

The planning methods of Chenjia Town international ecological residential area in Shanghai based on the ecological security

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1. Research Background

China has always been in the period of rapid development of urban construction since the reform and opening up, and the level of urbanization has increased from 17.9% in 1978 to 57.4% in 2016, with an average annual growth of 1-2 percentage points(Li,2017). However, in the same time of rapid development, the urban construction activities have also caused a series of ecological security problems, such as environmental pollutions, crowded, waste of land resources, natural disaster, and other ecological damages. These phenomena make people gradually realize the importance of changing the way of urban development, and exploring a road to balance of the quality of ecological and environmental, the benefits of economic and social, and the environmentally sustainable development(Wang,2006). Because of the residential area is not only the closest place to our daily life, but also the key factor of restricting urban ecological security, and can reflect the contradictions and challenges of the urban ecological security crisis caused by the urban construction activities(Huang,2010), the paper tries to explore a planning method of residential area based on the ecological security, and in the process of solving the "urban diseases" and other ecological security crisis, to creating a kind of harmony livable environment between man and nature(Teng,2006).

2. An Analysis of the Concept of Ecological Security

Ecological security is an emerging research field of ecology, and its definition was first proposed by the International Institute for Applied Systems Analysis in 1989, meaning that there are no threaten in human's life, health, well-being, basic rights, source of living, necessary resources, social order, adaptation to environmental changes and so on(Fang et al.,2001). Nowadays, the analysis of the definition of ecological security mainly including general and narrow two levels both at home and abroad. The generalized ecological security is an ideal state, meaning that the city will not have an ecological crisis, nor is it threatened by any potential ecological risk factors. The ecological security in the narrow sense is mainly for a specific research object, focusing on the key factors that constrain its ecological harmony, and by regulating the significant constraints that affect the specific objects, to improve the level of ecological security(Wang,1997).

Based on this, the article systematically combs the existing research results, founding that most of the studies focus on the construction of ecological security evaluation index system and the application of ecosystem management of built residential areas at present(Sun et al.,2012; Yang et al.,2013; Shao,2002), lacking systematic research on the planning theory and method of ecological residential areas under the concept of ecological security. So the paper takes the planning of the Chenjia Town international ecological residential area in Shanghai as an example, by establishing the four in one planning strategy of the compact residential areas, the green travel residential areas, the environment-friendly residential areas, and the low-carbon environmental protection residential areas, to explore the planning

theory and method of ecological residential areas under the concept of ecological security. On this basis, the plan tries to make a further subdivision, and to establish the planning system of ecological residential areas, including four secondary indicators and thirteen third-level indicators, and try to combine the concept of ecological security and the planning subsystems of residential areas, and to guide the development and construction of ecological settlements.

Table 1: The planning system of the residential area under the concept of ecological security

<i>The planning system of the residential area under the concept of ecological security</i>	<i>the compact residential areas</i>	<i>Group size</i>
		<i>Enclosed neighborhoods</i>
		<i>public Utilities</i>
	<i>the green travel residential areas</i>	<i>Road density</i>
		<i>Walking system</i>
		<i>Bicycle system</i>
	<i>The environment-friendly residential areas</i>	<i>Bus system</i>
		<i>Water system</i>
		<i>Green layout</i>
		<i>vertical greening</i>
	<i>the low-carbon environmental protection residential areas</i>	<i>Low - carbon housing</i>
		<i>Low - carbon public buildings</i>
		<i>Green facilities</i>

3. the planning of the Chenjia Town international ecological residential area

3.1 Development background and current characteristics

In 2008, Shanghai was selected as the first low-carbon pilot city in our country, and then Chongming Island, Lingang, and Hongqiao business district was selected as three low-carbon demonstration areas of Shanghai . The planning area locates in Chenjia Town, and covers an area of about 4.4 square kilometers, which is the key area of development of Chongming Island. The status quo is mainly paddy field and irrigation channel, and the existing planning is difficult to meet the development requirements under the new context in terms of land use, road traffic, green landscapes and public service facilities, urgently needing to construct the international advanced level of ecological residential area under the concept of ecological security. Shanghai Tongji urban planning&design institute undertook the planning and design work of the project, and I had the honor to participate in part of the work. If the relevant date in the article is no references, then they are from the project.



Figure 1: The land layout planning



Figure 2: The urban design

3.2 The concept of planning

The planning takes the concept of ecological security into the subsystems of the residential area, and propose a more natural, healthier and more enjoyable way of life, specifically including: a compact residential area, the green travel residential area, the environmentally friendly residential area, and the low-carbon residential area.

