Global Environment Facility

“Large City Congestion and Carbon Reduction Project”——

Study of Synergy Policies of City’s Transport Planning and Master Plan

Final Report (Revised)

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June 2016

Contents

0 Executive Summary

In accordance with the grant agreement entered into by the People's Republic of China and the International Bank for Reconstruction and Development (World Bank) on July 26, 2013, the Ministry of Transport of P.R.C. and its Transport Planning and Research Institute ("one of project implementation units") concluded a project agreement on October 28, 2013. Transport Planning and Research Institute, Ministry of Transport, carried out this work under the agreement. Afterward, the World Bank adjusted the task outline of the project based on its overall situation, mainly increasing the contents related to TOD study.

After the signing of the project implementation agreement, the research group collected relevant data, interviewed some research institutions, conducted some field surveys, refined the task outline on the basis of preliminary analysis and developed a work plan. In early May 2014, it received the "no objection" opinion of the World Bank on the work plan. After that, the research group analyzed the tasks of the project, conducted an in-depth study on project connotation and defined the objectives, main contents and methods of the research through expert consultations, seminars and other forms, while proposing the main problems and the next step plan specific to each task.

Then, the research group had field surveys in Shenzhen, Harbin and Chengdu. It surveyed and studied the typical cases of coordinated planning and had a number of discussions to understand the development model, advanced experience and existing difficulties and problems of Chinese cities. Then, it carried out the researched based on the results of these surveys, literature references and expert consultations. So far, the research group has submitted the technical document *Research Proposal*, such research reports as *Case Studies on Domestic and Foreign Urban Transport, Land Development and Space layout*, *Case Studies on Typical TOD Modes in China*, *Methods and Case Studies of Urban Transport Carrying Capacity Assessment*, *Policy Frame Design* and *Policies and Recommendations*, as well as the process management files including monthly reports and semi-annual reports.

1. Project Overview

1.1 Background

With the rapid development of economy and the acceleration of urbanization, in China, urban motorization has entered a rapid development period. By the end of 2014, the national civilian vehicle population had amounted to 264 million units; the driver quantity of 2.44 million people ranked No. 1 in the world, and the automobile quantity of 154 million units No. 2 in the world. In nearly a decade, China's urban motor vehicle population saw a particularly evident growth, with annual increment over 15 million. The motor vehicle population had surpassed 10 million separately in 11 provinces and 1 million separately in 35 cities. The motor vehicle population was over 2 million respectively in 10 cities including Chengdu, Shanghai and Shenzhen. At the end of 2014, the motor vehicle population reached 5.591 million units and the number of civilian automobiles hit 5.324 million units.

In the context of the rapid development of motorization, in many cities, especially Beijing, Shanghai and other large and super large central cities, due to the rapid growth in the number of cars, traffic jams form, the average driving speed decreases, and residents' travel time is significantly prolonged, which results in huge economic losses, significant rise in per mile fuel consumption, sharp increase in pollutant and carbon dioxide emissions and aggravation in air pollution and greenhouse effect. According to surveys, the speed of motor vehicles averages at only 12km/h in peak hour in most Chinese cities and is as low as 8-10 km/h in the central urban areas, which is even lower than the normal speed of the bicycle. In accordance with *the Annual Report on Motor Vehicle Pollution Control in China 2014* released by the Ministry of Environmental Protection of the P.R.C., the total emissions of four vehicle pollutants by the nationwide motor vehicles hit 45.709 million tons, and automobiles, as the major contributor to this figure, emitted over 80% of carbon monoxide (CO) and hydrocarbons (HC) and over 90% of nitrogen oxides (NO_X) and particulate matters (PM).

The Ministry of Transport ("MoT") is the central government department responsible for directing urban passenger transport. Faced with the enormous challenge from increasingly serious traffic congestion and air pollutant emissions in big cities, MoT gives priority to easing traffic congestion and reducing carbon emissions. MoT has an urgent need to draw on international experience, develop effective regulations and policies and take reasonable technical and economic measures to guide the scientific development of the urban transport in China, ease urban traffic congestion and reduce carbon emissions.

Against the backdrop, the "Reducing Traffic Congestion and Carbon Emission Sources in Large Cities" Project funded by Global Environment Facility ("GEF") has been approved by the Ministry of Finance and GEF, and the relevant preparatory jobs have been underway. The World Bank is the international executive agency of the project, MoT the domestic central executive agency, and the municipal governments of Suzhou, Harbin and Chengdu local executive agencies. Three local management offices are responsible for promoting the respective implementation of the project, but the overall project management office of MoT for project planning and coordination. The "Synergy Policy of City's Transport Planning and Master Plan" Project in the charge of Transport Planning and Research Institute, MoT, one of major project implementation

units, is a subproject under the "Large City Congestion and Carbon Reduction Project" funded by GEF.

1.2 Project Objective

On the basis of analyzing the relationship among urban transport, urban space layout and land development, the project proposes the policies and measures on the coordination between urban mastering planning and transport planning, specific to the problem that China's urban master planning does not match with the transport planning and the management is discordant as well as the new situation of urban mobilized development. It aims to begin the scientific management of traffic needs and guide the rational distribution and healthy development from the origin, thus reducing traffic demand, equaling traffic flow, giving full play to the ability of transport infrastructure, easing traffic congestion and reducing greenhouse gas emissions.

The Synergy Policy of City's Transport Planning and Master Plan is required to be：

- Comprehensive. It should include the urban master planning, traffic planning management system and the analysis on the mutual relation.

- Prospective. It should reflect the spirit of reform, get rid of the constraints by the existing management system and propose corresponding policies, measures and recommendations according to overall master planning and transport planning,

1.3 Main Tasks

The main tasks of this project include: ① evaluating the status quo of the relation between Chinese urban transport, urban space layout and land development and utilization; ② preparing typical cases of domestic and foreign urban transport, land development and space layout; ③ proposing the policies and recommendations on strengthening traffic planning and urban master planning; ④ proposing policy guarantee measures; ⑤ carrying out result publicity and promotion.

Task 1：Evaluating the status quo of the relation between Chinese urban transport, urban space layout and land development and utilization

- Problem analysis and evaluation on Chinese urban space layout, the status quo of land utilization urban transport and the status quo of Chinese urban transport development;
- Analysis and evaluation on the status quo of TOD implementation in Chinese cities;
- Sorting relevant policies, regulations and management procedures of Chinese urban planning and transport planning, such as the Urban and Rural Planning Law of the People's Republic of China, project approval process and TIE system;
- Research and evaluation on the application of TOD in China.

Task 2：Preparing typical cases of domestic and foreign urban transport, land development and space layout

- Summarization and conclusion on the TOD modes of typical foreign cities (at least three foreign cases), and in-depth analysis of the impact on urban development;

- Research and summarization on the domestic and foreign integrated land development model around integrated transport hub and rail stations as well as the land investment and financing mode around rail transit construction;

- Research and summarization on the domestic and foreign planning management procedures and the typical cases of TIE system (at least three foreign cases).

Task 3：TOD content analysis and mode presentation

- Describing the content and basic ideas of TOD；

- Analyzing the typical features of TOD mode and highlighting the difference between TOD mode and traditional urban planning;

- Applicable analysis on different TOD modes, including how different types of regions and cities in China to choose the right TOD mode to correctly guide urban development.

Task 4： Framework design of the Synergy Policy of City's Transport Planning and Master Plan

- The element and indicator system design of the planning system based on TOD mode, with focus on the approaches for the coordination among urban planning, comprehensive transport planning, public transport and rail transport special planning;

- Proposing the urban layout oriented by public transport as well as the conditions and modes of land utilization to promote the rational growth of urban space;

- Proposing the composition frame of related policies and systems, including integrated land development, mixed land use patterns and financial support;

- Proposing the framework of the TIE policies on urban function layout and land use pattern, evaluating the traffic carrying capacity of urban layout and land development, especially, analysis on its impacts and requirements on urban public transport;

- Designing appropriate price mechanism and guiding TOD mode development by use of price leverage and through the adjustment of the prices of public and private transports;

- Strengthening the publicity on public transport and low-carbon transport and increasing the understanding and recognition of the citizens on TOD;

- Proposing the mechanism of the cross-coordination between urban master planning and transport planning in order to achieve the guidance, feedback and optimization by transport planning on the urban planning;

Task 5：Proposing the methods for the valuation on the results of the Synergy Policy of City's Transport Planning and Master Plan

- Establishing the system of the evaluation of the results of the implementation of the Synergy Policy of City's Transport Planning and Master Plan;

- Selecting the appropriate indicators to evaluate the results of the implementation of TOD modes, such as land use pattern comparison, relevant population density, average travel distance, traffic conditions and energy conservation;

- Clarifying related data sources and collection methods.

Task 6： Proposing policy guarantee measures

- Proposing land management system and development policies, thus providing a guarantee for the integrated land development of the peripheral areas of the transport hubs and the areas along the transport truck corridors.

- Proposing other safeguards for the coordination among relevant authorities.

Task 7： Carrying out result publicity and promotion

- Publishing, publicizing and promoting appropriate outcomes；

- Providing technical consulting for result application methods;

1.4 Project Management

The management of the project adopts project-based organizational structure, with all tasks around the project objectives. Mr. Jin Jingdong, head of the Institute of Comprehensive Transport, Transport Planning and Research Institute, Ministry of Transport, China, leader of the expert panel and urban transport planning expert, is responsible for grasping the overall completion of the project. Mr. Chen Jing, professional vice president of the Institute of Comprehensive Transport, Transport Planning and Research Institute, Ministry of Transport, China, and regional economic expert is responsible for controlling the technical contents of the project. The project contains a number of research items, including the status analysis, quality analysis, situation and demand judgment and future coordination policy means in terms of urban planning, transport planning, regional economy, space layout, land use, laws, regulations and policy guarantee. There are content duplications and overlaps among these items. Project-based organization structure can ensure the parallel development of various research fields and contents, and rational communication mechanism can ensure the reduction of duplicated work and improve the efficiency of project implementation, thus achieving the ultimate goal of the project.

1.5 Results

- Technical documents：

✓ Project Proposal

✓ Interim Report

✓ Final Report

- Thematic Research Reports：

✓ *Case Studies on Domestic and Foreign Urban Transport, Land Development and Space Layout*；

✓ *Case Studies on Typical TOD Modes in China*；

✓ *Methods and Case Studies of Urban Transport Carrying Capacity Assessment;*

✓ *Synergy Policy of City's Transport Planning and Master Plan - Policy Frame Design*；

✓ *Synergy Policy of City's Transport Planning and Master Plan - Policies and Recommendations*

- Research Report and Executive Summary：

✓ monthly, quarterly, semi-annual and annual reports

✓ research reports on typical cities (Shenzhen, Harbin, Chengdu, Suzhou)

✓ meeting minutes of interim results discussions (discussions with World Bank experts)

✓ meeting minutes of seminars on the Synergy Policy of City's Transport Planning and Master Plan

2. Status Quo of the Synergic Relationship between Transport Planning and Urban Master Planning

In recent years, with the accelerating urbanization in China, the degree of motorization is constantly increasing, and the interaction between transport planning and urban master planning is becoming increasingly close. However, for the time being, there are many disharmonious and discordant aspects between urban transport and urban development and construction. With the growing contradiction between rising urban transport demand and inadequate supply of transport infrastructure has made transport planning become a major problem facing the field of urban planning. And such contradiction is becoming increasingly complex and intensified.

From the perspectives of laws, regulations and policies, this chapter elaborates the interaction between the transport planning system and the urban planning system of China, and introduces the practical cases of model cities in terms of promoting the synergy between transport planning and urban planning. On this basis, it evaluates the synergic relationship between transport planning and urban planning and analyzes the phenomena and the causes of non-coordination.

2.1 Status Quo of City's Master Plan and Transport Plan

2.1.1 Laws, Regulations, Standards and Codes

（1）Transport Planning

In the transport sector, there are laws applicable to each specific mode of transport, such as *the Highway Law*, *the Railway Law*, *the Port Law, the Civil Aviation Law* and *the Waterway Law*, which all make provisions for the preparation and implementation of the planning for single mode of transport and emphasizes the coordination with urban planning, by putting forwards such requirements as **"coordination with the master plans on land use and cities"** and **"inclusion in local urban master plans of land use and cities"**. From the perspective of implementation, due to the legislative base, the planning for single mode of transport is strongly serious and binding, so it is well implemented.

No law has been enacted specifically for the traffic within cities. But *the Law of the People's Republic of China on Urban and Rural Planning* raises corresponding requirements on comprehensive transport planning and proposes that the contents of the master planning of cities and towns should include **comprehensive transport system planning** and other special plans. In recent years, the Ministry of Transport, and the Ministry of Housing and Urban-Rural Development have promulgated a series of standards and codes specific to urban road transport, rail transport, public transport, and external transport, including *the Code for Transport Planning on Urban Road, the Rules on Planning of Integrated Urban Transport System, the Code for Compilation of Urban Railway Network Planning, the Guidelines for Planning and Design of Urban Walking and Cycling Systems, the Code for Intercity Transport, and the Guidelines for Compilation of Urban Public Transport planning*, raising requirements for transport planning while highlighting that urban road planning, public transport planning, rail transit planning and slow traffic planning "**shall be based on, interact with urban master planning and be coordinated with urban master plan**" and "**shall consider the relationship between transport**

development and land use and be coordinated with the urban master planning and comprehensive urban transport planning". Among them, *the Rules on Planning of Integrated Urban Transport System* and *the Code for Compilation of Urban Railway Network Planning* also require that transport plan shall be complied simultaneously with urban master plans, and support transit oriented land use strategies in cities. Table 2-1 lists relevant laws, regulations, standards and codes in the transport planning sector, as well as the contents involving coordination with urban planning.

Table 2-1 Relevant Laws, Regulations, Standards and Codes in the Transport Planning Sector as well as Contents involving Coordination with Urban Planning[1]

No.	Title	Released by	Date of Implementation	Contents Related to Coordination with Urban Planning
(I) Laws and Regulations				
1	*The Highway Law of the People's Republic of China* (Adopted at the 11th General Assembly of the Tenth National People's Congress Standing Committee on August 28, 2004 / The People's Republic of China Presidential Decree No. 19)	Standing Committee of the National People's Congress	January 1, 1998 (2nd Amendment: August 28, 2004)	➢ Article 12 Highway plan should be complied based to the needs arising from the national economic and social development and national defense, and **be coordinated with the urban development planning and the development planning for other means of transport.** ➢ Article 13 Land planning for highway construction shall comply with the **master plan on land use,** with the land for highway construction being included in the annual land use plan.
2	*The Railway Law of the People's Republic of China* (Adopted at the 15th General Assembly of the Seventh National People's Congress Standing Committee on	Standing Committee of the National People's Congress	May 1, 1991	➢ Article 35 In the urban planning area, the lines, stations, hubs, and other related facilities of railways **shall be included in master plans of the related cities**. Land planning for railway construction **shall be included in master plans of land use**. The land required for future expansion or new railways shall be allocated by county or higher governments in their master plans of land use. ➢ Article 40 Grade separation is preferred at crossings between railways and

[1] Source: Sorted by the research group.

	September 7, 1990 / The People's Republic of China Presidential Decree No. 32)			roads. In the case of no grade separation, level crossings or walkways shall be provided in accordance with applicable regulations. Provision of level crossings or walkways in urban plan areas shall be jointly determined by the railway carriers or enterprises or other organizations using dedicated railways or lines **with related urban planning authorities**.
3	*The Port Law of the People's Republic of China* (Adopted at the 3rd General Assembly of the Tenth National People's Congress Standing Committee on June 28, 2003 / The People's Republic of China Presidential Decree No. 5)	Standing Committee of the National People's Congress	January 1, 2004	➢ Article 7 Port planning shall be compiled based on the needs arising from national economic and social development and national defense, properly utilizing coastal resources and following related urban plans, and be interfaced and coordinated with **master plans of land use, urban master plans**, river basin plans, flood control planning, marine function zoning, waterway transport development plans and development plans of other modes of transport **as well as other relevant plans required by applicable laws and regulations convergence and coordination.**.
4	*The Civil Aviation Law of the People's Republic of China* (Adopted at the 16th General Assembly of the 8th National People's Congress Standing Committee on October 30, 1995 / The People's Republic of China	Standing Committee of the National People's Congress	March 1, 1996	➢ Article 55 **Construction of civil airports shall be coordinated with urban development plans**.

