

A Probe into the Green Building Philosophy of New Campuses against the Backdrop of “Double First Class University Plan”

Zhihe Wang¹, Siqing Zou², Xiaoru Liu², Tong Li², Jiahan Zhang², Quyuan Feng^{1,*}

¹Dalian Polytechnic University Foundation Office, Dalian, 116034, China

²School of Architecture and Fine Art, Dalian University of Technology, Dalian, 116034, China
471690266@qq.com

*Corresponding author

Keywords: Planning and Design, Architectural Style, The New Campus, Space

Abstract: From the new era and new background of education mission, focusing on the construction of quality development of higher education and standing in the context of "double first-class" construction, the campus planning layout and architectural design concept is comprehensively explored. Construction is taken as a carrier of university reform and innovation that will promote the new campus to be green, intelligent and integrated. Integrated planning and layout as the main theme, improve the schooling conditions, optimism educational resources and perfect the schooling concept, thus promoting the comprehensive and coordinated development of higher education.

1. Introduction

“Building a high-level first-class university and a first-class discipline” is an important strategic decision made by the CPC Central Committee and the State Council in the centenary of the founding of the Party. It is of great practical significance to enhance the level of China's educational development, strengthen the country's core competitiveness, and to base itself on the long-term development vision of education [1]. The new campus construction project came into being under the background of the country's vigorous promotion of “double-first-class” construction. How to scientifically and effectively promote the connotative development of higher education and how to accurately serve the development of regional and industry economy has become the strongest voice of “new educational infrastructure”. Therefore, it is imperative to make scientific planning and overall layout to promote the planning and construction of new campus according to law efficiently and orderly.

2. Overview of Construction Projects

Dalian Polytechnic University Continued North Campus Project is located in the northwest of the main city of Dalian, the area enclosed by the west side of Northwest Road and the north side of Songjiang Road, and is close to Dalian Zhoushuizi International Airport (Figure 1). The land acquisition scale of this project is about 32.20 hectares (collective land is about 25.53 hectares,

state-owned mines and state-owned construction land is about 6.67 hectares), with a total area of about 27.69 hectares. The nature of the land is for education and scientific research, which meets the general requirements of urban planning.

The construction of the continued land acquisition campus (the north campus) project is implemented in accordance with the principle of “one-time land acquisition, overall planning and phased construction”. The west side of the north campus continues to be built to the current river canal, and the east side is the mining area of the cement plant, where the environmental pollution problem is serious. The whole construction site is high in the east and low in the west, but the terrain on the west side is relatively gentle. The overall building height is greatly affected by the clearance height limit of Dalian Safety Supervision Administration of Civil Aviation. The green vegetation on the west side of the north campus is dense and the natural ecological environment is in a good condition. At present, the school leaders have set up the headquarters of the leading group for the project construction of land acquisition and continued construction of campus (the north campus), and are actively and orderly promoting the land acquisition work.



Figure 1: Location map of the proposed land acquisition for the new campus

3. Planning and Design Concept

The planning and design of the new campus is an eternal topic. No matter from the selection of design techniques such as overall planning, functional zoning, traffic streamline, etc., or the optimization relationship from the bottom of the map theory to site analysis, landscape environment and construction technical guidelines, all efforts are made to create a new campus construction concept that can be inherited and inherited, and make contributions to the construction of the new campus through brainstorming, practical research and objective reality.

3.1 “One Axis” is the Main Line.

The overall planning of the new campus is not only reflected in the structure of architectural space, but also continues the development of the surrounding areas. The planning of the spatial structure of the new campus should fully conform to the geographical characteristics of the northeast climate, and be based on architectural aesthetics, landscape planning, planning and construction techniques (Figure 2) to ensure the normal use of the school’s use function and traffic function. No matter in the architectural space or natural landscape, they all contain strong regional cultural characteristics, full of strong characteristics of the campus context, and build a spatial structure model of “one axis, two districts and three centers”.

