

Building of slow-moving system in Urban Landscape Planning based on the situation of China

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Abstract—Ever since the arrival of post-industrial era, cars have been widely used and popularized in an unexpected degree. In order to decrease the situation of traffic jam, many cities began to search for the construction method of slow-moving system, yet they are lacking of a systematic theoretical support. In this paper will from three aspects (slow-moving network, slow-moving landscape and slow-moving facilities) to research.

Keywords—Slow-moving system, Slow-moving network, Slow-moving landscape, Slow-moving facility, Community way, Leisure way..

I. INTRODUCTION

AFTER experiencing excessive traffic jams, some cities in foreign countries are gradually attaching importance to slow-moving traffics, it is of great significance to the reasonable optimization of travelling structure and the prerequisite for guiding healthy and harmonious development of urban traffic, It attempts to find ways of improving the health of communities through lowering traffic flow and its accompanying pollution and safety hazards. Recently, many scholars begun to research slow-moving system construction methods from traffic level and relevant practice in many cities, It is expected to effectively ease the conflicts between people and vehicles relying on providing independent and continuous traffic network to pedestrians and cyclists. But there is still lack of research in slow-moving landscape, slow-moving facilities and the relationship between slow-moving network and surrounding land use. Apparently in such development context, researches on urban slow-moving traffic from the point of view of an urban designer and explorations of "slow-moving cities" "oriented by human beings" are of great and important significance.

II. SLOW-MOVING SYSTEM IN CHINA

A. Definition of slow-moving system

Slow-moving system refers to urban bicycle traffic, pedestrian system and relevant supporting facilities. Slow-moving traffic in China was firstly proposed by the Shanghai Urban Transport White Paper which was enacted in 2002, and it consists of traffics walking and cycling.

The goal of slow-moving system is to eliminate the dilemma of slow-movers and meet people's demands in safety, comfortableness and freedom. According to these demands, many scholars have summarized three elements of building slow-moving system[1]: They are slow-moving network, slow-moving landscape and slow-moving facilities. Slow-moving network: It is the structure framework of slow-moving system. The road network include cycling, walking. It is the fundamental element to provide people roads for walking and bicycling. Slow-moving landscape: It covers all spaces used by pedestrians and cyclists. The space not only includes the network itself, but also includes network's surrounding environment. It also meets the slow-movers needs in "sight-seeing". Slow-moving facilities: General term for all facilities which have certain functions for pedestrians and cyclists. It is to meet the slow-movers' needs in "use". Therefore, slow-moving network is a starting point of these three elements in building slow-moving system, and then combined with the slow-moving landscape and slow-moving facilities, together to promote the quality of slow-moving system. So, this paper will research from these three aspects (Fig.1).

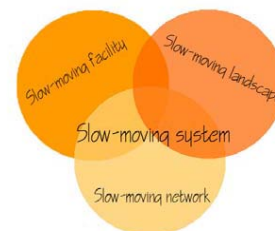


Fig.1: Construction elements of Slow-moving system
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B. Research gap

Presently only a few theoretical researches on slow-moving system were performed in our country, yet they are lacking of a systematic theoretical support. The major resources are the traffic rules enacted by each city and the dissertation researches by scholars. Currently the researches in our country mainly focus on the perspective of urban traffic planning by concentrating on the slow-moving network construction, and ignore the slow-moving landscape and slow-moving facilities. Because of the lack of good coordination and corporation among these three elements, the existing slow-moving system

has not achieved the desired effect.

C. Definition of Slow-Moving System in different cities

1) Shanghai

In 2007, the definition by Shanghai slow-moving System Plan contains meanings of two perspectives: firstly, "slow-moving traffic is an independent traffic means indispensable for gearing with other traffic means, and secondly "slow-moving traffic is not merely a traffic means, but also an important component of urban living system"[2]. The Plan proposes to build over 300 slow-moving cores distributed in the downtown area of Shanghai and decades of slow-moving traffic safety areas--safety islands (Fig.2). Moreover, inside the slow-moving island, by making use of the pedestrian facilities on the express ways, major and secondary ways, as well as the few non-motor vehicle ways paralleling with the major roads, a relatively independent and safe slow-moving traffic space can be offered to short-distance travel [2].



