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Human-centered Design for Green Landscape of Urban Streets

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Abstract This paper first introduces the development process of urban street green landscape in China and the human-centered thinking of the design of urban street green landscape. On the basis of detailed elaboration of the basic theories of urban street green landscape, it analyzes the existing problems and causes for urban street green landscape. Then, from the perspective of human-centered thought, it comes up with several measures for optimizing the green landscape design of urban streets, to provide much more human-centered experience of urban street green landscape.

Key words Urban streets, Green landscape, Human-centered thought

1 Introduction

With constant increase in the society's respect for and emphasis on human nature, the green landscape of urban streets increasingly reflects the characteristics of human nature. However, during the rapid development of urbanization in China, in order to meet the travel needs of motor vehicle traffic, the humanity that the street green landscape should have is placed in a lower position. In consequence, there are prominent problems in the use of street green landscape, safety and comfort, and ecological art, such as failure to select suitable tree species in accordance with local conditions, excessively large flower ponds, lack of pruning of large trees, and scarce shade space. Human-centered thought has been expounded by sages in ancient times of China. For example, the idea of "unity of heaven and man" proposed by Zhuangzi (Chuang Tzu) has a profound impact on later generations. In western countries, the "humanization" originated in ancient Greece with the Italian Renaissance as its peak. In modern times, scientific humanism is unfolding. For example, in the study of psychology, scientific humanism explores the hierarchy of human needs and puts forward the theory of human basic needs.

2 Development history of urban street green landscape in China

The record of road greening in ancient books first appeared in *Rites of Zhou* (Zhou Li). The people of the Zhou Dynasty had already started the work of road greening, which they called "row trees". In 221 BC, the managers of the Qin Dynasty planted a tree 7 m away on the royal road. In the Western Han Dynasty, locust trees were planted on both sides of the road in Chang'an City. In the Western Jin Dynasty, the common street trees on the roads

of Luoyang were elm and locust tree. During the Northern and Southern Dynasties, many willows were planted on the roads of Jiankang City (now Nanjing City). In the Tang Dynasty, there were many kinds of fruit trees on both sides of the streets in the north, and kapok in the south. During the Northern Song Dynasty, Dongjing (now Kaifeng City) planted peach trees, plum trees, and lotus roots beside the moat of the imperial city. In the Qing Dynasty, acacia, *Platanus orientalis*, and Italian black poplar from North America were successively introduced into China.

After the founding of New China, the green landscape of urban streets in China has experienced the following stages. (i) During the economic recovery period from 1949 to 1952, China's cities were dilapidated due to long time of wars and there were few street trees. (ii) From 1953 to 1957, many cities began to consciously implement urban street greening within various planning frameworks. (iii) From 1976 to the 1990s, the implementation of a series of laws and regulations prompted the greening of urban streets to enter a new period of development. (iv) Since the 1990s, many technical regulations promulgated by the government have made great progress in the construction of street greening.

3 Overview of the human-centered design thought

3.1 Origin of human-centered thought Human-centered planning thought emerged in the construction of ancient Chinese cities. The earliest written records appeared in the Zhou Dynasty's *Kaogong Ji of Rites of Zhou*. However, the construction of ancient cities in China did not take it as the golden rule. Instead, the cities were constructed in accordance with local conditions on the basis of examining the environmental factors. Therefore, in ancient capitals, there were cities with free layouts like Jiankang City. The human-centered planning thoughts of ancient Chinese cities are reflected in the unity of heaven and man, and Tao follows the nature. The ancient Greek period was the birth period of the western thought of "humanization". At that time, the famous saying "man is the measure of all things" was the earliest and best embodiment of such thought. After getting rid of the shackles of medieval theology, human-centered thought ushered in an unprece-

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dedented development in the Italian Renaissance in the 14th century, and was widely accepted through the Enlightenment Movement in France and the religious reform movement in Germany. After the Industrial Revolution, human-centered thought became the dominant social thought as the bourgeoisie became the dominant class of the society.

3.2 Causes for emergence of the human-centered thought

3.2.1 Inevitable result of human social and economic development. The economic base determines the superstructure. When the level of social and economic productivity is low, practicality is people's greatest requirement for design, and whether the design can meet people's psychological needs is not in the range of too many considerations. When the socio-economic level develops to a certain level, the design cannot stop at practicality, but needs to take into account both aesthetic and psychological needs. Such a design shows human-centered characteristics. Generally, the development of human society and economy will definitely bring about the emergence and development of human-centered design.

3.2.2 Refutation of functional rationalism. Before the 1960s, both in the field of planning and architectural design, the functional rationalism took the absolute dominant position. It seems to be rational and uniform, but it lacks human considerations, which led to a comprehensive criticism of its monopoly, monotonous, cold style and spiritual connotation by the postmodern planning thoughts after the 1960s. Urban streets under functional rationalism are wide and straight, but there are few tourists because there is no human-centered idea in the design, which is not acceptable in the modern cities. Scientific humanism can greatly compensate for the shortcomings of functional rationalism.

