

Ecological Urban Design for Science Education and Innovative District in Suzhou Industrial Park, China

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At present, the global environmental and ecological crisis are the emerging trends, resources, environment and economic development is the biggest dilemma facing mankind. Although nature's ecological environment and inclusive with carrying capacity, but as human beings to endlessly go on to seize resources, uncontrolled discharge of waste, permanent damage to the natural environment and directly endanger the living conditions of human beings. Natural disasters world-renowned expert Bill • Maikguer in the "7 years to save the planet," declared that if greenhouse gases in the 7 years from now can not be controlled, then in 2015 the Earth will enter an irreversible vicious cycle. Therefore, the protection of Earth's ecological system, to maintain ecological balance, without delay.

Although China's economic growth rate and economic growth have been envied in the world, but the resource costs and environmental costs are also rising fast in the channel. China's economy will go to two major trends in the future, that the knowledge economy (KE) and the circular economy (RE), Science and Education Innovation District in Suzhou Industrial Park is at the match point between the two economies, based on its excellent scientific and technological innovation and superior industrial base. The goal of urban design is based on low-carbon eco-concept, to make it as a technology innovation and incubation of high-tech enterprises and low-carbon eco-city construction in pilot area.

1 Chinese traditional philosophy of ecology

Chinese traditional philosophy of eco-city is rich in ideas. Lao Zi think that ecology is an important part of the world, Biology comes from natural, people comes from nature, and they must be given in terms of natural survival. Different from the West which emphasize the dualism of man and nature, the traditional Chinese philosophy is the performance of life, harmony, balance and other important ecological concept of thinking. Ecosystem is a product of cycling sport, "Dawson of the German animal of, shape of, as the situation." The environment make it a definite shape, it forces the growth constraints. Ecology follow the rules inherent in movement, the cycle, cycle and prosperous. Ecological changes driven by its internal.

1.1 View of Life

In Chinese philosophy, the world and all things are seen as a living presence. Since the "Book of Changes", China constructed an assimilative "three material" enough to "become all things music," "the scope of Heaven and Earth," Schema in this world, man, human society and nature constitute are independent system, but also by some kind of inner life force that are together form a closely connected whole.

1.2 Harmony

Pursuit of harmony is the basic philosophy of value orientation. Harmony found in the earliest "national language • Zheng language", Things are complement and coordination of a variety of factors. Harmony includes diversity, difference, contradiction and even conflict, but things will eventually reach a higher level of unity and coordination, that is harmonious. The sun and the moon changes, alternating cold and heat and so a natural phenomenon, constituted by both yin and yang, must follow the law of yin and yang Variation. The harmony of yin and yang and the role of rigid-flexible birth to endless life in the universe. Harmony between man and nature should remain consistent, They need preserve stability and harmony of nature, especially the maintenance of ecological balance.

1.3 Balance

Balanced view of Chinese traditional philosophy see all things as a trend toward a harmonious balance in life is relatively stable, the balance of power in the process of coordination. All things are mutual penetration of coordination between yin and yang, balance to be all things to exist as a basic premise. Development and change process is reflected by the shift of the imbalance between yin and yang, but the process towards a new equilibrium. "In" things that constitute the elements of the adaptation of the state are reasonable. Different and complementary seek the harmony of the whole, not only the organic balance and dynamic balance

2 Eco-city development

2.1 Eco-city origins

Eco-city (eco-city) is an implication of social, economic, physical development and coordination of the overall ecology of the artificial complex ecosystem. Originated in the late 19th century British social activist Howard's Garden City. In 1971 UNESCO launched the "Man and the Biosphere Programme," first proposed "eco-city." In 1996, the Register-led "Urban Ecology" organization for the establishment of the ten principles of ecological city. Eco-city "ecological" including natural ecology, social ecology, economy and ecology aspects, is a complex ecosystem, reflecting the city and its surrounding environment in a symbiotic relationship as a whole, its meaning is the harmony between man and nature, urban and natural ecosystems harmony. Eco-city is the core of economy, ecological economic model to replace the traditional model of economic growth, "man in harmony with nature," "economic, social, environmental and sustainable development" as the value orientation, not only to meet present and future generations to achieve survival and development needs, but also to protect the human environment of the complex ecosystem.

2.2 Eco-city feature

(1) Integrity.

