

Research on Architectural Design Schemes of Colleges and Universities under the Background of Intensive Development

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Abstract: With the urgent need for talents in China's market, university building planning will become a hot project in China's construction. At present, most colleges and universities are gradually relocating to the periphery of the city, and forming a spacious, connected and composite campus space. However, there are some problems in the land use in the architectural design schemes of various colleges and universities, such as the low land use rate, the formalism of campus layout and the decline of environmental quality caused by large-scale campuses. This paper expounds the principles of intensive design of various types of University buildings, and puts forward intensive design strategies for spatial organization, functional elements and spatial environment.

1. Research background

1.1 Literature review

Campus planning in Colleges and universities presents new features such as intensive, open, large-scale and ecological. Campus buildings in Colleges and universities show the trend of group, large scale and concentration. Taking the business school building of Hehai University as an example, Guo Qinen et al studied and solved the problem of space intensive design of university education building from five aspects: efficient streamline, integrated space, resource sharing, composite function and overall modeling (Guo et al, 2015). Intensification of resource building, which includes intensive utilization of regional resources and energy saving of buildings, is the key direction of sustainable development of society. Han Yanlin and Wu Bin took the architectural design of teaching buildings in Chengdu University of science and technology as an example, from the planning of overall resource sharing layout, to the plane layout of teaching buildings, to the design of building energy saving, discuss the intensive design ideas of teaching buildings (Han and Wu, 2015). Wang Yang et al. analyzed the characteristics of intensive compound teaching buildings, such as humanization, high efficiency, adaptability and land saving, and explored the key contents of space diversity and suitable density under intensive design by using relevant design means (Wang et al, 2012). Wang Yang and Ye Ziteng, referring to the intensive practice of architectural design at home and abroad, put forward the function, structure and traffic space design strategy of cultural building complex (Wang and Ye, 2012). Wu Zhiyi analyzed the meaning, spatial quality and natural characteristics of the intensive campus architecture, discussed the problems of land resource utilization in the campus planning, and proposed a more reasonable campus design scheme which is more in line with the needs of teachers and students' activities from the perspective of regional characteristics and climate characteristics (Wu, 2018).

1.2 Purpose of research

With the rapid development of campus construction in all kinds of colleges and universities, campus building planning has entered a period of vigorous development. China's land resources belong to non-renewable resources, which are congenitally rare. The demand for land use is increasing gradually, which puts forward higher standards for campus building area standards and building use types, and also meets objective requirements such as sustainable development. In the situation of land shortage, there are some problems in the building, such as the structure is not

perfect, the function space is not rich enough, the building plot ratio and the density are not reasonable. According to one-sided and extensive planning of low-density land use forms, with the help of intensive concept design of various types of University buildings, is the trend of campus planning development. How to design a green campus building and show the sustainable development of the building has become an important research topic.

2. The problem of land use in campus building planning

2.1 The challenge of training talents with the ability of intelligent technology application

At present, the per capita campus use area of Chinese students is nearly six times larger than that of American students. From the perspective of intensive land use, there are problems in the use of campus land in China. Some key colleges and universities merge with other colleges and universities, resulting in the school being divided into several campuses. As a result, it is difficult to integrate the infrastructure between campuses. The construction facilities of each campus are not at the same level, and the existing resources can not be used efficiently (Wang et al., 2014). Under the overall layout of the government, most colleges and universities gradually move to the edge of the city. When colleges and universities acquire part of the land, they can buy it at a lower price, which leads to maximizing the campus area as far as possible. When planning construction land, the campus will be full at one time, resulting in not only low building density, but also no room for the future architectural design and development of the campus. China's universities on the edge of the city have a large green area and fresh air. However, the transportation between teachers and students is not convenient on campus, and there is a disconnection between their life and urban life.

2.2 Campus layout is partial to formalism

The overall planning of campus is composed of many elements, such as landscape, traffic and function, to meet the needs of teachers and students. When planning campus, colleges and universities pursue a graphical campus layout model. Especially in the center of the new campus, the general layout of the campus is placed. Campus planners prefer large areas of water when designing construction land, regardless of climate. Due to the climatic conditions in the northern region, the water body will not become a landscape element in a year, or there is no water system in the original terrain environment, but large-scale water body elements will also be shaped in some university campuses (Fu and Xu, 2017). The main entrance of most campuses is designed to show the atmosphere of the campus. This kind of design creates a more formal campus environment, which is not in line with the image of students' youthful and lively. At the same time, the campus environment is basically the same, lacking innovation and uniqueness. This heavy form of campus layout planning ignores the teaching function requirements of university buildings, wastes land resources, and lays a hidden danger for future maintenance of campus management.