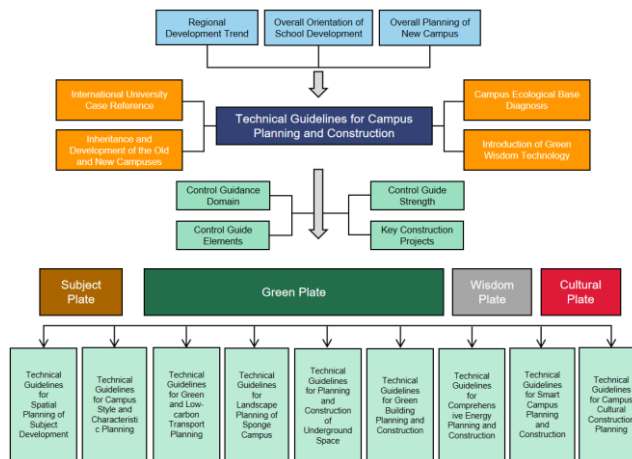


Figure 2: Relationship diagram of construction technical guidelines

Under the ecological landscape axis, humanistic knowledge landscape axis and water, hardness, physical and other spaces, let all functional areas form a unified whole [2], create an ecological corridor with “wisdom in hold and elegance in mold”, create an overall planning layout form with “one axis as the main line”, conform to the organic growth of surrounding single buildings, and the orderly connection between new and old campuses.

3.2 The “Two Districts” are Connected

The two districts mainly mean that the new and old campuses are divided into the south campus and the north campus by the main axis running through the north and south, and the central axis of the campus is used to arrange greening and landscape axis belts, just like the human skeleton, to connect all the landscape elements of the new campus, and to construct a rolling landscape space, which can be extended as well as extended. At the same time, an important landmark building (traffic corridor) will be added to the new campus, which will become the connecting pen of the new campus.

The new campus mainly reflects the rise of science and technology, innovation and time. The planning of the new campus should conform to the planning and layout of the South Campus, follow the simple and minimalist layout style, avoid the exaggerated architectural posture, avoid the incompatibility between the new and old buildings, and create an architectural posture with discipline characteristics under the condition of fully respecting the texture of the existing buildings, as shown in Figure 3.

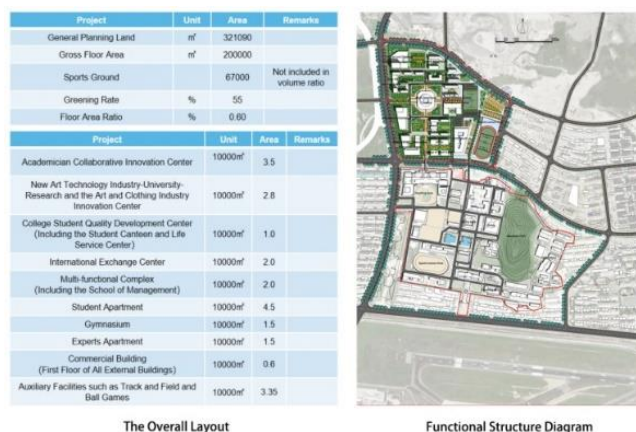


Figure 3: The general plan of Dalian Polytechnic University campus

3.3 The Coordination of “Three Centers”

In order to alleviate the boring space of the main axis of the new campus, it is suggested that the new campus should be formed into a coordinated space with the First Canteen, the comprehensive building and the new library as the three centers, gradually optimize the spatial structure of the campus, enhance the close relationship between each teaching group, enhance the spatial dialogue between each teaching group and various communication places, and increase green corridors, courtyards, landscape architecture, etc., so as to make the whole campus an organic whole [3].

The “No.1 Canteen” as the center mainly reflects the communication circle between teachers and students, and students will depend on the surrounding places while enjoying the delicious food. The second center is the educational core of the campus with the parking lot and basketball court on the east side of Block A of the comprehensive building. The location is extremely special, which is not only the central hub for daily class study, but also an important transportation hub connecting the new campus. Taking advantage of the terrain of the new campus, the underground cultural and artistic corridor channel is established, and the underground digital corridor landscape belt is created to enhance students' sense of belonging, pride and history to the school. The third center is a characteristic building centered on the “new library” of the new campus. The center of the whole new campus takes the library building as the main axis, and group buildings with various functions are arranged around it. The center is revered in the form of circular radial group layout, highlighting the architectural core of the new campus. The new library should be innovative in architectural modeling and concise in discipline development to form a space structure of “building blank space”.

4. Architectural Design Style

Campus architecture is the precipitation of solidified history and culture, and it is the interweaving and integration of subject culture, and the architectural style often permeates the school-running philosophy. Therefore, the new campus buildings should be designed by using modern architectural functions and structural principles, or take the minimalist style of modern architecture as the style, or take the local style of traditional architecture as the blueprint.

4.1 Subject Architectural Elements

Subject architecture is based on the development characteristics of existing disciplines in our school, which condenses the artistic elements of subject characteristics into architectural design elements, and uses this element to adjust the functional layout and design style of single buildings, so as to create the inherent architectural style of the discipline.