Eco-city should pursuit social, economic and environmental benefits of the integration, spatial integrity and the integrity of the time. Should be based on macro geographical context of the overall effectiveness of environmental assessment, rather than the local micro-benefit evaluation. Should pursue sustainable long-term effects., rather than short-term effect.

(2) Geographical.

Eco-city should focus on specific geographical, time and social, economic, political background, highlighting the city of the Resources feature fully. Such as "Water City" in the

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water network intensive South region is ecological, but it is not in the arid region ecology.

(3) High-tech.

Eco-city applicatie more and more new technologies, to achieve a balance between man and nature. Such as solar, LED lighting, ice storage, ground source heat pump, roof rainwater harvesting, river water cycle cooling, pneumatic garbage collection, green and renewable materials, water-saving irrigation, use of a number of energy saving, environmental protection, eco-technology and "green building "and so on.

(4) Cyclical.

The key to eco-city is to introduc the cycle production and consumption patterns in the process of building. Such as to reduce waste, recycling waste, the guarantee of traditional energy and new energy alternatives, sustainable water use, wastewater reuse, etc., to achieve recycling eco-city.

2.3 Eco-urban development patterns

Since 80s, 20 century, many cities have made the international Eco-city construction projects such as the United States, Berkeley, Cleveland, Portland metropolitan area, San Francisco's eco-city plan, Bangalore, India, Denmark, eco-village plan, Australia's A Dred, Curitiba Brazil, eco-city plan. The ecological model of urban construction, including tightening the city, and the "green transportation" development model, community-driven development model, ecological networks and biochemical both the original development model, technological development model green city, etc..

3 Ecological Urban Design

3.1 Goal of Ecological Urban Design

Ecological Urban Design will integrate the concept of ecology in urban design, study urban space from ecological perspective, guide urban space with ecological strategy , optimize urban space with ecological technology, assess urban space with ecological benefits, establish efficient, harmonious, healthy, sustainable urban environment. Eco-city design will become the main direction of development of urban design.

3.2 Method of Ecological Urban Design

(1) study urban space from ecological perspective, the general urban design pay more attention to the image of the City in physical form and other content, such as roads, borders, regions, nodes and other markers. Ecological urban design first study the urban space from the ecological perspective, including urban natural landscape pattern, ecological plaque ecological corridor, etc. From the resource and environmental conditions, analysis cientificly the topography, weather characteristics, environmental characteristics of local resources and carrying capacity, seeking sustainable urban development. based on not damage the resource and environmental regeneration and under resource constraints.

(2) guide urban space with ecological strategy

Ecological strategies, including land-intensive, green transportation, green communities, green buildings, green infrastructure, Ecological Urban Design guide urban space by different strategies. Such as land-intensive, mixed land use advocacy, capacity ranks the city layout to replace the mixed production ranks divided city layout; green transportation advocacy to reduce car travel, public transport along the transport hub to replace the balanced development of high-strength development of the urban space; green community advocacy

Tang Lei, Zhang Quan, Ecological Urban Design for Science Education and Innovative District in Suzhou Industrial Park, China, 46th ISOCARP Congress 2010

communities, human ecology, with aggregate capacity of urban space to replace the previous discrete urban space; green building and initiated a new material, the use of new technologies, emergence of fantasy mood, smart technology and interactive experiences of ecological architecture, rich colors, shapes and sizes urban space to replace the traditional style of urban space; green infrastructure, promoted the use of energy saving technology, eco-garden to replace the crowded city space city space broken

(3) optimize urban space with ecological technology

At present, eco-technology development rapidly, renewable green energy, ecological construction technology provide strong technical support for the Ecological Urban Design. It designed according to local conditions, highlighting key ecological technology. It focuses on reducing waste, recycling-oriented society; or focus on research and practice of green vegetation cover the surface of urban spaces and buildings, rain-place into the ground, or the promotion of building energy saving technology focuses on materials, using recycled materials, etc., through advanced technical means to improve the ecological status of urban ecosystem.

(4) assess urban space with ecological benefits

Eco-efficiency refers to the eco-system of the reach of their range, the full value of the human good, including life-system benefits, environmental benefits provided by the system, the unity of life and environment, the overall benefits, but also including the whole provide material and spiritual benefits, it is an important basis for assessing the merits urban space should be combined with the economic and social benefits. Urban design should make full use of urban green absorption of pollutants and reduce the heat island effect, while simple, stress practical results, and low-cost items into the environment, social welfare, and protection of cultural heritage, continuing urban context.

