

Research on Rural Community Planning and Architectural Design based on Green Ecological Concept

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Abstract

Taking the planning and construction of villages and towns in Zaozhuang City as an example, combined with specific engineering practice and rural community planning based on the concept of green ecology, this paper expounds in detail the architectural design method of Xijiao new village, Binhu Town, Zaozhuang City, in order to improve the living environment of rural residents.

Keywords

Green Ecological Concept; Rural Planning; Community Planning; Architectural Design.

1. Introduction

Binhu Town is located in the northwest of Zaozhuang City, located in Dushan Bay on the east bank of Weishan Lake. It has convenient land and water transportation, rich tourism and mineral resources, developed shipping, and huge development potential. Binhu Town Jiao New Village construction project is approved by the Shandong Provincial government, is the first in Zaozhuang city to implement economical and intensive land use, in the form of village coal pressing residential building construction, and is also a demonstration project of the new socialist rural construction in the town.

2. Planning Guidance and Optimizing Spatial Layout

On the basis of fully considering the future agricultural development, mineral resources development, aquatic products improvement and tourism development of Binhu Town, investigate the large villages with development prospects, which are conducive to the concentration of farmers, and have complete infrastructure and public facilities, guide the villagers to correctly understand the relationship between the construction of New Countryside and their own interests, fully listen to the villagers' opinions on the village planning and design scheme, carry out ecological energy-saving planning for the overall layout of the building complex, and optimize the building thermal environment, In order to improve the transformation and new construction planning of the new rural community.

2.1. Reasonable Base Selection and Site Planning

Buildings should not be arranged in valleys, depressions, ditch bottoms and other concave sites, and low-lying places are easy to form "frost hole" effect; The relative position of the building cluster needs to be reasonably arranged. Good sunshine can be obtained in winter and building shadow can also be used for shading in summer.

2.2. Reasonable Building Orientation

In addition to the lighting requirements, the orientation of the building also needs to pay attention to the effect of heating and ventilation. Make full use of solar energy in winter and prevent the invasion of cold wind. In summer, use building shadow and air flow to reduce the surface and internal temperature of buildings.

2.3. Reasonable Sunshine Spacing Design

In order to ensure that the rear buildings between the front and rear rows of buildings can obtain the required sunshine in the specified time and day, in addition to meeting the requirements of national specifications, it is also necessary to establish and improve the regulations on building spacing and sunshine spacing in the local city in combination with the actual situation.

2.4. Set Up Wind Barrier to Reduce Heat Loss

In the building cluster, turning the higher buildings back to the winter cold wind can reduce the impact of the cold wind on low buildings; In the building group, the building spacing is controlled within the range of 1:2, so that the rear buildings can avoid the influence of cold wind.

2.5. Use the Natural Environment to Adjust the Microclimate

The existing trees, vegetation, water environment and favorable terrain can be used to improve the temperature, air humidity, wind speed and heat radiation around the building.

In addition, the site selection of new rural communities also needs to meet the following requirements:

Full consideration should be given to the combination of developing agricultural production and improving farmers' lives. With the development of China's agricultural modernization, the rural production mode and farmers' lifestyle have changed, and the construction of rural houses and corresponding communities have also changed. The new rural planning should not only consider the reality of rapidly improving farmers' lives, but also realize the long-term significance of promoting the development of agricultural production.

According to the distribution of villages, we should improve the intensive use of land and the scale of agricultural production. For the site selection of the new rural community, the distance between the building and the public transport system should be considered as short as possible, the existing old village and the large village in front of the combined village should be taken as the construction site as far as possible, the sections that are convenient for the use of natural resources should be selected as far as possible according to the local climatic conditions and geographical environment, and the ecologically safe areas should be selected for construction to avoid the selection of ecologically sensitive areas. We should adhere to the harmony between man and nature, try to preserve the historical features of the village, protect the ecological environment, and highlight local and rural characteristics.

