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Campus Planning and Design of Nantong Institute of Technology Under the Background of Green and Development

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Abstract. Green and development have important guiding significance for campus planning and design. The article analyzes the campus planning and design project of the Hai'an campus of Nantong Institute of Technology as an example, and explains that campus planning and design are the basis and norms for the construction of universities and the guarantee for the sustainable development of the school. Taking the green concept as the center, reasonable campus planning and design can comprehensively reflect the characteristic concept of the school, interpret the cultural vision of the campus, and meet the diverse functional needs of teachers and students' research-practice-humanistic spirit. It can enhance the centripetal force of students, play an imperceptibly important role in enhancing the sense of identity and belonging of the campus image, and can promote the overall, coordinated and ecological development of university campus construction, and thus better exert the ability and role of applied universities. It is the source of the intention to create planning and design, and the core idea of campus design.

1. Introduction

The American "Life" magazine commented on the university: "University is one of the greatest events in this millennium, because it has created a place to continue the civilization of the entire world, and it has also cultivated a large number of wise men who fully understand the world." The social openness of modern universities emphasizes the new thinking of the age of talent training. The planning and design of college campuses under the concept of green and development has become one of the new topics of campus construction. It carries the comprehensive function of cultivating students' professional knowledge and skills, social responsibility, innovative spirit and practical ability.

2. The meaning of campus planning and design

Campus planning for colleges and universities is a comprehensive discipline defined between urban planning and individual buildings. It is the "baton" for the primary thinking of modern colleges and universities in the process of campus construction. It is a form of reduced regional planning that covers all planning principles. A reasonable campus construction plan is the concrete implementation of the college career plan, the basis and norms for the construction work, the guarantee of the school's sustainable development, and also the frontier idea for the division and connection of functional areas in the school. A complete campus construction plan can inherit the school's history and culture, reflect the characteristics of the region and industry, create an ecological and landscaped campus artistic conception of the school's humanistic spirit and characteristics, and guide the total campus size, basic



style, pattern, transportation. The campus design is based on the campus planning, and the planning and imagination are constructed through visual entities. It is a large area design work with campus as the research object under the guidance of various upper-level planning, including the combination of campus space, the embodiment of the spiritual connotation of the university, the division of functional areas, open space processing, campus architectural design, road traffic system, garden landscape setting, Intelligence and supporting facilities, etc.

American planner Kist Williams believes that "an important criterion for evaluating the quality of a campus plan is to see whether the plan can maximize the stimulation of people and other students, teachers, tourists, artworks, books, and unconventional activities...". The planning and design of modern university campus is no longer the traditional concept of school function, but the concept of "micro city" model with openness as the premise of spatial planning.

3. Planning and design of the Hai'an campus of Nantong Institute of Technology

The Hai'an campus of Nantong Institute of Technology is the first comprehensive undergraduate university in Hai'an County, Nantong City. In an open social environment, the reasonable planning and design of the campus is an important material condition for cultivating talents. An excellent campus environment shows the vitality and academic atmosphere of the university in terms of software and hardware. The planning and design of Hai'an campus of Nantong Institute of technology should not only reflect the spiritual connotation and cultural characteristics of the school, but also meet the diversity of teacher and student research-practice-humanities, and realize the regional and characteristic expression of the construction of local application-oriented universities, realize the regional and characteristic performance of the construction of local application-oriented universities, and shape the visual interpretation of campus culture. It is also the environment for teachers and students to rely on for learning and living. At the same time, it also strives to become the miniature "best business card" of Hai'an City (Fig. 1).



Figure 1. Overall bird's eye view.

3.1. Overview of Nantong Institute of Technology Hai'an campus

Nantong Institute of Technology is a full-time general undergraduate college with the goal of cultivating applied talents. The Hai'an campus is located on the north side of Nanhu Avenue and the east side of Shanghu Avenue in the National Hai'an Economic and Technological Development Zone. The overall terrain of the campus is flat and the land use efficiency is high. There is a naturally formed river flowing from west to east in the land. The natural environment is excellent. In planning and design, we should try our best to integrate with nature to form a pleasant green campus. We should cooperate with the function of Hai'an campus to serve the local economic and social development, combine the characteristics of undergraduate colleges for training applied talents, create a unique campus cultural atmosphere. The main economic and technical indicators are shown in Table 1.