4 Ecological Urban Design - Urban Design District, Suzhou Science and Education Innovation

4.1 Background

Suzhou Industrial Park Science and Education Innovation Zone is located in Suzhou Industrial Park in the southern, eastern Dushu Lake, currently in higher education from a single district to set Chan Xueyan for the integrated development stage. Early Science and Education Innovation Zone to economic development and material focus on spatial planning, the lack of low-carbon eco-concept, land, resources, inadequate attention to environmental issues. In recent years, scientific and educational innovation propose to create low-carbon eco construction target area, through the design of ecological cities sought to their opportunities to shape into the financial ecology and scientific research, traditional and modern, Sheng Huo and tourism as a whole, has a distinctive educational Yanfatese and Green Suzhou local culture, technology, livable new city. Range of urban design to the north, Dushu Lake Road, south Eastern Avenue, west Dushu Lake, east Star Wah Street, the planned total area of 1559.27 hectares.

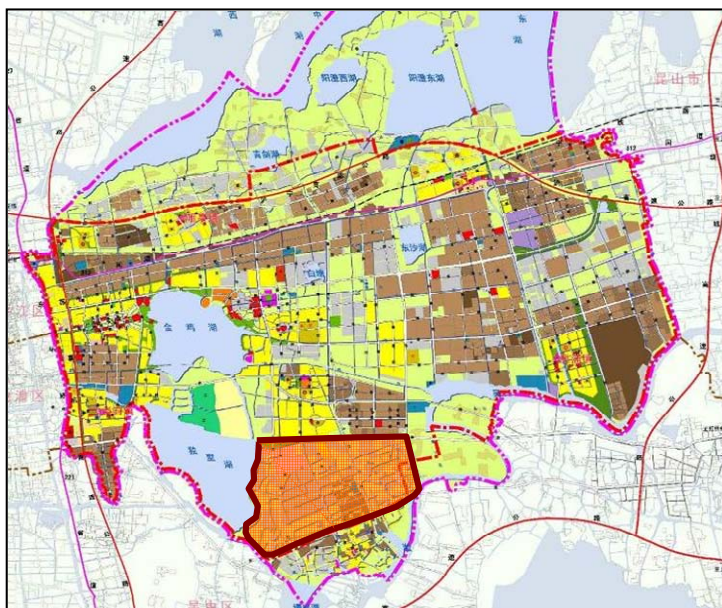


Figure 1 Location Map

4.2 Urban design objectives and strategies

(1) Low-carbon way to create "compact" Science and Technology Park

Stresses balance on production and living, balance of learning and living, based on functional walking scale division of the community, emphasis on community land within the appropriate mix, to achieve distribution of low-carbon. Green travel guide Center System Center System site and the combination of methods to guide green travel, parking control combined with the district to promote travel structural optimization. Traffic behavior analysis and integration, travel guide to enhance quality, to achieve reduction of carbon transport.