3.3 The compact residential area

A high density and multi-type residential area.

Reasonable residence density. By drawing on the number of living units on the residential land in the famous ecological residential area at home and abroad, the plan determines the number of living units on the residential land under different volume ratios in reasonable, and achieve a high density of living residential areas, such as the Hammam Newcastle, the Burlington Eco Village, and the Chongming East Beach.

Table 2: List of Recommended Residential Density

Floor area ratio	Living density (unit / ha)
1.6	100-130
1.2	70-80
1.0	60-70
0.6	>40

3.3.1 Enclosed neighborhoods.

Jane Jacobs once said: "If a city's streets look very interesting, the city will also be very interesting(J.Jacobs,1993)".Because of the street is an indispensable place for residents' daily life activities, such as pass, neighborhood contacts, shopping, leisure, and entertainment, the plan uses the layout of the neighborhood. Through the enclosed house, the plan creates a street atmosphere, a multi-level communication space, and a vibrant residential street space, and achieve the person car branch at the same time.

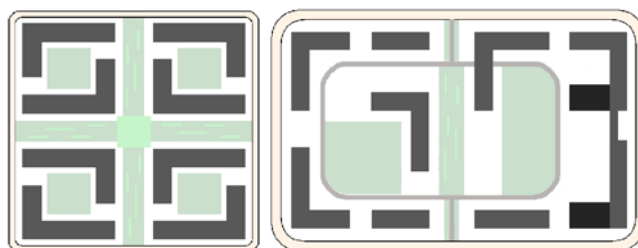


Figure 3: The layout of the enclosed neighborhoods

3.3.2 Diversified residential building types.

The plan taking account of the residential needs of residents of different ages and types, including the core family, the single young professionals, and the elderly, etc, and providing a variety of residential building types, such as old - age apartment, micro apartments, affordable housing, SOHO, and townhouses, etc.

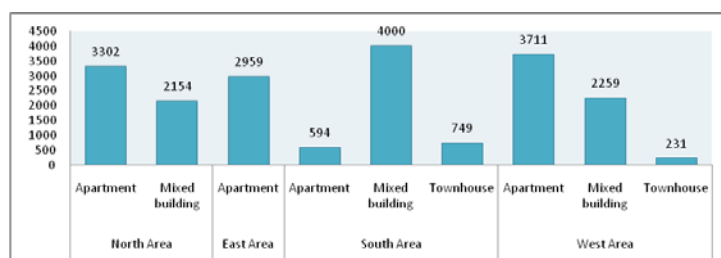


Figure 4: The statistics of different types of residential households

3.3.3A Convenient and complex public service network.

By combining the layout of the neighborhood, the plan set up a well-distributed public service facility along the streets, and forming a comprehensive public service network, creating a vibrant residential neighborhood. Also, through the layout of public service facilities, the plan can further increase the residential employment opportunities, and form a sustainable development of living networks.



Figure 5: The layout of the Public service network

3.4 The green travel residential area

3.4.1Walking friendly street network.

Compared with the large-scale neighborhoods, the small-scale neighborhoods have significant continuity and permeability in space form, suitable neighborhoods and street scales, suitable walking and vibrant public spaces and so on. So the plan combines with the core living circle, commercial and residential mixed land and residential land, forming three different types of street scale. In the core life circle to increase the density of street road network, the density of the street road network is 150 * 150m. In the commercial and residential mixed areas, the density of the street road network is 200 * 200m. In the external residential block, the density of the street road network is 300 * 300m.

3.4.2Bicycle friendly road network.

The planning layout different bike road systems in different areas. Firstly, forbidding the entry of motor vehicles and encouraging to use the public transport and bicycles in the scope of the core living environment. Secondly, allowing the bicycles and cars to be mixed, but the *speed limit at road for vehicle* in the general living area, thus encourage residents to use more bike travel, and create a bike movement characteristics of residential areas.

