

Research on the Development Mode of Slow Traffic System in Cities Based on Low-carbon Concept

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Abstract The slow traffic system, which has a series of advantages including low cost of traveling, green environment protection and fewer resource-consuming, indicates its important role in the urban traffic system. This paper, through the research on the slow traffic system and based on current slow traffic system construction, puts forward new urban traffic mode including connection of “BRT (bus rapid transit) and PBFR (public bike free rental), integration of NBT (Normal Bus Transit) and TBB (take bicycle on bus), and planning of SCF (special cycle facilities) and SFW (special foot way) and NBT(normal bus transit).Finally,the paper Provides a reference for exploring urban green and sustained development.

Key words Slow traffic; Sustained development; Traffic mode; System planning; Low-carbon

1 Introduction

The 21st century is the century of advocating green environment protection and sustained development. The slow traffic which is represented by walking, bicycle, walking & bus, bicycle & bus and so on, is not only an important means to achieve green environment protection and sustained development but also a solution to end interface of the last mile in urban transportation. In the context of increasingly severe urban traffic and deteriorating living environment of urban residents ascribable to sharp increase of the urban population and motor vehicles, it is very urgent to develop ecological city construction based on slow traffic system.

2 Definition and Feature

Slow traffic is a traffic mode which leads urban residents to change their transportation from private car to public transportation, through close combination among walking, bicycle and public transit system etc, develops and advocates a multi-system, such as walking & bus and bicycle & bus so as to hold back waste of city recourse, reduce car trips, lessen the tail exhaust, alleviate urban traffic jams, increase travel efficiency of residents and realize the seamless engagement.

Table 1 Index Parameter of Main Urban Transportation in Normal Speed

Means of transportation	Speed (km/h)	Dynamic space taken (m ²)	Average num. of load bearing people (man)	Average space taken by passenger (m ²)	User cost (Yuan)
walking	3~5	1.0	1.0	1.0	0
bicycle	10~15	8.0	1.0	8.0	0.3
motorcycle	15~40	40.0	1.2	33.3	4
Compact car	20~50	120.0	1.5	80.0	18
bus	16~25	80.0	50.0	1.6	1.5

(Source: Urban Traffic)

From the above definition and Table 1, we can easily find that, under the same operating condition (normal speed), compact cars rank No. 1 in average area taken by passenger, secondary to motorcycle and walking, bicycles and buses occupy the least, which can easily explain why car trips are villain for urban traffic jam. Therefore, developing slow traffic, such as walking, bicycle and bus, is an important means to reduce such pressure. Additionally, in terms of resource consumption, compact cars also consume most, then motorcycles, after that are walking, bicycles and buses. It also indicates that choosing walking, bicycle and bus can effectively save resource and meet the requirements of urban low-carbon living and sustainable development.

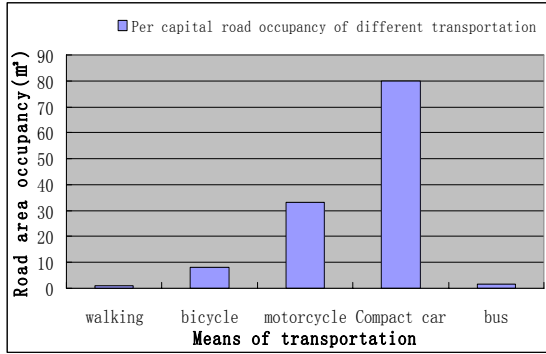


Figure 1 Per Capital Road Occupancy

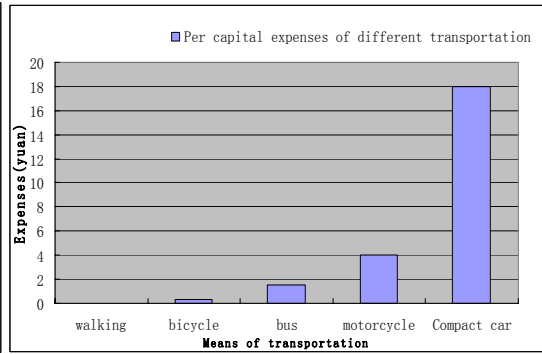


Figure 2 Per Capital Expenses

To sum up, we can easily know that the slow traffic has following features: environmental protection, alleviating traffic jams, suitable for short trips (as below Tab.2 shown), fewer resource-consuming (as Fig.2 shown), widespread in every corner of city and realizing the seamless connection of “door to door” and “the last meter”.

