

Practices of Constructing Green Environment on Campus

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Abstract: University campus is the place to live and work of college students and teachers. It is important to build a green environment. The article focuses on north campus of GTIIT, the characteristics of region climate environment are introduced, the overall campus layout, physical wind environment, optical environment, acoustic environment and campus landscape are analyzed.

1 Foreword

Buildings cannot exist independently. They are always built in a specific area, relied on surrounding environment and in groups. University campuses have their peculiarity: for one hand, the activity people are mainly students and teachers, which is relatively stable; for the other hand, buildings for all kinds of functions are complete, including buildings for scientific research and teaching, and including dormitories, canteens and living facilities, as well as sports facilities and places for public activities; for the third one, they are generally expandable, as the university scale expands and the quantity of students increases, the campus will continue to expand. In recent years, people pay more and more attention to the construction of campus environment from green buildings to green campus and intelligent campus, and then to wisdom campus.

Where, green buildings have developed in China over 10 years. In the beginning, there are some misunderstandings. At present, only select and create the green construction technology which is suitable for the local and select most applicable technology and products to integrate to buildings, can we have true green buildings [1]. This paper takes the northern campus of Guangdong Technion Israel Institute of Technology (GTIIT for short) as an example and introduces various aspects of green environment construction on university campus [2].

2 Construction practices of the northern campus of GTIIT

2.1 Characteristics of local climatic environment

The northern campus of GTIIT is located in Jinping district, Shantou city of Guangdong province. Shantou city is located at the junction of the Tropic of Cancer and the South China Sea, a subtropical marine climate, the winter without severe cold and the summer without

intense heat, the annual average temperature of 21 ~ 22 °C, the annual sunshine duration of 2000 ~ 2500 hours, the annual rainfall of 1300 ~ 1800 mm and average humidity of 82%. It is an area suitable for living. From the view of territorial division of green building energy saving design, it belongs to a region of “hot summer and warm winter”. From the view of the climate analysis chart, the prevailing wind of Shantou city in the whole year is an east wind, where, there is most southeast wind in summer and most northeast wind in winter, with obvious character of monsoon climate, a relatively hot and humid climate [3]. See figure 1, 2.

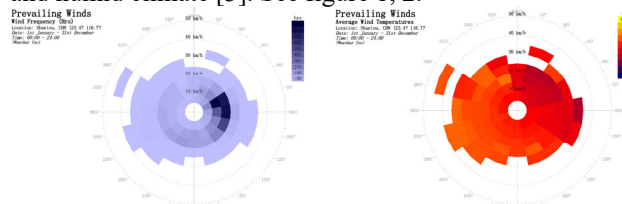


Figure 1. The prevailing wind in the whole year

Figure 2. Annual temperature

in the whole year

In the aspect of orientation, consulting figure 3 and 4, yellow parts are positions with most favorable orientation, and red arrows are directions of the maximum radiation quantity for the hottest three months in a year. It can be found that buildings in Shantou are best to face towards the south, and to avoid the influence of excessive radiation with a western exposure.

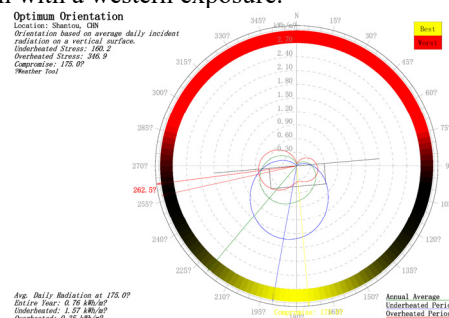


Figure 3. Best orientation

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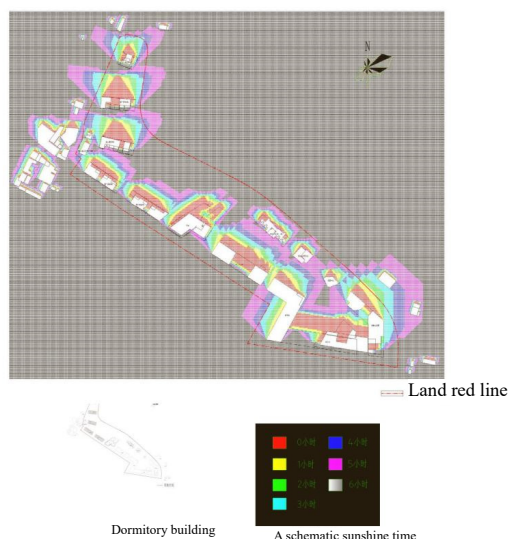


Figure 4. Sunshine analysis

2.2 Overall campus layout

The campus covers an area of 102 mus and is an elongated and irregular plot, near the national road in the south and a massif in the north. The distance of the campus from north to south is about 150m and the width from east to west is about 500m. The whole campus layout has following characteristics: according to the natural terrain, a layout of lower in south and higher in north is adopted, catering to the massif at utmost; a connection with water body via garden landscape is established and a public platform for rest and communication is provided; each building is connected in a form of courtyard for crowd to pass freely; weatherproof corridors are throughout the whole campus and connected by landscape platform in the middle [4]. See figure 5, 6.



Figure 5. Campus aerial photograph



Figure 6. Reinforced concrete corridor

2.3 Physical environment

Physical environment mainly includes wind, light, sound environment, etc.

