Application of "Green and Low Carbon" in the Design of Expressway Service Area

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Abstract. With the development of the country and the sustainable development of the society, all kinds of infrastructure construction and transformation of our country have been greatly promoted. With the emergence of modern transportation equipment and the rapid development of expressway, the design of expressway service area, which is the equipment related to the highway, is also getting higher and newer, not only to meet the needs of modern transportation, but also to adapt to the development of the environment. The service area is an indispensable part of the construction of the service area in China, and its service demand diversification, energy and resource use are also important components. Compared with other urban buildings, architecture is a special architectural form. It should not only be humanized, but also meet the psychological and physiological need of users, and pay attention to the symbiosis of architecture and environment, energy conservation and emission reduction. Introducing the concept of "green building" into the buildings in the service area can not only solve the problems of resource shortage and energy consumption reduction in the service area, but also have important significance for expanding the research on building energy conservation and environmental protection in China.

Keywords: Green and low-carbon · Expressway · Service area design

1 Introduction

Due to its special geographical location, it is separated from the urban area. Therefore, the energy consumption and pollution control of the service area cannot completely rely on the internal system. This has led to the insufficient utilization of the resources in the service area, the discharge of sewage and dirt, and the high energy consumption of the wall insulation system. In the long run, it will not only have a negative impact on the development of the service area, but also endanger the ecological environment. In addition, in the construction of high-speed service areas, if appropriate environmental protection technologies are not adopted, the daily operating costs of high-speed service areas will soar, resulting in huge consumption of human, material and financial resources. In the long run, this is unfavorable for the future development of the high-speed service area.

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At present, in the modernization of urban infrastructure, green buildings have become an important force to maintain ecological balance. If green buildings are applied in the construction of high-speed service areas, it can not only reduce energy consumption, but also improve the treatment efficiency of wastewater and sewage; at the same time, it will also promote the development of high-speed service areas. In terms of ecological environment protection, the adoption of green buildings will help promote the healthy development of urban ecosystems and promote the sustainable development of cities.

2 Research Background of Green Building

As an important home of mankind, the earth provides abundant resources, but also faces great challenges. With the rapid development of China's economy, the global resource and environmental problems are becoming more and more prominent, and the environmental crisis is becoming more and more serious. Therefore, we should not only strive to protect the natural environment of the earth, but also actively explore the path of sustainable development. With the two global energy crises in the 1970s, mankind has gradually realized that it is impossible to realize the rapid development of society and economy without taking the cost of ecology. Therefore, we should advocate saving resources and protecting the earth; the construction industry is the largest resource consumption, so we should adhere to sustainable development. Therefore, the energy conservation design movement in the construction industry has also risen, and the concepts of "low energy consumption building", "solar residential", "ecological building" has also risen, and various energy conservation technologies in the construction industry have also emerged, thus forming the concept of "green building".

3 Theoretical Framework of Green Building Design Method

After entering the 21st century, the architectural concept and sustainable concept advocated in architecture has become an irreplaceable trend. There are many studies on green buildings in China. The "green building" system architecture proposed by Dr. Zhou Ruoqi of Xi'an Jiaotong University can provide useful reference for future green buildings. The system takes the green housing in the loess hilly area as the research target, and on this basis, the composition factors and patterns are summarized, which is a reference way. Based on the idea of sustainable development, combined with the needs of social and economic development, the idea of symbiosis between human and nature, and the idea of symbiosis between artificial environment and nature is highlighted. It is based on the traditional architectural concept in the past, closely combined with the concept of sustainable development, and combined with humanities and sociology, technical science and spatial morphology; it provides scientific basis for it from many aspects, such as economics and ecology, and strives to create a sustainable living space. Consider the components of green building system from the perspective of demand, space and construction; Environment and benefit, all elements interact with each other to form the whole design. The main factors are reflected in the design methods of buildings, and show different trends: the demand level pays attention to "people-oriented", reflecting

people's physiological, psychological and social needs; In space, focus on the relationship between artificial space, natural space and human activity space, including space function, shape, scale, scale, etc.; In building construction, we should pay attention to the integration of regional technology and adaptive technology with modern high technology, so as to effectively deal with various problems in construction; Environmental problems: ecological environmental problems, pollution problems, resource problems, disaster problems; In terms of benefits, we should focus on cost, production and benefits; Assessment, etc., using the overall planning method at all levels above to create a comfortable, healthy and safe living space.