	Presidential Decree No. 56)			
5	The Waterway Law of *the People's Republic of China* (Adopted at the 12th General Assembly of the 12th National People's Congress Standing Committee on December 28, 2014)	Standing Committee of the National People's Congress	March 1, 2015	➢ Article 6 Waterway planning shall meet the river basin planning and **regional comprehensive plans** that are established in accordance with law, be in line with water resource planning, flood control planning and marine function zoning, and be coordinated with relevant professional planning involving comprehensive utilization of water resources as well as **legally developed urban and rural plans,** environmental plans and other relevant plans and military facilities protection zoning.
(II) Standards and Codes				
6	*Code for Transport Planning on Urban Road* (GB50220-95)	Ministry of Construction (now the Ministry of Housing and Urban-Rural Development)）	September 1, 1995	➢ 1.0.4 The transport planning for urban roads must **be based on relevant urban master plans**, to meet the demand for transport arising from the land uses and **assert the impact of urban road transport on land development intensity**. ➢ 7.1.4 The land area for urban roads shall account for 8% to 15% of urban construction land area, and the percentage is preferably to be **15% to 20% for large cities with population of over 2 million**. ➢ 7.2.3 **The FAR of land development shall be coordinated with the carrying capacity of the transport network transport and the traffic conditions of the road network**.。
7	*Rules on Planning of Integrated Urban Transport System* (JC [2010] No. 30)	Ministry of Housing and Urban-Rural Development	February 2, 2010	➢ Article 3 Integrated urban transport system planning is an important part of the urban master planning, serving as the basis for the government to implement construction of the integrated urban transport system, regulate transport resources, promote green transport, guide coordinated development of regional transport,

				inter-city transport and intro-city transport, harmonize sub-systems of the urban transport system, support strategic specialty plans for urban economic and social development, and compilation of specialized plans of urban transport facilities, organization of passenger and cargo transport system, short-term transport plans, local transport improvement plans, etc. ➢ Article 5 Integrated urban transport system planning **shall be complied simultaneously with, interact with, and be coordinated with urban master planning**. ➢ Article 15 **Results of integrated urban transport system planning shall be complied simultaneously with, interact with, and be coordinated with urban master planning**.
8	*Code for Compilation of Urban Railway Network Planning* (GB/T 50546-2009)	Ministry of Housing and Urban-Rural Development	April 1, 2010	➢ 1.0.3 Compilation of urban rail transit network planning **shall be based on the overall city planning, in line with the city's comprehensive transport system planning. Urban rail transit network planning shall be carried out simultaneously with urban master planning**. ➢ 1.0.4 Compilation of urban rail transit network planning shall utilize resources in an efficient and intensive manner, implement national policies prioritizing public transport, **support policies on transit-oriented urban land use, and promote the sustainable development of cities and transport**.
9	Guidelines on Planning of Integrated Urban Transport System (JC [2010] No. 80)	Ministry of Housing and Urban-Rural Development	May 26, 2010	➢ 1.2 Role 1.2.1 Comprehensive urban transport system planning is an important part of the overall urban planning, as strategic planning for guiding development of integrated urban transport in cities. ➢ 2.1 Stages of work

				1.2.1 Compilation of comprehensive urban transport system fall into four stages, include status quo research, specialized studies, framework results , and planning results. 2.1.2 Compilation of framework results **shall be interfaced with that of overall urban planning.** 2.1.3 Compilation of planning results **shall be interfaced with that of overall urban planning.** ➢ 4.7 Mandatory requirements 4.7.1 **Mandatory contents of overall urban planning** to be included: urban trunk road system network, urban rail transport network, transport hubs layout. 4.7.2 Regulatory indicators for guide the planning of transport subsystems shall be included as mandatory contents. 4.7.3 Depending on the specific conditions of a city, additional the mandatory contents may be provided. In general, planning of external transport facilities and transport stations and yards may be included in mandatory contents.
10	*Guidelines for Planning and Design of Urban Walking and Cycling Systems* (JC [2013] No. 192)	Ministry of Housing and Urban-Rural Development	December 30, 2013	➢ 1.2 Compilation of planning of urban walking and cycling systems shall: 1) Be interfaced with comprehensive urban transport systems, and be coordinated with the overall urban transport development strategy, realizing effective connections between all modes of transport. 2) Be coordinated with various relevant planning. **The planning shall be based on the overall city planning, and be coordinated with the detailed regulatory plans and other plans**. Meanwhile, the planning **shall give clear requirements for detailed regulatory plans and other plans to be subsequently prepared.**

11	*Code for Intercity Transport* (GB50925-2013)	Ministry of Housing and Urban-Rural Development	June 1, 2014	■ 3.0.1 Planning for intercity transport development and system layouts **shall be based on the national and provincial urban system planning and other superior statutory planning.** ■ 3.0.2 The functions, scale, layout, and short-term construction plans of external transport facilities shall be determined appropriately based on the scale of the external traffic passenger and freight transport, transport organization and urban layout requirements, **with coordinated use of land, shorelines, waterways, airspaces and other resources**.
12	*Guidelines for Compilation of Urban Public Transport Planning* (JYF [2014] No. 236)	Department of Transport	November 19, 2014	■ Article 3 Compilation of urban public transport planning **shall consider the relationship between urban transport development and land use, and be coordinated with the overall urban planning and integrated urban transport planning**. **Land for urban public transport facilities shall be included in detailed urban planning.**

(2) Urban Planning

The Urban Planning Law of People's Republic of China passed by the NPC Standing Committee on December 26, 1989 was China's first law on urban planning, urban development and urban administration. It was an fundamental law governing urban construction and development enacted by the country's highest authority for regulating compilation, purpose, mission, policies, principles and requirements in urban planning, making them highly authoritative. In the following 20 years, China has formulated and implemented a large number of laws and regulations on urban planning and administration. Currently, the system of relevant laws and regulations can be categorized into five levels, i.e. national laws, national regulations, ministerial rules, local laws and local regulations.

The Law of the People's Republic of China on Urban and Rural Planning, effective on January 1, 2008, was drafted on the basis of *the Law of the People's Republic of China on Urban Planning* and *the Regulations on Village and Town Planning and Development*, taking into account the newly emerging conditions, and has been the highest law on urban planning in China since then. After compilation, urban plans shall go through statutory review and approval processes for them to be legally binding.

The Law of People's Republic of China on Urban and Rural Planning makes it clear that **master urban plans shall cover comprehensive transport systems**. *The Rules on Preparation of Urban Plans*, and a number of other regulations and rules have been promulgated under the framework of the Law on Urban and Rural Planning, involving transport planning, but only to the extent as a part of master urban plans or as specialized plans. Table 2 reviews relevant standards and codes concerning transport planning as well as the contents involving coordination with urban planning.

Table 2-2 Contents Involving Coordination with Traffic Planning in the Standards and Codes Concerning Transport Planning [2]

No.	Title	Released by	Date of implementation	Contents related to coordination with transport planning
(1) Standards and Codes				
1	*Rules on Preparation of Urban Plans* (Adopted at the 76th Standing Meeting of the Ministry of Construction on October 29, 2005 / Oder of the the Ministry of Construction No. 14)	Ministry of Construction (now the Ministry of Housing and Urban-Rural Development)	April 1, 2006	**Urban master planning** ➢ Article 29 The overall planning framework shall include the following contents: (VII) **transport development strategies and the principles of layout of main external transport facilities**. ➢ Article 30 City-wide urban system planning shall include the following contents : (V) **determination of city-wide transport development strategies**; **generally determined layout of transport**, communications, energy, water supply, drainage, flood control, waste disposal and other major infrastructure facilities, key social service facilities, dangerous goods storage **facilities**. ➢ Article 31 Planning for the central urban areas shall include the following contents: (ix) **the transport development strategies and the overall layout of urban public transport, implementation of bus priority policies, layouts of major external transport facilities and major road transport facilities**. ➢ Article 32 The mandatory contents of the overall urban planning: (IV) urban infrastructure and public service facilities. Including: **urban trunk roads, urban rail transport network, layout of transport hubs**; urban water sources and protected areas and other major municipal infrastructure; layout of culture, education, health, sports and other major public service facilities.

[2] Source: Sorted by the research group

				➢ Article 34 Overall urban planning shall **specify the principles for compilation of specialty plans for integrated transport**, environmental protection, commercial outlets, health care, green system, river and lake system, protection of historical and cultural towns, underground spaces, infrastructure, comprehensive disaster prevention and so on. **Compilation of various types of specialty plans shall be based on the overall urban planning**.
				Short-term urban development planning ➢ Article 36 Short-term urban development planning shall include: (ii) **short-term transport development strategies**, and **layout of main external transport facilities and major road transport facilities**.
				Urban zoning plans ➢ Article 39 Zoning plans shall include the following contents: (e) **boundary lines, cross sections, control point coordinates and elevation of urban trunk roads; alignment and width of branch roads; location and size of major intersections, squares, bus stations, transport hubs and other transport facilities; alignment and right of way of rail transport lines; and size and distribution of major parking lots.**
				Detailed plans ➢ Article 41 Regulatory detailed planning shall include the following contents: (II) building height, building density, floor area ratio, green rate and other regulatory indicators; **requirements for public facilities, location of entries and exits, parking, building setback and boundary lines and so on**. (IV) **Location of entries and exits, parking, boundaries of public transport stations/yards and location of stations, other facilities for walking and other modes of transport. Boundaries, cross sections, intersection types and channelization measures, coordinates and elevation**

				of control points. ➢ Article 43 Constructive detailed planning shall include the following contents: (iv) **traffic organization proposals and design based on traffic impact analysis**.
2	*Rules on Compilation and Approval of Provincial Urban System Plans* (Adopted at the 55th Standing Meeting of the Ministry of Housing and Urban-Rural Development on April 25, 2010 / Oder of the Ministry of Housing and Urban-Rural Development No. 3)	Ministry of Housing and Urban-Rural Development	July 1, 2010	➢ Article 24 The plan outlines shall include the following contents: (V) Requirements for improvement of the space layouts of rural and urban areas, including those for provincial space layouts in rural and urban areas, system of rural and urban residential points, and optimization of rural residential points, in accordance with the requirements of comprehensive, coordinated and sustainable urban and regional development, by taking into account the economic and social development and population, resources and environmental conditions; **recommendations on layouts of provincial integrated transport and major municipal infrastructure, public facilities;** areas requiring coordination and guidance on the provincial level, and guide the region, and major infrastructure layout and other related issues to be jointly coordinated with adjacent provinces (autonomous regions, municipalities directly under the central government. ➢ Article 25 Planning results shall include the following contents: (IV) **regional integrated transport system clearly coordinated with space layouts of rural and urban areas**. Including **the principle of development objectives, strategies and facilities of provincial integrated transport coordinated with space layouts of rural and urban areas; distribution of provincial integrated transport networks and major transport facilities; integrated transport hub cities and requirements for their planning**. (VII) Clear requirements for subordinate urban and rural planning.

				Requirements shall be specified for **coordinated development of cities and towns in local areas**, space layouts of rural and urban areas, resources, ecological and environmental protection, **transport and infrastructure layout**, space development control and **other planning based on actual conditions of the province / autonomous region.**
3	*Rules on Evaluation of Implementation of Master Urban Plans* (Trail) (JG [2009] No. 59)	Ministry of Housing and Urban-Rural Development	April 16, 2009	➢ Article 12 Master urban plan implementation evaluation reports shall include: (V) the impact of related policies of land, **transport**, industry, environment, demography, finance, investment or others on implementation.
4	*Guidelines on Review of Master Urban Plan Transport System* (JG [1998] No. 161)	Ministry of Construction (now the Ministry of Housing and Urban-Rural Development)	August 3, 1998	➢ II. Focus of planning review (V) comprehensive urban transport layout. **Whether urban transport has been planned in a harmonized manner? Whether the urban transport system planning meets the needs of modern traffic management? Whether the layout of the city's external transport system has been coordinated with the urban transport systems and its long-term development**?
5	*Rules on Compilation and Approval of City and Town Detailed Regulatory Plans* (Adopted at the 64th Standing Meeting on December 1, 2010 / Order of the Ministry of Housing and Urban-Rural	Ministry of Housing and Urban-Rural Development	January 1, 2011	➢ Article X The regulatory detailed planning should include the following contents: (III) The size of land used, scope and specific control requirements and underground pipeline control requirements for infrastructure, public service facilities, public safety facilities.

	Development No. 7)			

2.1.2 Related Policies and Guiding Opinions

（1）National Level

In recent years, the State Council, the Ministry of Construction and Housing, the Ministry of Transport and other ministries have released many guiding opinions and specific support policies on the development of urban public transport as well as the comprehensive development of transport hubs and the surrounding land, so as to promote the coordination between transport planning and urban master planning with TOD, alleviating urban congestion, reducing energy consumption and emissions, etc. as the focuses and starting points.

- Priority Given To Public Transport

In 2005, the General Office of the State Council promulgated *the Opinions on Priority Given to Development of Urban Public Transport* (GBF [2005] No. 46) released by the Ministry of Construction and other ministries, and the Opinions provided that giving priority to development of urban public transport is an important means for **improving the efficiency of transport resources and alleviating traffic congestion**, and that **urban transport planning shall be coordinated with the overall urban layout and distribution of population and industries**, and stressed the need for **establishing modes of public transit-oriented urban development and land allocation**.

The Guiding Opinions of the State Council on Prioritized Development of Urban Public Transport (GF [2012] No. 64) required that "**detailed regulatory plans shall be interfaced with public transport planning, giving priority to land allotment for public transport facilities**. For new public transport facilities, the aboveground and underground spaces, shall **be developed in an integrated manner** by following market practices; for existing public transport facilities, the land owners are encouraged to conduct **multi-level development** in line with relevant plans and with uses unchanged."

In 2014, the State Council promulgated *the National New Urbanization Plan (2014- 2020)* and regarded giving the priority to the development of urban public transport as an important task during improving the sustainable development capacity of the city, proposing to "**put public transport in the prime location of urban transport development, accelerate the building of urban motorized travel system with focus on public transport**, actively develop BRT, modern trams and other large-capacity ground public transport systems and scientifically and orderly boost urban rail transit construction; **optimize public transport and line settings, boost the formation of public transport priority access network,** increase coverage, punctuality rate and speed and basically realizing the 500-meter full coverage of public transport stations in the central urban area of the cities with a population over 1 million; **strengthen comprehensive traffic management, and effective regulation and rationally guide individual motorized transport demands;** promote the information sharing and resource integration of various modes of transport and urban road traffic management system."

The Ministry of Transport released *the Opinions on Implementation of the Guiding Opinions of the State Council on Prioritized Development of Urban Public Transport* (JYF [2013] 368) clearly requires **improvement of the capability of planning and regulation**: Firstly, to **enhance compilation of plans**, **by improving compilation of integrated urban transport plans and urban public transport plans, which shall be included in urban regulatory detailed planning after approval by municipal governments**. By taking into account the requirements for

economic and social development and the travel needs of urban residents, to appropriately plan and construct a ground public transport system relying on buses and trams, including bus rapid transit, modern trams and other large-capacity public transport systems, optimize lines and network structure, layout of stations, arrangement of hubs and major transport nodes, implement division of functions between various public transport modes, strengthen coordination with walking, cycling and other travel modes, and improve safeguards. Secondly, to **strengthen planning and regulation**: to **encourage public transport support and planning guiding urban development, strengthen coordination with relevant governmental departments, in the preparation and adjustment of urban master planning, land use planning, regulatory detailed plans, thoroughly consider development of urban public transport and the travel needs of the public, harmonize the space layout, function zoning, land use and traffic demand, scientifically plan public transport development and layout of urban functions, improve the role of urban public transport in guiding urban development**. Thirdly , to **promote implementation of plans**: Under the leadership of municipal governments, **establish a coordination mechanism for public transport participated in by authorities for urban transport, development and reform, public security, finance, land and resources, planning and other departments, clearly define responsibilities, carefully organize the implementation of urban public transport plans**. To formulate annual implementation plans for urban public transport to ensure implementation. At the same time, to **promote integrated urban transport administration**, including **reasonable guiding of traffic demand**, and based on the conditions of urban transport supply and demand, through **comprehensive use of legal, economic, administrative and other means**, effectively regulate and appropriately guide individual demand for motorized transport, apply administrative measures in large cities, such as differentiated parking fees by area and by types, and park and ride systems; **implement traffic impact evaluation (TIE), execute TIE for urban construction projects**, such as proposed construction of airports, railway passenger stations, waterway passenger terminals, road passenger stations, residential areas, business districts and other large projects; implement traffic impact analysis, prediction and evaluation, propose options, administrative measures and support public transport facilities for preventing or mitigating the traffic impact, urge developers to implement the standards of support public transport facilities based on the traffic impact evaluation results, and **ensure synchronous design, simultaneous construction and simultaneous acceptance of support facilities and the principal components of urban construction projects.**

In 2011, the Ministry of Transport released *the Circular on Matters Related to Public Transport City Demonstration Projects* (JYF [2011] 635), launching the project of creating public transport cities. It is intended to choose certain **large and medium cities** for creating **pilot Public Transport Cities** as these cities have dense urban population, high public transport demand, higher level of urban public transport, fast development of urban rail transit or BRT, and government policies clearly supporting urban public transport development, so as to establish the dominance of **urban public transport** in the urban transport system, **significantly enhance the role of urban public transport in guiding urban development, and ease traffic congestion**. Since then, the Ministry of Transport has identified pilot Public Transport Cities in two batches (JYF[2012] No. 550 and JYF[2013] No. 652). The Public Transport City Demonstration Project is an effort for implementing the public transport prioritized development strategy, **regulating and guiding the traffic demand, alleviating urban traffic congestion and pressure on resources**

and the environment, and promoting sound and rapid development of public transport in China in the new era, and its influence will be far reaching.

- Development of Integrated Transport Hubs and Other Urban Transport Infrastructure

In 2013, the State Council released *the Opinions on Strengthening Development of Urban Infrastructure* (GF [2013] No. 36), requiring to **strengthen development of public transport infrastructure**, and encourage qualified cities, by following the principle of "respect for current conditions, and orderly development", to develop subway and light rail systems, **exert a key role of subway and other public transport in driving urban public transport and related industries**; and actively develop high-capacity ground public transport, accelerate development of dispatch centers, parking, maintenance yards, terminal stations and intermediate stations; and **promote development of transfer hubs, charging pile, charging stations, public parking and other support service facilities, which shall be incorporated into urban renewal projects and new urban area development projects for simultaneous implementation.**

In 2014, the State Council released *the Opinions on Support for Integrated Land Development in Railway Construction* (GBF [2014] No. 37), clearly requiring implementation of policies on integrated development of land for railway construction and that adjacent railway stations and yards, support for railway construction, and promotion of new-type urbanization; adherence to the "multi-modal interconnection, multi-level development, functional integration, economical and intensive use" principle in **integrated development** of land for railway stations and yards and adjacent areas; for regulatory detailed plans for railway stations and yards and adjacent areas, organization of simultaneous design, refine the spatial arrangement of buildings, road and transport plans, development intensity, timing and sequence of construction, promotion of seamless interconnection between various transport modes, and driving construction of **integrated transport hubs**.

——Central Urban Work Conference and the Opinions on Strengthening Urban Planning and Construction Management

Central Urban Work Conference was held in Beijing on December 20-21, 2015, which was the highest standard of urban work meeting after the first one in 1978. The conference stressed the status of the city. “The city is the center of China’s economic, political, cultural, and social activities, and has a pivotal role in the overall work of the party and the country”; similarly, the city is also “the place where all kinds of factors and resources and social activities are mostly concentrated and the “locomotive” of building a moderately prosperous society and accelerating modernization; “urban development drives the entire economic and social development and urban construction has become an important engine of modernization”. The conference also pointed out that unified planning should be made in terms of space, scale and industry as well as in terms of production, life and ecology” to enhance the rationality of the internal layout of the city, enhance the permeability and microcirculation of the city; the planning and construction of urban transport, energy, water supply and drainage, heating, sewage, waste disposal and other infrastructure shall follow the concept of “green, recycling and low carbon”.

After the Central Urban Work Conference, the supporting document *the Opinions of the CPC Central Committee and State Council on Further Strengthening Urban Planning and Construction Management* was promulgated. In the part concerning the improvement of urban public services,

the document clearly proposes to optimize block road network structure and give priority to the development of public transport. Wherein the relevant rules include: The planning and construction of blocks will be strengthened, **the areas of newly built blocks defined level by level**, and the development of open and convenient living blocks featuring appropriate scale, complete facilities and harmonious neighborhood boosted. Block system will be promoted for the new residential quarters, and **in principle, no closed residential area will be constructed. The established residential quarters and institution compounds will be gradually open to achieve the publicity of internal roads, in a bid to solve the problem of road network layout** and promote the land conservation. The "**Narrow Road, Dense Road Network**" concept of urban road layout will be established to build **a road network system featuring rational grading of fast roads, primary and secondary roads. All kinds of "dead-end roads" will be cut through, thus forming a complete road network and improving road accessibility.** Road traffic safety facilities and traffic management facilities will be set in a scientific and standardized manner to improve road safety. **By 2020, the average road density of the urban built up area will be increased to 8 km/ square kilometers, and the road area rate to 15%.** One-way road will be actively used for traffic organization. The construction of bikeways and footpaths will be strengthened to promote green travel. Parking facilities will be rationally allocated, social participation encouraged and market access eased to gradually solve the parking problem. The urban traffic pressure will be eased with the improvement of public transport share as a breakthrough. The coordinated development of buses, light rails, subways and other public transports is planned in unison. **By 2020, the public transport share rate of mega-cities and super-cities will be over 40%, that of metropolitans over 40% and that of medium and small-sized cities over 20%. The construction of urban comprehensive transport hub will be strengthened** to promote the smooth convergence and convenient transfer among different modes of transport and internal and external traffics of the cities. The coverage of the dedicated public transport lanes will be enlarged. **A full coverage of the bus stops within 500 meters will be realized in the central urban areas**. Market competition mechanism will be introduced to reform bus company management system, and social capital is encouraged to participate in the construction and operation of public transport facilities to enhance the capacity of public transport.