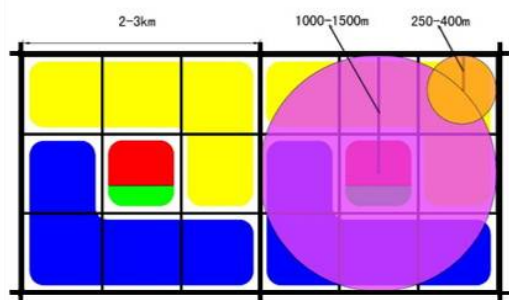


Figure 2 Schematic tour features mixed

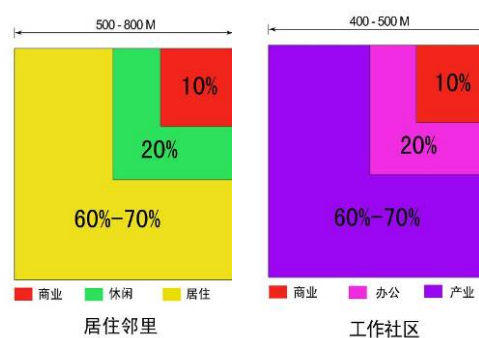


Figure 3 community site mixed-mode map

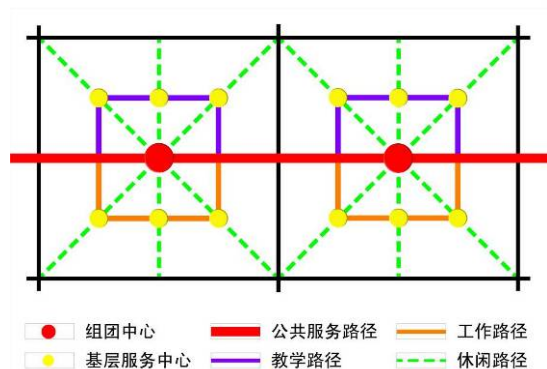


Figure 4 flow chart flow line model

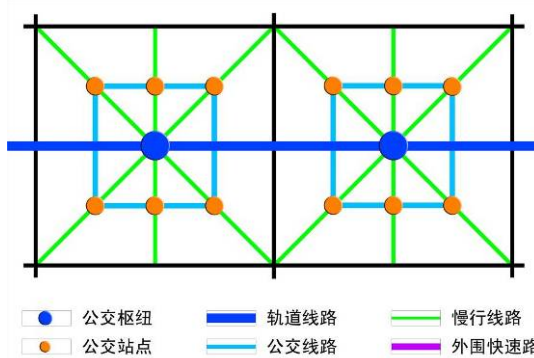


Figure 5 bus system model diagram

(2) Environment and ecology, to create "dark green type" Science and Technology Park

Enhance the carbon sink capacity, pay attention to eco-efficiency. Relying Dushu Lake surrounding environment resources, protection of local species, building integrated with the ecological environment of ecological landscape pattern. For analysis of carbon and oxygen balance of the total green space, increase tree coverage, expansion of green areas, to promote three-dimensional green, green eco-efficiency increased. Set buffer green belt along the lake, conservation of aquatic and terrestrial ecosystems in the transition zone, build consistent with the prevailing wind in summer air corridor, to improve the micro-climate.

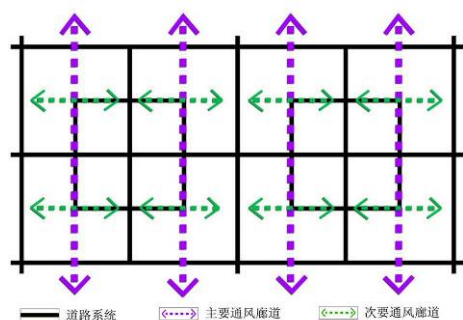


Figure 6 Analysis of Wind Map Gallery

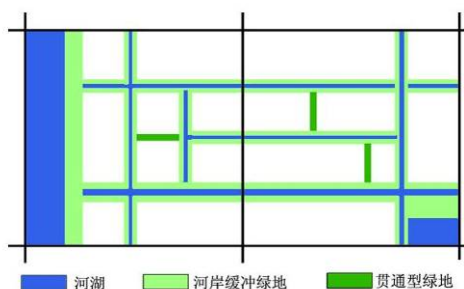


Figure 7 Analysis of the Green Corridor Map

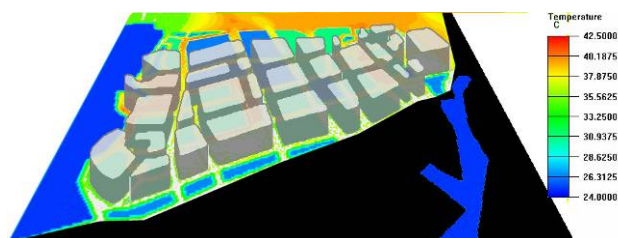


Figure 8 model simulation, layout guide green science

(3) Resource conservation, to build "economical" Science and Technology Park

To "reduce, recycle, efficiency" as a starting point, and land, energy, water and materials to achieve four objectives of conserving resources effectively. The use of land resources should be combined with a reasonable public transport hub to enhance the economic value of the land surrounding land and development strength, and guidance to enhance the development of underground space and incorporated into the planning target system; new energy use, should be dedicated to the promotion of green building, improve the energy efficiency standards reduce building energy consumption; the same time development and utilization of clean energy, reduce pollution emissions from energy use; water resources, and comprehensively promote rainwater, water reuse, water supply structure optimization. Waste resource utilization, and comprehensively promote waste separation and recycling, construction waste utilization system.

