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Research on Green Building Index System Based on Low Carbon Ecological Design in the Detailed Planning

Yunhua Zhang[a]*, Tao Feng[b]

[a] School of Civil and Architectural Engineering, Anyang Institute of Technology, Anyang 455000, China
[b] Planning and Architectural Design Institute in Puyang, Puyang 457000, China
jzyunhuazhang@163.com

Low-carbon ecological planning and green building at both levels have been carried out a lot of exploratory work. They also formed their own index system. However, as the basic unit of urban construction, green building is unable to form a direct relationship with the sustainable development strategy of the whole city and low-carbon ecological planning index. These studies are still a blank spot at present. This paper explores from the planning, design, management point of view. First, we combine the green building and the urban low-carbon eco-development goal. Then we extend the green building to a more macro scale. And we make it to combine with the low-carbon eco-planning index system. Finally, we establish the green building index system based on low carbon ecological designed in the detailed planning. Therefore, this article explores a feasible and enforceable development road.

1. Introduction

Today's world has entered a low-carbon era, low-carbon development has become the world's urban development of the core issues. The 18th National Congress of the Communist Party of China (CPC) also proposed to push forward the green development, circular development and low-carbon development. We should form a spatial pattern of saving resources and protect the environment, industrial structure, mode of production and way of life (He et al., 2015). We should also create a good production and living environment for the people and the global ecological. "Low-carbon eco-city" is the current hot topic of urban development. The low-carbon ecological planning integrates the low-carbon target with the ecological concept. It uses the system's thought to guide the transformation of the urban development mode, and puts forward the key stratagem and strategic stratagem (Luo et al., 2015). Through the integration of land, industry, transportation, energy, resources, environment, society and other low-carbon ecological strategy, we can achieve the harmonious coexistence of man and the natural environment, sustainable development. In contrast, green building pays more attention to the dialectical relationship between building function and land saving, water saving, material saving and environment protection from microcosmic aspect. It aims to reduce the impact of construction activities on the natural environment, so as to achieve resource conservation and environmental protection during the whole life of the building. It is not really important to discuss the differences between these three names and to make a conclusion as to what is right and what is wrong (Zapatalancaster, 2014). To determine their guiding direction, to summarize their connotations, to establish a universally accepted concept from urban planning to architectural design, and to promote urban sustainable development is both possible and necessary. In recent years, with the low-carbon as the core of the ecological planning concepts have been proposed, there have been a number of domestic low-carbon eco-city project practice and some low-carbon eco-city background based on the typical function index system.

2. Analysis of current low-carbon eco-planning index system at home and abroad

2.1 Research on low-carbon ecological planning at home and abroad

Many large cities around the world are vigorously promoting low-carbon eco-city construction. The United Arab Emirates Abu Dhabi Masdar and Tianjin in the new eco-city, have introduced a "low-carbon eco-city" concept (Lah, 2015). The concept of integrated low-carbon ecological planning includes both the application of

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low-carbon technologies, such as the use of renewable energy, building energy-saving transformation, the construction of public transport system, and planning and guiding mechanism. In the land, transportation, energy, greening, construction, low-carbon eco-city has a corresponding planning concepts and action content. Low-carbon eco-city planning and construction has become a global trend, including Denmark Copenhagen, Freiburg, Germany, London Low Carbon City, Vancouver livable cities have explored a suitable self-development of low-carbon ecological construction mode. Some local governments in the United States have also introduced action plans for urban low-carbon development, such as Alameda, California (Bhattacharya, 2014). However, because of the large-scale urban development stage in the West, both the urban pattern has been basically formed, and the suburban adjustment and modification of the urban spatial structure is very difficult. Therefore, the western discussion on energy saving, emission reduction and environmental protection focuses on green building. The existing building concerns the energy-saving transformation and small-scale ecological communities. Therefore, it is very important to explore a low-carbon ecological implementation path from the macro-planning level, which is suitable for the national conditions.