The single buildings in the new campus are mainly characterized by marine food, fashion design, art design and other disciplines. In the process of single building design, the unique architectural design elements of the disciplines should be fully considered (Figure 4). For example, the single building of Academician Collaborative Innovation Center should highlight the blue color based on ocean research, and the blue plexiglass should be used to highlight the facade effect when designing the facade windows of the building, and the building lines should be as deep as the flowing seawater waves; The new single library building should stand in the center of the new campus with an open spine, highlighting the decorous feeling and fullness of the library; The single building of the international exchange center should respect the historical architectural forms of foreign universities, and adopt architectural elements such as columns, gables, arched doors and windows, flying buttresses, domes, etc. to show an open, inclusive and shared design style; Students' activity building should provide more communication space, study space and creation space, and adopt the

the architectural style is Glasgow (Art Nouveau) style to show the campus intention of mountains and waters (Figure 6). Combining with the historical characteristics of architectural design style of our school, the new campus group buildings should take this tone as the design basis, pay attention to innovation while restoring the historical architectural features of our school, and set off the innovative development of Industry-University-Research, a new art department, with simple and simple architectural design techniques. On the basis of the investigation of the architectural style of the existing campus, the architectural design style of the new campus should strive for unity and coordination, and should also pay attention to the harmonious integration of the architectural style and the surrounding environment [4].

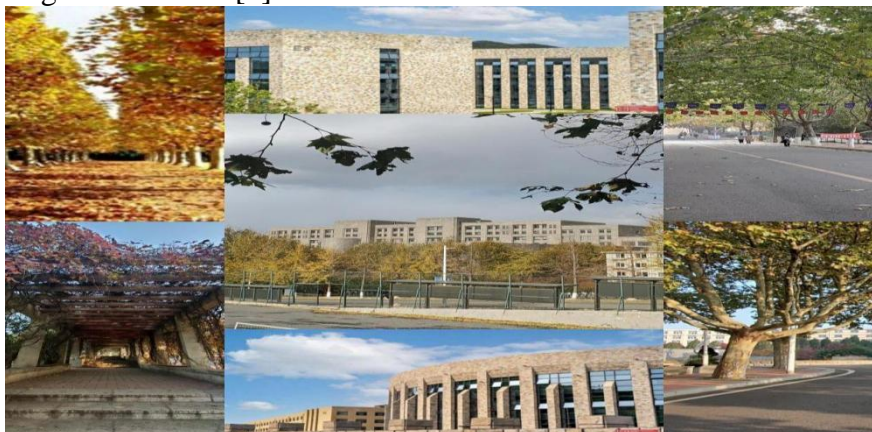


Figure 6: Building facade design elements

4.3 Architectural Form

Most of the existing buildings in our school are arranged in an orderly way in the form of a “straight line”. The most representative architectural forms mainly include: the architecture of Art and Design College is built on the basis of historical evolution, showing an H-shaped architectural form; Yushan No.1-No.4 apartment building pays attention to open and inclusive living places, showing a \perp -shaped architectural form; Comprehensive teaching building architecture explains the design concept of landscape and landscape environment co-prosperity, showing a Π -shaped architectural form; The building of Engineering Training and Innovation Center for College Students is in the form of a zigzag building, which meets the needs of students' practice and teachers' teaching.

Therefore, the new campus of our school should obey the existing architectural forms and the surrounding landscape environment (roads, canals, etc.) of existing buildings in the form of single buildings, avoid exaggerated and complicated design techniques (such as V-shape, W-shape, etc.) adopted by deconstructionism, and always keep a sense of awe, respect and belonging to new buildings. The architectural form of student apartments should be in the shape of “—, \perp and Π ” ; Academician Collaborative Innovation Center, International Exchange Center and Industry-University-Research Teaching Building of New Arts Department should return to the shape of “U” and “H”; Multifunctional complexes involving student activities should return to the rectangular- ambulatory-plane shape - like the Chinese character “hui” and so on.

5. Architectural Space Design

The architectural space design of new campus should be based on the comprehensive consideration of urban texture, regional culture, campus context and other comprehensive design

factors. And it should constantly pursue the coordination of architectural style and discipline characteristics, the integration of architectural characteristics and discipline characteristics, and the matching of architectural forms and discipline characteristics. At the same time, we should also pay attention to the extension of discipline development, the unity of architectural style, the connection of architectural space sequence and the sustainability of green buildings and ecological buildings.