Table 1. Main economic and technical indicators.

Campus scale	8000-10000 people		
Total land area of construction base	351737.4 m ²		
Total construction area	about 302750 m ²	Aboveground floor area:	about 297200 m ²

Gross floor area: 68648.56 m²

Building density	19.52%
Floor area ratio	0.84
Green area rate	35.01%

3.2. Analysis of Hai'an campus planning of Nantong Institute of Technology

Zhang Xianling put forward in "Thinking on the Overall Layout of Modern University Campus Planning in China" that "the integrity and openness of the campus pattern, the relatively centralized group layout of campus functional areas, the multiple characters of campus communication space, the configuration of campus landscape greening, the embodiment of the connotation of education in a broad sense, sustainable campus design, flexibility and dynamic regulation and control are all new concepts in campus planning and design." The planning and design specifications for the Hai'an campus are based on the land use redline map and task book provided by Party A, Nantong urban planning and management technical regulations, national, provincial and municipal planning and engineering design specifications, and "Building Design Fire Protection Code" (GB50016-2014), "Catering Building Design Code" (JGJ 64-89), "Building Engineering Traffic Design and Parking Garage (Yard) Setting Standard" (DG/TJ08-7-2014), "Civil Architecture Design General Principles" (GB50352-2005), "Code for Calculation of Building Area of Construction Engineering" (GB/T50353-2013), "Design Standard for Green Buildings of Jiangsu Province" (DGJ32/T173-2014), "Evaluation Standards for Green Buildings" (GB/T 50378-2014), "Public Buildings" Energy-saving design standards (DGJ32/J96-2010), "Design standards for thermal environment and energy-saving residential buildings in Jiangsu Province" (DGJ32/J71-2014), etc. At the same time, when planning and designing the campus, it is subject to the requirements and influences of factors such as land, roads, space, resources, and humanities and arts.

The overall spatial planning of the Hai'an campus integrates the humanistic spirit, cultural atmosphere, school brand and other elements of the long-term development and construction of Nantong Institute of Technology, with the natural environment inside the campus and the infrastructure outside the campus, which can optimize the overall spatial planning effects inside and outside the campus. The construction of the Hai'an campus emphasizes the clear building shape, the visual flexibility of the space and the sense of place, the compact layout and relaxation, and the overall art and beauty of the campus (Tab. 2).

Table 2. Design basis.

Design Basis	
1. Land use	Make full use of the current topography, combined with the layout of buildings, and effectively use the land.
2. Road traffic	Organize a reasonable road traffic system and pay attention to the convenience of access.
3. Combination of shade and face	Put most of the living and teaching rooms on the sun, and minimize the arrangement on the shady side.
4. Spatial form	Integrate the different spaces of the three major functional blocks of learning, life, and sports together, which is spacious and comfortable.
5. Resource sharing	Functional areas are organically combined, implemented in stages, independent of each other, and shared with each other.
6. Humanistic care	A relaxed, friendly, and well-mannered architectural model is the core idea of the Hai'an campus design, and the creation of a human-scale space is the source of our planning and design.

<i>7.Cultural connotation and artistic connotation</i>	Use visual and sensory information to build school cultural connotation, and use the information source of green landscape sketches to form the creation of artistic connotation.
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3.2.1 Planning and axis. The overall space planning of Hai'an campus adopts the form of axial spatial structure. The overall space of the campus is carried out along the fountain water area of the central square of the campus, and the layout is carried out from south to north. This layout mode has good macro controllability and sustainable expansion, and can effectively use the overall space to grasp the integrity, and facilitate the formation of a complete landscape environment and transportation system design. The main axis of the Hai'an campus has a "two-axis three-entry" spatial relationship, and produces a serialized composition. The two axes refer to the main axis from the main school gate to the core landscape square of the campus. The longitudinal main axis obtains a clear sense of centrality through the symmetry of the buildings on both sides. The horizontal main axis is from the west gate sports area to the core area of the campus main axis, emphasizing the symmetry and continuity of the axial campus planning. Three Entrances refer to a campus courtyard-style space with three levels of ceremonial entrance plaza, teaching office area, and life service area (Fig. 2).



