Experience of Developing Urban Transport systems in China

Expert Group Meeting on Planning and Assessment of Urban Transportation Systems

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September 22, 2016
Part 1

Introduction
Introduction

● Background and status of urban transport systems
General condition: Rapid expansion of urban population and area, significant increase of supply of traffic infrastructure, but the traffic demand grows faster

Town retains the farming community transport form; Transport was mainly on foot, waterway and horse carriage

At the beginning of the last century

After cities opened in China, modern road network appeared

People have private cars exceeded 100 Million cars, more than 200 Million electric moped

21st Century

1900

1950

1980

1990

2000

Emphasis was on the construction of public transport, mainly on electric buses.

Period for bicycle as an important means of transport

Focus on road construction to adapt to car-based society

Rapid development stage

Focus on the construction of bicycle system

After 50s
Introduction

- **Background and status of urban transport systems**
  - **Comprehensive transportation** has made great progress in China
  - **Urban transport** develops fast and contentious

2003-2015 Growth trend of passenger volume in China (million people/Year)

2009-2015 Growth trend of urban passenger traffic volume in China (million people/Year)
Introduction

- Background and status of public transit systems

Adhere to the development of public transport

<table>
<thead>
<tr>
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<tbody>
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<td>Transit companies are the main public transport providers</td>
<td>At the national level, proposed priority development is on public transport policy</td>
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</table>

25 cities,
Track total mileage: 3286 km

- Background and status of public transit systems

Adhere to the development of public transport

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Introduction

- **Background and status of public transit systems**
  Adhere to the development of public transport

- The State Council approved the Urban and Rural Construction and Environmental Protection Department Report on the city public transportation reform
- Circular to strengthen urban construction work
- Suggestion of the Ministry of construction on giving priority to the development of urban public transport
- Circular from the General Office of the State Council on forwarding the opinions of the Ministry of Construction and other departments on giving priority to the development of urban public transport
- Guidance of the State Council on prioritizing urban public transport development

August 27, 1953, Beijing Daily
Part 2

Urban transport policies
Urban transport policies

National urban transport policies
Governmental guidance to the direction of urban development

“New National Urbanization Plan” put forward the rapid urbanization and development of China, and has promoted urban agglomeration as its main form of development. Based on the concept of urban agglomeration and node cities, this placed other cities and towns as an important part, in coordination with the development of big, medium-sized and small cities. This concept follows the "two vertical and three horizontal" strategic pattern of urbanization.

“A number of suggestions to further strengthen urban planning and construction management work is to “put forward the overall goal of urban planning and construction management: to achieve the orderly construction of the city, moderate development, efficient operation, to build a harmonious and livable life, a vibrant, distinctive modern city, to make people's lives better.”
Urban transport policies

- National urban transport policies

Public transport priority development policies
Develop public transport (since the founding of new China) - Develop public transport (1990) - Give priority to the development of public transport (2005) - Public transport priority development (2012-)

<table>
<thead>
<tr>
<th>Time</th>
<th>Places</th>
<th>Issues</th>
<th>Meeting scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-03-03</td>
<td>Beijing, China Urban Planning and Design Institute</td>
<td>Internal start</td>
<td>Total group task</td>
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<tr>
<td>2012-03-15</td>
<td>Beijing, CSC IEAS</td>
<td>Official opening</td>
<td>General group task, public funding authority</td>
</tr>
<tr>
<td>2012-04-11</td>
<td>Beijing, CSC IEAS</td>
<td>General task</td>
<td>Total group task</td>
</tr>
<tr>
<td>2012-04-22</td>
<td>Beijing, Beijing Transport Research Center</td>
<td>Urban public transport priority</td>
<td>General group task, public funding authority</td>
</tr>
<tr>
<td>2012-05-13</td>
<td>Beijing, Beijing Municipal Commission of Urban Planning</td>
<td>Subtopics work promotion</td>
<td>Total group task</td>
</tr>
<tr>
<td>2012-06-05</td>
<td>Shanghai, Tongji University</td>
<td>Preliminary report on outcome of the subtopics</td>
<td>General group task, public funding authority</td>
</tr>
<tr>
<td>2012-07-07</td>
<td>Beijing, Beijing Transport Research Center</td>
<td>General task</td>
<td>Total group task</td>
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<tr>
<td>2012-08-04</td>
<td>Nanjing, Nanjing Institute of City and Transport Planning Co., Ltd</td>
<td>Report on outcome of the subtopics</td>
<td>General group task, public funding authority</td>
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<tr>
<td>2012-09-02</td>
<td>Beijing, Beijing Municipal Commission of Urban Planning</td>
<td>Review and preparation in the midterm</td>
<td>Total group task</td>
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<tr>
<td>2012-09-19</td>
<td>Beijing, Fengshian Jinyu Spa Resort</td>
<td>Midterm review</td>
<td>General group task, public funding authority, Expert review,</td>
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<tr>
<td>2012-12-01</td>
<td>Guangzhou, International Mediterranean Hotel</td>
<td>Total topic draft</td>
<td>Total group task</td>
</tr>
<tr>
<td>2012-12-22</td>
<td>Hangzhou, West Lake Hillview Int’l Hotel</td>
<td>Preparation of summary</td>
<td>General group task, public funding authority</td>
</tr>
<tr>
<td>2013-01-25</td>
<td>Beijing, Beijing Municipal Commission of Urban Planning</td>
<td>General topic</td>
<td>Total group task</td>
</tr>
</tbody>
</table>