4 Research on the Current Situation of Architectural Design of 3sx Provincial Expressway Service Area

4.1 Classification of sx Provincial Service Area

Sx province is located in the middle of the geographical map of China, between the middle reaches of the Yellow River and the middle reaches of the Yangtze River. The whole area is narrow from east to west, and narrow from north to south. Sx province's unique geographical location, cultural background and historical background make the types of expressway services also show obvious differences. According to the regional characteristics, the expressway service area in Sx Province can be divided into: the expressway service area in northern Shaanxi. The northern part of the northern mountain area is the mountainous area in northern Shaanxi. The landform on the expressway is very different. The service area is usually set around the city, and the service area is built by using the relatively flat terrain. Northern Shaanxi is a cold region, so thermal insulation and wind protection measures should be considered in construction. For example, Yichuan Service Area and Ansai Service Area. Guanzhong Expressway service area: Guanzhong is located in the south of the Beishan Mountains and the north of the Nanshan Mountains (Qinling Mountains). The terrain is relatively flat and can generally reach the service area interval. The building structure of Guanzhong service area should take into account the use of heat insulation and sunshine in winter, and the heat insulation, ventilation and sunshade in summer. Qianxian service area, Yongshou service area, etc. Expressway service facilities in southern Shaanxi: Southern Shaanxi is located in the southern Qinling Mountains, with many mountains, so the selection of service sites is restricted by the terrain. Since the terrain around the town is relatively low, this area is preferred; the main problem of mountain traffic is the parking and maintenance of vehicles passing through mountain roads and tunnels. If the service area is relatively large, a parking area should be set up between them. The construction of the service area in southern Shaanxi focuses on the ventilation and heat insulation effect. For example: Qinling Jinsi Gorge Service Center.

4.2 Classification According to Construction Site

According to the construction site, the expressway service in Sx Province is divided into: 1) the service area adjacent to the scenic spot: the service area is adjacent to the scenic

spot, not only responsible for providing services for the drivers and passengers on the expressway and the traffic, but also taking into account the various needs of the scenic spot, especially at the end of the week and during the public holiday; The relationship between these two aspects is a very meaningful issue. In addition, the landscape resources of the scenic spot should be maximized as much as possible, such as the Golden Silk Canyon. (2) The service area closest to the urban area: this service area is located around the big city, so the demand for service quality is also high. Provide vehicle refueling, refueling and maintenance within the service scope; In addition to car washing, it can also take into account the needs of logistics and distribution. On this basis, building a larger parking lot is also a factor that cannot be ignored. For example, in Xi'an, in order to solve the problem of urban congestion, large trucks cannot enter the city at night. As the main roads of vehicles in Xi'an pass at night, a large parking lot is set up on the expressway around the city, which is convenient for truck drivers. Such as drowning bridge service area, Qujiang service area, etc. (3) Service facilities adjacent to rural areas: This kind of service facilities is adjacent to rural areas and can promote economic development and employment in rural areas.

5 Analysis on the Current Situation of 4sx Provincial Service Area

5.1 Site Layout and Building Greening Design

Whether the planning and design of the service area is correct will play an important role in the regional traffic organization, the use of parking lots and the use of buildings. The service center in Sx Province is planned to be dominated by comprehensive buildings, most of which are located in the center or behind the center, and the parking lot is around the building, which is divided according to different vehicle types; Its function is obvious, but it often leads to the poor connection between the parking lot behind the building and the main building, which leads to inconvenience in use. From the architectural layout, some service facilities separate the guest rooms from the main road, and some service facilities are separated from the main road, which brings certain safety risks to passengers. In addition, some service areas do not take the connection between the direction of the building and the road into consideration when selecting the site, while most of the service areas are perpendicular to the main facade of the building and the road; thus, the use direction of the building is unreasonable. A livable service facility must be green, and green can not only improve the urban ecological environment, but also improve the urban ecosystem. The main buildings of sx provincial service center are mostly low-rise residential areas. In addition to parking and roads, there are also a lot of green areas at the construction site, which increases the space environment of the service area. However, from the perspective of greening, the area of lawn is the largest, with fewer trees and shrubs, which leads to the investment of human, material and financial resources in the parking lot. In terms of ecological benefits, although people generally believe that lawn has good landscape effect, its impact on ecology is minimal. Judging from the plant species in the service area, many service areas will choose some precious trees, such as ginkgo, but it was unexpected that trees that do not match the weather cannot survive.