Fig.2: Map of slow-moving district in Shanghai Shanghai Municipal People's Government, 2002.

Picture source: Shanghai Urban Transport

2) Hangzhou

In 2008, Hangzhou has adopted Hangzhou Slow-moving Traffic System Plan and formulated a development strategy of giving priority to development of public traffic: slow-movers first, advocating slow-moving traffic means, implementing "separated ways for fast and slow moving traffics" on the basis of safety, efficiency and equity (Fig.3); consummating the integrated travel means of "public traffic plus slow moving". [3].

The research methods in these cities are mostly taking pedestrian ways and non-motor vehicles as the framework of the slow-moving networks to divide cities into different areas that are connected by slow-moving plus public traffic. Yet the ultimate goal is to release the traffic pressure and to measure the effectiveness and reasonability of slow-moving system by safety and accessibility. Despite

the truth that the construction of the framework of slow-moving systems has built, few citizens can truly use them because the plans remain in the stage of traffic construction, and failed to incorporate the landscape design.

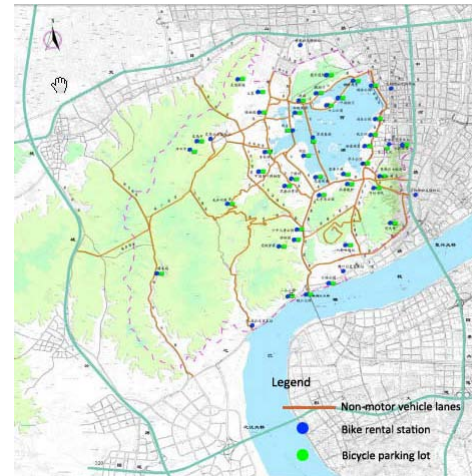


Fig.3: Map of Bicycle network pattern in Xihu scenic spot

Picture source: Compiling key points on the planning of non-motorized traffic system in Hangzhou.

III. BUILDING OF SLOW-MOVING SYSTEM

In light of the research of slow-moving theories as well as the case analysis in the preceding parts, the tenet of building slow-moving system is to pay attention to the subjectivity of human, and regard human beings, urban environment, natural environment, cultural historical environment as a whole. In the construction of slow-moving system, slow-moving network should be taken as the clue. By slow-moving ways, special landscape, environmental facilities and public facilities are connected together, and the interaction among them is also discussed. In the previous chapters the compositions of slow-moving system have been analyzed, that is, slow-moving network, slow-moving landscape and slow-moving facility, and in this chapter, the methods for slow-moving system construction are presented.

A. Slow-moving network construction

Slow-moving network construction in this chapter is from inside out and step by step: firstly, establishment of slow-moving network which depend on different traveling features; then according to the different type of slow-moving network give detail section design of path, and combine with the surrounding natural resources such as rivers, green land to create leisure slow-moving routes; and finally optimization of the design at the joints of slow-moving traffic and motor vehicle ways.

1) Slow-moving way organization

Slow-moving way can be generally divided into commuting way and leisure way. Based on the division and functions of slow-moving area as well as the traveling means, some strategies are given for planning.

Commuting way			
Types of traveling	Within slow-moving area	Neighboring slow-moving areas	Separated slow-moving areas
Features of traveling	Short traveling distance and great advantages in slow-moving	Medium traveling distance, mainly pass through collector roads, branch roads and traffic arteries repeatedly	Long-distance travel, pass through urban expressway and main roads, obstructing slow-moving significantly
Implementations	Slow-moving way within the area	Slow-moving way within the area + Inter-area slow-moving way	Slow-moving way within the area + Inter-area slow-moving way
Planning strategies	Short-distance slow-moving commuting	Short-distance slow-moving commuting+ public transport	Slow-moving+ public traffic+ slow -moving

Tab.1 Slow-moving way organization- Commuting way

Leisure way	
Features of traveling	High requirements on slow-moving environment, also requires good supporting facilities.
Implementations	Slow-moving exclusive way
Planning strategies	build along riverside and scenic area, connect with parks, scenic spots and vast green land