Figure 2. Planning analysis diagram

- 1- living service area,
- 2- planning secondary axis area,
- 3- planning main axis,
- 4- planning center node,
- 5- teaching office area,
- 6- sports area.

3.2.2 Functional partition. In order to use the campus space reasonably and efficiently and reflect the characteristics and positioning of the Hai'an campus of Nantong Institute of Technology, the functional area of the campus is selected as a centralized type, divided into entrance area group, teaching area group, living area group, and sports area group. Taking the teaching area group as the central focus, the other groups are closely divided around it, corresponding to the main site space of the campus, so that each space has its own independence and close contact with each other. The functional areas of the campus are divided into teaching area, administrative office area, life service area, sports area, business area, training area, student entrepreneurship area, reserved land and various supporting facilities (Fig. 3).

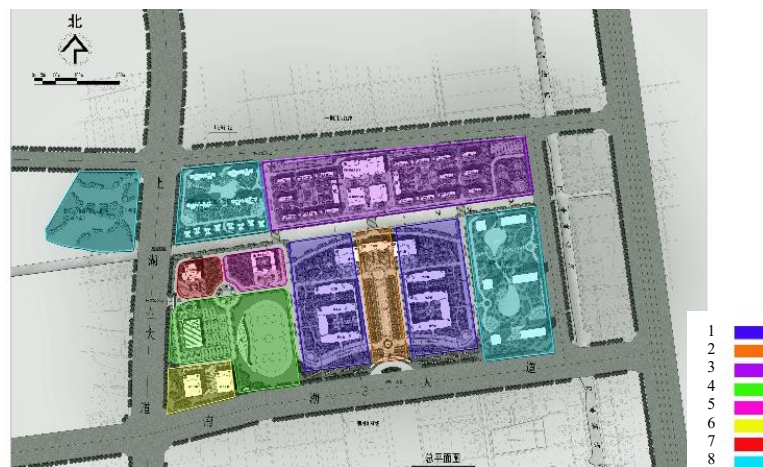


Figure 3. Functional area division map of the Hai'an campus of Nantong Institute of Technology

- 1- teaching area,
- 2- administrative office area,
- 3- life service area,
- 4- sports area,
- 5- business area,
- 6- training area,
- 7- student entrepreneurship area,
- 8- reserved land and various supporting facilities

3.3. Architectural design of Nantong Institute of Technology Hai'an campus

The original average absolute elevation of the site on the Hai'an campus is about 4.700 meters, the highest is 5.310 meters, and the lowest is 4.570 meters. According to the existing data, the elevation of the road center of Shanghu Avenue is 5.800 meters; in order to make the discharge of rain and sewage reasonable and convenient, the absolute elevation of the roads on the campus is set at 6.00 meters, which is about 0.2 meters higher than the surrounding municipal roads. According to the space needs of different functional houses, the requirements of craftsmanship for civil construction, and the space occupied by structural components and pipes, the safety level of the campus building structure is level two, and the design service life is 50 years. The seismic fortification category of teaching building, student apartment and logistics service building is class C, the building height is less than 24m, the building seismic grade is grade III, and the foundation design grade is grade C.

3.3.1 Architectural design analysis. The architectural design of the Hai'an campus combines modernist design with classical architectural elements, which certainly echoes the architectural style of the main campus of Nantong Institute of Technology, and has formed its own unique design style. Based on the campus planning and design concept of green and development, architectural design also pays attention to the application of building energy conservation, and earnestly implements the national energy conservation policy. The exterior wall of the building pays attention to heat preservation treatment to achieve the purpose of energy saving. Part of the building envelope structure adopts lightweight partition walls to reduce the weight of the building and save materials for structural components. The roof is designed in accordance with the "Energy Efficiency Standards for Public Buildings" and the "Design Standards for Energy Efficiency of Residential Buildings in Hot Summer and Cold Winter Areas". The overall energy saving design is adjusted and calculated in accordance with national regulations using special energy saving software. While adopting energy-saving building materials and structures, hollow low-E glass is used for windows and curtain walls, heat-insulating profiles are used for maintenance and support, and natural ventilation is used to achieve national energy-saving requirements.