Table 2 Relationship Between Trip Mode and Distance of Residents in Large and Medium Cities

trip distance (km)	Walking(%)	bicycle(%)	bus(%)	Cars and others(%)
0—1	6.5	32	0.7	2.3
1—2	30	60	1	9
2—3	15	50	15	20
3—4	9	40	20	31
4—5	2	30	40	28
5—7.5	0	20	50	30
7.5—10	0	10	50	40
10—15	0	0	50	50
>15	0	0	40	60

(Source: Urban Traffic)

3 Orientation of Slow Traffic

The slow traffic is a trip mode which is basic and natural to us. A complete urban transportation system surely consists of rapid transit and slow transit, two of which are complementary to each other. The combination of rapid and slow transit is necessarily required by harmonious development of urban transportation.

Nowadays, due to unbalanced development of rapid and slow transit (the rapid transit develops well while the slow traffic is nearly neglected), it is necessary to pay attention to developing the slow traffic. No matter how advanced the rapid transit is, the terminal traffic problem cannot be solved. The “last meter” shall be settled by slow traffic. The slow traffic, featuring low cost, environmental protection and fewer resources-consuming, indicates its significant position in the whole urban transportation system, especially in the green transport construction and sustainable development.

4 Status Quo of the Slow Traffic

Considering the future transportation development and unbalanced development of current rapid and the slow traffic, some governments in developed coastal cities have paid attention to the slow traffic and promulgated a series of policies to enforce the construction of slow traffic. Of the total, Shanghai, relatively prominent among other cities, took the lead in carrying out the subject called *Research on slow traffic System in Shanghai* in 2007, and soon launched *Shanghai slow traffic System Planning*, ensuring it to become the first city which included the slow traffic into the important subject of urban transportation science and technology and practically made it clear the importance of slow traffic in urban traffic system.

Wuhan has also taken some corresponding measures in the construction of slow traffic system. Against the backdrop of double-oriented society (resource-conserving and environment-friendly society)

construction, Wuhan timely launched *Implementation Measures on Public Bike Free Rental system*. According to relevant statistics, the rental sites in Wuhan have already reached more than 840 by the end of 2009. With the issue of such measure, the pressure on rapid transit transfer was relieved to some extent, car trips were reduced and urban air pollution was lowered.

Although some cities have taken measures for developing slow traffic, the slow traffic still was in a weak position in our urban transportation. Insufficient attention, lack of development and irrational development mode can be regarded as bottleneck in restricting development of slow traffic.

5 Research on the Slow Traffic Development Mode

As far as I am concerned, the slow traffic, as the indispensable supplementary in city rapid traffic and significant position in the future Urban Transportation system planning, is still far from own sufficient research. It needs more deeply and comprehensive research. Considering this reality, we make a preliminary discuss about the slow traffic development mode based on the realistic urban traffic development.

5.1 The mode of connected “Bus Rapid Transit” and “Public Bike Free Rental system”

BRT ,short for bus rapid transit, is a new type urban public transport system, by opening a specialized bus lane equipped with the specialized bus and building a new type of bus station. It makes the traditional public transit system up to the service level of the rail transit utilizing the modern mass transit technology with the operation management of Intelligent Transportation System(ITS), while the investment and the operation cost of BRT is lower than that of ITS and is as same as the cost of normal mass transit system. The mode of “Bus Rapid Transit and Public Bike free Rental (hereinafter referred to as PBFR)” is a transportation mode with low-carbon, harmony and high efficiency through setting PBFR sites connected to BRT stations, aiming at realizing seamless connection in residents’ trips, lowering the trip generation rate of motor vehicles such as private cars, alleviating the traffic jam, reduce the air contamination and increase the efficiency of residential trip.