3.2.3 The connotation and extension of humanization. The connotation and extension of humanization can be found in *A Theory of Human Motivation*. According to the content summarized in this book by the British psychologist Maslow, from low to high, from material to spiritual, human needs are divided into five different hierarchies: physiological needs; security needs; love and belonging needs; esteem needs; self-actualization needs. Physiological and security needs can refer to the connotation of humanization, while self-actualization, emotional esteem, belonging and identification correspond to the extension of humanization.

4 Basic theories for design of green landscape of streets

4.1 Concept of urban street greening In terms of form, the urban street green landscape includes many types of street green spaces. Street greening can meet the requirements not only by combination of colorful plants. In order to manifest the function and style of a city, the planning and design of street greening usually needs to consider the greening function, visual landscape, and ecological environment. There are many factors influencing the green landscape of urban streets. We can simply summarize them as the factors of the streets themselves and the human factors. The most important factor in the street itself is vegetation.

Plant growth habits, color forms and the combination of different tree species have a huge impact on the street green landscape. The plants on the urban streets are mainly local vegetation, so that the plant growth environment is suitable and easy to manage, and to form a unique landscape full of regional culture. To a large extent, the human landscape factors can shape the image beauty and artistic conception beauty of the city, reflecting the characteristics and recognizable features of the city, which also has a great influence on the green landscape design of urban streets.

4.2 Types and functions of street greening The types of street greening can be divided into the following types: street tree green belt, dividing stripe green belt, roadside green belt, road side green space, square and parking lot green space. Fig. 1 illustrates the meanings of these types of green space. Roadside greening has following functions. (i) Shading: For residents on both sides of the road, street trees can block the dust generated by vehicles and reduce the visual impact; for pedestrians and drivers, the violent summer sunshine makes people feel uncomfortable, while street trees with dense canopies can provide shade. (ii) Sound insulation: long-time of living in a noisy environment will bring serious physical and mental harm to people. The noise of vehicles will increase exponentially as the speed increases, while the trees on the street can well absorb and block the noise. (iii) Anti-glare: there may be a large number of buildings with glass curtain walls on both sides of urban streets. These glass curtain walls will refract sunlight and produce light pollution. If the driver of a high-speed vehicle is glared by refracted light, it may greatly interfere with the safety of driving, while anti-glare planting can reduce the probability of danger. (iv) Landscape: the various shapes, forms, and colors of plants are hugely attractive to urban residents. Appreciating the green landscape on urban streets can bring passengers and pedestrians a sense of pleasure (Fig. 1).

5 Human-centered design methods for street green landscape

5.1 Street tree green belt It is necessary to ensure the maximum amount of green landscape on the sidewalk with a fixed width, and to avoid obstructing the passage of pedestrians. For the tree species used for sidewalk greening, it is preferred to adopt local tree species, but some new tree species suitable for the local area should be consciously introduced, which reflects the diversity of tree species, and satisfies the aesthetic rhythm, so as to be harmonious and unified with urban streets (Fig. 2A). For example, in the sidewalk greening of Nanchang City, the local tree species-*Cinnamomum camphora* can be selected first, while avoiding the selection of tree species with flying catkins, peculiar smell, and easy to cause allergies as sidewalk tree species.

5.2 Dividing stripe green belt The dividing stripe green belt is in the carriageway. In order to ensure safety, pedestrians should be prevented from entering, so the dividing stripe green belt should not be designed as an open green space. There are also corresponding design specifications for the height of the plants

within the dividing stripe green belt. The height of the hedge should not exceed 0.7 m on the ground, which is 0.7 m of the lowest viewpoint height of the motor vehicle drivers, so low shrubs, and turf, *etc.* are generally selected for planting within the dividing stripe green belt. In order to minimize the interference of the oncoming traffic during the daytime and the light interference at night, the dividing stripe green belt should adopt low and dense planting, which does not obstruct the vision on both sides of the drivers. Besides, the dividing stripe green belt has the function of showing the image of the city to pedestrians and pas-

sengers. Therefore, plants with flowers and fruits that are not allergic and irritating to pedestrians and passengers should be selected to enhance the humanization of the dividing stripe green belt. Pedestrians are likely to be obstructed by the green separation belt in the middle of the street when crossing the highway normally. Too long sections are inconvenient for pedestrians to cross the street, while too short sections reduce the traffic efficiency of motor vehicles. Therefore, the separation design should be carefully considered. Generally speaking, 75 – 100 m is appropriate for urban streets (Fig. 2B).