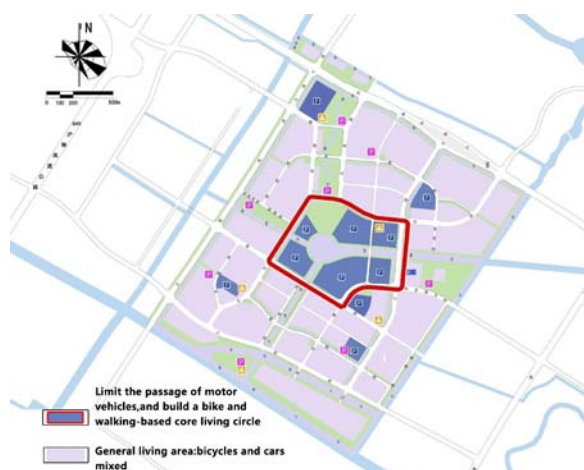


Figure 6: The sub-regional layout of the bike road system

3.4.3 Hierarchical layout of the bike road system.

By building a hierarchical bike road system, the plan improves the bike-friendly road network, and by providing bicycle parking facilities, the plan provides bicycle rental, shower, and other services. Regional bike road, the ratio of the bicycle travel accounted for about 40%, the function of the Regional bike road is mainly to contact the residential area and the surrounding parks, commercial center area, and mainly to long-distance commuting, can also be used as a fitness bike lane. To ensure the increasing demands for motor vehicle trips after the floor area ratio increased, the plan tries to reduce the width of the green belt, and change the road section to four lanes, and set a single-sided bi-directional bicycle belt in the same time. Through the isolated green belt between the bike lane and motor vehicle lane, to ensure the bike travels safely at a higher speed. Neighborhood bike road, the ratio of the bicycle travel accounted for about 60-70%. Controlling the enter of the motor vehicles in the core living area, and constructing the bicycles and walking-based road use system, and the road red line width of 12-15 meters, mainly for bike traffic, and as fire channel in the special case. Priority bike road, the ratio of the bicycle travel accounted for about 40%. Taking into account there are more cars in his part of the road, the planning tries to minimize the vehicles to turn right, and ensure the safety of the bike lane. So the planning puts the bike lane locates on the inside, and the right turn lane locates on the outside, and design protection isolation belt between the two lanes. General bike road, the ratio of the bicycle travel accounted for about 20%. The main roads within the residential area, and use the conventional road sections.



Figure 7: The hierarchical layout of the bike road system

3.4.4 Bicycle channel section.

The main bicycle channel section: In order to ensure the increasing demands for motor vehicle trips after the floor area ratio increased, the plan tries to reduce the width of the green belt, and change the road section to four lanes, and set a single-sided bi-directional bicycle belt in the same time. The secondary bicycle channel section: Emphasizing the status of bicycle traffic in the secondary channel, and try to reduce the proportion of road traffic, in the case of Meeting the number of bike lanes and the width of the green belt. The bicycle dedicated section: mainly for bicycle and walk , and for the fire truck in a state of emergency.

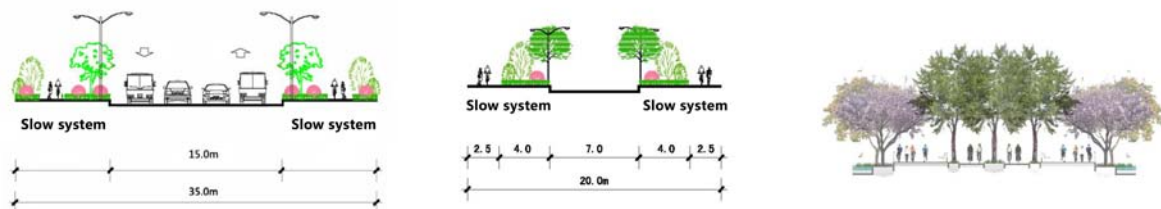


Figure 8: The different types of bicycle channel sections

3.4.5 Bus sharing rate of 40%.

Combining with the status quo of the original bus lines, the plan layout a total of twelve bus lines, including one city long-distance bus lines, two island bus lines, seven regular bus lines, and two other bus lines. The layout of the bus station is one for every 600 meters, and the service radius of about 300 meters(5 minutes walk distance), and satisfy the requirement of covering more than 90% of construction land.



Figure 9: The layout of the Bus system

3.4.6 Convenient transfer facilities.

Through the layout of the convenient transfer facilities, the plan provide facilities with good facilities. For example, to increase two bus transfer points on the basis of the existing bus terminal, and to provide adequate bike parking spaces and public bicycle rental in the transfer point in order to strength the bike and bus transfer, and finally reach the target of 5 minutes to reach the bus station, 15 minutes to reach the local work point and the transport hub.