Tab.2 Slow-moving way organization- Leisure way

2) Section design of slow-moving way

Comfortable and safe width of the cycling path

A safe and comfortable cycling environment is important to attract cautious cyclists, the young, old, and women. The width of the bicycle path determines both flow, risk of conflict, and user profiles. Generous width is important to create a comfortable cycling experience. Narrow bicycle paths not only make overtaking difficult and are stressful for the cyclists but also increase the risk of accidents among cyclists. So a comfortable safety path needs enough wide bicycle paths, it can give cyclists margin and increase the pleasure of riding. Standard bicycle path width

A good bicycle path should increase the social pleasure of cycling, so give the space for two cyclists to keep up a conversation is necessary, thereby bicycle paths of minimum 220 cm width make it possible. But, if a third cyclist should be able to overtake them, the width must be 280cm.

Possibility for overtaking

Minimum width of bicycle ensuring safely overtaking another bicycle is 190 cm. "Tricycles are the Lorries of cycling and need extra wide cycle paths not to block the bicycle-traffic. They can carry both goods and people and should be accommodated well into the bicycle environment" (Hermansen, et al.).Exceptions- minimal version: According to the traffic engineering manual: "The minimum width of a path is 130cm" (China institute of highway traffic engineering manual editorial board, 1998).



Fig.4 Bicycle lane width of the sample
Picture source: Mexico_City_Gehl_toolbox

3) Section design of commuting way
Instruction on the section design of various slow-moving ways based on its classification:

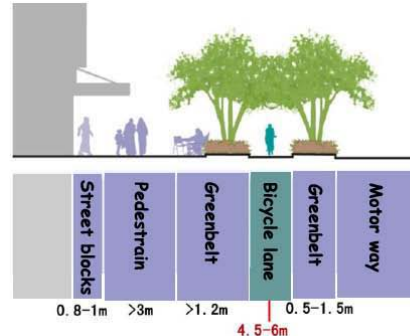


Fig.5 Slow-moving corridor

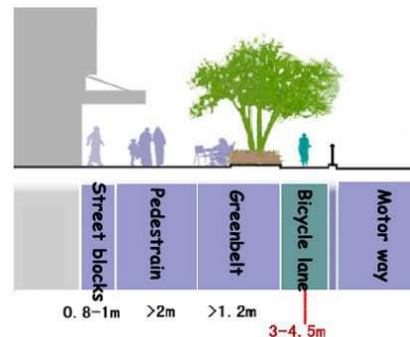


Fig.6 Slow-moving passage

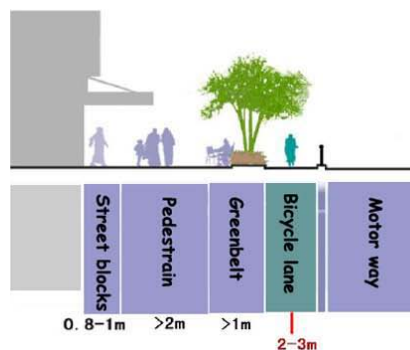
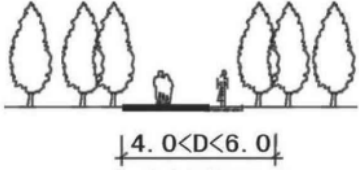
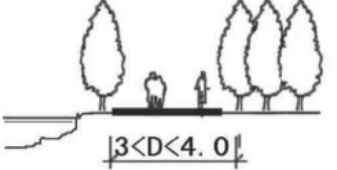
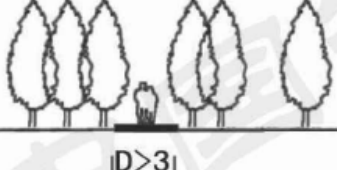


Fig.7 Slow-moving collector-distributor way

4) Section design of leisure way
Section design of leisure way shall be based on the width of existing ways when the minimal section is larger than 1.5m; when the road section (D) 1.5m<D<3m, the way can be taken as pedestrian way only; when m<D<4 m,

slow-moving integrated way can be built, and when $4m < D < 6m$, slow-moving integrated way can be built with separation from pedestrian way by colorful pavement [5].