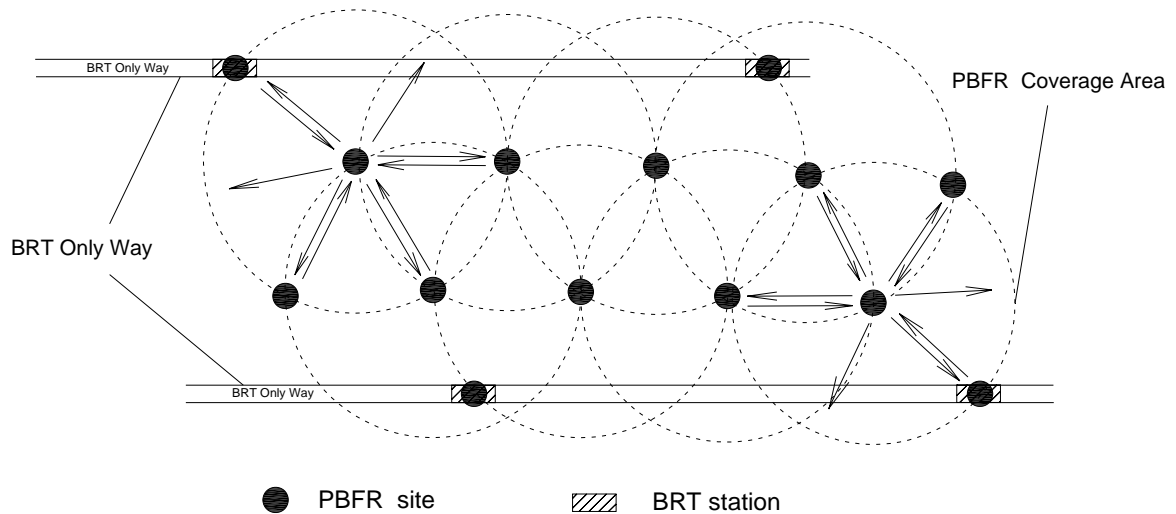


Figure 3 Planning Diagram of Connected Mode — “Bus Rapid Transit and Public Bike Free Rental System”



Figure 4 Public Bike Free Rental (PBFR) Site



Figure 5 Bus Rapid Transit (BRT) Station

This mode characterizes:

- (1) Leveraging advantages of BRT and bicycle system, through rational combination of high-capacity and rapidness in BRT with high accessibility and flexibility in bicycle system;
- (2) Forming a high efficiency transportation mode with “combination of fast and slow traffic and highly efficiency and harmony”;
- (3) Easily planning and implementing due to its low investment in urban infrastructure construction.

Applicable areas:

- (1). Regular street distribution;
- (2) Cities which have enormous urban population, traffic jam area, high usage of urban roads;
- (3) Cities which have insufficient government financial expenses in urban transportation infrastructure construction.

5.2 Mode of integrated Normal Bus Transit & Take Bicycle on Bus

The so called mode of integrated Normal Bus Transit and Take Bicycle on Bus enlarges passenger vehicles and sets a carrier zone in the extended area, which enables passengers to couple seamlessly buses and bicycles and improve transfer efficiency.

This mode characterizes:

- (1) Realizing the mobility and real-time convergence of transportation mode and combining advantages of bike and public transportation to the greatest degree;
- (2) Reducing the construction of bicycle parking lots and rental facilities;
- (3) Improving the transfer efficiency of bicycles and buses effectively;
- (4) Lowering the government’s investment in traffic infrastructure construction.

Applicable areas:

- (1) Having undeveloped bus rapid transit;
- (2) Where urban traffic infrastructure construction is imperfect or relatively lagging;
- (3) Where the governments lack of funds in traffic infrastructure construction.

5.3 Planning mode of slow traffic system consisting of special cycle facilities, special foot way and normal bus transit

Planning mode of slow traffic system consisting of “‘special cycle facilities’ (hereinafter referred to as SCF), ‘special foot way’(hereinafter referred to as SFW) and ‘normal bus transit’ (hereinafter referred to as NBT)” refers to set up a green, flexibly linked and orderly operated transportation planning mode based on slow traffic system which can give full play of all transportation, effectively relieve the deteriorating of local transportation, improve living environment of regional residents and their life quality.

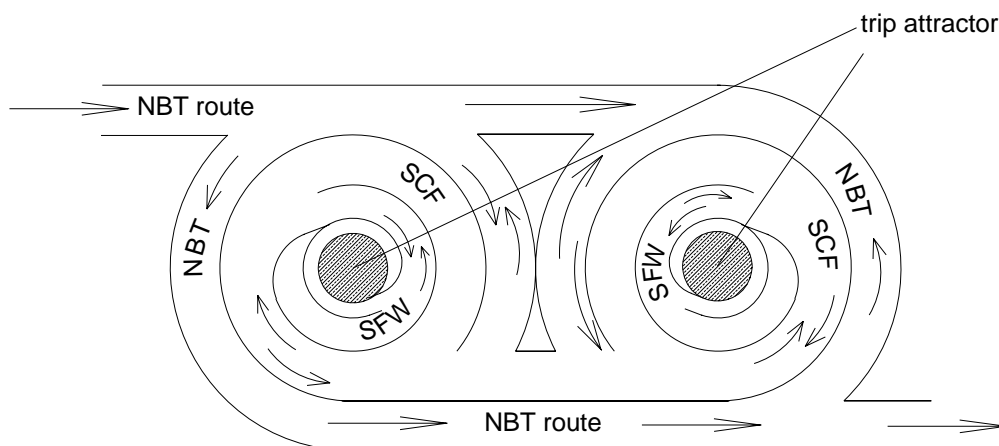


Figure 6 Concept Plan of Slow Traffic System Consisting of “SCF, SFW and NBT”

As is shown above, the special cycle facilities are set only for bicycles, totally different from general cycle path that we saw in ordinary life. Apart from only allow bicycles rather than pedestrians and other motor vehicles to pass through, More importantly, they are painted with special warning colours (red, yellow or green) and have warning signs in their entrances and exits. As such, special foot way, different from the ordinary foot way which is always occupied by motor vehicles at will and does

not get a position in the traffic system is entitled to special and complete legal status and inviolable share in traffic through traffic laws and regulations once the planning mode is established. It also has special warning signals and routeway just like special cycle facilities.