2.2 Practice of low-carbon ecological functional areas: a case study of Beijing

In recent years, Beijing has carried out low-carbon ecological practices in Yanqing county, Fengtai Changxin store and Changping future science and technology city. In the low-carbon urban and rural planning of Yanqing County, the method and planning method of urban and rural planning carbon emission assessment are studied systematically from the perspective of spatial planning. Then they put forward the urban and rural overall planning carbon emission measurement framework, analysis model, urban and rural planning carbon emissions analysis database and so on (Varia et al., 2017; Tasnadi-Asztalos et al., 2015). Fengtai district presented the eco-city planning strategy, which included spatial planning, resource utilization and ecological restoration phase integrated. They also have developed innovative low-carbon rules. Research and implement the use of control technology to eco-city objectives into the urban planning and management methods, put the 10 ecological indicators into the land in the bidding and completely solve the ecological development goals in urban construction, "landing difficult" problem, which are the first fully integrated and implementable eco-planning projects in Beijing, as show in Figure 1.

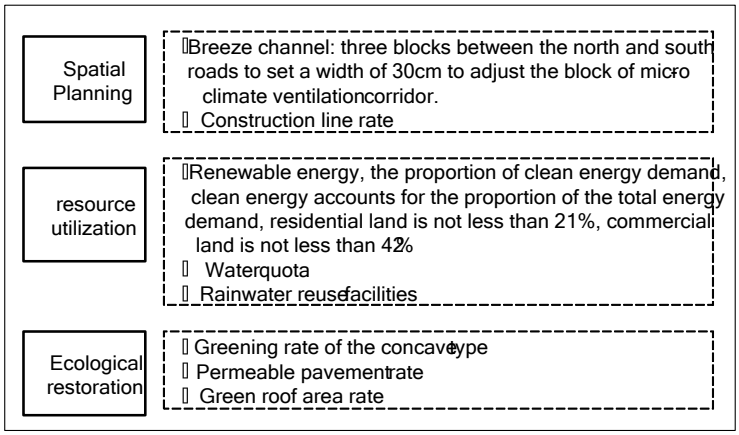

Figure 1: Planning index of green building ecological community in Fengtai District

3. Analysis of the current green building index system at home and abroad

3.1 Foreign green building standards and the development of ideas

From the 20th century, 90 years, the Western countries have introduced a variety of green building standards. These criteria vary in the specific evaluation methods. Japan's comprehensive assessment system for building environmental efficiency (CASBEE) proposed the evaluation of green buildings need to take into account the positive and negative factors. They introduced the building environmental efficiency index (BEE) to comprehensively examine the overall balance between building performance and environmental costs (Zhou et al., 2015). The German Green Building Assessment System (DGNB) combines the economic indicators with the full lifecycle concept to introduce the life cycle cost (LCC) scientific calculation method of buildings, which is used to analyze the construction cost, operating cost and recovery cost of green buildings. So the green building can really achieve the established building performance optimization and environmental protection and energy conservation goals.

3.2 Research on existing green buildings at home

The domestic green building research is divided into two levels of design and evaluation. To implement the low-carbon eco-city strategy, the green building and ecological city development docking must have applicable. There must be implemented index system, which is based on low-carbon eco-detailed planning of green building index system as a support (Peng et al., 2015). It is very necessary to draw lessons from the relevant research achievements and practical experiences of international domestic research on green building index system based on low-carbon ecological detailed planning. Due to the difference of development path at home and abroad, in the aspect of system, plate, operation method, this article is more direct experience from some domestic leading exploration. As for the practice of foreign-related research, we are more concerned about their green building design concepts, the relationship between standards and design behavior, the development of specific indicators and control methods and other aspects of the results.

