

# Analysis of Natural Lighting and Environmental Energy Conservation Design in Architectural Art

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**Abstract.** As the construction scale of construction projects in various regions of China continues to expand, the usable land area in various regions of China becomes smaller and smaller, and the construction density of urban construction projects becomes larger and larger. As for the space demand, the natural lighting performance and environmental energy conservation of construction projects are more easily recognized by the audience. This paper mainly analyzes the natural lighting design of architectural art, and further explores the solar deflection environmental energy conservation design based on the light-oriented system, hoping to provide corresponding reference for the future natural lighting and environmental energy conservation design of architectural art.

## Introduction

Natural light is a green environmental protection resource that can be used indefinitely. With the continuous increase of the number and scale of urban construction projects in China, construction projects are becoming more and more compact. In addition, as the strategy of green environmental protection and sustainable development in our country is put forward, if modern construction enterprises want to occupy a favorable position in the market competition, in the process of natural lighting design of actual projects, only by effectively utilizing natural light source can we replace indoor artificial light sources with natural light source, thus realizing the purpose of saving power resources and improving the environmental energy conservation design of modern urban construction projects. Therefore, in modern architectural art design and construction, it is crucial to strengthen natural lighting and environmental energy conservation design.

## Analysis of Natural Lighting Design in Architectural Art

Architectural Form and Natural Lighting Design. At the present stage, with the strategy of sustainable development being gradually put forward in China, the production and living mode of unrestricted demand has been unable to continue. Only by fully utilizing natural light source and effectively implementing environmental energy conservation and protection can we create a better and healthier living environment for future audiences. Natural lighting is an indispensable part of modern ecological architecture design. It can not only achieve energy conservation and emission reduction, reduce atmospheric temperature, and weaken the environmental problems caused by global warming, but also show the close relationship between the internal environment and external environment of architectural art fundamentally, which is conducive to promoting the coordinated development of urban construction projects and natural ecological environment. Natural light source is the solar light source. The sun moves with the change of building mode, so the building image changes with the movement of natural light source. Based on this law, the overall quality, plane design, section design and the virtual and real external wall of the building engineering are all the most basic form conditions of building engineering, which play a vital role in the actual effect of natural lighting design in engineering. Whether from the lighting effect of the project, the improvement of indoor visual comfort, or from the treatment of a certain type of performance objectives within the construction project, the engineering form and lighting design process are closely linked and inseparable. This requires that in the design of natural lighting and environmental

energy conservation in actual architectural art, engineers must take the lead in determining whether the main purpose of natural lighting design is lighting, or passive cooling and passive heating, and determining the overall effect of the final design. Only after defining the design objectives can we carry out the research on the engineering form and lighting connection on the basis of material aspects. Generally speaking, the form of foundation engineering is mainly composed of volume and quality of building engineering, plane design, engineering section and external wall. The natural lighting in the interior of the project is mainly to explore the specific day lighting methods, which determine the lighting area and direction of the project space. In terms of principle, the overall lighting method of a project must be designed according to the different requirements of the space performance of the project, while the main purpose of the form is to represent the essence, which is composed of different indivisible elements. The form construction generally precedes the design and guides the specific direction of the overall design. Thus, form can coordinate all kinds of elements as a whole. As far as form design is concerned, in order to maximize the scientificity and effectiveness of natural lighting design, it must take the determination of natural lighting principles and laws as the basis of design. Only in this way can we further clarify the specific content and methods of lighting design, so as to effectively guarantee the overall quality of natural lighting and environmental energy conservation of architectural engineering art.