Before the construction of the project, Xijiao new village conducted a basic investigation on the number of original villagers, the number of homesteads, infrastructure construction and supporting public service facilities, so as to lay the foundation for further analysis and planning; As the coal mining in Zaozhuang City has a history of one hundred years, there are a large number of mined out areas and collapse areas in the area, and some villages are built on them. Although the settlement in the collapse area has been basically stable, the engineering geological conditions are poor. From the perspective of earthquake resistance, most of them are not suitable for construction. Therefore, according to the actual situation of Zaozhuang City, the seismic safety evaluation shall be carried out for the construction projects in the above areas, and the seismic fortification requirements shall be determined according to the evaluation results. Conduct in-depth topographic and geological survey before planning, and then carry out village and town planning and site design, so as to effectively avoid the seismic intensity area and coal mine pressure area with potential impact in this area, and create a safe environmental space.

Based on the above investigation and analysis, Xijiao new village construction project selects the new village site in the west of the town residence and at the intersection of tengbin tourism special line and Jiwei Road, and builds 16 multi-storey residential buildings. The community

supporting projects include apartments for the elderly, clinics, kindergartens, cultural squares, and basic supporting facilities, roads, water, electricity, networks, etc. The project is planned to cover an area of 58000 m², with a total construction area of 50000 m². The planned new village will save an intensive land area of more than 110 mu. After the integration of villages, the environment, land and resources have been integrated, the quality of life and environment of farmers have been effectively improved, the intensive use of land and the large-scale and mechanization of agricultural production have been improved, and the sustainable development of coal industry in this region has been promoted.

2.6. Analysis on the General Plan of Xijiao New Village

2.6.1. General Layout

The general layout first considers the actual use function of the building. In terms of layout, the functional distribution from north to south is villagers' residential areas, apartments for the elderly, clinics, kindergartens and community supermarkets. The residential area is composed of 16 multi-storey buildings, which form an enclosed group through layout, in which the green belt and water system are placed, the low-density buildings and the central landscape are seamlessly spliced to provide a leisure living environment, and the health room and kindergarten are placed in the central landscape belt. The elderly apartment and community supermarket are located at the secondary entrance, and a large landscape spray pool and shady parking lot are set up to divide the space. The bamboo garden and plum garden are arranged orderly and skillfully, with scattered and distinct levels, which enriches the landscape in the plot.

2.6.2. Traffic Organization

According to the overall planning consideration, the site owner's entrance is set on the main road. Roads are set around the building, which can be used as fire lanes. Pedestrian flow lines are designed in each area to achieve the diversion mode of some people and vehicles, and barrier free design is considered.

2.6.3. Architecture and Greening Landscape

The buildings are arranged orderly in the plot. The landscape design combines the arrangement and style of the building community, makes full use of the water environment advantages of the existing river, enlarges the landscape nodes at the main entrance, and makes grape trellis around the building buildings. The designed green belt not only beautifies the community environment, but also changes the microclimate of the buildings.

3. Technical Design and Optimization of Building Energy Conservation

The green building design of new rural communities is not a simple green building, a replica of urban buildings, or a monotonous "one side of a thousand villages", but grasp from the rational building plane design, appropriate building shape design and envelope design with good thermal performance, and take the road of green building design with local characteristics to achieve the purpose of energy conservation.

3.1. Reasonable Door and Window Design

Among the total energy consumption of building envelope, the energy consumption of building doors and windows accounts for 50%. Doors and windows are the weakest part of building thermal insulation performance, so improving the thermal insulation performance of doors and windows is an important way to ensure building energy conservation.

3.1.1. Increase the Air Tightness of Windows

In order to reduce convective heat transfer, the sealing performance of doors and windows is good. In the building energy-saving design standard, this performance of doors and windows is

expressed by air tightness. In addition, the ventilation function of buildings should not be satisfied by the gaps of doors and windows, but by the controllable building structure and the ventilation structure of doors and windows.