4. The overall thinking of the green building index system based on low-carbon ecological detailed planning

4.1 Analysis of index system, low-carbon eco-planning and green building

Low-carbon eco-city strategy, detailed planning plate and architectural design of the mutual correspondence is closely and indivisible. For example, low-carbon eco-city strategy in the transport sector to promote the development of non-motor vehicle traffic, and detailed planning plate space planning, traffic organization and architectural design of the building blocks, landscape environment are closely linked. The need to adopt a small scale in the planning level block design, to create a pedestrian, bike travel friendly city scale, and to ensure that the bus station coverage; At the building level, we need to control the distance from the building to the bus station and provide a comfortable non-motor vehicle access environment, so as to gradually implement the low-carbon eco-city strategy. In addition, on the concept of low-carbon eco-city strategy in the green plate and building blocks, we need more detailed planning from the aspects of space planning, traffic organization, resource utilization, ecological environment and other aspects to the architectural design of the implementation, as shown in Figure 2.

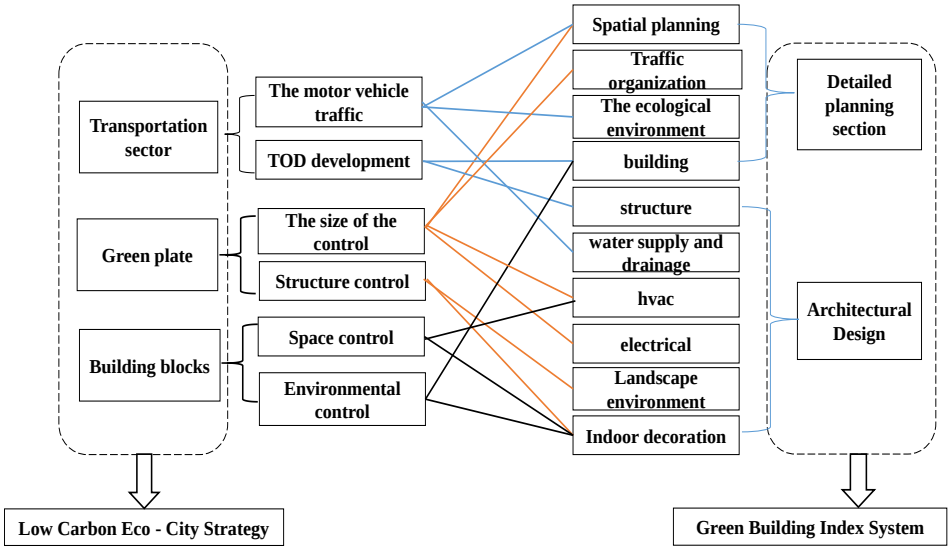

Figure 2: Index correspondence between low-carbon ecological city strategy, detailed planning, and architectural design

4.2 The overall idea of the index system

Based on the low-carbon development of the city, the management index system of "planning pilot, index control, index implementation, index verification" is established. Then the green building index system based on low carbon eco-detailed planning is constructed. The detailed planning stage and architectural design stage of the indicators are interrelated and can be implemented in the planning approval process. Finally, we can ensure the implementation of planning strategies and architectural design through the logo evaluation.

5. Green building index system based on low- carbon ecological detailed planning

5.1 Setting principles of indicator system

In order to realize the comprehensive benefits of green building in resource saving and environmental protection, it is necessary to realize the four goals of environmental protection in the design stage of the building, and to create a good foundation for the implementation of low carbon eco-city strategy in the detailed planning stage condition. The unified index system which is originally scattered in each section should be set up and extended to the more macroscopic scale. Through the docking with the planning index, the city's sustainable development of the formation of a direct correspondence between the green building and low-carbon eco-city strategy is to achieve integration. The main influencing factors are classified into four categories: spatial planning, traffic organization, resource utilization and ecological environment according to the urban planning specialization, and the detailed planning and design. The main influential factors are analyzed. The indicator system is a reflection of Beijing's low-carbon eco-development goals in urban planning and architectural design, taking into account the needs of management and design. The index system corresponds to the capital construction procedure, and the requirement is put forward in every design stage, which realizes the full coverage of planning management and architectural design. The index system into the planning opinions, program review, construction drawing is to achieve the design of the whole process of management control. The high concentration of urban functions brings many problems, such as traffic congestion, environmental pollution and urban management. Resources and ecological environment are becoming more and more pressing. Urban construction is facing serious resource bottleneck. Energy resources, water, materials and other urban development core resources are heavily dependent on external support. Of which 63% of energy consumption for coal energy; serious shortage of water resources, only to reach the world average level of 1/30; biological community structure simple, 80% of the area. Therefore, the development of green building index system based on low carbon ecological detailed planning embodies the characteristics of Beijing and the economic strength. It also embodies the distinctive characteristics of Beijing. At the same time, it focus on the main contradictions facing the sustainable development.