2.3 Large-scale campuses lead to a decline in environmental quality

The development of campus construction in China is gradually moving towards a large-scale campus environment, which leads to many problems. For example, it is difficult for teachers and students to have a cordial feeling in the open campus, large-scale campus leads to the distortion of space size, and blind pursuit of large-scale campus leads to the loss of elegance in the campus. For example, in Changqing Campus of Shandong Normal University (Fig. 1), the overall planning overemphasizes symmetry and ignores the learning and living needs of teachers and students, resulting in a decline in campus comfort. In the latter stage of campus operation, universities are unwilling to destroy the original planning and design and loose management, resulting in the decline of the overall quality of the campus space environment. Students in the teaching buildings far away from the campus, out to participate in activities of low intention. The utilization rate of outdoor sports space is low, which leads to the decline of the overall vitality of the campus. When designing and planning campus buildings for the first time, colleges and universities did not leave space for future development and hinder the sustainable development of campus. When adding new

buildings, designers need to destroy the original campus planning. The imbalance of campus layout increases the cost of construction, resource waste and campus management.



Figure 1. Aerial view of Changqing campus of Shandong fan University

3. Principles of intensive architectural design in colleges and universities

Intensive architectural design shows the functional form of building life, and integrates single building with urban layout to form an organic building group. In the intensive design of all kinds of university buildings, the use function of buildings should be considered and the following basic principles should be met.

The principle of scale rationality involves the interior space and the exterior space of the building. The internal functional space planning of buildings needs to be designed according to the needs of users' activities, usually designed as livable space environment. Different forms of space scale can show different characters, such as openness, privacy and regularity. Reasonable spatial scale can improve the utilization rate of building external space, and meet users' material needs for space and enhance users' psychological feelings.

The principle of space efficiency can directly show the intensification of architecture. Designers combine the internal functions of the building organically, which can reduce the demand of space area, thus reducing the consumption of resources and energy. Planners can increase the number of building use and prolong the use time of building space, which can improve the efficiency of space use and increase the green performance of buildings.

Climate adaptability principle refers to the design of buildings in combination with local climate conditions, which can effectively reduce the resources consumed by buildings due to climate factors, and is conducive to regulating the microclimate inside buildings.

The principle of sustainable development aims to combine the development of building construction and resource protection, promote economic development and meet people's demand for material building culture. To reasonably predict the future functional development of buildings and surrounding sites, designers aim to extend the service life of buildings, build flexible and changeable multi-functional space, and maximize the use of resources consumed by demolition and renovation.

The principle of technological adaptability is flexibly applied in the selection of strategies with different objectives, degrees and levels, and in combination with the local environmental factors of the building. Design planners strictly abide by the above design principles, which can effectively reduce the waste of resources, while reducing unnecessary human and material resources consumption.

4. Intensive design strategies for various types of university buildings

4.1 Intensive design strategy of space organization

The space of university buildings is mainly used for the study, life and entertainment of teachers and students. The buildings with more crowds are student dormitories, restaurants, teaching buildings, cultural and sports activities centers and libraries. In the intensive design of these university buildings, it is necessary to consider the architectural space design and campus space design comprehensively. In the process of design, we should pay special attention to the fact that the intensive design of spatial organization is not to reduce the scale of space. The designer can achieve the goal faster than the persistent reduction of space by reasonably planning space size and using reasonable space shape and scale. The manifestation of its spatial organization should take into account the traffic environment around the campus and the overall shape of the campus, and concentrate on planning and designing the spatial organization of university buildings as far as possible under the condition of ensuring the reasonable spatial organization.

4.2 The strategy of function element intensive design

The functional elements of university campus involve the components of campus, such as buildings, roads, environment and pipeline facilities, which together constitute an organic whole system. This requires designers to plan campus and carry out intensive design from a global perspective. The elements that constitute the teaching buildings in Colleges and universities include classrooms, tables and chairs, stairs, lobbies and windows. The elements of the dormitory buildings in Colleges and universities include the inner entrance hall, the accommodation rooms, the water room, the toilet and the stairs. These elements are independent and related to each other in the design of architectural space. The relationship and independence of functional elements are two common factors, which are opposite and complementary to each other. The concept of the intensive design of functional elements is like the golden mean in Chinese traditional culture, which requires restriction and balance. If one of them tends to design, it will violate the principle of multi-component design and fail to achieve the ideal effect of intensive design.

4.3 Intensive design strategy of space environment

The intensive design of the architectural space environment in various colleges and universities is a reasonable and regular layout of the elements of the internal space of the building. This intensive design strategy includes two meanings. The first is that the university building space belongs to the campus space, but the campus space and its organic components interact with each other, and the two spaces can interact with each other. Students' dormitory building, teaching building and dining room are the organic parts of campus. When dealing with students' learning activities and living and entertainment space, we need to carefully deal with the planning plan according to the public, semi-public, body type and traffic space. The second is the ideal university student sports center, catering center, learning center and accommodation center, which should be a fully functional system space. Its space design should meet the needs of all users for the building, including not only current needs but also future needs. The intensive design of the space environment of the system should follow a clear hierarchical structure and be divided into internal space and external space. The planner can simplify the structure space and add the functions needed by users to form a comprehensive and suitable space system for campus.

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