3.1.2. Reduce Heat Conduction

In order to reduce heat transfer through heat conduction, doors and windows should be made of materials with low thermal conductivity. In the design standard of building energy conservation, this performance of doors and windows is expressed by heat transfer coefficient. The K value is used to measure the heat transfer coefficient of the window. The smaller the K value is, the smaller the heat transfer is. In terms of improving K value and anti condensation ability, the warm edge technology of low radiation glass, inert gas and insulating glass and window frame materials with low heat transfer coefficient are mainly adopted.

Table 1. Heat transfer coefficient K of the common window frame section

Unit: W / (m²·K)

Ordinary aluminum alloy frame	Hot type aluminum alloy frame (Heat insulation strip width of 12.5mm)	PVC plastic frame (Three-cavity structure)	Wood frame (Hardwood) (Thickness of 70mm)
6.21	3.4	1.8	1.9

3.1.3. Set Building Shading Components

In order to reduce heat radiation transfer, doors and windows need to have good shading function. In the building energy-saving design standard, this performance of doors and windows is expressed by shading coefficient. When setting building shading components, the overhang of both ends of the horizontal sunshade and the overhang of the upper end of the vertical sunshade have an obvious impact on the shading coefficient. The longer the overhang length is, the better the shading effect is. At the same time, it is also necessary to determine the reasonable overhang length according to the building facade effect.

3.1.4. Control the Window Wall Area Ratio of Each Facade to Avoid Adverse Forms

The window wall area ratio reflects the window area of the room. From the perspective of reducing building energy consumption, the window wall area ratio must be limited. Floating windows and floor to ceiling windows are beautiful and exquisite, but floating windows are a great taboo for heat insulation and warmth preservation. Their heating and air conditioning energy consumption is large. Floating windows should not be set in bedrooms and living rooms in the north, otherwise problems such as condensation, water flowing and mildew are easy to occur in winter, affecting the normal use of the room. In addition, the temperature of windows in the room is the lowest in winter, and the downdraft is mostly concentrated around it. If a radiator of appropriate size is installed under the window, it can prevent cold radiation and cold air circulation. Therefore, French windows should be opened less.

3.1.5. Set the Door Bucket at the Main Entrance and Exit of the Building

Buildings in cold areas should not be equipped with open staircases and corridors, and their entrances and exits should be equipped with door buckets for separation, wind and cold protection.

3.2. External Thermal Insulation Design of Exterior Wall

The advantages of external insulation compared with internal insulation are as follows: 1 Wide application range; 2. Protect the main structure and prolong the service life of the building; 3. Basically eliminate the influence of "hot (cold) bridge"; 4. It is conducive to the stability of room temperature; 5. Improve the moisture condition of the wall; 6. It is conducive to improve the waterproof and air tightness of the wall; 7. Facilitate energy-saving transformation of old

buildings; 8. It can reduce the consumption of thermal insulation materials; 9. Increase the use area of the house.

3.3. Roof Thermal Insulation Design

The temperature difference heat transfer at the ordinary roof consumes a lot of heat. In summer, more outdoor heat is introduced into the room, and more indoor heat is lost outside in winter. In order to make the roof have obvious heat insulation effect and reduce the heat island effect, the following aspects should be paid attention to: 1 The architectural design meets the requirements of ventilation and daylighting; 2. The roof adopts sunshade components; 3. Consider the structural form of inverted roof; 4. The thermal insulation layer with high thermal conductivity should not be selected; 5. Greening the roof.

3.4. Application of Solar Energy

3.4.1. Solar Water Heater

Multi storey residential buildings can meet the space requirements of roof solar collector plates and are suitable for large-scale popularization and application. Due to the small accommodation space of roof solar collector plate in high-rise residential buildings, it is difficult to support all residents in high-rise buildings, and the wall mounted technology of collector plate is immature, which has potential safety hazards.

3.4.2. Solar Lighting in Public Areas

Solar photovoltaic lighting technology is adopted to provide electric energy by solar photoelectric conversion for lawn lamp, courtyard lamp, corridor lamp, etc.

4. Summary

The planning and design of green building construction in new green ecological rural communities not only directly improves the living conditions of farmers, but also is of great significance for protecting the ecological environment, building a resource-saving society, improving the level of rural public services and accelerating the process of urbanization.

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