This mode characterizes:

(1) Having a structure of crawler-type double helix, well arranged, which facilitates for different traffic modes in sound operations, complementary with each other;

(2) Establishing a good operation mode (see Figure 6) of slow traffic system, which has triad consisting of the external structure in NBT, central link in special cycle facilities and terminal access in special foot way;

(3) Requiring large quantities of government's capital investment in infrastructure construction due to its huge system planning.

Applicable areas:

(1) Having incomplete traffic facilities and large potentials of planning, generally for comprehensive plans in transportation of new urban areas;

(2) Where governments have sufficient funds in infrastructure construction of urban traffic;

(3) Where current transportation modes have had a certain size but are in a mess, without effective integration and good transfer link.

6 Conclusions

The development mode of slow traffic system in cities is necessary for creating a good living environment for urban residents. It is also the important research content of green and sustained development of urban transportation. This paper has done preliminary research on different modes of slow traffic system, which provides a breakthrough point for slow traffic system applicable to green harmonious and sustained development of cities, as well as idea and reference for relevant government departments and urban transport planning institutions in studying green and sustained development of urban transportation.

References

- [1] Li Ye. Discussion on Shanghai Non-motorized Traffic System Planning[J]. Urban Traffic, 2008,9 (7): 68-72 (In Chinese)
- [2] Zhang Yang, Zhao Yixin, et al. Layout Patterns of BRT Lanes and Turnouts[J]. Urban Traffic. 2009, 5(7): 27-34 (In Chinese)
- [3] Lv Guolin, Zhang Xiaochun. Biking System Development and Network Planning in Shenzhen[J]. Urban Traffic, 2008, 6 (7): 47-49 (In Chinese)
- [4] Qian Dalin, Liu Jiaming. Analysis on Arrival Distribution of Bicycles[J]. Mathematics in Practice and Theory, 2004, 34(5): 81-83 (In Chinese)
- [5] Guan Hongyi. Study on Urban Bicycle Traffic System[D]. Chengdu: Southwest Jiaotong University, 2004 (In Chinese)
- [6] Du Yulin, Niu Xueqin. Analysis and Management concerning Urban Slow Traffic Problem in the Downtown of Shijiazhuang [J]. Journal of Shijiazhuang Institute of Railway Technology, 2006, (3): 66-70 (In Chinese)
- [7] Zhumin, Zhou Nanchang, et al. Consideration and Improvement of Bicycle Transportation System in the Downtown of Tianjin[J]. Urban Planning, 2003, 3(4):61-64 (In Chinese)
- [8] Wang Fuding. Countermeasures for the Future Development of Bicycle Transport in China[J]. Planner, 2001,17(6):90-92 (In Chinese)
- [9] Yu Wencheng. Initial Research into Bicycle Traffic in the Downtown of Guilin[J]. Transportation Science and Technology, 2003 (4): 75-77 (In Chinese)
- [10] Wen Guowei. Systematic Planning for Urban Transportation and Roads[M]. Beijing: Tsinghua University Press, 2001 (In Chinese)
- [11] Xu Weici. Discussion on Urban Transportation Planning[M]. Shanghai: Tongji University Press, 1998:268-286 (In Chinese)
- [12] Feng Feifei. Building a Seoul Suitable for Walking[J]. Beijing City Planning and Construction Review, 2004,(4): 114-115 (In Chinese)
- [13] Zhu Hong. Three Major Subjects of China's Metropolitan Transportation Development[J]. Urban Public Transportation Planning and Management, 2002, 6 (3): 26-29 (In Chinese)

- [14] Jim Pravetz. A Review of Bicycle Policy and Planning Developments in Western Europe and North America[J]. Office of Transport Policy and Planning Government of South.Australia, 1995, (7): 6-9
- [15] Reid E. Traffic Calming: State of the Practice[J]. Washington, D.C.: Institute of Transportation Engineers, 1999,(8)
- [16] Lu Ke.Pan Haixiao. Evolution of Pedstrian Environment in Urban Area: Reviews of the Pedestrian Environment Improvement Practice in UK, Germany and USA[J]. Urban Planning Overseas, 2001, (6): 39-43