Public transport priority development —— In the urban administrative area, through the priority allocation of resources, build up and adapt to the market mechanism, government regulation and control, conform to the local economic and social development stage, public transport system with equal and efficient public services provided by various types of enterprises and other business organizations, lead traveler choose optimally, to guide urban intensive use of land and to save energy, protect and improve the living environment.

(Research achievements of the National Natural Science Foundation of China)
Urban transport policies

- National urban transport policies
  Traffic demand management policies
  - New opportunities for urban traffic demand management in the information age
  - Demand management is an important theoretical concept in urban traffic. Not limited to
  management measures, it should include the evaluation of existing policy effects, analysis of the
differences in domestic policy environment, and guide the construction of facilities, paying more
attention to the internal coordination and effectiveness of the transportation system, while
ensuring good balance with the urban space.

Theoretical studies that have been carried out

a) Based on accurate understanding of transport demand characteristics, evaluate on different aspects of
traffic demand management measures, to explore alternative ways to manage urban traffic demand under
changing country conditions. We should pay attention to the time effectiveness of each measure, public
acceptance and financial capacity of the government.

b) Use information technology to understand perception on individual behavior and travel demand. Based
on the aim, principle and the elements of traffic demand management, establish and evaluate the methods
and mechanism of transportation policy formulation and evaluation, construct urban traffic demand
management policy system framework using big data.
Urban transport policies

- Ongoing and planned major urban transportation projects
  - Guangzhou BRT
    - Urban construction of large ground transportation system model
    - Maximum maximum transect volume exceed **2.69 million people/One direction / hour**, Asia's busiest BRT system
    - It was awarded the “**Beacon Award**” by the Secretariat of the United Nations Framework Convention on Climate Change

![Graph showing passenger volume and speed comparison](image)
Urban transport policies

- **Ongoing and planned major urban transportation projects**
  - Guangzhou BRT

- Avoid **blindly copying and relying on rail transit priority development models** without taking into **consideration the local economic** and social development, and to fully **integrate, renovate and transform**, and **make full use of existing facilities** to complement ecological urban renewal.

- Help **solve “the last mile”,** improve public choice of public transport trips.
Urban transport policies

- **Ongoing and planned major urban transportation projects**

  Guangzhou BRT

  More than 20 cities have built BRT systems: Beijing, Guangzhou, Lanzhou, Hefei, Changzhou, Yichang, Yiwu……

  \[ \text{BRT+Greentransport=urban vitality} \]
Urban transport policies

- Ongoing and planned major urban transportation projects

  Hangzhou public bicycle sharing system

- By the end 2015, Hangzhou has built 3504 service points, 84,100 vehicles. Total number of bike rental has reached 114.5 Million bikeshare users, frequency of bike rental per day has reached 313,600 bikeshare users. **Daily maximum rental reached about 44.86 Million users.**

- In October 2013, American newspaper “USA Today” reported that Hangzhou public bicycle scheme is **the world's 16th best public bicycle sharing scheme.**

- In 2015, it won the 2nd Tehran Golden Adobe Award presented by the Tehran municipal government and UN-HABITAT during the World Cities Day and the 2015 National Golden Card Project.
Urban transport policies

- Ongoing and planned major urban transportation projects
  Hangzhou public bicycle sharing system

- Make the best use of the local conditions to meet people's demand for urban transport services
- Fully reflects the differences in "public transport priority development":
  a) It complements public transport capacity in large cities and megacities in China.
  b) It is an important measure and model to improve the quality of urban travel in small and medium-sized cities.
Urban transport policies

- Ongoing and planned major urban transportation projects
  
  Hangzhou public bicycle sharing system
  
  More than 120 cities to provide public bicycle service to promote urban green transport revival.
  