（2）Local Level

At the local level, Shanghai, Shenzhen, Wuhan and other major cities in China have released local guidelines and rules for promoting the construction of public transport systems and guiding urban development.

The Circular of the Shanghai Municipal People's Government on Releasing the Opinions on Implementation of the Law of the People's Republic of China on Vehicle and Vessel Tax" (HFF [2011] No. 95) expressly provides that the vehicles and vessels which have been approved by competent authorities for use in public transport shall be exempted from paying the vehicle and vessel tax for the time being. *The Circular on Release of the Code of Public Transport Line Passenger Last Mile Service* (Trial) (HJK (2011) No. 357) released by Shanghai Municipal Transport and Port Authority specifically provides for the last mile service which is convenient, flexible and low-cost for residential areas, connecting rail transport stations and public transport hubs with efficient and easy-to-access short-distance bus service. Creation of a last-mile public transport network will drive forming of the three networks of passenger transport, and support the optimization and adjustment of public transport lines around the municipality. The last-mile

public transport network will keep serving the city center and new urban areas, and resolve the difficulties in transfer or short trips of residents, cover gaps of public transport lines, and avoid superposition with existing lines.

The Regulations of the Shenzhen Special Economic Zone Road on Traffic Safety Administration promulgated by Shenzhen Municipal People's Congress Standing Committee specifies that the compilation of integrated transport layout plans, traffic specialty plans, road traffic safety administration plans shall follow the principle of road traffic safety, order and smoothness, to **give priority to development of public transport**, protect the appropriate access of various travel modes to road transport resources, and establish an **integrated public service network** with rail transport as the backbone, conventional bus network and taxis as supplement, and non-motorized transport as extension.

The General Office of Wuhan Municipal People's Government Office released *the Circular on Acceleration of Construction of Urban Public Transport Stations and Yards* (WZB [2012] No. 18), requiring to further improve the understanding of the importance of urban public transport stations and yards, accelerate the construction of urban public transport stations and yards, as **prioritized development of urban public transport** is not only an effective measure for alleviating urban traffic congestion, but also inevitable for improving the urban living environment and promoting sustainable urban development; planning of urban public transport stations and yards shall fully reflect the principle of prioritized development of urban public transport, be adapted to urban development, public transport networks, and population and industrial distribution, be interfaced with a variety of transport modes, such as railway, aviation, long-distance passenger transport, ad private vehicles, in order to facilitate the travel of citizens.

2.1.3 Existing Exploration Practices

(1) Establishing cross-department coordination mechanism within the municipal government to coordinate the compilation and effective implementation of transport, urban development strategies and planning

The governments of many cities in China have established special steering groups with members from the planning, transport and other authorities in order to ensure the institutional safeguards for coordinated development of the cities and their transport.

Chengdu has established a mechanism involving the authorities for transport, planning, housing and the traffic police control with assistance from design institutes, and a general transport steering group with defined clear responsibilities of various departments. The Chengdu Transport Commission is responsible for formulating the macro-strategies for transport; the Chengdu Planning Administration is responsible for inclusion of transport strategies into the urban master planning to facilitate their implementation, and for selection of specific project proposals and key hubs; the Chengdu Housing and Rural-Urban Development Commission is responsible for organization of review of urban and transport planning; The Traffic Department of Chengdu Public Security Bureau is responsible for administration of operation of urban traffic.

Nanjing has established the Urban Governance Commission, which is a coordination and consultation body under the municipal government, and is responsible for formulation of comprehensive urban administration strategies and plans, and, as authorized by the municipal government, organizing, guiding, supervising and assessing the performance of urban governance. The Urban Governance Commission is comprised of representatives from experts, citizens,

communities and organizations, to mobilize the public to participate in urban governance, promote transformation of urban governance from government administration to interactive and collaborative governance by the government, social organizations and the general public, to improve the urban quality, image, and living environment and make the city a better place to live.

(2) Attaching importance to general aviation reservation of land for public transport in urban planning, especially that for new urban areas and towns

The Planning Bureau of Dezhou City has put forth transit-oriented planning strategies for integrated transport, reserving bus lanes in annual road plans and including proposed public transport stations and facilities into the urban master planning, by setting aside 34 hectares of land for public transport stations and yards; strengthening cycling route network planning, carrying out non-motorized transport planning, and appropriately allocating bicycle parking.

Wenjiang District, one of the nine districts and six counties of Chengdu, is located in the west of Chengdu, and was made a district in 2002, having become an important part of Chengdu. As the core area of the western new area of Chengdu, Wenjiang follows the requirement for "establishing a separate urban area" by improving the urban functions and forming a multi-function city center, to achieve combination of industry and city, and balance between employment and residence. The new round of urban master planning and transport planning adheres to the "transport first" strategy by reserving the land for intra-city rail transport ring line, strengthening the point-to-point rail transport link between the downtown area and the core of Tianfu New Area, to avoid contiguous development with the city center.

(3) Introducing innovative land transfer practices or administrative measures to promote the integrated development of the land along the rail transport lines

To ensure that development of subway in Harbin, the Harbin municipal government promulgated the Rules of Harbin on Subway Land Management in 2008, allowing the Metro Group to finance with land within 1 km along both sides of subway lines. Meanwhile, the Harbin municipal government has allotted 166 lots of about 200 square kilometers of land for the development, and has formally approved the use of 74 plots, covering an area of about 100 square kilometers.

Shenzhen imposes reasonable limitations on the qualification of land bidders, which shall have been approved for construction and operation of subway and ancillary facilities, and have experience in construction and operation of subway lines, and provides for land-related rights and interests as well as ownership, incomes, hand-over of related ownership. Meanwhile, Shenzhen Subway has developed real estate above the Qianwan depot, Henggang depot, Tanglang depot and some other important depots, with revenues from the real estate for subsidizing operation of subway lines.

(4) Establishing land use rights by level, and innovating multi-level development of rail transport and hub construction

In Shenzhen, land use right transfer for rail transport stations and the surrounding land centers on subway, providing three levels of land use rights: The underground space is for subway operation and transfer, with land use rights being allotted by the government; the space 0-9 meters aboveground is for depot worships and public parking and is partially available for bidding, and the space 9 meters above the ground is for integrated development by successful bidders, such as policy-favored housing, commodity housing, offices, business apartments, hotels, commercial facilities, affiliated public service and engineering support rooms, through public bidding

processes.

In addition, Shenzhen's practice of real estate development above subway effectively combines subway and real estate development to realize win-win results and serves as a good example. Firstly, this practice effectively improves the utilization of urban land and intensity of land use; secondly, this practice conforms to the "Property Law", which allows transfer of land use rights by the aboveground, ground and underground levels; thirdly, the transfer of land use right involving different owners with clear provisions on ownership and rights, promoting the fine management of land resources.

(5) Innovating investment and financing mode to ensure the construction and operation capital of rail transport

In terms of investment and financing, Harbin Metro Group has two main tools: borrowing and land development with allocated land. Land development is conducted either by Metro Group along as the primary developer or jointly by Metro Group together with other enterprises.

Shenzhen has set up an investment and financing platform for rail transport. With supportive government policies, the rail transport operator is given the right to development of real estate and resources along the rail transport lines through legal procedures, and rail transport operator realizes revenues from external sources through market operation. This practice of investment and finance creates profits for the rail transport operator, and realizes market operation. The government provides the resources (land) for financing, and then Shenzhen Metro secure financing for subway construction through market means, then repay borrowings with revenues from development of the land resources.

(6) Establishing traffic impact evaluation system, reducing the impact of development projects on the surrounding transport systems and creating good transport conditions for project operation

Traffic impact evaluation not only analyzes, anticipates and evaluates the impact on traffic after construction project planning and implementation, and proposes technical methods and rules for prevention or mitigation of adverse effects for transport design, transport control proposals and measures. Currently, traffic impact evaluation in China is mainly for evaluation and optimization of transport organization design and layouts of transport facilities of construction projects, and proposes appropriate recommendations for improvement. By studying the relationship between urban development projects and growth in transport demand, traffic impact evaluation analyzes the extent and scope of impact of the projects on urban transport, and thus determines corresponding measures or revision to reduce the impact of the projects. Before approval of a project or implementation of traffic control measures, TIE analyzes and evaluates the extent and scope of the potential impact on the level of service of transport after completion of the project or implementation of traffic control measures, to determine their feasibility or seek solutions.

Beijing was the first city to include traffic impact evaluation system in urban planning administration as a mandatory component. In October 2001, with approval of the Beijing municipal government, the Beijing Municipal Planning Commission formally released *the Circular on Traffic Impact Evaluation for Certain New Construction Projects*, which specifies that the findings of traffic impact evaluation, review and verification shall serve as a basis in review of the design proposals for construction projects. The indicators in TIE reports may be based for giving requirements for controlling the scale of construction and intensity of land development,

designating works to be borne by developers for improving the surrounding traffic environment, and requiring suspension or discontinuation of the projects. The Circular also stipulates that the owner of each project subject to traffic impact evaluation shall engage a qualified design or consulting institute to conduct the traffic impact evaluation, and such institute shall hold Class-A qualification for urban planning and transport consulting. In February 2002, Nanjing Planning Bureau and Nanjing Public Security Traffic Bureau released *the Rules on Procedure for Planning and Administration of Traffic Impact Analysis for Large Construction Projects*, which gives general requirements for construction projects subject to traffic impact analysis and the procedure for administration of traffic impact evaluation. For example, the rules are applicable to large public construction projects with sites in traffic sensitive areas in Nanjing.

Since then, more and more cities have become aware of the increasing importance of traffic impact evaluation. Shenzhen, Shanghai, Tianjin and other major cities in China have included traffic impact evaluation system in urban planning administration as a mandatory component. These efforts help address the increasingly severe urban traffic problems, conduct fruitful exploration into integration of urban land development and transport issues, and include urban traffic issues in the scientific research and regulation with law. Traffic impact evaluation anticipates the potential traffic problems to be caused by construction projects, proposes solutions to these problems, serving as a basis of decision making by governmental departments in land-use planning and transport development, and helping regulate traffic demand and alleviate traffic congestion. It also help prevent problems related to people access, car parking and traffic organization due to lack of forecast and integrated planning after completion of projects, and avoid possible waste of funding arising from reconstruction due to traffic problems.

2.1.4 Summary

In fact, the current laws, regulations, standards and codes of China in the field of transport planning have considered the relationship between urban master planning and land utilization, and emphasize the interaction with the urban and rural planning. However, all of these laws and standards take transport planning an element of urban system planning as well as urban master planning. From plan development to approval and then to implementation assessment, transport planning is carried out within the framework of the urban master plan, and such planning contents as urban function zoning and land layout have less coordination and interaction with transport planning.

The 18th national party of CPC has put forward that "the rule of law is the basic way of managing state affairs", and made "establishment of a government based on the rule of law" one of the important goal of building a well-off society in an all-round way. Taking into account of the resolutions and recommendations of the National People's Congress and the proposals of the CPPCC involving the rule of law in the transport sector reached in 2013, the Ministry of Transport released *the Opinions on Establishment of a Government Based on the Rule of Law in Transport in an All-Round Way*, requiring the rule of law in fields from transport planning, construction, operation, administration, and workplace safety, paving the way for and safeguarding reform and development in transport in terms of the rule of law.

In 2013, the Ministry of Transport drafted *the Opinions on Establishment of An Integrated Transport Regulatory Framework*, which sets a plan for harmonizing legislation efforts in the field of transport and has been considering the legislation plan for *the Law on Comprehensive*

Promotion of Transport. The Ministry of Transport will conduct legislative research and prepare for driving legislation of *the Law on Comprehensive Promotion of Transport*.

From the attention of China's transport sector to the rule of law, we can expect that the laws and regulations in the field of transport planning will be further improved, to drive closer interaction between transport planning and urban master planning. However, influenced by the responsibilities of MoT, the laws and regulations fail to make detain provisions on the traffic within cities, especially the planning on road, rail and other facilities. How to tighten the coordination between MoT and MOHURD at legislation, policy, technology and other levels provides the legislative basis and technical guidance for coordinated master urban and transport planning in cities. It is a problem to be addressed in the future.

2.2 Evaluation on Coordination between Transport Planning and Urban Planning

2.2.1 Insufficient Traffic Considerations in Urban Planning

(1) Irrational structure of land use, mismatching between employment and living space, and over high pressure on public transport

In China, most urban land developments expand from the center outwards, with city spreading like a pan cake. In this process of "spreading", serious traffic congestion problems are caused by poor layout of land uses and functions, improper land use structure, unreasonable land use intensity, the size and direction of urban land use out of control, and low intensity of land use.

In the evolution process of urban spatial structure, the mismatch between employment and residence is a significant manifestation of confusing land layouts. Excessive employment in the city center leads to excessive increase traffic volume, while the land available in the city center becomes increasingly scarce due to high density of employment, and cannot meet the requirement for transport. High concentration of urban functions, excessively large functional areas, and insufficient transport facilities result in even more serious uncoordinated development of urban transport and land use.

In Beijing, for example, every 10,000 people have 6,000 jobs available in the city center. In the urban renewal plan, the planned population is 910,000, while 990,000 jobs would be available. However, every 10,000 people have only 2,200 jobs available in Wangjing of Beijing, and 2,300 jobs available in Huilongguan in the outskirt, well below the whole municipality's average. In fact, residential areas such as Anhuili, Anhuibeili and Huizhongli near Yayuncun in the north are of over hundred hectares in each area. Wangjing, Tiantongyuan and Huilongguan are all large residential areas. The planned area of Wangjing is 16 square kilometers, with a total resident population to be 600,000, equivalent to a medium-sized city, and it current resident population is about 300,000. The planned area of Tiantongyuan is nearly 10 square kilometers, with a total resident population to be 400,000. The planned area of Huilongguan is nearly 10 square kilometers, with a total resident population to be 300,000. In the absence of proper employment arrangements for the housing, these areas are mainly for residence. The time-space patterns of regional travel vary significantly, with long daytime peak travel duration, and the main traffic corridors are subject to increasingly evident tidal characteristics. The relatively confined nature of such large-scale residential communities surrounding the city center has created a new "compound" housing, separates the urban road network system. Employment centers like

Zhongguancun and Yizhuang are too large, resulting in a evident tidal traffic flows. The places of work are cut off from those of life residence, resulting in increased commuting distance, extended commuting time, exacerbated reliance on cars, and deformities in traffic structure. Excessive separation between residential and commercial areas causes extremely uneven traffic distribution, with serious tidal effects.

Box 2-1 Tiantongyuan Residential Area, Beijing

Tiantongyuan is a residential area outside the North Fifth Ring, with a straight line distance of 34km from Tiananmen. It is a purely residential area with a population of nearly 400,000 in 2011. Beijing's traffic and travel survey data in 2010 shows that the morning travel peak period of Beijing residents is from 7:00 - 8:30, while that of Tiantongyuan is from 7:00 - 7:29. Separation of employment from residence has caused more concentrated peak period of travel and longer time of travel for the residents, impairing the quality of life generally.

Table 2-3 shows that in 2005, the average commute time of Tiantongyuan residents was 52.1 minutes, 13.8 minutes higher than the average commuting time in Beijing of 38.3 minutes. In 2010, the average commute time of Tiantongyuan residents was slightly reduced due to opening of subway line 5, still higher than the average of the whole municipality. During peak hours, the cars of subway line 5 are heavily crowded. Separation of employment from residence not only leads to extended commute time, but also significantly reduces the comfort of travel.

Table 2-3 Contrast between Tiantongyuan and Beijing City in Residents' Commuting Time[3]

Area	Year	Average Commuting Time (min)	Maximum (min)	Minimum (min)
Tiantongyuan	2005	52.1	190	5
	2010	45.7	180	2
Beijing	2005	38.3	360	1
	2010	43.6	240	1

Tiantongyuan is a pure residential district with large residential areas in and around it, and cannot attract sufficient employment opportunities, characterized by evident separation between employment and residence. In 2010, the out-going commute rate was as high as 87.3%, while the in-coming commute rate was only 26.3%.The traffic flow from Tiantongyuan to the city center is heavy, as shown in Figure 2-1.Due to the main function being residence, almost all the employment flow of residents points to the city center, and the residence between employment and residence is long, reflecting the extended commuting distance of residents.

[3]Source：Long Ying, Zhang Yu, et al. Vol.67,No.10, 2012 Analysis on Beijing's Jobs-Housing Relation and Commuting Travel Based on Bus Pass Scanning Data. *Journal of Geographical Sciences*, Vol.67, No.10, 2012.

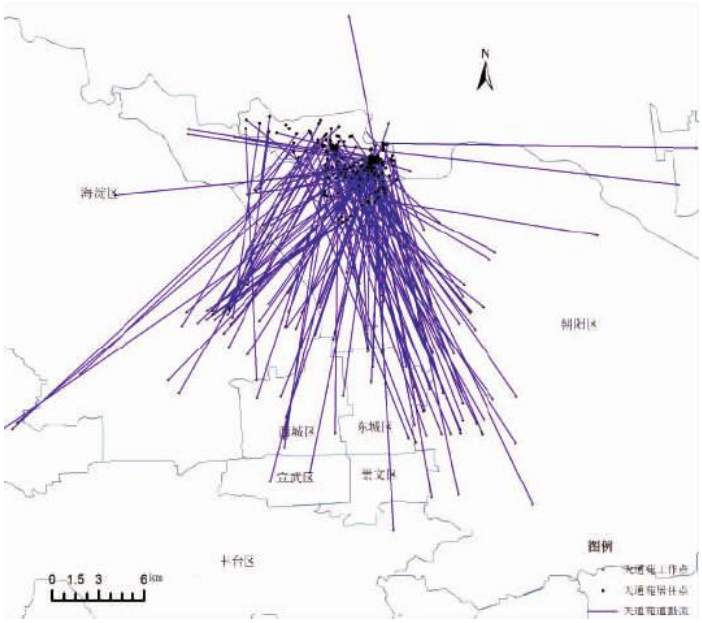


Figure 2-1 Commuter flow of Tiantongyuan Residential Area 2010[4]

Figure 2-2 Queues outside Tiantongyuan Subway Station in Peak Hours[5]

[4]Source：Long Ying, Zhang Yu, et al. Vol.67,No.10, 2012 Analysis on Beijing's Jobs-Housing Relation and Commuting Travel Based on Bus Pass Scanning Data. *Journal of Geographical Sciences*, Vol.67, No.10, 2012.
[5] Source: Internet

(2) Over land development in some areas, insufficient supply of public transport facilities and lagged construction sequence

With the swift development of society, economy and urbanization in China, the form of land use and urban spatial form are changing. The land value in the metropolitan centers is soaring, and high-intensity development has been an inevitable trend of the development of the central areas. On the one hand, cities are attracting more and more population and land, expanding in size. On the other hand, urban functions are being gradually restructured, with increasing attention paid to functional zoning and breaking traditional urban patterns. In this process, inappropriate land use intensity is common, leading to increasingly prominent traffic problems.