5.1 Functional Zoning of Buildings

The north side of the new campus is a centrally reserved utility area, and the south is organically connected with the original campus, mainly for the Academician Innovation Center and the College Student Quality Development Center, the middle part is the learning area, and the east part is for the life service and sports leisure. Combined with the existing public transportation facilities, residential buildings on the west side of the land and the Macalline commercial district, the main entrance of the new campus is located on the west side of the land, which echoes the Macalline Enterprise Innovation Base. The external communication and R&D functions are arranged along the boundary of the west side of the land, thus enhancing the academic atmosphere of the whole innovation base and providing convenience for teachers and students to travel. The south side of the new campus forms an underground entrance passage with the comprehensive building, connecting the traffic space of the new campus, which is conducive to the exchange of activities between teachers and students in the new campus, so that teachers and students do not feel estranged due to the sense of distance.

The continued construction of the new campus adopts the functional layout mode of banded groups [5], and the north-south direction runs through the whole campus with the Miaosi Road as the central axis. According to the functional requirements, the new campus is divided into seven functional areas (Figure 7), namely, library, living area, sports and leisure area, life service area, academician innovation center area, international exchange center area and college student quality development center area. The location and functional orientation of each area are as follows:

① The library area, that is, the central shared area. It refers to the existing landscape water system of the comprehensive building of our school, and lays out green landscapes, architectural sketches, etc. It not only separates the functional areas properly, but also connects them, which is the finishing touch of the new campus.

② The living service area is located between the west side of the sports and leisure area and the east side of the library. It is mainly composed of guest houses, boiler rooms, power distribution rooms, clinics, etc. It is arranged on both sides of the road as far as possible, which is convenient for campus heating, material transportation, etc.

③ The living area is mainly located on the east side of the new campus, mainly considering the ecological environment of state-owned mines and the actual situation of living service facilities and phased construction. Divide the student living area into two basically equal parts, each of which includes dormitory, canteen, activity center, supermarket, bathing and hairdressing, bookstore, flower shop, Internet cafe, small playground, etc., so that each area is relatively independent and complete, and the two areas are separated by greening.

④ The sports and leisure area consists of three modules: stadium, gymnasium and natatorium, which are open to the public in a centralized way (China Resources 24th City Community). There are independent entrances and exits in the sports and leisure areas, and greening is used as a proper barrier between the venues and other functional areas.

⑤ The Academician Innovation Center adopts a group courtyard layout, which is located on both sides of the east-west axis. The library serves as the sharing center of the cultural square, and according to the characteristics of campus construction by stages, there is room for development to

adjust its functions accordingly.

⑥ The International Exchange Center is located on the west side of the new campus, close to the Macalline commercial block, creating a prosperous scene suitable for foreign friends to communicate with, and also symbolizing our school's education concept of openness, tolerance, harmony and integration, and enhancing our school's international popularity.

⑦ The College Student Quality Development Center is located on the east side of the comprehensive building of the existing campus, and strives to build a quality education platform such as social practice and voluntary service, scientific and technological scholarship and innovation, sports and arts and physical and mental development, community activities, skills training, etc., and guide students to grow up in an all-round way in intellectual, aesthetic and moral education.