5.2 Architectural Facade Modeling Design

The expressway service area is an indispensable means of transportation on the expressway. Its architectural form is not only an important cultural window, but also its unique regional characteristics and cultural heritage. The cultural and regional differences of each region of sx make it very different in architectural form. The comprehensive structure of the main building of Yongshou Service Area adopts the combination of inclined roof and roof, which is different in height, making its form more abundant, but there is a certain waste in space; The Huangling service area is located near the scenic spot. It adopts the traditional architectural form in the architectural form. On the basis of the sloping roof, it adopts the traditional architectural form with regional characteristics; For example, windows are the window decorations of traditional houses. Other service facilities are modern. The symmetrical plane forms a symmetrical facade, which has a rigorous facade, and uses two large glass windows with full height; visually, it is very dignified and lacks affinity. On the whole, the architectural style of the service building in sx province is relatively simple, similar to the general complex building and office building, lacking the characteristics of traffic construction; at the same time, the lack of detailed design is very large in the scale of the building, and it is difficult to make people feel friendly psychologically. In terms of the color of the building, it is regular; it will not make people feel "eye-catching".

6 Service Area Design Strategy Based on Construction Elements

The construction element of the green and low-carbon system is the technical support of the building. Without technical support, it cannot be fully implemented. At present, there is a large amount of energy consumption in the construction of urban service facilities in China. While building "green" areas, the concept of "green" is introduced into the construction of "green". The "green" technology breaks through the limitations of conventional technologies and combines natural ventilation and lighting, low energy consumption enclosure, renewable energy utilization, reclaimed water recycling, efficient energy-saving heating, energy conservation and other comprehensive utilization technologies, and harmless waste discharge technologies. In the construction of service facilities, the use of green construction technology can better improve the environmental, social and economic benefits, and promote the sustainable development of urban construction.

6.1 Utilization of Solar Energy Technology

As we all know, solar energy is the cleanest and richest resource in the world. The use of solar energy will not pollute the environment and will not affect the environment. In the absence of other buildings, if it is in a sunny place, especially in the north; it is convenient to use solar energy. In the single building of service facilities, both solar energy and hot water can be considered. The solar hot water system can gather the radiation of the sun together, and then pass through an energy conversion device. The heat generated can be used to provide hot water for residential, kitchen and bathroom. In a single building,

solar energy can be used to generate electricity. Sunlight generation is the use of light conversion devices (the sun) to directly convert solar energy into electricity, which is used for building lighting and daily electricity consumption. The single buildings of service facilities are generally small, which are more suitable for this type of power supply, such as rest rooms, supermarkets, etc.

6.2 Effective Utilization Technology of Water Resources

Water shortage has become a common problem for many countries and countries. In the construction of service facilities, how to reasonably use water resources is an urgent problem to be solved. The toilets in many service areas do not have enough water, resulting in poor sanitation. In addition, a large number of cars cleaning also bring pressure to the utilization of water resources. In order to effectively solve the problem of water resources, we must strengthen management and reduce the waste of water. At the same time, we should pay attention to "opening up sources and reducing costs", and pay attention to the recycling of rainwater, the efficient use of water, and the reuse of water.

6.2.1 Rainwater Recycling Technology

Concentrating rainwater near the service area can effectively reduce the leakage in rainy season, reduce the tension of water supply and effectively use water resources. First of all, the roof of the building can be used for rainwater collection, introduction of green space and storage facilities. Second, use roof water collection, filtration, sedimentation, sand filtration, retention tank and disinfection; the processed treatment pool can be used for landscaping and car washing. Third, the water pump is used to send it to the water column at the top of the building for toilet flushing. In addition, after storing rainwater and sewage, the rainwater from the square, courtyard and road in the service area can be collected and introduced into the water storage equipment for storage.