Today, urban transport system deviates from land use in big cities of China. The land developments in some areas of large cities often are of high strength and improve by all means the floor area ratio of land. Such super-strength land developments that are driven by economic interests result in a swarm of people and vehicles, which occupy a large number of transport resources, making the central city face huge traffic load. Moreover, urban transport supply is still based purely on the road, further increasing the proportion of car travel and causing traffic jams in the urban center. Poor supply capacity and service level of public transport system and the fast large-capacity planning and lagged construction of subway, light rail and BRT are hard to satisfy the needs of the high-strength land development in large cities. Although some large Chinese cities have accelerated the pace of construction of rail transit in recent years and Beijing and Shanghai have been among the top rank of the large cities in the world by the total mileage of rail transit, in terms of density and level of service, they are still at a low level, as shown in Table 2-4 and Figure 2-3.

Table 3-2 Operating Lines of Urban Rail Transit in China (2014)[6]

No.	City	Numbers of Lines	Number of Stations	Total Mileage (km)
1	Beijing	18	321	520.3
2	Shanghai	14	337	539.2
3	Tianjin	4	87	140.0
4	Guangzhou/Fosan	10	164	260.2
5	Shenzhen	5	131	176.3
6	Chongqing	4	115	192.6
7	Nanjing	5	92	176.9
8	Wuhan	3	78	95.3
9	Chengdu	2	49	60.8
10	Shenyang	2	44	55.0
11	Xi'an	2	40	52.2
12	Suzhou	2	46	51.3

[6] Source：Statistics and Analysis of Operating Lines of Chinese Rail Transit 2014 — Chinese Urban Rail Transit "Annual Report Express" II

13	Kunming	3	33	60.1
14	Hangzhou	2	43	65.2
15	Harbin	1	18	17.5
16	Zhengzhou	1	20	26.2
17	Changsha	1	19	21.9
18	Ningbo	1	20	20.9
19	Wuxi	2	46	56.0
20	Changchun	2	48	48.3
21	Dalian	1	18	63.4
	Total	**83**	**1770**	**2699.6**

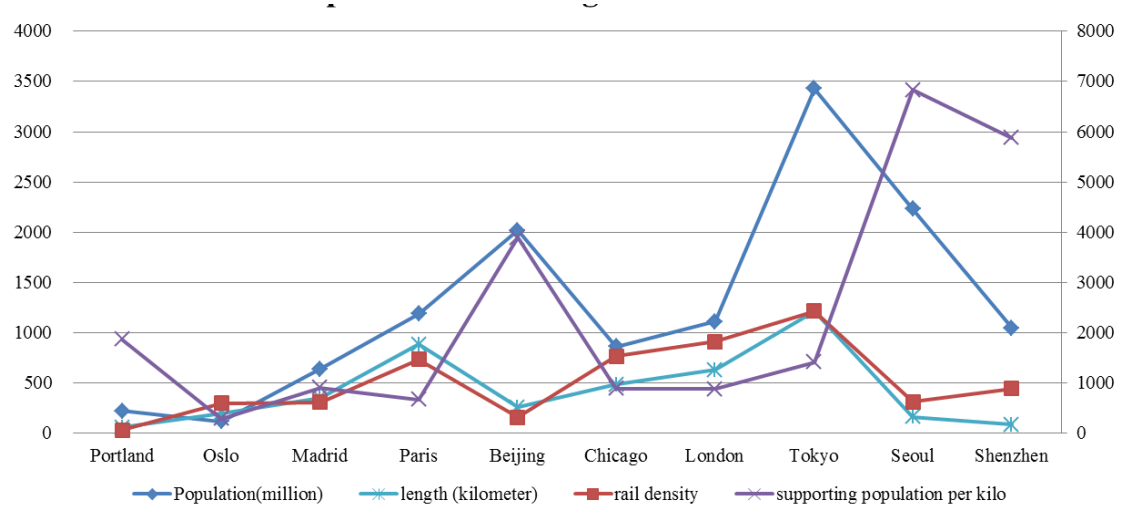


Figure 2-3 Rail Transport Development in 10 Large Cities of the World[7]

In China, urban public transport generally lags behind urban planning and construction, and unreasonable travel structure is very prominent. The investment in real estate almost kept fast growing all the time in Beijing from 2000 to 2012, as shown in Figure 2-4. However, in the meanwhile, the investments in transport and public transport in urban construction had been in low-speed steady growth, showing a serious lag, and public transport eyed an even lower growth. Fairly lagging investment in urban transport results in that urban traffic carrying capacity is hard to support high-strength land utilization model. On the one hand, it causes growing urban traffic congestion and decreased quality of life of residents; on the other hand, it causes relative shortage of urban public transport resources, accelerates the growth in the demands for private car travel and worsens travel structure.

[7] Source：Sorted by the research group

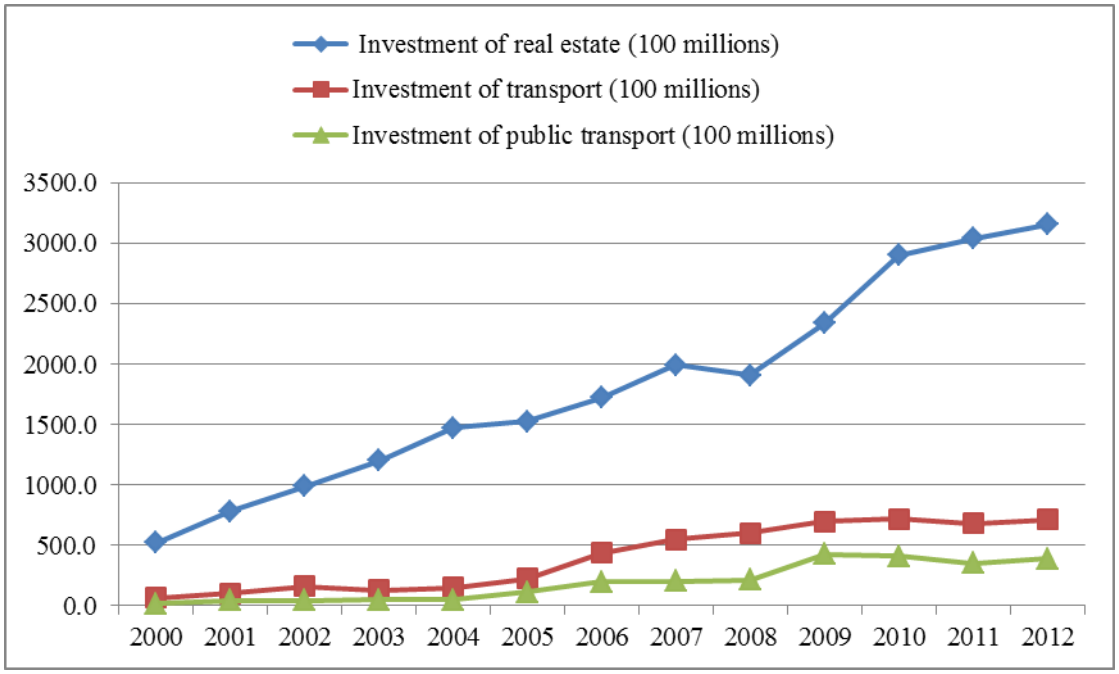


Figure 2-4 Percentages and Composition of the Investment in Urban Transport in Beijing 2000-2012[8]

2.2.2 Planning System uncoordinated with Management System

(1) The local of the legal basis for comprehensive transport planning makes it difficult to play the role of guidance and feedback on the overall urban planning.

Under the institutional framework of current laws and regulations, legal basis exists for the planning for single mode of transport, but the lack of the legal basis for comprehensive transport planning directly results in the weak binding power of the comprehensive transport planning at the city level, which needs to be included in urban master planning to ensure its implementation. Urban internal transport planning, as an important part of urban comprehensive transport planning and a special item under urban master planning, has a relatively week feedback role in the urban master planning. Therefore, comprehensive transport planning and urban master planning can be mostly unified and coordinated in terms of content and procedure, but in fact, it is difficult to guide and feed back urban master planning.

[8] Source：Drawn by the research group in accordance with relevant data of *Beijing Statistical Yearbook*

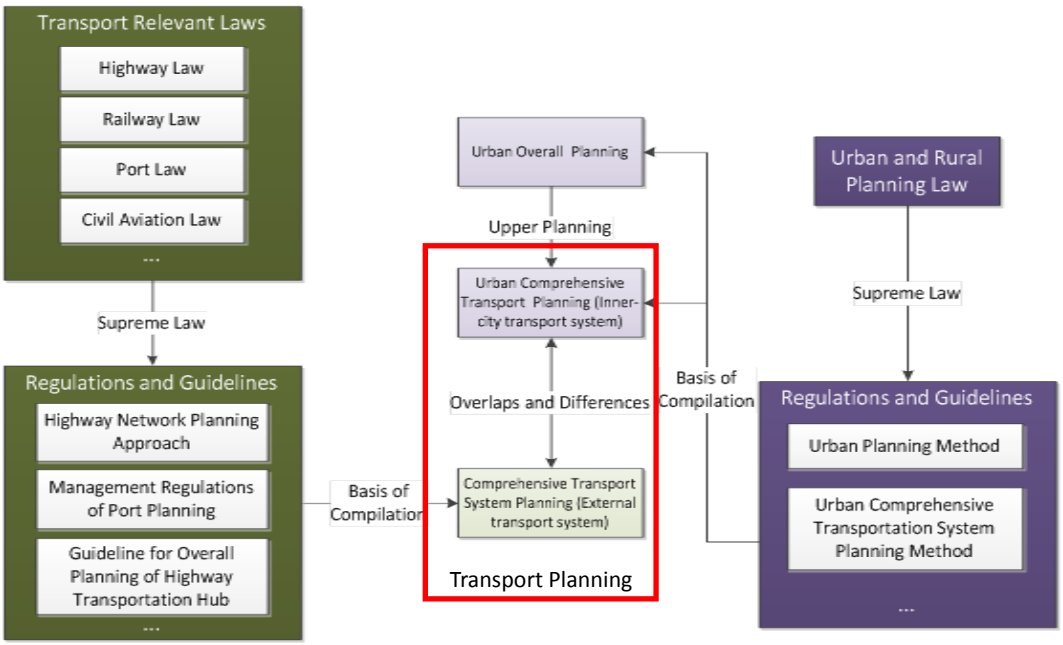


Figure 2-5 Related Laws and Regulations on Transport Planning and Urban Planning [9]

As a practice of transport planning in China, transport plans are generally prepared on two levels for cities, i.e. city center and city area due to the influence by management system, as shown in Figure 2-5. One relates to integrated transport system plans, which are usually prepared by municipal traffic departments in accordance with *the National Expressway Network Plan, the National Coastal Port Distribution Plan, etc.*., focusing on external accesses, including highways, railways, water carriage, urban and external transport hubs, as such ports, airports and logistics parks. Such plans rarely involve urban roads, rail and other transport facilities within the city. The other relates to integrated urban transport plans, which are often presented as an important part of master urban plans or as specialized plans, focusing on the transport system for urban areas, including roads, parking, stations and yards, and public transport. Their development is generally organized by the municipal planning department in accordance with urban master plan. Such plans scarcely deal with the transport system outside the city center. However, some elements of the two types of transport plans are intertwined, usually corresponding to the interface between the city's outer transport system and inner transport system, such as an integrated transport hubs and station facilities. Typically, these two types of transport plans are prepared by transport authorities and urban planning authorities respectively, subject to different laws and regulations. Although the focus of the two types of plans are different, but there are some overlapping between them lacking coordination and harmonization.

（2）Traffic planning and urban planning are dominated by different authorities, inter-authority coordination is more difficult, and transport planning lacks feedback mechanism to the overall urban planning.

Currently, the functions of transport planning and urban planning are executed by MoT, MOHURD and local governments. Generally, the preparation of master urban plans is often organized by urban planning authorities; the preparation of transport plans is often organized by

[9] Source: drawn by the research group

the transport authorities or urban planning authorities. Some of these authorities are peers, so the complicated relationship between them adds to the difficulties in coordination in plan development and implementation.

Figure 2-6 illustrates the relationship between authorities for transport planning and urban planning. As a specialty of urban master planning, transport planning is subject to administration by multiple relevant departments. Urban master planning is often superior over transport planning; therefore, transport planning has to comply with the urban master planning in terms of both contents and structure.

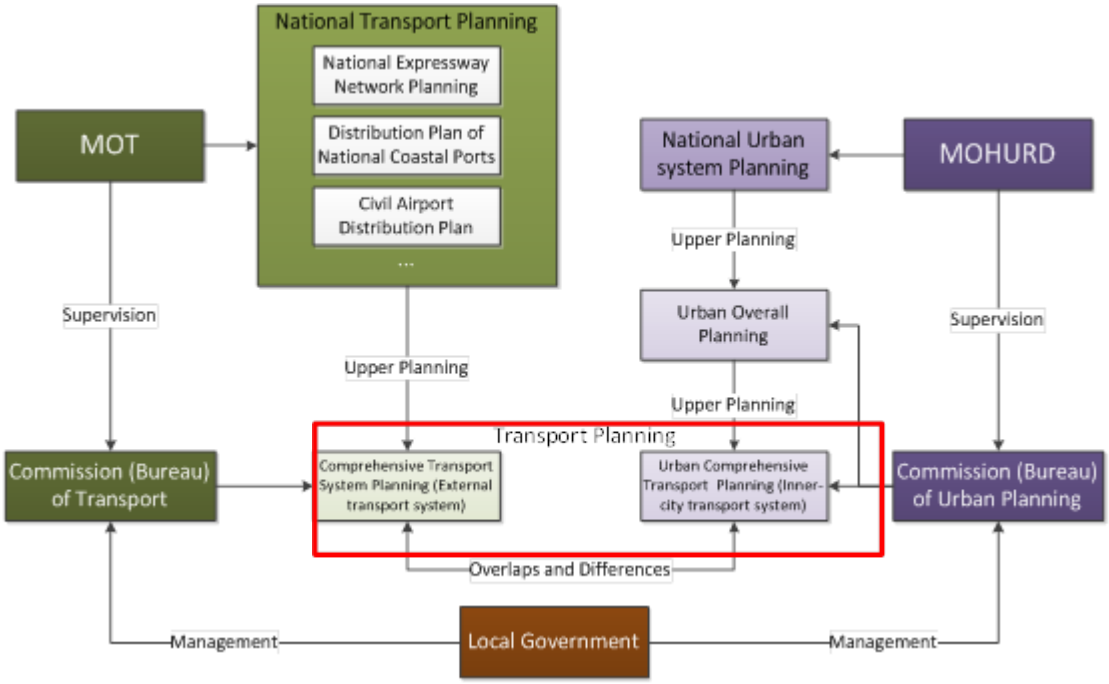


Figure 2-6 Authorities for Transport Planning and Urban Planning [10]

In fact, planning itself should be a top-down whole. Currently, three planning systems lie with the authorities for land and resources, those for planning, and those for development and reform. As a result, interfacing and coordination is lacking between economic and social development plans, urban plans, urban transport plans and urban use master plans of cities. In the current planning systems, compilation of urban plans and land use plans lack attention to restraints from transport infrastructure resources. Moreover, transport planning is often conducted after urban master planning, so there is hardly any room for improvement in space layout and giving feedback to urban master planning. In transport planning, due to the limits from the social and economic development and from knowledge, planners may fail to consider the impact of rail transport on urban development, and the changes to characteristics of traffic in the case of changes to certain public policies. When the development of the city outpace the expectation or relevant policies change, traffic planning cannot be adapted to the needs of urban development.

At the local level, cities lack organizations which can address various issues and coordinate efforts of related departments with necessary authority in planning. Instead, there are a number of peer

[10] Source: drawn by the research group

departments responsible for different aspects of the city. Transport planning and urban master planning often involve urban and rural planning, housing and development, transport committee, and other authorities. In some cities, some aspects (such as rail transport) in transport plans and master urban plans content also involve other departments or enterprises, such as national land and resources authorities, rail transit planning and construction leading groups and urban investment and development companies.

2.2.3 Lack of Policy Support Measures and Technical Means

Although China's current laws, regulations, standards and codes have given consideration to the coordination between traffic planning and urban planning, imperfect land use system, land use classification criteria and technical means and the frequent failure in effective implementation of laws, regulations and policies result in that traffic planning is uncoordinated with urban planning.

(1) Demand for transport construction land is not answered in urban master planning

With the establishment and improvement of China's market economy, urban land use has been transformed from free allocation to paid transfer. After the establishment of the paid urban land use system, those previously allocated land may be transferred after pay the transfer fee. As a result, many users of previously allocated land become lawful suppliers of land, making the primary land market a buyer's market. The availability of previously allocated land on the market has greatly weakened the ability of government's regulation of the land supply.

In Chinese cities, the land for urban infrastructure (including transport infrastructure land, such as rail transport, urban roads, freeways, general highways, transport hubs, stations, etc.) has been allocated for free. The site selection and construction of transport facilities are subject to existing land conditions, urban rivers and water systems, forestry, farmland and cultural heritage conservation and other factors. In built-up urban areas, those restraints are more prominent, increasing the difficulty in alignment selection and construction activities.

In development of transport infrastructure, the transport authority often assumes the costs for land acquisition, demolition, compensation and construction. With the establishment of the land market, land prices have kept increasing. The better the location (downtown areas for example) is, the higher the prices and construction costs. If government funding is insufficient, construction of transport infrastructure will fall behind the plans and demand.

Therefore, existing land use conditions and various constraints involved in land development, and the funding demand due to increasing land development costs, hinder actual implementation of transport plans.

(2) Lack of consideration for transport in current criteria of land use classification, difficulties in mixed land uses

In the current system of urban planning, land use planning is an important carrier for realizing the planned control objectives, reflecting the urban land use objectives in the plans. Therefore, an important means of urban planning is to classify urban land, and formulate rules on use of various types of land, to control urban land development and its structure. Classification of urban land is the premise of compilation of land use plans. From 2012, China began to implement the new standard *Code for Classification of Urban Land Use and Planning Standards of Development Land* (GB50137—2011). The new standard still adopts classification method by the nature of land use, and refines and adjusts the classification, providing for 8 categories, 35 sub-categories and 44

divisions of land uses. See Table 2-5. There are also some local relevant standards in some large cities, such as *Shenzhen Standards and Guidelines on Urban Planning* as well as Hong Kong's classification system. The classification in these standards is mainly based on the nature of land use classification based, taking into account the primary nature of the land development or land ownership.

Table 2-5 Classification of land use in *Code for Classification of Urban Land Use and Planning Standards of Development Land*

Table 2-5 Classification of land use in *Code for Classification of Urban Land Use and Planning Standards of Development Land* [11]

R	A	B	M	W	S	U	G
Residential	Public administration and service	Commercial and service	Industrial	Logistics and warehousing	Transport facilities	Public facilities	Green

Generally, China's urban land classification is oriented to planning, design and land use statistics, based on land functions and uses by the properties and characteristics of land itself, and applied in all levels of planning, including master planning, district planning and regulatory detailed planning. However, the urban land classification criteria are determined from the perspective of urban planning. They do not consider the factors generating traffic demands and make no additional explanation on the characteristics of the generated traffic demands or the impact on the traffic system. Due to the lack of refection of transport characteristics in urban land, it is unlikely that all planners clearly understand the intensity and distribution of transport needs for various types of land use layouts.