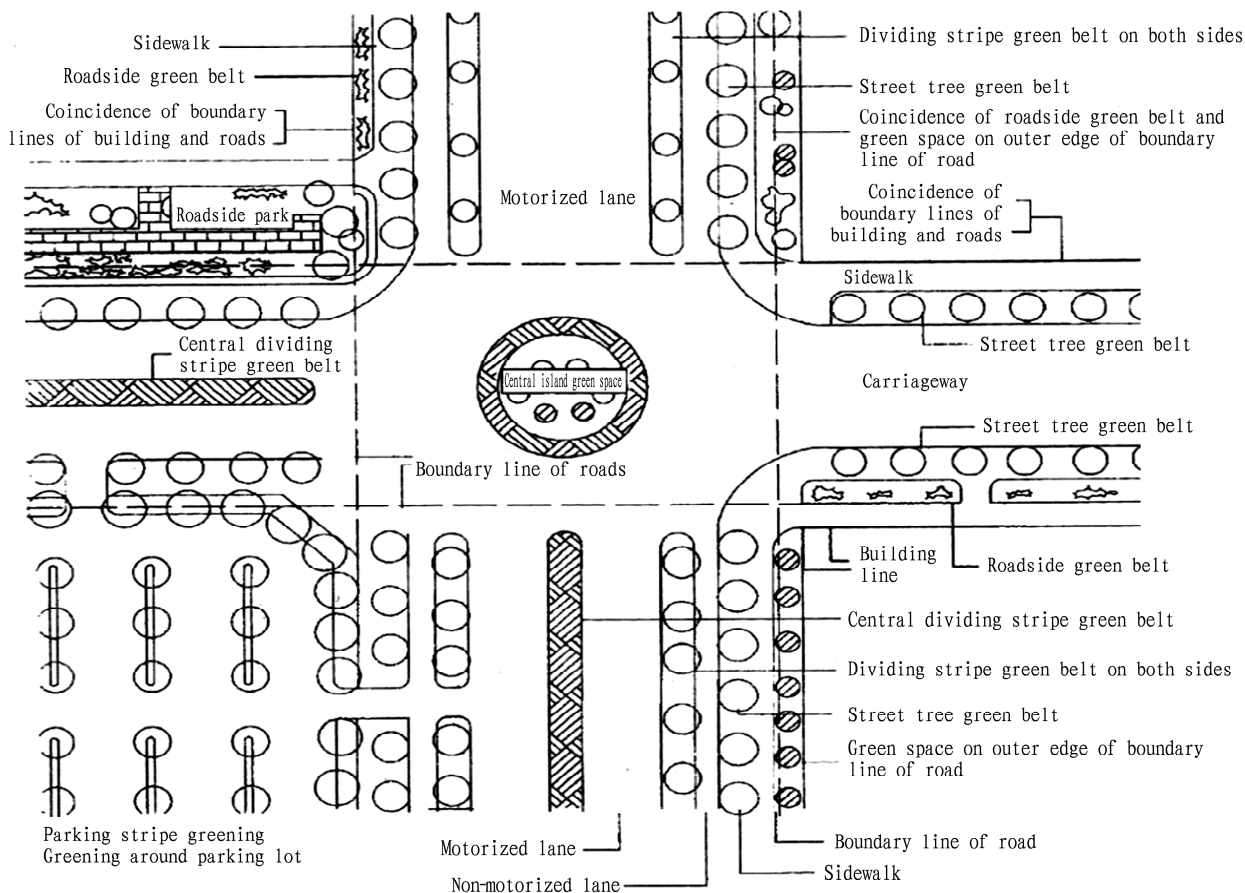


Fig. 1 Types and functions of street greening

5.3 Roadside green belt A common design element on the roadside green belt is the tree hole. Excessively high tree hole curbs can easily hinder or even trip pedestrians, so when the sidewalk is narrow, the curbs around the tree hole should be level with the sidewalk. On the sidewalk narrower than 4 m, in order to meet the needs of humanization, the tree hole curbs higher than the road surface should be removed to ensure the safety of pedestrians.

The types and planting patterns of plants on the roadside green belt have a great influence on the human-based design of the roadside green belt. The neatly arranged arbors effectively separate the slow-moving sidewalk and the fast-moving roadway. If the sidewalk is so narrow that only one row of trees can be planted, it is preferred to plant it on the side close to the sidewalk so that pedes-

trians can get more shade. If the sidewalk is wide enough, the trees are best planted in the center (Fig. 2C).

5.4 Traffic island green space The traffic island green space is composed of the central island green space, the directional island green space, and the grade-separated junction green space. The central island green space, as a special form of street greening, in principle only has an ornamental effect. In order to avoid obstructing the sight of motor vehicle drivers and pedestrians, the central island green space is suitable for planting dense evergreen trees and large shrubs. The plants in the directional island green space should not be too high, because the driver always observes the changes in traffic flow at the directional island, so it is preferred to plant ground cover plants that creep on the ground. If the

green space at the grade-separated junction is large enough, it can be designed as a roadside park without prejudice of the safety of vehicles and pedestrians, and the surrounding residents and pedestrians also can come here to play or take a rest. The height of the green hedge in the grade-separated junction green space should be lower than 0.7 m, to ensure that the driver has a clear line of sight to observe the traffic flow (Fig. 2D).

