectural design challenges the traditional architectural design methods. "How to apply solar energy

technology to all aspects of architectural design is a new subject that every architect will face.”

Rui Wang, in the journal Ekoloji’s 2019 Issue 107, published an article entitled: “Livability Design of Residential Building Environment Space”, this design method puts forward the properties of residential building environment space. The road and floor connections for each floor are considered to be independent. According to the distribution of the floor, the cross-story path is analyzed by using the structural network model, and the optimal crossing path of all parking points in the multi-storey building space is obtained. The outdoor environment space of residential building is designed according to architectural style, road space and green space planning. The interior design is combined with the outdoor design to complete the indoor space design. The experimental results show that the method has high accuracy in selecting the optimal path and high accuracy in the plane. The building area is large and the residents are satisfied with the design of environmental space. On this basis, on another point of view, combined with light environment pollution, the design method of green ecological building is put forward.

By studying the evolution process of the concept connotation of green ecological building and the development course of green building and ecological building at home and abroad, this paper starts with the concrete implementation of the whole process of architectural design, such as light environment design, landscape design and so on. This paper discusses the countermeasures in the process of green ecological architecture design.

2 Idea Description

In the process of planning and design, in combination with the actual environmental factors, in the construction practice, the best efforts should be made to avoid the damage to the environment. During the operation period, to avoid causing harm to people’s living space, we should strive to ensure the health, comfort and safety of people’s living space, and make the damage to the environment the least after the building is demolished, which is what we call “green ecological building”. Therefore, we can regard “green ecological building” as a building that can live in harmony with nature on the basis of reducing the use of resources and energy to the greatest extent (Li and Xiong 2017).

2.1 The sources of energy

1) The natural lighting is made to the maximum utilization: The atrium and glass curtain wall are used to make full use of light energy to ensure that there is enough light in the room. Through the improvement of lighting effect in the building, the solar reflector is installed in the building, and then combined with the related technology, the sunlight is introduced into the room by intelligent control. The technical method can effectively improve and control the light environment of a building, and can effectively avoid the waste of resources caused by artificial lighting.

2) Improve the thermal insulation performance: For example, for the special treatment of hot bridge, to achieve this purpose effectively, the use of louver and double insulation glass is a good technical choice.

3) Adequate natural ventilation: The particularity of ecological building is reflected in whether the building can realize natural ventilation through the effective use of natural conditions, or whether the building ventilation can be well controlled by building intelligent control technology (Liu et al. 2018). One of the most common techniques to achieve an effective adjustment of the ventilation in the room is the intelligent control of the automatic windscreen.

4) Control through heat preservation and heat insulation: In the design of the building, the comprehensive consideration should be given to the specific actual and thermal insulation of the local climate. Through the intelligent control of some substances to control the changes of temperature and humidity in the building caused

by sunlight radiation, with the minimum energy consumption to achieve a comfortable indoor environment.

5) Control by intelligent sun-shading technology: The method of the invention is based on the concrete practical basis of the change of the sunlight by means of intelligent control means, so that the sun-shading coefficient of the building can realize the interaction balance through the targeted means, and finally the illumination balance in the building is realized, and the purpose of meeting the special needs is achieved.

2.2 Optical environment system

1) To change the design mode and concept of green lighting: The understanding of new lighting quality and the continuous innovation of its technology have led to the innovation of its design method and concept. There are mainly personalized design and so on, such as you can control the lighting yourself. According to the difference of the light demand of the individual, the self-regulation is carried out to meet the requirements of the individuation; Select the light color that meets your needs, create a good atmosphere, and achieve the purpose of spiritual satisfaction.

2) In order to design the light environment of the green building, it mainly refers to the creation of a brand-new building image, which changes the appearance of the building.

3) The light environment of the green building is made to exert the functions of energy conservation, environmental protection and the like to the maximum extent: At present, the negative effect of light illumination is generally paid attention to, resulting in light pollution and light interference. Therefore, it is necessary to maximize the light environment of green buildings in energy saving and environmental protection.

The design of the building is not only to emphasize the beauty of the building, but also to consider the influence factors of the natural environment, such as the prevailing wind direction, the lighting condition, the dry humidity of the air, and the like on the building, and the comprehensive design of the building model in combination with the local climatic conditions (Wu 2017). First of all, a concept is defined: the figure coefficient of the building, the ratio of the surface area of the outer surface of the building to the volume of the building as a whole. Building shape coefficient is the decisive factor to judge the gain and loss of building heat. Therefore, designers should appropriately reduce the outer surface area of the building on the premise of properly and appropriately dealing with the use function of the building, on the basis of keeping the whole shape of the building neatly and neatly.