  2010: Ministry of Housing and Urban-Rural Development launched "China's urban pedestrian and bicycle traffic system demonstration project"

  - 2014: Carried out the third phase of demonstration project to scale up
  - More than 123 cities, 200,000 service sites, 510,000 bicycles, 11x bigger than the French system.

The total number of public vehicles operating in different countries
Part 3

Urban transport indicators
Urban transport policies

Transit Metropolis indicators
In order to guide the establishment of Chinese Transit Metropolis, identify the performance measurement objectives in each city, and scientifically evaluate the performance of Transit Metropolis development, Ministry of Transport enacted the indicators system of performance measurement for Transit Metropolis.

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator Name</th>
<th>Indicator Type</th>
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<tr>
<td>1</td>
<td>Motorized modal share of public transit</td>
<td>Measurement</td>
</tr>
<tr>
<td>2</td>
<td>500-meter coverage ratio of public transit stations</td>
<td>Measurement</td>
</tr>
<tr>
<td>3</td>
<td>Public transit vehicle ownership 10 thousand per capita</td>
<td>Measurement</td>
</tr>
<tr>
<td>4</td>
<td>Public transit on-schedule rate</td>
<td>Measurement</td>
</tr>
<tr>
<td>5</td>
<td>Average speed of public transit vehicle in peak hours</td>
<td>Measurement</td>
</tr>
<tr>
<td>6</td>
<td>Degree of satisfaction of public transit passengers</td>
<td>Measurement</td>
</tr>
<tr>
<td>7</td>
<td>Utilization rate of public transit smart card</td>
<td>Measurement</td>
</tr>
<tr>
<td>8</td>
<td>Number of daily public transit trips per capita</td>
<td>Reference</td>
</tr>
<tr>
<td>9</td>
<td>Average age of public transit vehicles</td>
<td>Reference</td>
</tr>
<tr>
<td>10</td>
<td>Income level of public transit employees</td>
<td>Reference</td>
</tr>
<tr>
<td>11</td>
<td>Energy consumption intensity</td>
<td>Reference</td>
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</tbody>
</table>
Urban transport policies

● Transit Metropolis indictors

(1) Motorized modal share of public transit
• Definition: In the statistical period, the percentage of resident trips using public transit in total motorized trips (unit: %)
• Computing method:

\[
motorized \ modal \ share \ of \ public \ transit = \frac{public \ transit \ trips}{total \ motorized \ trips} \times 100\%
\]

(2) 500-meter coverage ratio of public transit stations
• Definition: In the statistical period, the ratio of the area of 500-meter coverage by public transit stations to the area of built-up area in the city centre. (unit: %)
• Computing method:

\[
500-\text{meter coverage ratio of public transit stations} = \frac{area \ of \ 500-\text{meter coverage by public transit stations}}{area \ of \ built-up \ area \ in \ the \ city \ centre} \times 100\%
\]
Urban transport policies

● Transit Metropolis indictors

(3) Public transit vehicle ownership 10 thousand per capita
   • Definition: In the statistical period, the equivalent number of public transit vehicle ownership per 10 thousand people, calculated by the urban population. (unit: veh/10 thousand people)
   • Computing method:

   \[
   \frac{\text{public transit vehicle ownership per 10 thousand people}}{\text{urban population}} \times 100\%
   \]

(4) Public transit on-schedule rate
   • Definition: In the statistical period, the average on-schedule rate of buses and mass transit railway. (unit: %)
   • Computing method:

   \[
   \frac{\text{public transit on-schedule rate}}{2} = \frac{\sum (\text{on-schedule departure runs} + \text{on-schedule arrival runs})}{\sum (\text{total planned runs} \times 2)}
   \]

   \[
   = \frac{\sum (\text{on-schedule departure trains} + \text{on-schedule arrival trains})}{\sum (\text{total planned trains} \times 2)}
   \]
Urban transport policies