5.5 Roadside green space Residents living in cities desire to get close to nature. As the main element of the green space on the street, plants have the functions of purifying the air and reducing noise, so they are very attractive to residents. Surveys have found that people are more willing to walk or stay in the green space beside the street with rich plant landscape when time permits. On the side close to the city road, some anti-smoke and dust-retaining plants can be planted to purify the air, such as *Magnolia grandiflora*, *Koelreuteria paniculata*, *Paulownia fortunei*, *C. camphora*, *Elaeocarpus decipiens* Hemsl., *Sapium sebiferum*, *Viburnum odoratissimum* Ker-Gawl. var. *awabuki* (K. Koch) Zabel ex Ruml., etc. At the entrance or in the central landscape, it is recommended to combine landscape elements such as water features, mountains and rocks to plant plants with rich colors and distinct seasons to form a landmark landscape that attracts people to enter. Plants with high branch points and dense canopy are conducive to the formation of a pleasant under-forest space. The arrangement of leisure facilities can meet the needs of users for chess, card games, chat, and rest (Fig. 2E). In the green space near the residential area, it is required to avoid cultivating plants that may scratch people, such as *Pyracantha fortuneana* (Maxim.) Li, *Mahonia bealei*

(Fort.) Carr., and even more toxic plants such as *Nerium oleander* L. and *Hyacinthus orientalis* L..

5.6 Square and parking lot green space People are the main body of urban square space. When designing an urban square, it is necessary to fully consider the needs of people, conform to their behavioral psychology, and create a humanized space for people's communication, exchange and sharing, and reflect the awareness of humanistic care. In the present cities, slogans prohibiting entry into the lawn are widespread, but in fact the lawn should be a place open to pedestrians. In order to facilitate the maintenance of the lawn, the city administrators turn a blind eye to pedestrians' needs and just forbid the pedestrians to get close to the lawn. This is really a manifestation of lazy governance. It is recommended that administrators refer to some foreign design experience and design open lawns to reflect care for people. In a square, people who play in summer may often need shade, and people who play here in winter need to enjoy the warm sunshine on the seats. In this situation, the design of the square must be mainly planted with large deciduous trees, such as ginkgo, *Platanus orientalis* and so on. In order to shade the vehicles parked in the parking lot, the trees with dense canopies can be planted individually or in rows, such as *Populus tomentosa*, *P. fortunei*, and *Styphnolobium japonicum*. In this way, vehicles and drivers in the parking lot will not be burned by the scorching sun, and the trees in the parking lot form a natural barrier between vehicles and pedestrians, thus it will make pedestrians feel safe and improve the humanization of the parking lot green space (Fig. 2F).



Note: A. street tree green belt; B. dividing stripe green belt; C. roadside green belt; D. traffic island green space; E. street side green space; F. square and parking lot green space.

Fig. 2 Human-centered design of street green landscape

6 Conclusions

Humans come from ancient jungles and have a natural yearning for plants and the natural environment. In the steel jungle of

present cities, such yearning is much more magnified. In order to satisfy human beings' natural longing for green, urban street green

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a significantly higher number of people admitted to official careers in Meipi Village than in Zhuqiao Village. In the comparison of characteristic buildings, it is found that Meipi Village pays more attention to the design of sacrificial space, while Zhuqiao Village pays attention to Fengshui and has more public service space. They all have the same preference for Fengshui. In terms of culture, the farming culture and mercantile culture are same. The difference is that Meipi Village has a red culture, while Zhuqiao Village has a printing culture. The two villages have different characteristics of cultural heritage.

5 Conclusions

In this article, it is found that ancient villages under different cultures have similarities such as location, content of public life and development of commercial culture, and also have differences including structure, road texture and content of daily life. The villages have their own history. We should respect history, conform

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landscape design is indispensable. However, it is necessary to understand that urban life has changed the way of life of human beings in subtle ways. The pursuit of street landscapes by humans is no longer the original barbarity, but a humanized street green landscape adapted to urban life. On the basis of sorting out the types of urban street green landscape, we came up with some pertinent humanized design measures for various types of green landscape. Of course, this study still has obvious shortcomings, such as it is just a qualitative analysis and it lacks quantitative analysis methods in the evaluation of humanization. This is the point that needs to be further improved in the future learning process.

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to culture, and plan to continue their context, rather than to ignore the facts. Only in this way, can the history be better protected, and homesickness be kept.

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