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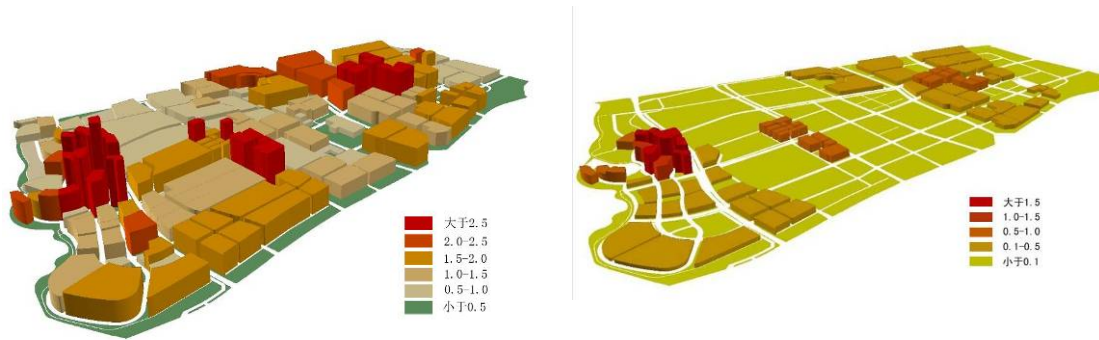


Figure 9 Schematic diagram of development intensity above and below ground

4.3 Urban Design Features



Figure 10 siteplan



Figure 11 bird's eye view

(1) Ecological landscape pattern - "Welcome Lake access River, surrounded by green, water pulse Adventure"

Science innovation of the ecological landscape pattern and tend to increase the "Towards Lake access River, surrounded by green, the water clock aspect" of the feature. Dushu Lake and east of the west side of the river landscape is Wusong EDUCATION INNOVATION East important ecological corridor, its waterfront landscape from east to west into the different functional groups, which is surrounded by 15-140 m wide green belt around the region water network clouds, crisscross. Urban design by Dushu Lake along the Yangtze River to the coastal and lakeshore Wusong restore the natural shape, river hydrological regulation, waterfront shoreline ecological design measures to maintain the continuity of the area of ecological, hydrological and landscape heterogeneity, ecosystem integrity and biological diversity, to meet the requirements of ecological safety, protection of ecological resources, ensuring ecological corridor Chang, appropriate arrangements for recreational activities, the ecological environment, biological communities to maintain the habitat and migration.



Figure 12 Plan of Landscape Pattern



Figure 13 ecological corridor and open space plan

(2) Land use - intensive, mixed

The site of the main functions are city center, lakeside leisure, education, science and technology research and development (creative industry and bio-nano-Park), living facilities, pilot incubator base. Urban design should follow the principle of intensive use of land to reduce the waste of land resources, improve the function of the mix of land utilization, industrial and residential as mixed use to the full stock of urban space, reduce the land of blind expansion. The relative concentration of urban development, intensive tour, drawing close, reduce vehicle traffic, build a walking system and green landscape, the formation of network-like open space system.

(3) Green Traffic Organization - efficient, three-dimensional

Green Transportation" is a low-cost (economic cost and environmental costs) of transport mode, is harmonious coexistence of man and nature, the optimal choice. Science, education, innovation and Public Transport Priority Development Zone (light rail, BRT) rather than the private car, give priority to pedestrian traffic rather than automobile traffic, public transport axis and the hub of high-intensity development, and frontlines. Intelligent transportation system is running, using GPS global satellite positioning system, GIS geographic information system and GSM / EDGE wireless network, to achieve real-time vehicle location and monitoring. To develop three-dimensional transport, such as the intersection of the interchange system, two,

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three walking system and underground pedestrian system. Planning Continuous smooth, the scenery of the bicycle lanes, bicycle parking and rental set point. Construction of slow traffic network, creating and green travel modes suited to slow human systems and pleasant waterfront landscape on foot system.