Types of way	Standard section diagram	Capacity
Leisure way	 <p>Separate pedestrian way and non-motor vehicle way by pavement</p>	639 vehicles/H
	 <p>Slow-moving integration</p>	497 vehicles/H
	 <p>Pedestrian way only</p>	Low capacity

Tab.3 Section design of leisure way

B. Slow-moving landscape design

In light of the analysis in the preceding chapter, we can conclude that slow-moving ways can be divided into commuting and leisure ways, therefore construction of slow-moving landscape can also be classified as street landscape and natural landscape accordingly. This chapter will propose different landscape design methods as per these two types of slow-moving ways.

1) Street landscape

Street landscape refers to the landscape in the space along the slow-moving ways and aims at fusing slow-moving with urban life, and allowing people to feel the charm and interest of slow-moving space. In order to meet the above requirements, street landscape should be characterized in the following features: good accessibility, and no influence on the connectivity of slow-moving ways; attractive and appealing, including the multi-functional streets along the slow-moving ways, diversified building surface with proper colors, and street plazas etc.[6]. Through the above requirements, slow-movers can be provided with diversified visual contacts. Their requirements in shopping and going to world can also be satisfied, while their needs in entertaining, relaxing and exercising can also be met as well. Therefore, this chapter will discuss slow-moving landscaped design from these perspectives [7]:

Street landscape with mixed functions (Fig.8)

Color design of street buildings

Design of building facades at ground floor
Natural and ecologic slow-moving landscape

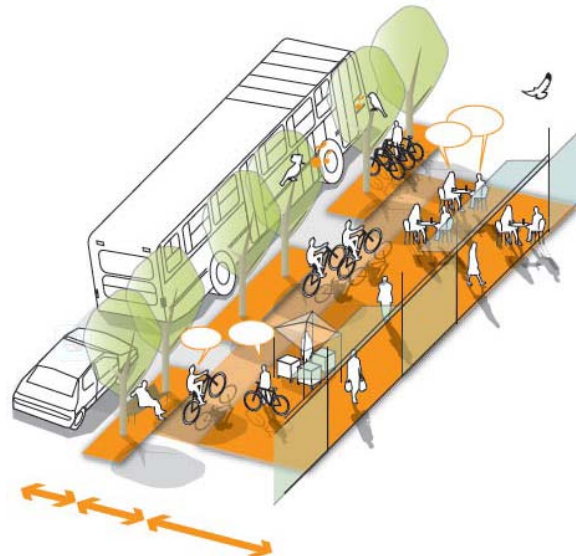


Fig.8 More space and better quality in slow-moving
Picture source: Mexico_City_Gehl_toolbox

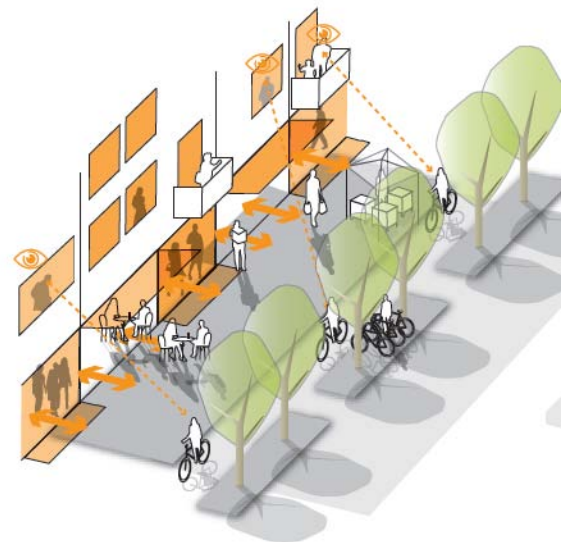


Fig.9 Diagram of positive construction interface
Picture source: Mexico_City_Gehl_toolbox

C. Building of slow-moving facilities

1) Bicycle parking facilities

A good slow-moving system should provide a lot of parking options to cyclists, “from short stays to long stays, from on street parking to highly protected parking within parking structures and finally bicycle parking that can be placed in buildings that promote bicycling, educate and inspired for bicycling topics” [7]. In order to invite more people to use cycling, we should provide a positive cycling-environment, make people not only have a secure parking place, but also provide convenience to cyclists, so bicycle parking facilities should always be placed where people are and where people want to go. So, we should give slower-mover a safe and convenient location (Fig.10).