Figure 10: Transfer the layout of the facility

3.5 The environmentally friendly residential area

Take the water as an important part of the ecological and rainwater management system: As is known to all, the density of the river network can reflect the sparse degree of river distribution, and the higher the density, the more obvious the retention of rain, playing an important role in the retention of rainwater. While the water rate reflects the size of the river distribution area, and the higher the water level, the higher the capacity of rain and flood control, playing an important role in the rain and flood transfer. And the two interact with each other, reflecting the richness of river distribution and water storage and drainage and self-purification capacity. Based on the above analysis, the plan tries to promote the status quo of the water system, and the density of the river network is increased by 1.07 (km / km²) on the original basis, the water surface rate is increased by 0.53% on the original basis, and exceeds the average river network density and river network rate. In addition, through the expansion of the internal water ring, and convergence with the residential park, the plan formate the internal and external water ring, and strengthen the flood control and drainage capacity, and through the improvement of water network system, formate the experience of the Jiangnan water dwelling. And the new planning of the water network connected to the network, not only enhance the ability of rainwater storage capacity, but also reduce the urban surface run off.



Figure 11: The layout of river water system

Habitat into a network, strengthen the construction of diversified green space: The plan tries to strengthen the construction of a wide range of green space, and to improve the participation of green space, and to play the role of dot-like green space in a more efficient way. The final realization of the park green service radius of 500 meters, five minutes to reach.



Figure 12: The layout of green space system

Put the farmland as an important part of the open space: Green space is not only exist in the open space, the construction of epidermal planting is also very necessary. These vertical green patches through the green environment with the city as a whole, and can be a reasonable and effective expansion of the entire city's vegetation area, improve the city's comprehensive ecological benefits. In the residential building roof on the introduction of farmland, not only has the production function, as well as the ecological service function and the recreation function and the educational function, which reduces the pollution caused by the transportation of long-distance agricultural products. And can also be a green base for urban landscapes.

3.6 A low carbon green residential area

The research of low carbon green residential area is divided into three levels, including low-carbon housing, low-carbon public buildings and green infrastructure. Due to space constraints, the article only to do a brief introduction, and do not elaborate.

Low - carbon housing. The planning of the Low-carbon housing mainly including five aspects: the planning site and outdoor environment, having land and hydrological environment, Water saving and water use, Saving material and material resources and indoor environmental quality.

Low - carbon public buildings. The planning of the Low-carbon public buildings mainly including three aspects: saving land and hydrological environment, energy conservation and energy use and indoor environmental quality.

Green infrastructure. The planning of the green infrastructure including six aspects: energy, transportation, underground space resource utilization, regional environment, regional greening, and resources.

4. In conclusion

Nowadays, the planning method of the ecological residential area is still in the initial stage of development practice in our country. However, it is undeniable that with the deep implementation of the new urbanization in China, the ecological residential area will be the goal of planning and construction of the future residential area, and is of great significance for the sustainable development of urban economic and society and the construction of healthy, livable, safe eco-city(Chen et al.,2012). The paper take the planning of Chenjia Town international ecological residential area in Shanghai as an example, by establishing the four in one planning strategy of the compact residential area, the green travel residential area, the environment-friendly residential area and the low-carbon environmental protection residential area, to comprehensively explore the planning theory and method of ecological residential area under the concept of ecological security. In the area of the compact residential area, by establishing a reasonable living density, enclosed neighborhoods and diversified residential building types, the planning of the ecological residential areas advocates a different age and type of residents living together, and through the rational distribution of public service facilities, to create a compact and dynamic residential area. In the area of the green travel residential area, the planning of the ecological residential areas pay more attention on walking friendly and bike friendly, through the zoning of the layout of the public transport system, and the convenient transfer facilities, to make the share of public transport to reach 40%. In the area of the environmentally friendly residential area, the planning of the ecological residential areas takes water as an important part of ecological and rainwater management system. By making the water system into a ring, to construct a wide range of green space system, and by making the farmland as an important part of open space, to improve the city's comprehensive ecological benefits. In the area of the low-carbon residential area, the planning of the ecological residential areas pays attention to the low-carbon residential, low-carbon public buildings and the construction of green infrastructure, to achieve saving water, saving land, saving materials and saving energy.

The study of the planning of the ecological residential areas is a deepening subject, so in the process of planning and construction of ecological residential area, we should clearly understand that the development goals, the planning index systems and the planning requirements of the planning and construction of ecological residential area will be different with the difference of regional and the urban socio-economic development stage. Such as cold areas and hot areas, developed areas and underdeveloped areas an so on. Therefore, the planning method of the ecological residential area should also be combined with the development stage, development conditions and overall urban planning of the local cities, and put forward the practical planning and design strategies according to local conditions, which need further in-depth research and innovation.

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