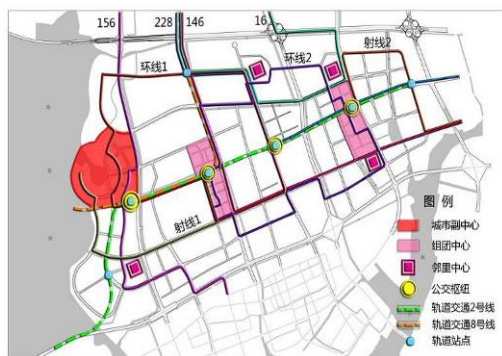


Figure 14 Schematic layout optimization of conventional public transportation network

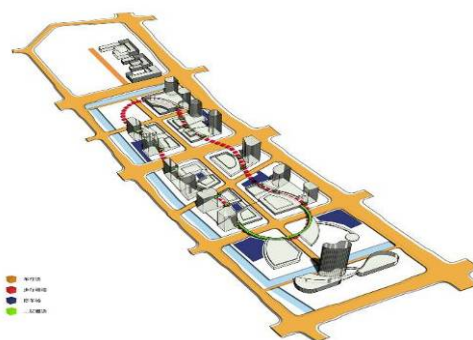


Figure 15 Traffic analysis of three-dimensional map

(4) Space landscape system - "eco-green solvent, three heart "

From the viewpoint of urban design, visual corridors, view, three levels of space on the space integrity of the landscape system, then the interface on the street, skyline, building color, building style research. In emphasizing the visual elements, but also concerned about the space landscape with the social and psychological significance, focusing on the urban context of the relationship between background.

"Eco-green solvent": outside the district and interconnected ecological system, relying on existing water systems, combined with slow system, strengthening the waterfront's accessibility, the green solution to the Area.

"Three Heart Xiangying": Moon Bay, Greenfield Street Business Centre, Weir Road Business Centre, King three central nodes along the axes of invasive Court Road, through the landmark, the interface elements such as the city dealt with the formation of distinctive features, illuminated with the core functionality Area.

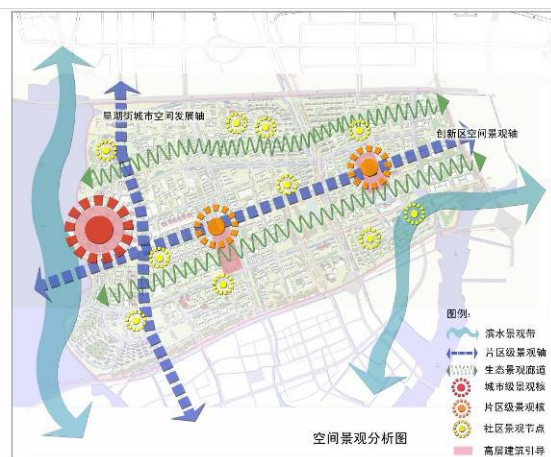


Figure 16 Spatial landscape

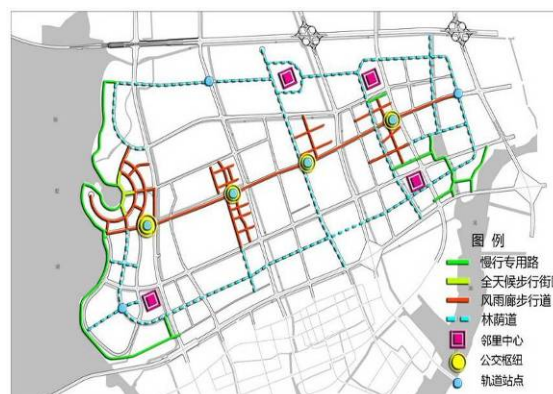


Figure 17 Slow system plan

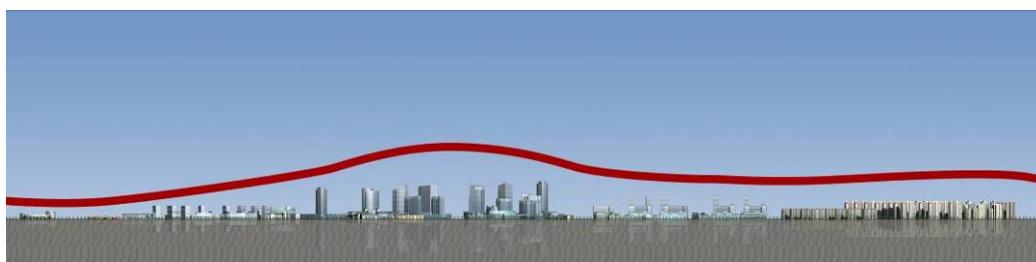


Figure 18 Spatial landscape

(5) Analysis of human behavior - multiple, dynamic

Human behavior and the environment is a two way relationship, conduct an impact on the environment and vice versa, the environment also will be constrained human action. People-oriented urban design, peeling structural level, in-depth analysis of science, education, innovation and regional characteristics of various types of human behavior, observing the area and the diversity and spontaneity of the region, including college students and high faculty teaching, industrial research and development staff, service service industry workers, foreign workers and associated personnel entertainment and leisure activities, life's behavior, the behavior of human activities in shaping Correspondency multi-type, multi-scale features of the site have their own space. People travel through the analysis and optimization of public transport system.