2.3.1 Physical wind environment

According to building layout on campus, simulation software of CFD wind environment is adopted to calculate. The orientation of building group on campus is southwest-northeast, catering to the outdoor orientation in summer, so that there is suitable wind velocity in the field, and the wind velocity flow field is evenly distributed without stagnation area or vortex area. The shape of the building on the east side results in high wind speed, between 3.75 and 7.5m/s, while general wind speed at other positions is between 0.32 and 3.12m/s.

The campus is located in coastal areas, so the wind pressure on both sides of buildings is larger, which contributes to natural ventilation. It often blows southerly wind or southwest wind in summer, so an space on stilts is arranged on the first to fourth floors on the west side of Administration Building which is oriented directly south to north, a space on stilts is also arranged on the first floor of Teaching Laboratories which is oriented southwest to northeast. These spaces can bring summer wind to the inner courtyard so as to avoid a sultry and windless “dead” space. In winter, the wind is shifted to northerly wind, so some cold wind from northwest and northeast can be obstruct by Education Building and Research Building.

Indoor average wind speed and ventilation rate all meet requirements in simulating calculation.

2.3.2 Physical lighting environment

Different indoor environments have different requirements, for example, Student Dorm is a residential construction, Administration Building is an office construction and Education Building and Teaching Laboratories are educational construction. When students are on campus, they spend most of time indoors. Studies indicate that human eyes have higher visual effects in a natural light environment, so it shall be guaranteed that each room has enough and evenly distributed brightness; adopt natural light as far as possible and prevent glares. Refer to figure 7 and 8,

distribution of daylight factors of typical floor in building are shown.

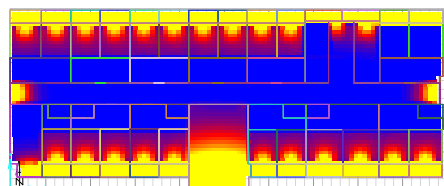


Figure 7. distribution of daylight factors of Dorm

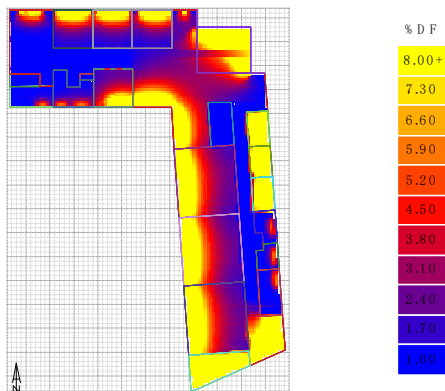


Figure 8. distribution of daylight factors of Education Building

2.3.3 Physical acoustic environment

Buildings on campus have higher requirements to acoustic environment. Traffic noise, air-conditioner noise and noise of construction equipment are main noise sources. Simulation analysis is as shown as Table 1 that sound transmission loss can basically follow up with requirements.

Table 1. Building enclosure structure and Sound transmission loss

Part	structure	Sound transmission loss	Min value	Max value
Exterior wall	Full-body tile 5mm + cement mortar 20mm + concrete hollow brick 200mm + cement mortar 25mm	48.54	45	50
Interior wall	150mm Light and solid compound bar wallboard	47.5	30	—
Floor	Reinforced concrete 120mm + sound insulation pad 5mm + fine aggregate concrete 40mm + cement and mortar adhesive layer 4mm + non-slip polished tile	50	45	50
External window 1	Ordinary aluminum alloy window + medium-light-transmitting Low-e glass 6mm + air 19mm + transparent glass 6mm	35	25	30
External window 2	Ordinary aluminum alloy window 6mm + silver-grey heat-reflecting coated glass 6mm	29	25	30
Household door	General real wood door	30	25	30

2.4 Landscape of campus

Through a comprehensive consideration of indoor and outdoor, a warm and integrated campus landscape environment is created.

On the northwest side of the second and third floors of Canteen, large glass windows are adopted for a closer look of the landscape lake and a far view of massif, bringing the good change of restriction of space and people's physical and mental feelings, as figure 9.

On campus, rigid pavement includes pervious type and impervious type. Pervious pavement mainly adopts pervious concrete with 65%. Pervious concrete is composed of coarse aggregate whose surface is covered with a thin layer of cement slurry so that a honeycomb structure with evenly-distributed holes is formed, with characteristics of breathability and permeability. Its bearing capacity can reach the bearing standard of C20-C25 concrete, which meets the requirement to drive a compact car.

The combination of enclosed space between buildings and landscape design form one by one Courtyards. A rest saloon or a discussing space which increases the plenty and probability of campus space is created as figure 10.



figure 9.Exterior landscape of canteen



figure 10. Courtyard space

Campus greening water adopts a water-saving irrigation method of the combination of micro-spray irrigation and drip irrigation, where, the large space adopts micro-spray irrigation and the small space adopts drip irrigation. The drip irrigation comes from Israel. In 1960s, in order to develop agriculture in water-deficient areas, Israel developed drip irrigation technology.

2.5 Existing problems

Because of the surrounding environment, the layout, and so on, there are some problems left. Such as, the office building is near the national road, so it is quite noisy and makes influence on use. Experiment buildings and hall and toilet in dormitories lack natural lighting. Sports venues are lack, and so on.

3. Brief summary

The north campus of GTIIT, its success includes full consideration of local climatic environment, proper handle of entire distribution, direction of buildings and physical environment, etc. At present, it has become a successful and delicate case of green campus in Guangdong.

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