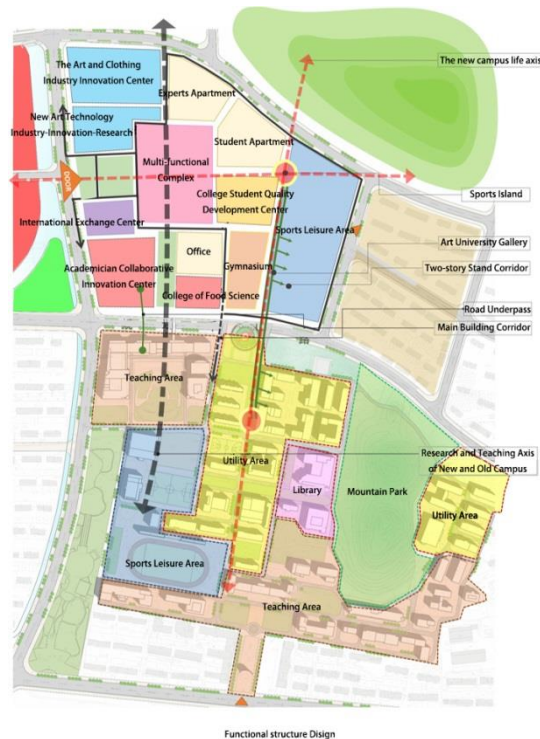


Figure 7: Campus traffic streamline organization

5.2 Traffic Network

The land of the new campus is relatively square, and the road network planning layout should be compatible with the functional layout of the original campus. Therefore, it is more suitable for the traffic flow line of the new campus to adopt the layout mode of checkerboard and ring. The main path between functional areas is realized by the “net format” road. On the two-way road, the branch roads are matched to form the road network structure of the campus, and the center of the road is evacuated to each branch road with the circular square as the transportation hub. The circular road can not only increase the hierarchy of the road landscape, but also serve as the center of the new campus to effectively connect with the checkerboard road network, ensuring the integrity and connectivity of the road network, which can not only realize the zoning management, but also strengthen the traffic links among various functional areas. Make full use of the wide green separation belt to strengthen the landscape connection on both sides of the road, and at the same time avoid the interference of driving sight.

The extension line of the new central area of the campus runs through the main building groups, and the shared spaces such as the teaching area, the innovation center area and the student living area are combined to become the “vitality axis” of the campus road traffic. At the same time, it can quickly evacuate the transit traffic, strengthen the accessibility of the campus road traffic and enliven the campus road traffic environment. Chessboard-shaped road network can connect all road traffic spaces and run through all corners of the campus, which is convenient for pedestrians and vehicles to reach the building groups directly, while the ring-shaped road network structure takes the campus square as the center, showing a layout in the shape of “single center + ring” layout.

5.3 Road Streamline

Reasonable functional zoning is the foundation of road streamline, so it is necessary to fully analyze the traffic flow at the beginning of considering functional zoning. Based on the concept of separation of people and vehicles, a large area of traffic flow is placed on the edge of the campus or the main vehicle streamline of the campus, and separate entrances and exits are set to ensure the integrity, accessibility, safety and ecology of the pedestrian system inside the campus.

The main users of the new campus road streamline are students, teachers and administrators, among which the students' traffic route is generally “teaching area → student living area → sports area → scientific research experimental area”. Teachers' transportation routes are generally “teaching area → administrative office area”; however, according to the nature of their work, managers' travel time and travel characteristics are scattered. Combined with the road pattern of the new campus, the streamline of the motor vehicle traffic organization should be indicated as a solid line, and traffic management signs such as speed limit and no honking are set on the motor vehicle road.

Based on the above comprehensive consideration, the domestic traffic demand management concept is introduced into colleges and universities, and the main measures include: ① economic measures-adopting parking time-sharing billing, increasing parking fees from the edge of campus to the center, and alleviating the congestion and environmental damage in the center;

② Diversion of people and vehicles: provide bike-sharing and public transportation subsidies for teachers and students, set up car ferry connecting facilities, widen the main axis of the campus and implement the traffic network of people and vehicles diversion;

③ Smart system: use the campus network system to encourage teachers and students to join the online parking and car rental system, and reserve parking spaces and share parking areas by mobile phones.

6. Conclusion

To sum up, in the design of campus architecture, we should not only satisfy its functionality, but also strengthen the cultural atmosphere of campus, inherit the cultural atmosphere of campus historical buildings and highlight the cultural spirit of campus discipline buildings. The construction of colleges and universities is not only the need of the school's own development, but also the need to adapt to the development of the times. It plays a vital role in gradually improving the school-running conditions, ensuring the school-running quality, enhancing the social credibility and influence, laying a solid foundation for the sustainable development of campus construction and drawing a new blueprint for promoting urban construction and regional economic development.

Acknowledgments

This research is supported by “the Fundamental Research Funds for the Central Universities” DUT19RC (3) 044.

References

- [1] Cui Jian. *Research on Strategies and Paths of Constructing High-level Universities in Gansu Province*. [D]. Lanzhou: Lanzhou University, 2017.
- [2] Li Weili. *Research on traffic streamline organization design of urban complex*. [D]. Nanchang: Nanchang University, 2016.
- [3] Ding Liping, Gao Jing. *Research on Campus Planning and Design Based on Usage Evaluation Method - Taking Chenggong Campus of Kunming University of Science and Technology as an example* [J]. *Urban Architecture*, 2019, 16(09):32-33.
- [4] Zhong Chen. *Research on the external form of libraries in new campuses of Shanghai universities*. [D]. Shanghai: Shanghai Jiao Tong University, 2009.
- [5] Lu Xiaochen. *Analysis of the functional layout and traffic characteristics of the new university campus*. [D]. Chang 'an: Chang 'an University, 2015.