In addition, among China’s current land classification standards, the lack of the standards for mixed land use results in a certain degree of difficulty in comprehensive development and layered utilization. Although national ministries and some local governments have issued a series of guidelines on promoting hub comprehensive development and mixed land use, such guidelines are at a more macro level and specific and operational standards lack in the actual implementation process.

In China, the only criteria of classification taking into account transport factors is those adopted in traffic impact evaluation regarding construction projects. For example, the current *Technical Standard for Construction Project Traffic Impact Evaluation* (CJJT141-2010) classifies construction projects by land use type into 11 categories. See Table 2-6. However, such classification of construction projects is mainly used in traffic impact evaluation, which can hardly affect the related urban planning and transport planning. The classification is too fine to be used early stages of urban planning.

Table 2-6 Classification of Construction Projects in Technical Standard for Construction

[11] Source：Code for Classification of Urban Land Use and Planning Standards of Development Land (GB50137—2011)

Project Traffic Impact Evaluation[12]

T01	T02	T03	T04	T05	T06	T07	T08	T09	T10	T11
Residential	Commercial	Service	Office	Stadiums and gardening	Medical	School	Transport	Industrial	Mixed	Others

2.2.4 Limited Effect of Existing TIE System

Traffic impact evaluation has been considered a key means to reduce the impact of large-scale projects on traffic. In fact, the design of projects is seldom guided by traffic impact evaluation, because of the following reasons:

(1) TIE system construction lags behind

Legal status of TIE. TIE system establishment in urban planning and management, in essence, is whether to allow a particular construction project to be constructed, namely an administrative license. At present, a lot of places regard local normative documents as the basis of TIE. However, with the implementation of *the Administrative License Law of the People's Republic of China*, the legal effect of local documents is too low for the setting of TIE system. *The Road Traffic Safety Law of the People's Republic of China* provides that if road and public building facilities can not meet the condition, there is a need for reconstruction and expansion, use stop or other purposes, but it does not mention TIE. *The Regulation on the Implementation of the Road Traffic Safety Law* only makes a general requirement on the TIE system, and further provisions should be made for TIE objects, authorities the convergence with urban planning management, preparation unit, technical standards and burden sharing. The status quo stipulated by the law makes TIE hard to exist as a kind of system.

TIE technology lacks standardization. The standardization of TIE technology should include procedure standardization, technical standardization and evaluation standardization. But in China, some deficiencies exist with these three parts. First, in some cities, TIE still fails to become a link in urban planning approval, and only when the authority believes it necessary, TIE will be carried out. Second, the technical methods involved in TIE, such as requirement analysis model, travel capacity analysis and traffic assessment methods, directly quote foreign research results and fail to fully reflect the characteristics of domestic mixed traffic and the relationship between traffic and land use, which causes a large difference between the evaluation results and the actual situation; Third, Chinese cities vary in characteristics, overview and experience, so it is hard to determine the object, scope, Evaluation Indexes and degree of influence of TIE, which affects the accuracy of the TIE.

TIE lacks standardized management. First, TIE involves urban construction department, planning department, policy traffic management department, etc., and there are difficulties in terms of data collection, data acquisition, plan coordination and plan implementation. Second, as TIE mostly dissociates between the planning department and policy traffic management department, resulting in that various authorizes have unclear management authorities. Third,

[12] Source: Technical Standard for Construction Project Traffic Impact Evaluation (CJJT141-2010)

currently, TIE consultancy costs are borne by the developer and developers may have an impact on TIE reports for project initiation, leading to a lack of fairness and feasibility of the results.

(2) Hard to make feedback on site selection for traffic impact evaluation

Currently, project owners entrust consulting firms to conduct traffic impact evaluation in application for construction permit generally after the former acquired the site, rather than in the site selection process when the government analyzes the traffic impact of the project. When the project owner has obtained the site, the intensity and nature of development has already been determined, so it is difficult for traffic impact evaluation to object the site selection. Considering the financial interests, the firm conducting the traffic impact evaluation is likely to stand in the shoe of the owner to justify the project's feasibility. Therefore, **the role of traffic impact evaluation is not to verify the feasibility of a project, but to reduce the traffic impact of the project under the current management practices and rules.**

(3) TIE reports vary in quality

The owner is only concerned about the contents affecting the approval of construction schemes. Since the developer engages a consulting firm to conduct traffic impact evaluation and the traffic impact evaluation report is not a determinant in the feasibility of a project, the developer is only concerned of distribution of vehicle entrances, provision of parking and other indicators which affect the approval of the designs, does not care about internal transport organization and other aspects which require specialized knowledge and are less evident in design, assumes that the architectural design institute should have made appropriate internal traffic organization, and take preparation of traffic impact evaluation report an element for approval.

Price competition faces preparation units. The government has not established specific qualification requirements for TIE report preparation units. As a result, many institutes are engaged in preparation of TIE reports, and there is competition to some extent on the market. As the preparation unit has no high requirements for the quality, the competition between evaluation institutes is manly in pricing, which adversely affects the quality of the report due to lack of funding. For example, the collection and survey of travels, traffic and other basic data are often omitted due to cost reasons.

Reviewers are largely concerned about the impact of construction projects on traffic. TIE report is not a determinant in the feasibility of a project. Quality is not a key subject in review. Moreover, traffic problems are elastic and the forecast is subject to uncertainties. The experts do not necessarily know better data and information than the drafting firm, so they lack of the scale to be strict. Due to a variety of reasons, no traffic impact report would be rejected in expert review. The drafting firm is not motivated to improve the traffic design of the design, and the TIE report totally relies on its consciousness and expertise. The final improvement and control of the traffic design largely depend on reviewers of transport authorities.

(4) Architectural design is disjoined from transport design.

Traffic organization design should be an important part of the design of architectural projects, especially in the era with increasingly prominent traffic congestion problems as a result of urban development. The traffic of an architectural project not only affects the external traffic, but also plays a critical role in exertion of the intended uses of the project. For example, the rental of offices and the traffic customers to restaurants are closely related to the access and ease of parking traffic. However, due to different educational background and knowledge structure between

architectural engineers and traffic engineers, it is common that architectural designs give no due attention and space to traffic problems. In preparation of TIA reports, architectural engineers and traffic engineers should communicate with and support each other, but in fact they work independently and lack of cooperation.

2.2.5 Summary

Base on an analysis on the incoordination between transport planning and urban planning currently in China, we can know that in major cities, there are no statutory specialized coordinating bodies in the fields of transport planning and urban planning, and only some cities have had some explorations in the forms of “leadership team” and “joint meeting”; for the absence of coordination procedures, most matters under coordination are discussed case by case. No fixed coordination mechanism has formed, and the degree of public participation is not high; the safeguards for planning coordination are still not in place, relevant technical guides, standards and codes are mostly macroscopic and fail to effectively guide the coordination issue in the preparation process of specific traffic planning and urban planning, and no incentive mechanism has been established for the coordination issue in the implementation process.

3. Studies on Synergic Planning Cases

The studies of domestic and foreign scholars on the policy on the coordination between urban planning and traffic planning can be divided several stages. The main research approaches include geometric analysis, spatial analysis, quantitative analysis, behavioral analysis, etc. Analysis and studies are conducted to urban and traffic development in combination with region, economy and behavior. With a deeper understanding of the interactive relation between city and transport, a transition has been seen from the initial theoretical study on the interaction relationship to the consideration of traffic function in urban planning in the aspect of urban and transport development, and eventually it developed into coordinated urban and transport planning.

This chapter examines some typical advanced application cases, introduces some practice and experience of coordinated urban and transport planning and proposes development and improvement suggestions based on the national conditions of China. According to the different stages and focuses of implementation, the experience is divided into three parts: 1) Coordinated planning; 2) planning and management and implementation; 3) guarantee policies and means.

3.1 Coordinated Planning

3.1.1 Ideas of Planning

Compared with China, some foreign countries began urbanization and motorization earlier and also once experienced rapid and unordered urban expansion. In constant explorations and practices, foreign countries recognized that only integrated city-traffic development can better ensure sustainable development. Therefore, in the advanced development cases of foreign countries, it is an essential part to clarify the concepts and ideas of coordinated planning in the early stages of planning.

First, thoroughly implementing integrated development concept to ensure overall, long-term and continual planning

o promote the concept of integrated development, foreign cities often refine the objectives at the levels of national long-term development strategy, regional development ideas and urban development principles and implement the development concept through the development of planning principles and planning objectives. Meanwhile, in the successful cases of coordinated urban and traffic development, coordinating planning is implemented on the whole area level, rather than just a corridor or a community. By implementation of this kind of development mode throughout the area, it can give full play to scale effect, and form the advantage of integration, so as to change the land form of whole area and travel characteristics to promote regional development.

The objects of the coordinated planning of different regions and cities usually include: 1) to reflect powerful and effective long-term vision; 2) to maintain regional economic vitality; 3) to reflect regional features, and adopt the differentiated economic development strategy; 4) to make the most of existing industries and infrastructure; 5) to take large-capacity public transport development as an opportunity to improve regional mobility, and form the ideal pattern of land use; 6) to ensure balance and stability of transport system, pay emphasis consideration on interaction between land use and transport, and implement land use - traffic integration planning; 7) to

improve and guarantee community facilitation and quality of the people's livelihood; 8) Protection and common development of adjacent area; 9) Sustainable development; 10) Deep collaboration of all departments.

Case 3-1 Puget Sound Integration Plan

Puget Sound, surrounded by several major cities including Seattle, Tacoma and Everett, is a fjord located in the Pacific Northwest of the United States. From 2003, Puget Sound, to collaborate with the development strategy proposed by the US Congress and the Department of Transport, began to the research on the 2040-oriented strategies for the growth management, environment, economy and transport development. The Development strategy research, led by the Bay Area Council, cooperated with local officials, public institutions, interest groups, and other individuals, had been gradually formed the *Vision 2040* (hereinafter referred to as the *Vision*). the *Vision* includes five aspects covering environmental framework, regional growth strategy, relevant policies guiding growth and development, implementation plan, and supervision & security implementation scheduling about the future development of Bay area, which put forward clear policy goals on environment, development model, housing, economy, traffic and public services.

Vision 2040 especially puts forward to promoting traffic - economy - land use integration development. Different to past *Vision*, this *Vision* is not a conceptual planning, by which the development target is put forwarded not only programmatic and directional principles, but also integrated regional growth strategy of depth fusion of quantitative transport, economy, environment based on population, jobs and other prediction. It formulated top-down cooperation plan facing subordinate counties, actual implementation plan, supporting measures implemented based on planning framework giving priority to target and policy, which provides powerful guarantee for implementation of planning, and a more clear and more binding guidance for their subordinate county make their own plans.

In goal setting, policy principle and propulsion method, *the Vision* emphasizes to strengthen the cohesion between land use and transport planning, promote growth management, transport and economic development integrated decision. In particular, in the traffic policy goals, the Vision points out to provide more travel mode choices, increase the travel mobility, and reduce the environmental impact and greenhouse gas emissions through public transport development. Subsequently, to cooperate with the *Vision*, all cities within Puget Sound also put forward more explicit, detailed regional planning concepts and conducted a new round of urban planning, so as to implement the development strategies in *the Vision.*

Second, encouraging TOD to promote scientific urban layout and rational development

A large number of domestic and foreign cases have showed that transport system is not only the support of urban functions but also an important tool leveraging urban development. In the coordinated transport and urban planning, an important measure is to encourage the use of TOD. It is a development goal set by many cities before planning to “improve regional mobility and form an ideal land use pattern by the chance of high-capacity public transport development”, which is also always carried out in the subsequent planning and project decision-making process. In the stages of new town planning and old town transformation, the means and methods of IOD are slightly different. In time of new town planning, the functional layout of the city is simultaneous with the layout of rail transit and other mass and medium-capacity passenger transport systems,

important public facilities laid around the stations of rail transit. Meanwhile, concentrated development is conducted to the areas along the rail lines, thus forming development corridors; however, in time of old town transformation, since the important facilities and functional areas have taken shape, the current and future potential important development corridors of planning are identified generally in accordance with the distribution of commerce, employment and residential areas. Moreover, the lines connecting public transport are laid out along the corridors, and intensive and compact secondary developments are conducted near the stations to increase land value and guide the changes in the travel models in the areas. This planning concept not only is favorable to tighten the public transport ties among major areas and ease the pressure on the ground traffic but also can improve the efficiency of land use and save considerable infrastructure investment.

Box 3-2 Transport Oriented Development (TOD) Case

1. Copenhagen

As early as in 1947 Copenhagen has put forward the far-sighted long-term planning - "Finger-Shape Planning" with its own characteristics, by use of the rail networks and subway network that have been built or are under construction. Through the joint development of rail transit and new towns, the places where stations are situated were planned into residential centers, with the development of the city mostly concentrated near the stations. This made subway become a main way of transport in this area. At present, the construction and development of new town is in five directions -- south, southwest, west, northwest, and north. For 60 years, despite constant personnel changes of the local government, the “finger” development policy has always been there.

Early in the 1970s, due to the surge in vehicle ownership, people once called for building a loop road to connect all “fingers” and then developing each node into a sub-center. However, planners held that this might result in a city development pattern dominated by motor traffic. Finally, as the plan for loop construction was terminated due to the oil embargo and ecological protection events, finger plan could continue to implement, which made the city form of the Copenhagen develop under the fingers plan.

The Finger Plan requires all development must be concentrated near the stations. In *the Planning Area of 1987* (revised edition), the important function facilities in all areas shall be built within the scope of 1 km around the stations, thus reducing the commuting traffic to the city center. The following planning revision in 1993 paid more attention to this. The “Limited Guide” policy developed by National Environment Agency required that the area covered by rail transit service shall conduct concentrated urban construction within the scope of 1km around the rail transit stations.

In the last revision of the Plan, the government expanded the scope of guide from rail transit to conventional buses, requiring the new buildings in each year must be concentrated near the bus station. The allowed building density around the rail transit stations is increasing, and the subsidy policy for development density also has stimulated the development of commerce.

2. Curitiba

The two major development concepts of Curitiba are:

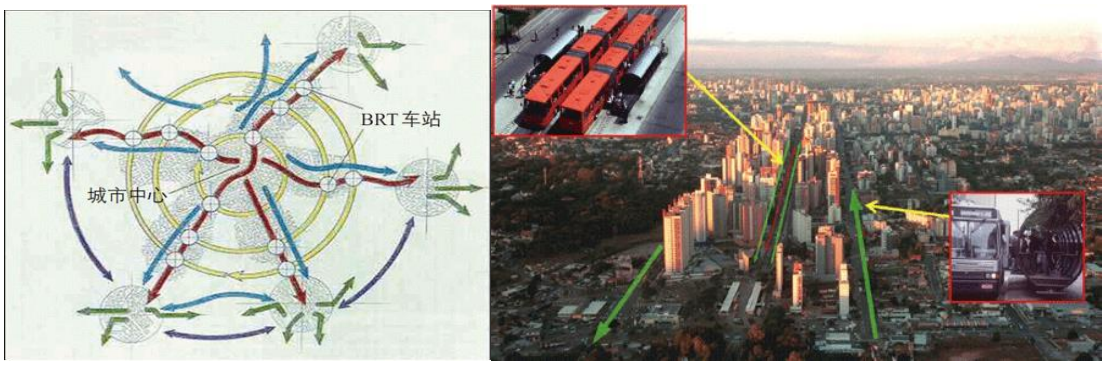
1）BRT guides towards linear development

Curitiba is a world-famous city for guiding urban planning by traffic planning. The urban development of Curitiba is in strict accordance with the planning. Five radiation axis of BRT system forms five linear development axis of the city. The central Axis is bus rapid transit BRT system, with both sides for motor vehicles. On the both sides along the axis, there is high-intensity development; urban high-intensity building development is focused on five axes while high-strength development is prohibited in other areas. City's main business, commercial, and public activities focus on five axes. There are strict low-volume residential areas between axis, and the development of high-rise buildings is prohibited.

The integration of public transport system with BRT system as the core provides the foundation for layout and development planning of Curitiba city. Curitiba did not develop according to "pie overspreading" mode. Within the scope of more than 400 square kilometers of the city, the city center only accounts for 50 or 60 square kilometers and 1.6 million of the city's population has not focused on the downtown area, with city's population density of only 3,700 people/ km^2.

2）Multi-level bus service network with transfer hub as the core

BRT lanes, cylinder station, transfer hub and bus lines with different service functions constitute the Curitiba integrated public transport system. Bus hub stations are located in the axis of the integration of public transport network, which can be divided into transfer stations and terminal stations. Transfer hub station provides corresponding space on the platform for different lines, and connects these platforms in the form of underground tunnel to facilitate the convenient transfer of passengers. The terminal hub station is located at the end of structure axis road, matched with large infrastructure to handle more traffic between the surrounding area and the downtown area. In addition, the management institutions (such as marriage registry, community service center, etc.) in each district are all set up in or around the hub stations or initial and terminal stations.



BRT 车站：BRT station

城市中心：central urban area

Figure 3-1 Urban Development Form and BRT Corridors of Curitiba[13]

3. Singapore

Since 1970, Singapore has experienced high-speed economic development period with population increasing by nearly 50%, downtown area increased by nearly 20%, and urban land increased by nearly 40%. The Singapore government seized the favorable opportunity of rapid development to

[13] Source: Internet

make public transport guidance plan on urban land. In 1971, the government of Singapore developed Overall Plan referred to as "Ring Planning", which provided the construction blueprint for next 20 years. Within annular region around the core parts of the city, population and industries in the center of the city were evacuated to the new town that was formed long the rapid transit corridor with both residential and light industrial functions; When rail transport network construction was complete, all of satellite towns have subways, and the site also became the center of the new town.

The planning also put forward taking the mass rapid transit system (MRT) as the main national traffic line, through which residential areas, business district, shopping centers and entertainment places, etc. are connected. The timing of MRT construction was very good, and now Singapore is one of regions with fastest growing in the world; it means that the MRT has great advantage to guide and strengthen the development of an area, and hence lead to the formation of the whole urban form.

At the beginning of new town construction, although the construction of rail transit system has not yet started, the land was reserved in accordance with the planning for planning and layout of public transport community. All new towns adopt comprehensive, high-density and high-level development mode, guide the development by public transport. Each town has a large downtown, and there are 5 to 7 sub-centers surrounding it, most of which covers an area of 40 hectares with 4000 to 6000 communities. Within 5 minutes walking distance of each residential area, there are shops, schools, recreational facilities, etc., to provide people with necessities of Life. With good each town infrastructure and complete functions, it can fully satisfy residents' work, entertainment, leisure, shopping and other needs, for which people only go to central or other towns in holidays, and thus, effectively reduce the urban traffic flow.

Third, emphasizing jobs-housing balance as an important basis for the development of public transport

Third, emphasizing jobs-housing balance as an important basis for the development of public transport

Promote the development of public transport and guide rational urban distribution. On the one hand, business, employment and housing oriented travels produce and attract the areas to lay bus lines to ensure the convenient accessibility of the inter-regional public transport; on the other hand, rational layout planning should be conducted within the regional scope for the sake of jobs-housing balance. The inner-regional travel is guided as much as possible to reduce the inter-regional long-distance car use. The dependence of the residents' way of living on public transport is strengthened through planning.