(6) Ecological community management - democracy, public

Broad public participation in urban design eco-city is an important part of success, 实施 "to community-oriented" development process, to encourage more staff participation in eco-development, eco-Yi Shi Jiang Dao through the development of ecological 社区, construction, maintenance aspects . To raise public ecological awareness, promoting innovative areas of the construction of science and education and healthy development. Strengthen the public is science innovation area producers, builders, consumers, and the important role of guardian to cultivate their good environmental sense of responsibility to actively participate in environmental protection, a civilized way of thrifty green consumption, with regard to environmental and sanitation awareness of the law, to save resources, energy and material recycling obligations and responsibility.

(7) Indicator system - add, improve

Through urban design of the regulatory plan for feedback and check, add 20 indicators, of which Class 2 land management, construction management class 5, class 5 traffic control, resource use category 5. Among them, mandatory targets may not be changed.

Table 1 New Regulatory Plan Index System Table

	Provides indicators	Leading indicators
Land Management (Add 2)	Ground floor area ratio	Mixed land use degree Δ
Construction Management (New 4)	The proportion of green roof Δ	Building paste line rate
	roof cover solar facilities Δ	Podium building height
Traffic Control	Bicycle parking spaces	Bus site coverage Δ

(Add 5)		bypass pedestrian crossing distance Δ
		Slow Slow lines and facilities are
		Slow line import and export orientation
Ecological Environment (Add 3)	Permeable surface area ratio (unit Δ , block)	Local Plant Index Δ
	Tree cover (unit Δ , block)	
Resource utilization (Add 5)	Build infrastructure capacity rainwater to stay	The proportion of the total water reuse rainwater Δ
	Way with construction of water facilities	PV collection load
		Geothermal energy collection capacity

(8) Eco-technology - cycle, high-tech

Concept based on recycling economy, the use of waste exchange, recycling, clean production methods, structure "resource producers, processors, producers, waste disposal," the industrial ecosystem. Through physical integration, integration of water resources, energy integration, technology integration, information sharing and infrastructure sharing, and ultimately the pollution zone "zero emissions." Meanwhile, the building design based on sunlight and ventilation analysis of key climate factors, towards the choice of building space to create, functional organization of targeted design aspects. Building energy side for size and color design, external maintenance of structural design, passive solar, rooftop solar and green, light guide technology, technology, promoting the use of water-saving sanitary ware, collect roof rainwater, application of grass brick or permeable-type floor tiles to such as local rainwater infiltration.



Figure 19 bird's eye view of Moon Bay



Figure 20 Moon Bay siteplan



Figure 21 bird's eye view of King Weir Road



Figure 22 King Weir Road siteplan



Figure 23 bird's eye view of R & D Area



Figure 24 R & D Area sitePlan



Figure 25 bird's eye view of Industrial District



Figure 26 Industrial District siteplan

5 Conclusion

Ecological Urban Design practical low-carbon technology, technical subject; to educate the industry and new industries for the industries subject; to produce home-oriented land use mix for the development of the main; to mass transit, public transport, cycling, walking and other green transportation for the transportation subject; to green building for the construction of the main; to ecological and sustainable as the main objective to explore innovation in science, education, ecological environment protection affordable under the conditions of all existing ecological characteristics, strength and balance development of the relationship between the ecological carrying capacity of land; optimization of energy utility, achieving low energy consumption, use renewable energy, local energy products and recycling technologies; to create a safe, healthy living, working and recreation space, according to local conditions, highlighting local characteristics in Suzhou, China's eco-city design made a meaningful attempt.

Tang Lei, Zhang Quan, Ecological Urban Design for Science Education and Innovative District in Suzhou Industrial Park, China, 46th ISOCARP Congress 2010

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