3.3.2 The ceremonial entrance plaza. The entrance area group of Hai'an campus is composed of five parts: entrance ceremonial square, teaching area, administration building, library, and student activity center. These five parts together constitute the "living room" of the new campus. The concise form of composition, with water and fountains as the central elements, and the symmetrical display of walkways and landscapes, form a solemn visual sense, which conforms to the humanized characteristics of the new campus (Fig. 4).

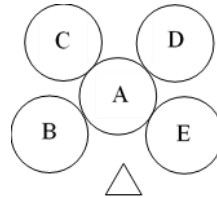


Figure 4. Centralized type.

*A- teaching area,
B- entrance ceremonial square,
C- administration building,
D- library,
E- student activity center*

3.3.3 Cluster form design. The teaching area group is the core space of the campus, and the teaching functional courtyard can dominate the atmosphere of the teaching area and show the overall image of campus planning and design. The architectural design of the teaching area of the Hai'an campus adopts the form of courtyard enclosure, which mainly guarantees the needs of teaching venues. It also provides a place for teacher-student exchanges and transmits free and open information, which is an invisible sharing. The cascading teaching and functional courtyards integrate elegant classical plots with chic, exquisite modern techniques through the processing of spatial levels, and changes in windows and materials (Fig. 5).



Figure 5. Rendering of buildings on the Hai'an campus of Nantong Institute of Technology.

4. Landscape design of Nantong Institute of Technology Hai'an Campus

Campus landscape design is an important manifestation of environmental cultural connotation and modern functions, and can realize the practical value of scene blending in artistic perception and comfortable space environment. The landscape design of the Hai'an campus adopts a compositional form of dots, lines, and planes interspersed with each other. The greening system adopts a combination of water and plants, and embellishes the configuration of humanistic sketches in exquisite places, so that the environment has a sense of territory and recognizability, satisfying teachers and students behavior and psychological needs of the environment. According to the local climate characteristics of Hai'an, the Hai'an campus has established a multi-level, three-dimensional greening system on the campus to purify the campus air, absorb noise, and create a refreshing and pleasing visual environment. Dense cluster greening is arranged near the main entrance of the school gate and near the intersection of urban roads. Planting tall trees can beautify the urban environment and highlight the humanistic temperament of the school. The central square enclosed by the building is the central green space, which uses natural vegetation and planting to better process the abstract artificial space alternately. The campus landscape node formed between the teaching buildings has a quiet and elegant natural landscape in the teaching courtyard. The quiet and natural green landscape in the semi-enclosed courtyard effectively isolates the

noise interference between the teaching buildings. Evergreen trees are often used for road greening, and some deciduous trees are selected as roadside shade trees to create a campus ecological space of "shade in summer and sun in winter".

5. Conclusion

According to the theory of modern educational architecture, campus, as a material carrier, should influence everyone living in it with its planning and design. Through the analysis of actual cases of the newly-built Hai'an campus of Nantong Institute of Technology, it is believed that campus construction not only provides teachers and students with a space for learning and living, but also takes green and development as the basic concept, and comprehensively reflects the school's unique concept, humanistic quality and campus uniqueness. Through the analysis of the actual case of the newly built Hai'an campus of Nantong Institute of technology, it is considered that the campus construction not only provides teachers and students with a space environment for learning and survival, but also takes the green and development as the basic concept, comprehensively reflects the school's characteristic concept, humanistic quality and unique temperament of the campus, explores and forms the interaction and relationship between the humanized place and the education guidance, and successfully shapes the unique planning ideas and architectural features of Hai'an campus of Nantong Institute of technology. They have been the source of students' educational identity, cultural connotation and artistic connotation, which provides a certain reference value for the planning and design of new campus in the future.

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