**Building Volume and Natural Lighting Design.** At present, artificial lighting has been widely used in urban construction lighting. The demand for natural lighting in modern construction projects is getting lower and lower. Due to the restriction of natural lighting design no longer, the construction scale of large depth and large volume gradually appears, which also leads to the continuous reduction of the relationship between the internal and external natural environment and natural landscape of the construction project to a large extent, and the natural light source and natural ventilation are greatly hindered. Although artificial lighting can meet the needs of room audiences, it is impossible to ban the positive effects of natural light source on audiences' physiology. The energy consumption of modern buildings can largely lead to the emergence of audiences' psychological and physiological diseases. Without natural light source, a project can not be called a real building. Only by following the entrance of natural light source, can the brightness and temperature of the internal light of the construction project at different times of the day and in the four seasons of the year be adjusted, so as to create a more comfortable visual experience for the audience. Therefore, in order to fundamentally ensure that all positions of the construction project can be exposed to balanced natural light, architectural art designers must do a good job in the design of the volume of the project and the natural light of the plane and section of the project in an all-round way. In the design work of natural lighting for building volume, for small-volume building projects, natural lighting design can choose two or more sides of lighting, and for large-volume building projects, vertical lighting wells, internal courtyard or hall lighting can be used to ensure adequate lighting inside the building. For the areas with high summer temperature in southern China, it is of great significance to control the internal space temperature scientifically. The overall lighting design of the project is suitable for the natural lighting structure with small width and large depth. However, in northern China, where the winter is longer and the temperature is lower, it is necessary to protect the temperature of the interior space effectively. The overall lighting design of the project is better to choose the design method of large width and small depth. From the point of view of natural light source, with the deepening of the project depth, the illumination level of the internal natural light source will gradually decrease, which also shows that, on the one hand, the depth of the project can not be too high, on the other hand, the obstruction of the natural light source by the partition wall in the space should be reduced to the greatest extent. Only in this way can we fundamentally guarantee the sufficient illumination and the uniform distribution of light in the interior of the building project, so as to create a better living environment for the audience.

### **Energy Conservation Design of Solar Deflection Environment based on Light-Oriented System**

The energy conservation design of solar deflection environment is mainly based on the reflection principle of plane mirror. It mainly uses the more flexible and intelligent application of natural light

source to ensure the best angle of light entering the room, including the energy conservation design of lighting and thermal engineering in building engineering, which effectively introduces natural light into the space for lighting, and saves the electricity of indoor lighting to a great extent. With the gradual expansion of the number and scale of urban construction projects in China, sunscreen glass or vertical shading cloth are widely used in the external walls of high-grade office buildings in cities, thus effectively blocking or shielding the solar light source, leading to the increasing demand for artificial lighting in the interior of space. However, the energy consumption of lighting facilities in the interior of space is much higher than that of heating or refrigeration systems. Therefore, in order to fully implement the sustainable development strategy of resources and energy in China, strengthening the overall use efficiency of natural light sources can fundamentally reduce the power loss of construction projects. Effective application of energy conservation design of solar deflection environment can fully meet the needs of light comfort in engineering space and ensure the thermal comfort in the whole space. Its main purpose is to change the light intensity by adjusting the specific direction of natural light, so it has two properties of light protection and supply. Therefore, the energy conservation design technology of solar deflection environment is a kind of technology that can control the entrance of natural light into the engineering space or let it reflect back. Generally speaking, the actual location of installation of solar deflection system is generally in the engineering glass roof or external wall. According to the correlation between the solar deflection system and the project itself, there are mainly three schemes: installation outside the construction project, installation inside the construction project, or integrated installation inside the insulation glass. If the height of the sun is high, the solar deflection system is suitable for the installation outside the project. Under the guidance of the solar deflection system, the sunlight above 90° will move towards the outer wall defense line, and only a small part of the light will enter the room. If the sunlight is reflected and not absorbed, the temperature of the external wall can be effectively avoided. The light recovery technology installed in the project can deflect 50% of the total light to the outside of the building space by using the reflection of the solar light and heat. Due to the existence of glass layer, only 15% - 25% of the natural light enters the inside of the building space. When the solar deflection system is installed inside the insulating glass, the relevant staff can obtain a attenuation factor data of less than 0.2. Compared with the thermal environment created by external shading, it can obtain a better indoor thermal environment. According to the different state of glass layer, 90% of the natural light will be blocked out, and only 7%-10% of the natural light will enter the room in a light-thermal way. At the present stage, the natural lighting in the construction space in China generally involves the use of louvers to block the light. Although this natural lighting design method can achieve better shading effect, it can also lead to some heat accumulation, which can easily lead to the increase of the internal temperature. Especially in summer, such louvers can be directly used as heat absorption equipment and indoor air partition board. Therefore, this method is not recommended for energy conservation design of natural lighting environment in modern architectural art.

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