In the planning process, the planning on plot division and land use nature is only a part of reflection of this concept. But, as the allocation of housing and jobs occurs in the market, the inner-regional actual balance should give consideration to the guidance in the two aspects below: 1) The number of jobs and dwelling units in the region, i.e. balance; 2) The proportion of the number of workers in the region, i.e. self-contained.

Box 3-3 Cases of Jobs-Housing Balance

1. Hoje Taastrup New Town Plan

In mid –1960s, Copenhagen set up a new town——Hoje Taastrup in the southwest- along the

figure direction, to take it as mode as a template to guide development of more new towns; the city land development attached great importance to the balance of employment and living, mainly surrounding the rail transit station. The development axis spread outwards from the station, and connected the residential area, on both sides of which a lot of public facilities and commercial facilities had been gathered, and new city center did not allow the car, walking, cycling and ground bus coexisted in the area. Thus, new city travel could be conveniently realized without relying on cars. In this way, the mutual promotion between rail transit and land development was formed within actiniform corridors in Copenhagen: it was very convenient by rail transport which made people want to choose working or living around the station, so as to provide a lot of commuter traffic for rail transit, while the existence of commuter traffic promoted the commercial development along the route; the hybrid development of working, living and business was further convenient for rail transit passengers, and would continue to promote land development along the route.

2. Bel-Red Corridor Plan

Bel-Red corridor is located in Bellevue, Washington, USA is band-shaped area enclosed by a few main highways. Due to the Bel - Red area as old employment area of Bellevue, mostly light industry, its living area accounts for very low ratio, so in a new round of planning, planning personnel think it is necessary to increase residential community in the area to improve the regional energy, and support the public transport development. In particular, the planning also specifically points out that the position of community should be arranged along in concentration areas of bus, public services and employment, and meanwhile, promote the construction of economically affordable housing and staff houses to attract employees of different income levels by solving their housing problems, reduce travel of long distances, and reduce car use frequency. For residential area that has been built, bus lines are developed timely to induce residents to travel by public transport. Another bright spot for planning is that it not only considers job-housing balance within the area, but also takes into account the planning of nearby Bellevue downtown area and Redmond city (high-tech zone that headquarters of Microsoft and Nintendo of in North America are located in), as well as plan and arrange residential area in job intensive area close to these two area.

Fourth, appropriately advancing development of the traffic environment to form a more sustainable land use pattern

It is a big opportunity for city development to guide urban transformation planning by use of public transport, therefore many cities focus on the specific line position and direction, line-side land development model, community distribution pattern and supporting bus lines of major bus lines in the early stages of urban planning. They also make corresponding land use plans for the layout plans of different stations. However, due to the inconsistency in terms of time and cycle between urban planning and rail transit planning, the urban development is even earlier than rail or BRT line transport planning in many areas, and the specific landing time, line position and direction of public transport projects and even whether the plans for them can be really implemented all face uncertainty. Therefore, in the planning scheme, it is a necessary prerequisite for whether city and traffic can develop collaboratively to create the environment for the development of public traffic.

In Copenhagen, for example, the construction of rail transit system goes before or simultaneously

with the line-side land development. Thus, at the beginning of development, rail transit system can be used to guide urban development, forming a compact and mixed land development model with the stations of rail transit as centers. After the basic completion of the land development along the routes, it satisfies the travel demands along the routes as main travel tool. Meanwhile, the national policies of Copenhagen clearly stipulate that best efforts must be made to encourage TOD, and if a particular project violates the principle, the national environmental authorities have the right to exercise the veto.

A summarization on the successful development experience, the formation of public transport development environment chiefly includes: 1) reserving land in advance; 2) conducting compact and high-density development of the plots where public transport projects may land; 3) optimizing conventional bus line network, enriching the "capillary vessels" of bus lines and emphasizing the seamless connection between conventional public traffic and future rail transit and BRT stations. The above three points are favorable for the creation of an environment suitable for bus development and conductive to the planning and introduction of large-capacity bus lines; moreover, they can guarantee a reduction on the cost of land demolition and the earliest entry into the construction phase in time of public transport project implementation.

Fifth, promoting the block convenience and advocating the "people-oriented" thinking

In coordinated urban and traffic planning, in addition to public transport layout, district functional orientation, plot division and development model, the key considerations include whether bus travel is convenient in the blocks, whether inner-regional facility layout can promote community residents to voluntarily use public transport and whether TOD is integrated into the city's new projects and those under development. The specific elements to consider include: 1) the convenience, timeliness, safety, comfort and cost for community residents to use public transport; 2) the convenience, comfort and safety of the routes connecting bus and community; 3) the reasonable advantage of public transport compared with other travel modes.

The means of planning can be roughly divided into three levels according to the plan range: 1) At the level of urban master (integrated) planning, comprehensive development areas (CDA) are planned along the medium and large public transport lines to promote the high-strength land mixed use and overall development of the line-side commerce, residence and employment; 2) At the level of zoning plan, social parking lots and bus hubs are set along rail transit stations, and developed comprehensive transport transfer systems are built to fully enhance the accessibility of rail stations and strengthen the appeal of rail transit to the residents in the surrounding medium and long-distance areas; 3) In the planning and design of stations and blocks, some comprehensive business, shopping and other facilities are firstly set at station entrance and exits and the surrounding areas to enhance the residence convenience around the stations; the planning for such slow travel systems as cycling and walking is strengthened around stations, business districts and communities to achieve a reasonable and convenient convergence among slow traffic, surrounding buildings and development spaces, improve the travel environment of slow traffic and increase the influence of slow traffic connections.

Case 3-4 TOD Development Plan of Chittenden Prefecture

Chittenden County is a county in Vermont in the northeast of the USA. The TOD planning made by Chittenden county, public transport system mainly includes buses operated by Chittenden highway administration, Champlain Flyer Company and State Authorities, as well as the bicycles

managed by traffic service agent operation. In the process of specific implementation of management, Chittenden County has formed a clear, detailed directive *Guidelines* to guide subsequent facilities design and construction. *The Guidelines* were made by the Consultation and Steering Committee consisting of many local planners and practitioners united by County City Region Planning Commission (CCRPC), in hope to the mixed land utilization and development and commercial development along the transport lines so as to form an efficient urban traffic system. *The Guidelines* put forward the specific goals of the county to develop TOD, chiefly including: 1) to improve the use efficiency of existing lands; 2) to enhance the better understanding and connection familiarity between transport and land use planning and conduct higher-quality design; 3) to create a more "friendly walk" community environment; 4) to improve the effective capacity of existing street network.

The Guidelines detail the provisions for the development and construction along the lines and achieve true humanity through the guidance for such details as street sign setting and border trees. In particular, *the Guidelines* propose corresponding strategies of land development and infrastructure construction based on pedestrian-scale and advocate he development of slow traffic. Detailed guidance provisions include:

1) Pedestrian-oriented environment should be the design of pedestrian-scale, with most suitable street scene and street construction ratio of about 3:1; 2) High-density residential areas are near the existing public transport lines, with walk distance to the bus line or stop of 1/4 to 1/2 miles; 3) Population scale is regarded as a main considerations of street scene and building construction, and visual walk space and secure connection are provided; 4) There must be a sidewalk at least within a quarter mile radius of bus stops.

3.1.2 Planning Approaches

First, using performance-based planning methods to strengthen the economic practicality of planning and enhance the enforcement of planning

In oversea advanced cases, performance-based planning has been proven as an important means to promote the good convergence between the development objectives and implementation effects and runs through the whole process of planning, covering preliminary study, plan preparation, investment plan arrangement and post-planning implementation impact assessment. The USA stipulates through legislation that during planning all the states and metropolitan areas must use proper performance indicators as the planning objectives and put forward the corresponding measures to achieve these objectives. Since the city - traffic integration is an important means to ensure sustainable urban development at present, the planning performance indicators in many cities and regions often cover the accessibility of public facilities, the mobility of districts and the convenience of community bus, so as to be in line with the national goal of coordinated urban and traffic development. Table 3-1 lists the more common performance indicators.

Table 3-1 Performance Indicators of Integrated Planning [14]

[14] Source: Summarization by the research group

Urban Development	Transport Development
Accessibility	Motor vehicle population
Density	Motor vehicle travel times
Mixing degree of land use	Motor vehicle driving mileage
Aggregation degree of land use	Travel mode option
Road connectivity	Travel route option
Road design	Occupancy rate of public transport facilities
Walking and bicycle facilities conditions	
Quality of public transport service	
Parking facilities and service quality	

Another major advantage of the use of performance indicators as collaborative planning indicators is: The indicators based on the results of implementation are favorable for the supervision and tracking of planning implementation progress which is clarified through the gradual realization of indicators. Lots of states and regions clearly stipulate in laws, acts, regulations, or local laws and rules that the planning documents should include anticipated operation report on the system and timely report upgrading should be conducted in the subsequent executions. The evaluation on system operation based on the proposed indicators ensures the process control of planning advancement. Specific evaluation contents generally include:

- After planning implementation, the process of the planned regions in achieving performance indicators and the contrast with the effect of other planning before the implementation;
- As for the MPO with multiple planning options, analysis and description should be made on the optimization and improvement of transport system specific to the recommended option, as well as the role of local policies and investment plans in achieving the performance objectives.

Second, emphasizing public participation and cross-border multilateral cooperation as well as the convergence and common decision-making of economy, land use and transport to ensure the harmony and effectiveness of "Multiple-Plan Integration"

Many countries include the public participation into their laws, so as to provide legal protection on promotion of social decision and maintenance of public interest. According to the laws, in time of developing regional, metropolitan and urban planning, convenient and reasonable opportunities shall be provided for the public for feedback when MPO makes planning, including all citizens, affected public institutions, traffic, public transport service providers, sidewalks and bike facility users, etc. At the same time, planning study should include the program planning with public participation, and make planning through consultation and interaction with stakeholders. On the public participation, following points shall be ensured for rules:

- Public meetings shall be held at the right time and place for gathering the public opinion;
- Visual means shall be adopted to describe the planning for easy public understanding;
- Release public information through electronic means (such as the Internet, etc.), provide simple and convenient and appropriate feedback interface, and encourage the public to provide comments.

Since ISTEA, American laws have regulated the application process on the metropolitan transport

planning compilation and related funds and funding allowance, the way for MPO and state governments to formulate long-term transport planning and access to infrastructure construction fund, and legislated procedure and means to ensure MPO giving play to the role in regional coordination. Moreover, according to the law, MPO members must include a number of members of different local government institutions and committee (planning, transport, environment, etc.) as well as members of the public (including local elected civil servants, transport workers, state officials, representatives of private businesses and non-profit organizations, general public). The structure of MPO members determined that the planning could represent interests of many parties, and also made for promoting the mutual coordination between different industries and stakeholders to ensure the fairness of planning scheme.

The Act also points out that all undue plans must be taken into account when the metropolitan area organizes to make planning, planning overall goals and performance indicators shall be directly incorporated into or for reference including transport planning and traffic improvement plan, which strengthens mutual connection and deep fusion between multiple plans. In addition, in above planning and performance indicators, in case of the selection of indicators, it shall consider: 1) cooperate with other planning, to ensure that the planning is easy to operate; 2) Performance indicators including public transport, promote the development of metropolis public transport.

Case 3-5 Bel-Red Corridor Multiple-Side Cooperation Planning Mechanism

Municipal planning department, community development department and transport department participated in and were responsible for Bel – Red's new round of area planning led by Bellevue city council. Public participation is seen as the first priority in the process of planning compiling, which permeated in all links of the planning.

Specifically including:

- ✓ Steering Committee was established, which served as consultant to guide the plan in the whole process and was responsible for the coordination of all foreign affairs. The committee was appointed by the City Council, which was made up of various stakeholders in the community. Its members include former members of City Council, members of current City Commission (Planning Commission, Traffic Committee and Park and Community Service Committee), representatives of Chamber of commerce and surrounding community residents within research scope;
- ✓ In the process of planning, Steering Committee actively interacted with the public, and took the public opinion as an important external feedback. Committee had regularly held foreign executive meeting for 19 times to report the planning study progress and results of the current period, and listened to the public demands and opinions. Main participants were the public and business leaders and owners.
- ✓ In addition to the regular meetings, the steering committee held workshops for many times on the selection of the alternative plans, visited Portland to study the metropolitan light rail system of Tri - Met , visited a number of sites along the line, studied the development of local TOD mode and relevant experience on re-planning and development within the area.
- ✓ Community meetings were held for many times and open houses organized by area. Meeting forms including kick-off meeting at the early planning (including scope definition, preliminary assessment of planning project etc.), as well as land use planning draft plan selection and research progress tracking report of tendency plan that participated in by all

community residents in the middle and later periods.

- ✓ Municipal government called in interest groups (i.e., business leaders and owners) that were affected most by the planning scheme for special review in different planning stages to consult related opinions from this key crowd on the planning, including key factors considered in land use and opinions on draft plan. The feedback will be elected as the important basis of final selected solution.

In addition to the emphasis on public participation, another feature of planning is cross-border cooperation. In addition to the diversified structure of above Steering Committee, many industry experts who are responsible for planning are on urban planning, economic analysis, traffic, engineering, and natural resources. More importantly, the formation of the planning scheme is not the simply pieced by research results of different experts of different fields, which considers influence factors of various industries at each stage comprehensively. Within the planning group, the next step of research can't proceed until the consensus between steering committee and the public is reached.

Meanwhile, to ensure the timely communication of many parties, a regular meeting system is also set up in the process of planning; Planning Group and Steering Committee report to the municipal commission on a regular basis. City Planning Commission, Transport Committee, Park and Community Service Committee and Environmental Service Committee that are responsible for long-term planning related matters will be responsible for the planning implementation for a long time after this round of planning issued to ensure the planning scheme reasonable and reliable, and operable in the process of future implementation. In addition, in every critical stage, the department also will report to the city council, and held joint meeting with the adjacent cities to discuss the focus of planning cohesion and common development.

Third, strengthening forecast and post-evaluation in the planning effects to promote coordinated and sustainable planning

It starts from two aspects for collaborative planning effect prediction and evaluation, which are traffic impact of urban construction project and impact of transport planning on economic social and environment. The evaluation accuracy, reliability and validity of these two aspects are the premise of planning collaboration.

With regard to urban planning and construction projects, according to *National Environmental Policy Act* of America, it must issue Environmental Impact Analysis to compare possible environmental impacts of different schemes to choose the optimal scheme with minimal Impact to the environment before the forming of planning. The environment here is not the natural environment in narrow concept, but the environment that affects the living of human life, which richer, and highlights harmonious and orderly development of city with different functions. In EIA report, a special chapter focuses on the research and analysis on the impacts of traffic on environment, including the changes to existing road traffic facilities and the traffic pressure of important intersections around the future bus stops. Many EIA reports also form different options for the bicycle and pedestrian systems in the area and conduct impact analysis so as to strengthen and improve the living and travel environment within the community.

The USA also has developed *the Enabling Act* for traffic planning. The *Enabling Act* requires planning staffs to provide detailed traffic impact assessment in addition to considering residents travel demand and goods flow in the preparation of metropolitan transport planning. What's more,

it makes clear that the traffic impact here is not the narrow impact within the transport sector, but the impact after project implementation on local planning growth, economic development, environmental protection and traffic system and so on, including comparison between different solutions on site section, facilities, construction timing, which is in more favor of the landing of transport projects, further emphasizes the importance of traffic project on local development and strengthens the right of speech of traffic in urban and regional planning.

Meanwhile, to cooperate with metropolitan transport planning, MPO also should organize Transport Improvement Plan (TIP), and governor and MPO shall be responsible for joint examination and approval. The plan should contain transport project consistent with current traffic planning objectives; the project construction schedule should be arranged according to the priority level listed in traffic planning, which shall be updated in every four years.

Fourth, emphasizing quantitative status research and future environmental impact analysis to ensure the cost effectiveness of planning.

In the area planning principles, one is to "make the most of existing industries and infrastructure. In the process of planning, how to dig potential existing industries and infrastructure, and stimulate urban development function through layout optimization and improving is one of important problems of planning. The basis of these studies is the present situation and forecasting future trends based on data analysis, including the models built based on quantification for land use, industry, transport, natural resources, etc. Meanwhile, other interregional planning are also taken into account: firstly, it is to ensure the inter-planning connection; secondly, under effect of multiple plans at the same time, it makes more accurate analysis on changes in the future.

Fifth, forging a multi-level planning system to effectively guide plan implementation

In many urban and regional planning, the formation of plans and the fixing of specific planning measures are both important links of plan preparation. A multi-level planning system takes shape in accordance with the contents and stages of planning, covering the layout of urban functions, infrastructure planning, site planning, design of streets and sidewalks and bus station design. By hierarchical planning, the planning projects are selected and the construction timing is developed, thus effectively guiding the plan implementation.

Among them, the site planning is the guidance for residential land development and commercial block development along the transport line, which makes clear the relation between residential land and transport line side, controls residential development pattern, and forms a scientific and reasonable mixed land use structure. Through encouraging integration of construction of Merchandise Street, slow traffic facilities and safety facilities &concept, it stimulates the urban economy mode by virtue of business development by linking up walking with public transport. Street and sidewalk design is relatively more detailed design process, including more construction indicators, which on the one hand, pushes the standardization of the public transport development, improve the level of public transport services through concrete operating measures and regulations; on the other hand, guide block design, improve residents' convenience and safety of transport, and improve the comfort of life. Bus site design is to design details of bus stops and waiting stations, provide a reliable, safe, and efficient public transport vehicle flow line, make reasonable layout plan, improve cohesion efficiency, and highlight the local cultural characteristics at the same time.

3.2 Planning Management and Implementation

3.2.1 National-level Integrated Development Vision and Planning Act

As a guiding document for local development, the local planning affecting the urban and regional development pattern; target concept and development strategy of country in different periods decides the development direction of domestic reality through the guidance of funds, policy safeguard measure and so on. Therefore, the national strategy, directly determines the traffic planning and urban planning guidance, while the collaboration degree between national strategy and local planning concept will determine whether the local development can be in accordance with the planning direction or not.

In view of the evolution of the ideas and concepts of development, despite different natural, historical, cultural and social development stages, the countries all take a path of sustainable industry - economy – traffic integration after years of exploration. In the development process, the national-level laws and acts on development strategies and plans play a pillar role and the strategy-concerned laws of the countries all feature stability and adaptability, ensuring the planning work adapted to changes with the national development needs and also guiding the goal of domestic planed development gradually adjusted to sustainable development from resource development, economic development and national service infrastructure construction.

In the United States, its urban development strategy went through there stages, namely the development suburban towns, long-distance highway guiding low-density land use and sustainable development highlighting smart growth. Correspondingly, its urban development model also experienced three stages, namely early urbanization, orderly urban expansion and decision-making on the mutual influence of urban and transport development. In particular, in the 1960s, although the planners had proposed to prevent the unlimited expansion of the metropolitan area, *the Federal-aid Highway Act* of 1956 and 1962 directly led to the rapid development of road infrastructure and further accelerated the development of low-density suburbs oriented by highway construction. It can be said that the failure of the planning objectives in this stage was a product of the incoordination between national strategies and planning concepts. After recognizing the contradiction between highway development model and sustainable development, the United States successively issued a series of acts and constantly adjusted and perfected the objectives, procedures and means of planning, providing legal basis and safeguards for more economical, equitable, reliable and collaborative planning.