6.2.2 Reclaimed Water Utilization Technology

Reclaimed water is the domestic wastewater with high quality that can be recycled into non-drinking water through simple process treatment. A reclaimed water collection pipeline can be set in the service area to collect kitchen vegetable washing wastewater, shower wastewater and washing wastewater; install outdoor reuse pipes to collect vehicle sewage; finally, the collected water reaches the quality standard of reclaimed water for greening and irrigation, toilet washing, vehicle washing, landscaping, etc. in the service area.

6.3 Energy-Saving Technology of Building Envelope

The enclosure of a building is usually a structure and decoration material that separates the space from the outside. The thermal insulation effect of the external wall of a building has a great effect on the energy consumption of the building, and the thermal insulation effect of the external wall will have a great impact on its energy consumption,

so the selection of energy-saving enclosure structure is the key to achieve the purpose of energy conservation. (1) Exterior wall: The energy-saving design of buildings aims to increase the thermal resistance of buildings, that is, reduce the heat exchange of buildings. Because the thermal insulation performance of the outer wall using single-layer materials is difficult to meet higher thermal insulation requirements, composite materials are currently used as the main choice of thermal insulation materials, and the outer wall thermal insulation technology is also used. (2) Roof: The problem of the roof is thermal insulation and heat insulation. You can choose appropriate thermal insulation materials and determine appropriate thermal insulation materials to achieve ideal thermal insulation performance. In thermal insulation design, it should be carried out by increasing the ventilation of the roof and improving the heat storage performance of the roof. In terms of the structural form of the roof in the service area, thermal insulation roof, planting roof, water storage roof, double-layer roof and other technical means can be adopted, and it should be coordinated with the appropriate weather conditions. (3) Doors and windows: In the enclosure of buildings, doors and windows play a key role in the energy conservation of indoor and buildings, and their energy consumption is about 40% - 50% of that of buildings. In the service building, to avoid the loss of energy from windows and windows, the following measures should be taken: 1) window frames with good thermal insulation performance. The door and window frame shall be of hollow structure to form a closed air film indoors and have good heat insulation effect. At present, aluminum doors and windows and PVC plastic doors and windows are more common. They have their own shortcomings. The improved thermal insulation bridge-cut aluminum alloy window frame is divided into two sections by nylon spacers, so that it cannot transmit heat. 2) Insulating glass: The selection of glass depends on the geographical location of the building. For example, on the sunny side, heat-absorbing glass and coated glass can be selected, which can effectively control the sunlight and reduce the air temperature; On the back, insulating glass, double-layer glass and insulating glass can be selected to achieve thermal insulation. 3) Strengthen the sealing of windows and windows. On the basis of the improvement, the sealing strip is added to improve the performance of its sealing element, and the sealing strip combined with rubber strip, plastic strip and plastic strip is used for different doors and windows. 4) Rationality of window wall ratio. Doors and windows account for a large proportion of the heat loss in the building, so reasonable adjustment of the window-to-wall ratio is an important measure to reduce building energy consumption. In the Design Standard for Energy Efficiency of Public Buildings, the proportion of the wall area facing the window shall not exceed 0.70.

6.4 Construction Waste Treatment Technology

There is a large amount of waste in the service area, and the existing simple placement method obviously has certain defects, which will not only cause environmental pollution, but also have certain impact on the environment. In the construction of service facilities, priority should be given to the garbage bins with garbage classification, and various kinds of garbage in different places such as kitchens, lounges and supermarkets should be classified and recycled. Because the service facilities have nothing to do with the urban area, it is not economical to build a waste treatment machine in its location. Therefore, the centralized stacking site is only selected in the downwind, but there must be closed

buildings and external space for tight isolation; and plant a lot of flowers and plants around it to clean the air.