● Transit Metropolis indictors

(5) Average speed of public transit vehicles in peak hours
• Definition: In the statistical period, the average annual speed of buses carrying passengers. (unit: km/hr)
• Computing method:

\[
\text{average speed of public transit vehicles in peak hours} = \frac{\sum \text{average speed of public transit runs in peak hours}}{\text{total number of runs in peak hours}}
\]

(6) Degree of satisfaction of public transit passengers
• Definition: In the statistical period, the average rates of valid questionnaire on performance investigation for the level of service of public transit. (unit: %)
• Computing method:

\[
\text{degree of satisfaction of public transit passengers} = \frac{\sum \text{score of single valid questionnaire}}{\text{total number of valid questionnaire}} \times 100\%
\]
Urban transport policies

● Transit Metropolis indictors

(7) Utilization rate of public transit smart card
• Definition: In the statistical period, the percentage of passenger volume using smart card in total public transit passenger volume. (unit: %)
• Computing method:

\[
\text{utilization rate of public transit smart card} = \frac{\text{passenger volume using smart card}}{\text{total public transit passenger volume}} \times 100\%
\]

(8) Number of daily public transit trips per capita
• Definition: In the statistical period, number of daily public transit trips per capita made by residents in urban area. (unit: times)
• Computing method:

\[
\text{number of daily public transit trips per capita} = \frac{\text{annual public transit passenger volume}}{365 \times \text{transfer coefficient} \times \text{urban population}}
\]
Urban transport policies

● Transit Metropolis indictors

(9) Average age of public transit vehicles
• Definition: In the statistical period, average applicable age of public transit vehicles in urban area. (unit: year)
• Computing method: \[
\text{average age of public transit vehicles} = \frac{\sum \text{total applicable age of single public transit vehicle}}{\text{total number of public transit fleets}}
\]

(10) Income level of public transit employees
• Definition: In the statistical period, the ratio of average salary of public transit employees to all local employees. (unit: %)
• Computing method: \[
\text{income level of public transit employees} = \frac{\frac{\text{average salary of public transit employees}}{\text{average salary of all local employees}} \times 100\%}{\text{average salary of public transit employees}}
\]

(11) Energy consumption intensity
• Definition: In the statistical period, tons of standard coal equivalent energy consumed by 10 thousand person-time. (unit: ton/10 thousand person-time)
• Computing method: \[
\text{energy consumption intensity} = \frac{\text{total tons of standard coal equivalent energy consumed by vehicles}}{\text{total passenger volume}}
\]
Part 4

Issues and challenges
Issues and challenges

● Urban traffic congestion

Urban traffic congestion problems in megacities, particularly in big cities, become more serious, and extend to the periphery, increasing travel time in and traffic congestion to small and medium sized cities.

”Traffic congestion becomes an urban disease”, is a reflection of, to a large extent, a flaw in theory and method of urban transportation system in China.
Issues and challenges

● Traffic pollution

- The focus of the discussion on traffic pollution is on the ownership of the city car and its oil and emission standards.

- Urban traffic scholars suggest that we should not only pay attention to transport emissions, but also to the overall operational efficiency of the urban transport system, optimize the traffic structure and improve operational efficiency.

e.g. Beijing PM2.5 shows that regional transport accounts for about 28-36%, local pollution sources accounted for 64-72%. Local pollution sources, motor vehicles, coal-fired, industrial production, dust accounted for respectively, 31.1% , 22.4%, 18.1% and 14.3%, catering and other emissions account for about 14.1%.
Issues and challenges

- Parking management problems
  - Design of old neighbourhoods cannot cope with motorization, new residential parking needs of residents are underestimated.
  - Serious shortage of public parking spaces in old public buildings; underground parking garage in new public buildings are not fully being used.
  - Parking management studies do not consider local requirements, particularly in new street parking development.
  - Parking information processing is still in its initial stage, dynamic parking systems still require further studies.
Issues and challenges

- **Green transport development**

  Urban traffic scholars should **reflect** on the problems brought about by motorization to bicycling and walking and propose green transport ideas (including walking and bicycling) to better adapt to the city.

  ![Non motorized vehicle lane occupied by motorized vehicle](image)
Part 5
Way Forward
Way Forward

- Research on urban transportation science

- Theory of transportation planning and management is based on the “engineering” perspective, hence it is difficult to cope with urban traffic problem.