Box 3-6 American Acts on Integrated Development

In 1991, the United States passed *Intermodal Surface Transport Efficiency Act* (ISTEA), indicating that the transport of America had turned into an integrated transport development stage with sustainable development orientation. ISTEA clearly required the Department of Transport to transfer the work focus to how to use the current high and new technologies to solve the traffic congestion, environmental pollution, coordinated development of transport and how to adapt themselves to the ecology and environment. It required states and cities to make long-term comprehensive transport planning, attach great importance to the coordination and cooperation of various transport means, take efforts to improve safety and efficiency, and encourage the development mode of energy-saving and economic transport.

In addition to policies issued, Transport Management Department of the United States also made the corresponding fiscal subsidies and funds to match policy implementation, and set up the

ground transport committee for overall management to guide coordinated development between transport and urban economy, industry, environment and so on, and promote the preferential development of public transport. According to the 1992 American *Clean Air Act Amendment* (CAAA), the Transport Department shall have the right to cancel and withhold federal highway funds of city, which do not conform to American environmental air quality standards.

In 1998, President Bill Clinton signed TEA - 21, and put forward the development vision on reconstruction of the United States, increasing security, environment protection, creating opportunities, put forward the increasing investment of the government, set up funds to encourage theory and practice study, and provided technical support for the joint planning, which thereby alleviated traffic congestion, improved air quality, strengthened the integration of development, and built a sustainable community environment. The law continued the regulation of ISTEA to a large extent and stressed that the federal funds shall pay attention to that if the plan submitted by MPO can satisfy the demand of above vision at the time of supporting the transport supply, further strengthened that the MPO promoted the coordinated development of regional social equity and economic effect in addition to traffic planning.

Again in 2005, the United States signed *User-Oriented Secure, Reliable, Flexible and Efficient Transport Fair Act* (SAFETEA - LU) that strengthened the study of MPO on system safety, emergency plan, traffic improvement projects, and especially the public participation in the process of planning, and made clear that electronic version should be provided for all planed and complied research result for the public reference.

In 2012, the act of *Progress in the 21st Century*（MAP-21）issued by America changed the policy and planning framework on investment to guide the growth and development of national transport infrastructure. According to the MAP - 21, the United States would provide stable investment in construction of roads, bridges and public transport system for all states and communities, and ensure the accessibility of public transport and service quality of community by promoting the development of multiple ways of travel, thus promoting the integrated urban and transport development. The main investment plan of the act includes National Highway Performance Program (NHPP), Congestion Mitigation and Air Quality Improvement (CMAQ), Large City Program, etc.

According to the Map - 21 Act, Federal Public Traffic Management Bureau and Federal Highway Administration issued enabling act *State and Metropolitan Area Traffic Planning Act*. In addition, *Federal Highway Funding - Metropolitan Transport Planning* (23 U.S.C. 134) and *Comprehensive And Multimodal Transport Plan - Public Transport: Planning Plan* (49 U.S.C. 5305) make clear on planning responsibilities, goals, mechanism, method and content of metropolitan-traffic integration, which provides metropolitan planning compilation as well as a legal basis for the integration development decision-making idea[i]. At the same time, strategic vision is directly reflected in the planning content. The planners should put forward matching index as the planning objective to strategic vision proposed on country, metropolitan area, state or regional level as required, in planning research and preparation process.

23 U.S.C put forward following goals to cooperate with other legislation and national development vision according to national interests: 1) To encourage and promote land surface traffic system safety and efficient management, operation and development so as to guarantee the flow need of people and goods, promote economic growth & the development of the state and

urban area and meanwhile, and minimize fuel consumption and air pollution through reasonable transport plan of metropolitan area and states; 2) To encourage metropolitan area planners and organizers, Ministry of Communication and public transport operators to participate in the traffic, improvement and development planning of metropolitan area and state.

Unlike the USA, due to the lack of land and high dependence on energy import, Japan had been taking a policy of encouraging public transport to strictly control and regulate land development activities in history. It also supported and guided urban development with rapid rail transit to achieve sustainable urban and traffic development. In addition, in order to prevent and correct market failures, solve the domestic regional disparities, coordinate the interests between the central government and local governments, among the departments and the localities, and ensure the maximization of national interests, Japan enacted the laws on comprehensive land development, providing a reliable basis for the land development of Japan.

Box 3-7 Laws and Planning on Land Development and Use in Japan

In 1950, Japan developed its first fundamental law on land development, the Act on Comprehensive Land Development. In 1952, the Act was revised, with adjustments in terms of financial security, legal regulation and the role of land review meeting. This Act is composed of four planning systems: National Comprehensive Development Plan, Prefectures Comprehensive Plan, Local Comprehensive Development Plan as well as Special Regional Comprehensive Development Plan. In 1974, Japan enacted the revised *New Comprehensive Land Development Act* and specially developed *the Law of Land Use Planning* for the land use part in the original *Act on Comprehensive Land Development*. According to the above laws, Japan established a complete system of land planning and respectively had five times of national comprehensive development of land respectively in 1962, 1969, 1977, 1987 and 1998. By the time of the fifth national comprehensive development, Japan's integrated rapid transit system had been formed, marking the basic completion of the land development work in Japan. Land development concepts must be radically changed. To adapt to the new changes in land situation, in 2005, Japan revised *the Law of Comprehensive Land Development Planning* into *the Law of Land Formation Planning*, with the four-level structure turned into the two-level structure in land planning system. It proposed the target of sustainable development was proposed as well as such concepts as "wide-range local circle" and "new public" and based on them to develop a new round of planning, *Land Formation Planning*.

Corresponding to the development laws, the previous comprehensive land development planning of Japan were all to make corresponding improvements and have new initiatives on the basis of the previous planning and in combination with the actual situation. The first and second national comprehensive developments focused on industry development, the third and fourth on livable life, and the fifth and sixth on sustainable development based.

In terms of land use, the laws enacted by Japan include *the Land Improvement Law* (1994), *the Land Survey Law* (1951), *the Law on the Special Measures for Land Survey Promotion* (1962), *the Land Acquisition Law* (1952), and *the Law on the Special Measures for Public Land Acquisition* (1962), *the Land Price Publicity Law* (1969) and *the Law on Promoting the Expansion of Public Lands* (1972), which provide the legal basis and safeguards for the land acquisition during national development and urban construction.

In recent years, the Japanese national policy promotes the integration development of rail transit and urban, which adopts development pattern from the city center to the satellite cities. In 1988, "Multi-Polar National Land Management Act" was formulated, which encouraged the development of business center surrounding the Tokyo through tax and financial support in hope of creating more self-absorbed area surrounding the Tokyo to provide dual opportunity on employment and living with the purpose to reduce commuting people, and alleviate the pressure of rail transport and road transport. Commuting subsidies paid by employers promote more people to choose to live in peri-urban areas, eliminating the fiscal pressure on distance commuting.

3.2.2 Adopting "Big Transport" Department System

The domestic and international experience shows that government department setting, the setting of "Big Transport" department system is favorable for looking at the transport issue out of the industry and putting on the transport issue in such aspects as land, housing, energy and environmental protection. By coordinating such factors as management departments at all levels, infrastructure, management measures, price adjustments and land use, comprehensive planning management and rational transport structure layout are carried out to promote the mutual convergence and integration of the various modes of transport, rationally allocating resources, reducing damages to the environment and wasteful use of energy, ensure the rational use of land and other natural resources and the coordinated development of the public transport system. This reduces the administrative costs and also facilitates the travel and transport of residents and goods to a maximal degree, thus increasing the running efficiency of the city and the overall effectiveness of the transport system.

It is worth learning, during the construction of big transport system, Japan and the USA make regulations by legislation as much as possible, from policy and detailed practice rules, on national transport policy, planning, organization, institution setting, rights and obligations of administrators and the managed, the source and distribution of transport construction capital to ensure the state's effective transport management and the gradual perfection of "Big Transport" system. In addition, in terms of the setting of administrative authorities, in the USA, Japan and France, the giant-department centralization does not interferes with the exercise of local administrative authority; on the contrary, the central big transport management department does not directly manage local transport. Hierarchical administration is implemented on the central and local levels, but the central government and their local functional organizations still play an important role of macroeconomic regulation and control, which ensures the harmonization of the central government and fully mobilizes the enthusiasm of local government administration.

Box 3-8 Case of "Big Transport" Department Setting

1. USA

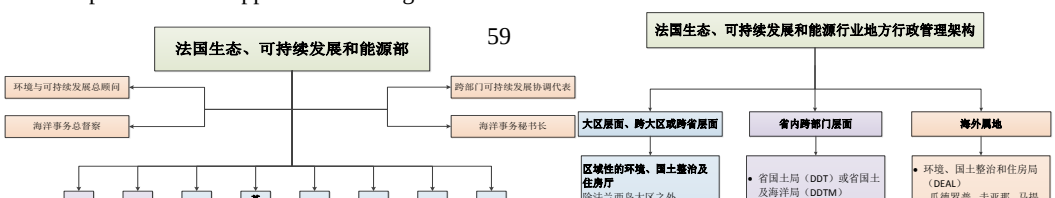
In the 1960s, the USA began the reform of big transport system. In October 1966, the US Congress passed *the US Department of Transport Act*, which clearly states that the purpose of establishing the Department of Transport is to turn the past decentralized management of the federal government of water, land and air transport to unified management so as to ensure the government's unified planning, organization, coordination and strengthened management effectiveness of various models of transport, and its main job is to develop transport policies, ensure transport safety and take charge of the supporting plans of various modes of transport. The act also further indicates that there is no administrative subordination relationship among the central, local state and municipal traffic authorities, between the transport management departments of states and counties are independent from and parallel with federal transport department, and the federal Department of Transport is only responsible for the communication, liaison and negotiated settlement of the dispute through mediation in accordance with law from the perspective of national overall traffic layout and when problems appear with the transport running system of the states.

According to the act, the USA totally included the businesses managed by 8 departments and commissions and over 30 departments and bureaus that originally managed the transport affairs in the federal government into the Department of Transport. On April 1, 1967, the USA Department of Transport was officially established. It consists of Office of the Minister and 12 functional institutions, namely Federal Aviation Administration, Federal Highway Administration, Federal Motor Carrier Safety Administration, Federal Railroad Administration, Federal Transit Administration, Maritime Administration, National Highway Traffic Safety Administration, Inspection & Supervision Office, Office of Pipeline and Hazardous Material Goods, Research and Technological Innovation Administration, St. Lawrence Waterway Development Company and Ground Transport Committee.

2. France

France managed the transport system according to administrative divisions, which formed transport management system on national, regional and provincial, and town levels. At the central level, all modes of transport, environment, housing, etc. are under unified management of the Department of France Ecology, Sustainable Development and Energy (MEDDE) (hereinafter referred to as department of sustainable development); this country set up corresponding organs to exercise the industry regional management functions. Sustainable Development Department integrates the functions of a lot of departments including housing, urban planning, transport, energy, environment, equipment, ecology and marine. It is mainly responsible for the formation of legal framework on environment, traffic, housing, energy and so on inconsistent with European policy, which was the country's major infrastructure manager. In the field of transport, the Sustainable Development Department was responsible for the formation of transport policy and laws and regulations to ensure the coordinated development of any transport modes and infrastructure of various regions with a focus on the traffic infrastructure planning, social and economic impact assessment of all kinds of transport modes, infrastructure and transport safety regulation and formulated to promote effective policies of various transport means cohesion and coordinated developments.

[15] Source：http://www.developpementdurable.gouv.fr/.



3.2.3 Establishing Institutionalized Planning Management and Coordination Mechanism

The national big department system provides a macro basis for the planning concepts, procedures and means of integrated development of transport, but in the specific planning and implementation process, establishing institutionalized planning management and coordination mechanism at the local level is also a necessary means to ensure the convergence among the inter-regional transport plans and between transport planning and the planning of other departments. The establishment of regional planning and coordination mechanism generally includes identifying the levels of coordinating organizations, clarifying staff composition, developing process for planning and management organization, stipulating the methods and means of joint decision-making, etc. The regional planning and coordination organizations at different levels vary in terms of scope, composition and size.

Box 3-9 Cases of Regional Planning Management and Coordination Organizations

1. USA's MPO

The Federal Highway Funding - Metropolitan Transport Planning stipulates that all the urban areas with a population over 50,000 must establish metropolitan planning organization (MPO). MPO is not only responsible for the transport decision of single administrative city but also for that of the city agglomeration constituted by multiple adjacent cities. According to the specific circumstances of the city, the more populous are usually set up a separate MPO, and the less populated area sets MPO department in local planning administration or transport bureau.

1) Organizational Structure

MPO has no fixed organization structure. But, as a decision-making body, MPO generally includes: 1) policy or executive board; 2) Technical and Citizen Advisory Committee; 3) supervisors and employees. Among them, policy or executive board, the highest decision-making body of MPO, is composed by the stakeholders and convene meetings according to a fixed period (2-3 times a year) to consider the important content of MPO; Technical Advisory Committee is responsible for providing specific strategies or project proposals to the highest decision-making institutions and also provides, as a professional third-party organization, technical analysis and expertise and answers citizen questions on specific matters. Generally speaking, MPO will have a technical advisory committee and a citizen advisory committee and establish a subcommittee to discuss specific issues like environment, bike, travel demand models, etc. In addition, MPO also sets a standing body that consists of the director and staff and is responsible for convening board meeting, preparing documents, promoting inter-agency coordination, listening to public opinions and feedback and managing planning process. MPO staff can also directly provide technology assessment and evaluation opinions on transport projects, planning and activities or hire a third-party consultant to collect the data needed for analysis.

2) Functions

The region and scope of the urban agglomerations managed by MPO are defined by the federal government, and their specific statutory functions include: 1) establishing decision-making platform and integrating multi-side stakeholders; 2) determining the plan (including the recent optimization plan and long-term plan) and assessment and evaluation mechanisms, including preliminary forecast and post-evaluation mechanisms; 3) developing recent transport improvement

program (TIP), including project objectives and financial budget; 4) developing long-term integrated transport planning of urban agglomerations/ regions; 5) ensuring public participation and being responsible for inviting the citizens and other affected constituencies to participate in the planning work. Meanwhile, in the case of clearly defining the capital expenditure of transport project, the federal laws grant MPO the right to spend federal funds. According to regulations, the federal government funds of MPO must be distributed downwardly through the MPO channels, with management evaluation made.

In addition, after the completion of metropolitan planning, metropolitan secretariat, as the planning supervision and management party, also will submit an assessment report to the Congress every four years (i.e. TIP implementation cycle), report the implementation plan to the Congress and conduct effectiveness certification to the plan. The contents of the report include: Planning the role in terms of guiding transport investment, the progresses and effects of different MPOs in plan promotion, and the working process, existing problems and major results of different MPOs in achieving the objectives of planning after planning implementation.

With the continuous developments and progresses of the society, the MPOs of the USA also integrate a number of new non-statutory functions, mainly including:

If the MPO area is designated as a non-attainment area (NAA), MPO's transport planning will need additional transport energy conservation and emissions reduction planning requirements and MPO is responsible for the coordination of transport and American National Air Quality Planning. This is similar to that once an urban area is identified by the Ministry of Environmental Protection as NAA, additional energy conservation and emissions reduction plan should be developed in terms of transport and MPO is responsible for the coordination with the environmental protection planning of the Ministry of Environment Protection.

The areas with a population of more than 200,000 are designated as Transport Management Areas (TMAs). TMAs must develop traffic congestion management procedures or systems (CMS / CMP), so as to develop the strategies and acts reducing traffic congestion and increase traffic flow. TMAs usually have consultation with the state governments and develop surface transport program (STP) funded projects. For China, the early city agglomeration pilots should be the areas with larger population, which means that they are all TMAs-level MPOs. Therefore, they should have the function to control traffic congestion, need to be responsible for the development of traffic congestion control plans and have such law enforcement departments as traffic police, city management and price.

The MPOs in parts of the United States also often perform work outside the law. For example, the MPOs in California are also responsible for distributing non-federal transport funds for the cities within the area (for example, the distribution of the capital budget of relevant provincial and municipal in the area), some areas also give MPOs such management functions as land planning, street planning, TOD planning, urban boundary and smart growth, basically covering the contents related to traffic and street in land planning.

3) Funds

The financial resources for the federal government's road construction come from Road Trust Fund, which is from user-based taxes (mostly gasoline tax), and road funds can only used for road construction and major reconstruction projects. In 2010, the funds for the federal land traffic projects totally about $ 50 billion in the USA.

In 1964, the US Congress passed the *Urban Public Transport Act*, by which, the management functions of the federal public transit project were transferred from Housing and Urban Development to Department of Transport. Public transport projects gradually turned from loan projects from grant projects. With the release of the USA's Law of Public Transport in the 1970s, the public transport project funding increases year by year to over $ 10 billion each year now from the originally $ 1 billion each year.

Since 1973, the federal highway and public transit projects have begun to follow the transport planning and implementation plan of MPOs. 1.25% of Federal Road Fund and 1.25% of Public Transit Project Fund (over $ 800 million in 2010) are used to support this plan. These are the direct capital sources of MPO's federal agencies. Then, depending on the different management functions of MPO, coped with local relevant supporting funds and some temporary variable funds, it totals about $ 3.2 billion or so each year. The two constitute the sources of min financial resources of MPOs.

2. STIF and AOTU of France

France has set up a special agency to coordinate plan preparation, project operation and financial allocation.

Take region of Paris (French island, Paris city and other 7 provinces) for example, in the region, various passenger transport tools are managed and coordinated by Paris Regional Professional Transport Commission (STIF) designated by the government with the core principle as follows: change or create a line that cannot conflict with existing lines in traffic planning, STIF is responsible for selection of line operators; related departments of region of Paris, Paris Regional Professional Transport Commission (STIF), Paris Metro Company(RATP), Paris Transport Association (OPTILE), Paris Chamber Of Commerce And Industry, Passenger Organization, local governments and so on should jointly hold technology coordinating committee to make decision on modifying or creating a new line.

As part of whole transport planning, all operating companies in the region, including Paris Metro Company (RATP), French State-Owned Railway Company (SNCF), Paris Transport Association (OPTILE) must sign the contract with STIF. This contract determined services provided, remuneration distribution base, and award for improving the traffic and service quality. The contract period is normally three years or four years for the smooth implementation and timely change of measures. The law also stipulates that Paris Regional professional transport committee shall determine the operation ticket and coordinate the price gap between different services. In the actual operation, the remuneration of operating company is determined by the contract, and has nothing to do with operating income, while the STIF pays the price difference. As an organization and coordination institution for passenger transport systems such as state-owned railways, subways, trams, bus companies in region of Paris, STIF conducted distribution of income and expenses, management and coordination in passenger transport enterprises, to provide the system guarantee for integration operation of integrated passenger transport system in the Region of Paris.