5.2 Construction of index system

According to the operability and universality of the planning and design, the key indicators in the green design of the low-carbon ecological design and the architectural design stage in the detailed planning stage are extracted respectively. The green building design target control system is constructed from the detailed planning to the monomer design. To strengthen the planning stage and the architectural design phase of the link can help to achieve the overall planning and design optimization requirements. Low-carbon eco-planning index system initially includes 56 indicators. Through combing with the principle of planning and designing operability, the industry indicators such as non-compliance with the regulation features and the immature indexes such as the green plot ratio and the new energy vehicle refueling site are eliminated. Finally, the spatial planning, transportation organization and resource utilization are formed. It is the ecological environment 4 categories, 20 indicators of detailed planning index system. This system is consistent with the low carbon ecological planning theory system, which ensures the quantification and implementation of the low carbon eco - city strategy.

(1) Control the scale and compact the development. In terms of spatial planning, the index system controls the spatial planning by means of seven indicators: scale control, structure control and land use efficiency. The ideas for the design of indicator system were shown in Figure 3.

(2) Bus priority and job balance. In the aspect of traffic organization, two indexes of bus station coverage and ground parking ratio are put forward. Public transportation priority development strategy is suitable for the development of Beijing megalopolis inevitable choice. Static traffic system is an important part of the whole traffic system. By controlling the proportion of ground parking, it can reduce the restriction of static traffic on urban space.

(3) Save resources and efficient use. In the aspect of resource utilization, combined with Beijing energy characteristics, the index system includes four indicators of energy, water resources and solid waste, which are the planning and implementation of resource control in the low-carbon ecological concept. Including energy consumption per unit area and renewable energy contribution rate is an innovative indicator.

(4) Focus on ecology and improve quality. In Beijing urban greening construction, the design aims to watch. They don’t consider the ecological functions. The problems are as follows: on the one hand, green plant community structure is simple; On the other hand, species used are single. In order to exert the ecological effect of the Greenland system in the concept of low-carbon ecology, the proportion of forest land is proposed in the index system. In addition, in order to implement the concept of low-carbon ecology and to protect the groundwater environment, three indicators of rainwater runoff discharge, concave green land rate and permeable pavement rate were set up to strengthen rainwater infiltration and reduce rainwater discharge.

The level of architectural design put forward 27 indicators from the building, structure, water supply and drainage, HVAC, electrical, landscape environment, interior decoration seven professional. Architectural design indicators in the implementation of the low-carbon ecological strategy need detailed planning level indicators and transformation. Such as green travel, we proposed the "building entrance and the bus station from the distance of not more than 500m", the indicators and detailed planning level, "the bus station 500m service radius full coverage" convergence, from planning to ensure the implementation of architectural design. Energy efficiency of building materials, water-saving appliances, lighting power and other indicators are set in order to achieve detailed planning level of energy consumption control. At the part of green environment, we presented the "outdoor parking rate of not less than 30% shade", "The number of tree species per 100 square meters of trees is not less than 3", and "the number of woody plant species". They are a continuation of the detailed planning level of the proportion of forest land at the building level.