- Urban transportation should solve practical problems with a vision and strategy based on sustainable urban transport development, innovating on theory and method.

- Under the background of information technology, big data, cloud computing and other rapid development in science and technology, Engineering and Technology must continue to progress the urban transportation theory and propose the need to adapt to international, social and economic development and trends.
Way Forward

- Research on urban transportation science

The scope of the study of urban transportation includes the internal traffic within the urban administrative region, connection point with the external urban traffic and the intercity traffic within the metropolitan area.

The spatial scope of urban traffic theory research

Internal traffic of Urban Administrative Region

- Road transport, expressway, public transport, parking, shipping, transport order management and coordination of six systems

Urban external traffic hubs

- Road, railway, civil aviation, inland navigation, maritime transport, pipeline transportation and other transportation systems and urban transport hubs, e.g., stations and traffic hubs

Inter city traffic in metropolitan area

- Urban ring road, which is closely related to the central city and the surrounding area, is adapted to the urban area, beyond administrative boundaries, pay attention to the connection between central cities and small towns. It is characterized by city commuter traffic
Way Forward

● Research on urban transportation science

Urban transport network consists of six major systems as well as walking and cycling. Urban traffic network should strengthen the integration of the six systems and the connection of the organization of the bicycle and people, process urban internal traffic system and convergence of city's traffic and metropolitan transit station, emphasis on the overall system as "whole is greater than the sum of the parts".

The key to construction and operation of urban transportation network is the correlation between the various subsystems and the elements of the subsystem, coordination among different subsystems; complementary interaction of construction and operation, and its ability to improve the overall operational efficiency of the city.
Way Forward

Research on urban transportation policy

Research on urban transportation policy is the implementation of urban transportation theory study.

- The focus is on **the satisfaction of the reasonable demand of urban residents** and **the improvement of the overall effectiveness of urban operations**.

- It emphasizes that the theory of urban traffic is based on the method of **multi criteria thinking and systems theory**. Pay attention not only to engineering technology, but also between the legal, economic, fiscal and taxation relations.
## Way Forward

- **Research on urban transportation policy**

  Urban traffic is different from general traffic, the basic reason is that urban transportation involves different laws and regulations, standard system, information system, public funds, fare policy, etc.

<table>
<thead>
<tr>
<th>Regulations:</th>
<th>For example, the financial system: Urban road construction financial system</th>
<th>Road construction financial system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban traffic laws and regulations</td>
<td>Highway Law, road regulations, toll road management regulations</td>
<td>Construction loan repayment charges</td>
</tr>
<tr>
<td>Long-distance transport regulations</td>
<td>Railway Law, railway safety regulations, Railway Transport Safety Protection Ordinance</td>
<td>Gasoline tax (the original road maintenance)</td>
</tr>
</tbody>
</table>
| Town and Country Planning | Urban construction and maintenance tax | - By the city government 
| | Land transfer |
| Urban Road Management Ordinance | - By the city government finances, Local government financing platform |
| City Bus and tram passenger management approach | Maritime Traffic Safety Law, domestic waterway transport regulations |
| | For example, fare policy: Public transport fares policy |
| | Combine government finance (subsidies) and corporate finance |
| | Road transport fare policy |
| | Enterprise-based costing |
Way Forward

- Research on big data of urban transportation

- The aim of urban transport information can not stop for the purpose of advancing intelligent transportation technology, but it should be consistent with the overall development goals of the city in order to study the combination of information technology and urban traffic.

- Comprehensively consider public, private, civil society, and other different requirements, generally, to establish information sharing mechanism, promote research development directions and development policy concerning transportation information technology.

- To establish the information service system of open city traffic network as an important part of urban traffic, and consider the concept of an "open, sharing, collaborative" platform as the key link to complete the
Way Forward

- Research on big data of urban transportation

  Collaborative optimization method for construction and operation of urban traffic network of mega- and large central city or metropolitan area, under information environment.

  - Relying on mobile internet, big data, cloud computing and other emerging information technology, integration of data resources
  - Around the city circle formed by the central city, the urban core area and the urban and regional transportation connection, focus on proposing a collaborative optimization approach to the construction and operation of urban traffic network in the metropolitan area of mega and large central cities
THE END

THANK YOU FOR YOUR ATTENTION