6.5 Ground Source Heat Pump Technology

Using ground-source heat pump technology, using natural energy such as soil, groundwater and surface water, and using ground-source heat pump to provide heat and cold sources for buildings, is a new type of central air-conditioning system that can provide heating and cooling. Compared with conventional air conditioners, its efficiency has increased by 40%, saving about 40% of energy and energy. As the preferred technology for service facilities, the underground tube heat exchanger has been proved to be mature and feasible.

6.6 "People-Oriented" Design

The expressway service area is set up to meet the needs of passengers, so the design should take into account the psychological and physiological needs of passengers, and the external elements of buildings such as squares, courtyards, greening, etc.; Arrange and organize traffic reasonably. When setting the grid, we should pay attention to the convenience of the location and the rationality of the scale; There should be scenery to enjoy at all times and chairs for people to rest; the green space should have a sense of hierarchy, and various forms of greening should be organically integrated. The road should be clear and have a good guiding role; this line is very simple and convenient. In the interior space planning, we should try our best to achieve a comprehensive function and a standardized scale. Among the functional buildings in the building, the functions such as toilets, 24-h convenience stores and tea rooms should be added according to different needs, and the space layout of the building should be taken into account. The entrance, walkway and service equipment should be fully planned, so as to make the space inside and outside the building more humanized, so as to create a harmonious ecology suitable for the living environment.

6.7 "Environment Oriented" Design

Since the service area itself has the characteristics of "independence", the concept of ecology and environmental protection should be integrated into the whole process from concept to construction in the design stage of construction. First of all, we should reasonably grasp the needs of site selection and building materials from the perspective of disaster prevention and mitigation, and then comprehensively consider the surrounding terrain, hydrology, climate and other factors when planning. On the land with large terrain differences, plan according to the terrain to minimize the damage to the land itself, such as lakes and rivers around the land; It can combine the landscape and greening of the service area to give full play to the existing landscape; According to the local weather conditions, we should fully understand and analyze the local wind image, temperature and sunshine conditions; The effect of precipitation and air humidity on the structure. At the same time, it is also necessary to treat construction waste, and establish wastewater, waste and waste gas treatment facilities in combination with local conditions to minimize the pollution to the surrounding.

6.8 "Energy Saving" Design

The energy-saving of expressway service facilities is directly related to the quality of design. In the architectural design of service facilities, attention should be paid to the rational use of building space to achieve the purpose of saving resources. For large buildings such as restaurants and supermarkets, the floor height should be reasonably selected to minimize the proportion of the building area in the total area, and at the same time, the curved situation in the building space should be avoided as much as possible. In terms of lighting and ventilation, the impact of human factors should be minimized. On the premise of meeting the lighting requirements, large bay and large area glass curtain wall should be avoided as much as possible. The role of ventilation should be fully considered in the bay, depth and door and window layout of each functional room. In terms of the orientation of the building, it is necessary to ensure that the location of the main building is in a favorable direction. In addition, according to the local climate, economic and technical conditions, appropriate technologies and high-tech methods can be adopted to achieve building energy conservation, such as solar energy, ground source heat pump, reclaimed water treatment, etc.

7 Conclusion

The completion of the high-speed service area is a key link in promoting urban modernization and has milestone significance in promoting China's economic development. However, due to its unique location conditions, it is separated from the urban building system, resulting in a large amount of energy consumption and waste of resources; it poses serious danger to the local ecological environment. Therefore, it is necessary to promote the application of low-carbon green buildings in modern service industry. First of all, taking SX expressway service area as an example, starting from its location and main structure, it points out that its service facilities are insufficient, lacking aesthetic sense and sustainability. It is suggested to adopt the following methods: 1) use the "mountain" and "sea" in ancient Chinese as the basis for the second reconstruction; 2) Strengthen the division of service areas, and apply more humanization and science and technology here, such as: disabled people friendly, pregnant women friendly; Artificial intelligence technology, etc. (3) Actively implement the principles and policies of sustainable development, promote the application of energy-saving products in service areas, in line with the concept of low-carbon green ecology. At the same time, combined with regional climate characteristics and geographical location, technical support for green and low-carbon buildings is proposed. Starting from three different materials, the energy-saving technology of building enclosure structure in a region is discussed.

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