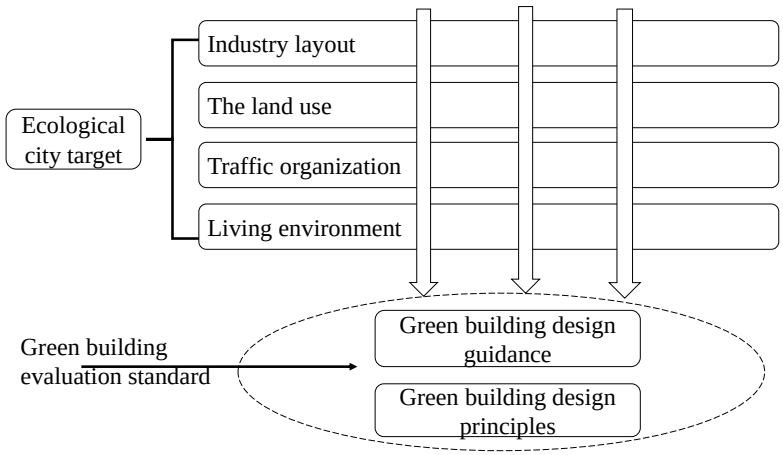

Figure 3: Thoughts by setting index system

5.3 Implementation of the indicator system

Indicator of the regulatory system is based on the project's infrastructure process as the main line. It is conducive to promoting the whole process of implementation. From the statutory basis for planning management, control detailed planning cut into the control phase of the implementation of specific green indicators. Combined with the management process, the design for the formation of the implementation of management approach is formed. In the capital construction process, we increase the corresponding implementation process, as shown in Figure 4.

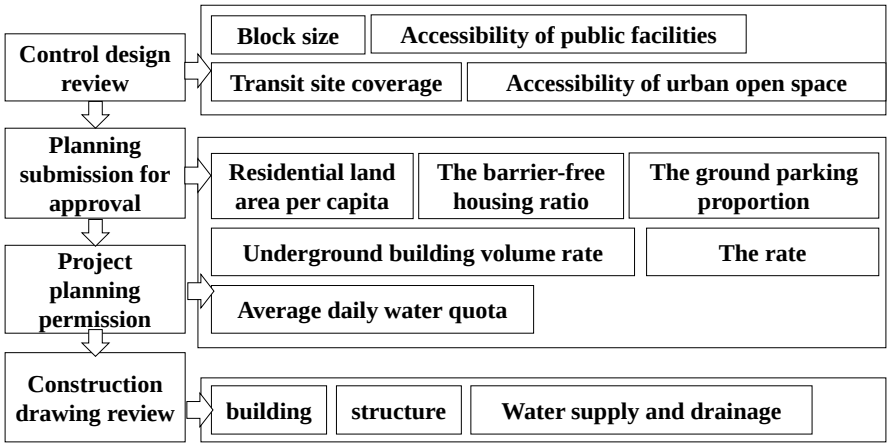

Figure 4: Framework of index implementation

In the design of the management unit, the project design documents at all stages of the stringent requirements. The indicator system and the green ecological requirements into the design process, and in the approval process set node control. This method is to ensure the specific implementation of low-carbon eco-city strategy.

6. Conclusions

Green building index system based on low-carbon ecological detailed planning is from the perspective of sustainable development. Combine the urban low-carbon eco-development with green building can establish a low-carbon ecological detailed planning stage and a green building design stage. We bridge gap between the planning concept and the implementation of the building, through the green building and low-carbon ecological planning to form a direct correspondence. The indicator system integrates the relevant professional to guide the green eco-city, i.e. green settlements, low-carbon eco-town, green building monomer and other aspects of planning and design work. It also offer a set of indicators which can be implemented system to promote low-carbon eco-planning and green building development in the world city. Nowadays, with the rapid progress of science, technology and society, as the people interesting in the pursuit of the quality of life, the green ecological balance and comfortable living environment, improving vision, so we will make full use of the environment of natural resources and efficient energy-saving materials to avoid excessive pollution to ensure the living environment for health and comfort in the design of the building. In this paper, we put adhere to the people-oriented architectural design concept. Further, this article explores a feasible and enforceable development road.

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