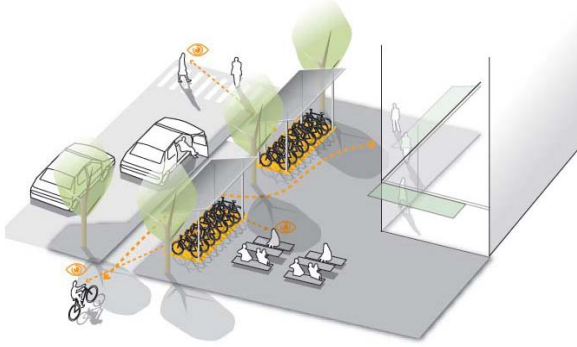


Fig.10 A safe and convenient location for bicycle parking

Picture source: Mexico_City_Gehl_toolbox

2) Public bicycle rental facilities

Public bicycle rental facilities is a good supplementation to the slow-moving traffic tools and extends the starts and terminal ends of public traffic service. Public bicycle rental facilities should be built as per the following principles:

① Give a systematic consideration to the rules of rail transit, BRT and normal public traffic, waterway traffic to optimize the whole public traffic system.

② Combine with critical traffic nodes, such as rail transit exchange sites, bus stations, pedestrian shopping area, tourist attractions, etc.

③ Be in harmony with the land use and surrounding buildings, take no influence on the surrounding buildings and well gear with the cycling way inside the slow-moving system.

④ Economical use of land and keep the bicycles in order. The following sites are preferred to be rental place: main entrance and exit of residential area, inside large communities, main entrance and exit of scenic spots and schools, and major traffic stations etc..

3) Pedestrian crossing facilities

The pedestrians crossing facilities can be divided into plane crossing facilities (like zebra crossing) and 3D crossing facilities (like overcrossings), yet their design should insist to the following principles: Principle of security: Crossing facilities are built for eliminating or at least alleviating the conflict between pedestrian and vehicles on one hand, on the other hand providing a safer crossing choice for vulnerable groups including the old, kids, the disabled and so on. Principle of convenience: The type, site and interval distance of crossing facilities can be determined based on the convenience degree of street crossing. They should well coordinate with the entrance or exit of residential communities, bus stations and the entrance or exit of business area. Principle of comprehensive use: crossing facilities is not only an important traffic space, but also a kind of public space which can be utilized comprehensively. In particular, 3D street-crossing facilities can be combined with commercial development and advertising to make the slow-moving space more diversified and interesting.

4) Setting of zebra crossing

Setting of crosswalks should also take the motor vehicle users and pedestrians' safety and convenience into consideration. First of all, settings of pedestrian crossing should give consideration to the whole road, based on which the number of zebra crossing can be determined.

IV. CONCLUSION

Based on the existing theoretical conclusion, detailed design methods are concluded in this essay. Under the guidance of construction principles, traffic network division and organization strategies, slow-moving landscape design thought and slow-moving facilities construction requirements are proposed. Taking slow-moving network as the foundation and backbone of the whole construction, commuting slow-moving ways and leisure slow-moving ways are generated--route organization and cross section design, followed by network optimization, slow-moving node construction--the detailed design of crossroads and pedestrian crossing facilities.

Slow-moving landscape design thought is related with slow-moving network design through building street landscape, creating special artificial landscape and using natural landscape skillfully. As for the street landscape design, through mixed function construction, street charm can be reinforced. Moreover, color and facet design of street buildings can reinforce visual effect.

Moreover, special artificial landscape can bring dynamic landscape to slow-moving ways. Enhancement of the fun of slow-moving landscape is mainly preceded from theme landscape and historical cultural landscape. Skillful use of existing natural landscape should be in consistence with the original landforms, combining with the natural water body with protection of the existing vegetation landscape. Slow-moving facilities should meet humanized requirements, comply with the principle of beautiful appearance and agree with the characters of construction sites. Slow-moving facilities should not only be qualified in safety, comfortableness and accessibility, but also comply with the principle of beautiful appearance, that is, to pay attention to diversification and unification, color and materials, rhythm and rhyme, symmetry and balance. Finally slow-moving facilities should agree with the characters of construction sites in order to make slow-moving facility to be a beautiful landscape of cities.

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