Considering the pollution of light environment, in the cold areas of the north where the demand for light is high, the main functional houses are arranged in the south direction of the building, and the ratio of window wall area to wall in the south direction is appropriately increased, and the north direction is due to the absence of sunshine conditions. Then more secondary rooms can be arranged to reduce the window opening area. Because of the hot summer in the south, the main goal of the design of architectural modeling is to improve the comfort of the interior. By increasing the real wall of the west wall, arranging the direction of the building in the wind direction, setting open space and other modeling measures to reduce the thermal radiation of the building. The purpose of strengthening the design of favorable terrain wind is to strengthen the site.



Figure 1 Outline and internal space of London City Hall

Considering the local climate and site conditions, saving energy consumption and avoiding energy waste, the London City Hall (figure 1) adopts a unique circular sphere design. In that aspect of form factor, the overall shape of the building is similar to the irregular spherical body of the ellipse, so that the design of the body is the feature of the body with the largest volume and the smallest surface area, and the loss of heat is reduced (Li 2017). In terms of light, the climate in London is similar to that in the northern part of China. The main body of the building tilts southward. (Kaur et al., 2017) The ingenuity is that each floor of the room to the south is a distance from the lower floor, so that the upper floor has the effect of shading the next floor. As a result, the tedious installation of sunshade is also subtracted. In terms of ventilation, the building is naturally ventilated through ventilation holes opened under the windows of indoor rooms. In addition, the building also adopts central environmental control system, ground source heat pump system and other energy-saving measures to reduce energy consumption.

Stereoscopic greening: It refers to the planting of green plants in the space part of the atrium, the corridor, the outer wall, the roof, the balcony, the veranda and the like of the building, so as to achieve the purpose of multi-level and multi-form greening of the building (see Figure 2). The three-dimensional greening has become one of the most direct ways to realize the green and ecological strategy of the architectural design, and it is one of the effective measures to improve the urban environment and purify the air in the city. And the greening of the atrium space and the side chamber space makes the space become the climate control valve which is connected with the indoor and outdoor, and not only reduces the indoor local temperature, but also reduces the illumination radiation in the room, and the co-workers can enrich the landscape and the space in the room.



Figure 2 Schematic diagram of building stereoscopic greening

3 Results

Combined with the site light (sunshine) environment for architectural design.

Comfortable natural light can create a more comfortable working and living environment for people. Good natural lighting plays a decisive role in building lighting energy consumption. Therefore, on the basis of complying with the relevant national standards, doing a good job of building natural lighting is an indispensable part of green buildings. When the mass of the building main body is large, in order to solve the problem of natural illumination, the atrium of the two buildings in the south and the north can be arranged, and the natural light is introduced into the interior of the building; U-type glass is used in the outer part and structure, and the natural light can enter the room evenly through the U-type glass, so that the office space can obtain a good natural light environment. Through this atrium design strategy, on the one hand, the problem of using space and lighting of indoor main functions is solved, on the other hand, through the design of two-story corridor and indoor floor, the natural wind is introduced into the interior. It is the building as a whole through the atrium to form a natural air duct, a good solution to the problem of indoor ventilation.

The exterior guard structure of the building adopts an intelligent and adjustable external shading system in the shading design. This system can adjust the turning angle of the louver according to the irradiation angle of the sunlight and the intensity of the solar light, so as to reduce the direct radiation of the solar light. The purpose of blocking or reducing thermal radiation, improving the internal environment of buildings and saving energy consumption.

4 Discussion

From the point of view of sustainable development, green ecological architecture has attracted more and more attention, so it will certainly occupy a dominant position in the field of architecture in the 21st century, and it has great space for development. At present, various forms of green building materials are emerging, and the progress of science and technology and information industry will also promote the development of green building, so the future construction will be more in line with the needs of people.

5 Conclusion

If the relevant government departments can take relevant measures to improve the traffic planning and design, for green ecological buildings, if they have such living conditions, the ecological strategy of the building will be more idealistic of the times. At the same time, the construction of transportation facilities is coordinated with nature, urban landscape and cultural atmosphere, and can even reach the modern traffic boundary of car, city, mountain and water integration. Under the condition that the demand for transportation in modern cities is increasing and the whole society advocates the development of low-carbon economy, the construction of green transportation system will certainly help promote the construction of ecological cities.

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