The "Urban Traffic Management Committee" (AOTU) appeared to satisfy the needs of "urban transport service" (PTU). As "urban transport service" (PTU) usually covers multiple towns, there is no direction relation between its scope and administrative division, and bus network construction and management affairs are accordingly separated from the governments of municipalities, for specialized unified management, "Urban Traffic Management Committee"

(AOTU) constituted by councilmen of relevant towns and cities was formed. as "Urban Traffic Management Committee" has the spontaneous social nature, each town is free to join or withdrawal from this organization absolutely; the town joining in this committee still retained urban traffic management for this town; as the management is no longer scattered in governments of municipalities, but turns to cooperation consultation platform of "Urban Traffic Management Committee" between towns and cities. French "Urban Traffic Management Committee" is the consortium for relative towns to unified organizational management of urban public transport with organization forms. Towns and cities could not participate in any consortium, and independently organize to develop their own urban public transport. In this case, the township government will take the responsibility of "Urban Traffic Management Committee ".

3.2.4 Promoting Planning and Management for Key areas

To ensure the coordinated and effective development of population and industry-intensive regions and specifically solve the traffic problems in key areas, USA and France both put forward the development idea of defining key areas for unified planning and management. In the USA, the Federal Transit Administration and the Federal Highway Administration jointly proposed the concepts of "urbanized area" (UZA) and "traffic management area" (TMA) and specially established planning management methods for the defined traffic management are to strengthen the deep city – traffic integration and interaction and joint development of the densely populated cities. France put forward the concept of "urban transport service area" (PTU). Local urban traffic management committees are in charge of the comprehensive planning of the service areas to carry out planning on such travel problems as walking, non-motorized traffic, parking and traffic transfer.

Box 3-10 Cases of Comprehensive Planning Management of Defined Areas

1. UZA and TMA in USA

The Federal Public Transport Administration and the Federal Highway Administration of the USA issued a joint statement on *Federal Register* that all urban areas with more than 50000 people were defined as the urbanized area (UZA), and especially the urbanized areas (UZA) with more than 200,000 people were defined as the traffic administrative zones (special area is not limited to the population of 200000, which should be applied by the governor and local MPO), and updated a nationwide traffic administrative zones according to the census cycle (usually for ten years) and according to the regional population change.

According to regulations, the traffic improvement projects of UZAs should be incorporated in metropolitan area planning, and meanwhile multi-state cooperation mechanism shall be established, and in addition, technical & financial support shall be provided through cooperation contract, treaty and so on to promote the development of integration of state and interstate. In addition, it should be led by the state government to set up joint institutes, which is responsible for the signing of cooperation contract and treaty as well as later organization & coordination & supervision.

Federal laws also stipulate that MPO also should refer to it and follow up in time, release relevant performance targets within metropolitan area within 180 days after issuing its performance goals for providers of relevant state and public transport to further improve the influence of traffic on the metropolitan development planning, and solves unharmonious goals and means as a result of

different planning periods and cycles.

2. PTU in France

In November, 1949, national laws issued by the France proposed the concept of "urban transport service" (PTU): If a single town organizes its own city bus independently, PTU was its district administrative boundary; If several towns organized to construct urban public transport network, PTU was the sum total of administrative jurisdictions of these towns. The Act enacted in 1973 law made modification for it. The delimitation of "Transport Service" was no longer with reference to the administrative boundary of each town, and only involving in built area covered by public transport service network; different to fixed administrative division, "urban traffic service area" may develop and change with the construction of urban public traffic network. *The National Internal Traffic Organization Policy Act* (LOTI) Promulgated in 1982 further affirmed that "urban transport service" as the legal space organization for the local government organizing the urban public transport.

In 1996, France issued *Atmospheric Protection and Energy Saving Act* (LAURE) that made clear urban traffic policy under the sustainable development target, and revived the *Urban Transport Planning* (PDU) as an important planning tool. It regulated that the urban area with resident population was more than 100000 must prepare the PDU with 5 compilation years, and explicitly formulated six formulation policies: 1) Reducing car traffic volume; 2) Developing public transport and low-pollution fuel-efficient transport (especially walking and bicycle); 3) Distributing existing road space reasonably to meet needs of different modes of transport; 4) Planning public parking lots in public places; 5) Organizing city freight transport reasonably to reduce environmental impacts; 6) Encouraging social enterprises to participate in organizing the employee commuter traffic, especially the car pool.

3.2.5 Sophisticated Financial Planning and Fund Management System

A clear, reliable financial system is essential to ensure smooth traffic project propulsion. Generally speaking, the fiscal systems for urban planning and construction and traffic infrastructure projects ensure the project's feasibility and the reliability of planning implementation mainly through the study of source of funds in the planning process planning, promoting local fund coordination in the planning propulsion and project management in later period: 1) The regional, urban and transport plans must include financial planning, and clearly state on how to promote the implementation of traffic planning adopted, and public and private funding sources expected to use in the promoting process, encourage to put forward additional investment and financing strategy, and corresponding alternative outlook projects; 2) Local governments, planning organizations and bus operators should develop their own financial allocation plans to ensure fund reserves and subsidies, etc. that can be used to support the implementation of traffic planning; 3) Certification is effectively advanced according to project promotion assessment and planning, the responsible units have the right to promote planning implementation by financial leverage and other means until the return of subsidiaries after passing the review.

Box 3-11 Capital Source and Distribution for Chittenden County's TOD Program

When developing TOD planning, Chittenden County pays much attention to the introduction of public and private funding sources to develop local TOD projects. Public funds include federal, state, regional, and local funds. Chittenden County government develops funds sources that are

interested in TOD project cooperation to further implement the TOD planning and the *Guidelines* through fund in following table.

Table 3-2 Main Capital Source and Distribution for Chittenden County's TOD Program[16]

Type	Resource	Main purpose
Federal Funds	Surface Transport Plan (STP)	Construction of highway, public transp and slow traffic
	Enhancement Program	Support and optimize Enhancem Program
	Transport, Community and System Preservation (TCSP)	Provide alimony contract, land donatio volunteers, etc
	Transport Traffic Administration (FTA)	Provide federal funding with proper use
	Congestion Mitigation and Air Quality Plan (CMAQ)	Provide funds to develop TOD to meet federal air quality standards to e congestion
State Funds	The VTrans Bicycle and Pedestrian Facility Grant Program	Provide appropriation on citywide bicy and pedestrian facilities construction
Regional Funds	TLC	All planning work of TOD project
（PUBLIC–PRIVATE PARTNERSHIPS）	Public-Private Development Agreements	Directly sign an agreement w merchants and developers to ensure implementation of Guidelines
	Location Efficient Mortgages	Access to capital through prope mortgage and so on

3.3 Guarantee Policies and Means

3.3.1 Bus Priority Strategy

In transit oriented development, "Bus Priority" is a very important security policy. The concept of "Bus Priority" is dated from the 1960 s in Paris, France. The economic plight as result of Second World War and the pressure of car industrial enterprises, French government encouraged private transport policy, which led to the dramatic increase of the Paris cars, and even near to paralysis of Paris traffic. The government had to change the pattern of growth in Paris, began to develop the public transport, and has obtained remarkable achievement. Subsequently, the United Kingdom, Germany and other developed countries also promoted the prior, efficient and sustainable development strategies of public transport system.

Box 3-12 Case of "Bus Priority" Development

1. "People-oriented" in Britain

Britain requires to control the car travel rate below 50%, takes the "people-oriented" development principle, and make bus priority policy with regard to convenience and comfort of the bus travel.

[16] Source：Chittenden Block Planning Report

For example, in the public transport system, urban residents can find the public transport sites, subway, light rail, bus stops and bicycle traffic within 500 meters of distance in anywhere, for which people can easily transfer and change the way to travel. At the same time, the British fare system adopts "one ticket system" for which a ticket can take you anywhere in the city within 24 hours a day and with unified ticket price even if it is the transfer, the repeat purchase of tickets is not allowed. On grab bar before each row of seats, the drawing-in button was designed, which can remind the driver of the elder arriving in the station.

2. “Speedy Operation” in Germany

The focus of Germany public transport is on how to improve public transport bus organization, to avoid interference with other road users, in order to improve the efficiency of public transport. On the road of bus priority, people realize that the effect by improving the reliability of public transport and reducing the time delay, is better than widening roads, construction of the underground rail system, which not only reduces the government's devotion to public transport, save the government finances, but also more effectively meet requirements of residents on travel, and attract residents to use public transport. On specific measures, Germany's Bus Priority Policy saves the time on vehicle stops, intersection signal loss, road surface disturbance and vehicles driving from city planning, public transport design, site selection, traffic signal management and so on to ensure that public transport is convenient from each link.

3. “Public Management” in Singapore

Singapore has established the Public Transport Council (PTC) to protect the public interest, specific duties include approval of bus lines, formulation of service standards, improvement of bus service, etc. In addition, the approval of bus fare is not in the hands of the government, but assessed and managed by PTC to ensure that the public can have plenty of public transport services and reasonable price, and also to ensure the sustainability of bus operating companies.

4. “Transit Agreement” and “public transport tax” of France

Since 1976, The French government has begun to provide unfixed fiscal appropriation for local transport infrastructure. A supportive fiscal policy is in the form of contract with local competent institutions, to provide financial subsidies for the urban traffic construction that is positive response to the national policy. Beneficial local agencies have a responsibility to finish the promised task in accordance with relevant provisions of the contract within the deadline. This fiscal incentive in the form of contract can be roughly divided into following three development stages:

1) Urban public transport development contract (1976 to 1986): Since the seventh five-year plan, the France decided to give priority to developing public transport nationwide, and issued "urban public transport development contract" in 1976, which provided financial support to the local public transport infrastructure construction by way of contract to promote the local public transport supply and reduce the pressure of investment "urban traffic management committee". After 1983, for the central government funding, the local committee submitted urban transport planning (PDU) to the central government, and made clear the concrete measures of developing urban public transport. During 10 years of implementation of this contract, the central government signed 115 development contracts in total with local governments involving the investment of 1.09 billion francs.

2) Urban public transport synergistic contracts (1986 to 1988) and modern contracts (1989 to

1989): After 10 years of large-scale infrastructure construction, the cost of public transport network operation and maintenance significantly increased. However, as there was no increase in funding sources for operation and maintenance, the service quality of public transport declined on the whole. To this end, the French government carried on the policy adjustment. It changed the original "development contract" into "synergistic contract" (1986 to 1988) and then into "modern contract" (1989 to 1994), turned the fiscal appropriation original for infrastructure construction into upgrading existing bus network, promoted advance operation and management techniques and equipment, hastened the development of bus information and other new services and carried out relevant researches. These helped it effectively reduce operating and maintenance costs and improve the quality of public service and also attract more uses for the public transport.

3) After 1994: In 1994, the French government made the reform for the bus fiscal subsidy system. On the one hand, the central government continued to provide financial help to improve local public transport; on the other hand, fiscal subsidy policy was added for the local railway construction (TCSP) that regulated that the central allocation should not exceed 20% of the total project cost for underground rail transit construction projects, but can be as high as 40% for ground rail transit project (light rail, bus lanes). In 2001, the central government has added a financial allocation again, specifically for helping local governments to implement the *Urban Transport Planning*.

In addition, France was the only one industrialized country that imposed "city public transport tax". In 1973, France made a provision in the form of law when the total population within "Urban Transport Service Area" (PTU) was more than 300000, the "urban traffic management committee" would have right to impose VT on this area while this threshold was lowered to 100000 and 30000 in 1974 and 1982 respectively. Objects of "City public transport tax" were enterprises with more than 9 employees located in the "urban traffic service area" and each enterprise total wages as the tax base; if the enterprise organized employees commuting traffic by itself, it can be exempted from VT.

VT, as a tax dedicated to urban public traffic construction and operation, was not compulsory. Its highest percentage charge was stipulated by the State Council, but local "urban traffic management committee shall have the right to decide to impose" or not, as well as practical percentage charge. What's more, percentage charges may be different for different towns in the same "Urban Transport Service Area ". Currently, the cap is: 1) It should be no more than 0.55% for "Urban Transport Service Area" with total population of 30,000 to 100,000; 2) It should be no more than 1% for "Urban Transport Service Area" with total population of above 100000 (except for Paris Region); however, this threshold can be as high as 1.75% if it needs to build the subway and light rail in this area.

This tax policy encouraged the medium and small cities and towns combining into consortium to a certain extent in the development of urban public traffic to reach to threshold for "city public transport tax". More importantly, it provided stable discretionary fiscal revenue for "Urban Traffic Management Committee". In addition to Region of Paris, the local ownership of French urban public transport network belonged to "Urban Traffic Management Committee". The Committee not only shouldered the task of public transport infrastructure investment, but also needed to pay for bus transport enterprise operating costs and share the risk. The former may get some of the central government funding, while the later one mainly relied on "urban public transport tax" and the gap was supplemented by the local finance.

3.3.2 Traffic Demand Management (TDM)

During the coordinated development of city and traffic, transport demand management (TDM) aims to, via comprehensive control and correct guidance of traffic demand, promote the promote rational use of transport facilities resources, guide the reduction of low-efficiency private vehicle travel and turn it into efficient public transit trip, so as to achieve a balance between traffic demand and supply. TDM is favorable to curb the growth speed of cars, maintain road traffic and environmental quality at a high level, and make the road construction investment in coordination with the city's overall development level. It objectively offsets the adverse impact of car growth on land use pattern with public transport orientation.

TDM means include **controlling** and **introductory** types. Specifically, the control means can be divided into: 1) Conventional measures, to limit the total amount of available space (parking, road network and intersections); 2) regulatory measures, to stipulate to range of using (such as parking spaces, time, road, region, vehicle models, personnel, etc.; 3) fee-collecting measure, directly collecting fees on the use of roads of facilities, and adopt "market mechanism" to distribute the use rights on the premise of "voluntary payment". Guided management includes: 1) reducing the total amount of travel through reducing travel activities; 2) reducing vehicle transport through he change of transport models and effectively using motor vehicle; 3) dispersing the traffic in terms of time and space.

Specifically, it can be divided into the following travel demand management policies:

(1) Priority Development Policy

Among various travel modes of urban road traffic, different transport modes greatly vary in terms of road space occupancy requirements, the degree of environmental pollution and energy consumption. Priority development policy is to give priority to the development of the transport modes featuring less land occupation, light environmental pollution and small energy consumption. The measures of priority development are developed in accordance with the reality of urban road network, energy possession and environmental control.

Public transport is offered with the highest priority of development in China, as it features the minimal per capita land area occupation and per capita pollution and energy consumption. In the cities with conditions possessed, such medium and large-capacity vehicles as subway, light rail and BRT should be developed; at the intersections, road segments and toll stations of cities, the priority access rights of HOV shall be achieved.

(2) Restricted Development Policy

In the existing road network, when the overall traffic load reaches a certain level, traffic congestion will aggravate. In this case, the development of some vehicles must be restricted (controlled) to ensure the equilibrium of the overall traffic level. Generally, those under restriction are the vehicles featuring low efficiency, poor condition, high pollution and high energy consumption.

Before the restricted development policy is adopted, there is a need to consider the level of development and load of road transport network, the existing transport structure and the characteristics and travel features of all kinds of transport vehicles. Especially, when the ownership of certain vehicles, such as motorcycles and private cars, has exceeded certain level,

measures should be taken to limit their development. The combination between priority development policy and restricted development policy can adjust and optimize the transport structure of the whole city so as to improve the overall transport efficiency of the system.

Different from priority development policy, restricted development policy will have some negative impacts. Therefore, before the implementation of restricted development policy, a comprehensive and detailed analysis and quantitative evaluation must be conducted on the positive and negative impacts that might be caused by the policy.

(3) Travel Ban Policy

When the overall load level of the road network in the central areas of mega-cities and large cities is close to saturation or is locally over saturated, there is a need to adopt temporary or long-time ban on some vehicles to manage the travel in certain areas and within a certain period of time.

Travel ban policy is generally for temporary travel management. During some important activities, such as large-scale international conferences and major sporting events (such as the Olympics), travel ban policy can be taken in certain areas; or the travel of some vehicles is banned according to their license plate numbers; during the peak hours, the travel of some vehicles is banned in some road segments. Travel ban also have some negative effects, so a comprehensive and detailed analysis and evaluation is needed prior to implementation.

(4) Economic Lever Policy

Economic leverage policy is to adjust travel distribution or reduce the needs for a certain type of travels through economic means. For example: exorbitant parking fees are charged for the vehicles in the central urban areas with relatively high traffic density and transfer costs are reduced to encourage vehicle drivers to reach their destinations (central areas) by bus; at the appropriate time, certain congestion charge is collected to reduce vehicle travel demand; lower charges are collected to the vehicles with their development encouraged, while higher charges to the vehicles with their development restricted, in order to improve the traffic situation.

Box 3-13 TDM Cases

1. Japan

The means used by the government of Japan to control and guide the traffic demand mainly include three aspects:

1）Imposing motor vehicle tax. Japan levies taxes on goods to producers, three types of tax to buyers (vehicle income tax or consumption tax, vehicle registration tax for each year, additional tax according to vehicle load) and transit duty on all highways inner and between Japanese cities. Moreover, Japan's fuel tax is three times as much as that in the United States. In addition, to further reduce the land use, the Japan encourage users to buy smaller cars, and no or less registration tax and parking demand tax will be levied for motor vehicles with engine capacity of less than 550 cc.

2）Parking lot restriction. In Japan, there are a small number of parking spaces available and under construction in cities. Moreover, the roads are relatively narrow, and parking spaces are very tense on the street. Meanwhile, Japan provides that before car registration, anyone must prove he/she has parking space that is not on the street in his/her residential area. The restriction in

terms of parking space reduces the comfort of car owners in time using and also controls the e number of cars purchased.

3）Encouraging bus travel via tax policy. On the one hand, Japan energetically encourages rail transit construction; and on the other hand, it stipulates that all workers can get as high as $500 a month for duty-free commuting subsidy from their employers on the principle of complete reimbursement, and those who drive cars can only get as high as 15% of this amount.

2. Singapore

The demand control means of Singapore mainly include three aspects:

1）Strictly imposing vehicle purchase tax. In late 1960s, the Singapore started to regulate the vehicle quota through tax. The import tax of 45% was imposed on all imported vehicles, and the vehicle registration fee of $670 was also added in 1980. However, as the growth of the income of people, these additional terms in reducing number of vehicles have no effect, an additional registration fees was introduced. In the 1980s, the additional fee rate was 175% of the auto market price, and now is basically remain at 150%. Although Singapore is one of the highest per capita incomes in Asia, these fees measures make the number of people buying car not more than 30% of its population.

2）Limiting motor vehicle supply. In 1990, the vehicle quota system (VQS) was officially launched, that asked all new vehicles to be with car license. Every month, Traffic Administration would issue a certain number of car traffic cards according to traffic situation and users got it through monthly bidding with use period for 10 years. Since the introduction of quota system, the price of owning a car was in a geometric growth. The Traffic Administration also obtained the considerable income in addition to adjusting the number of vehicles.

3）Road passage management policy. In 1975, the Singapore government began to introduce the famous Area License scheme (ALS) to adjust the road congestion. Government departments set up an area of 6 square kilometers as “limited passage area". From 7:30 to 10:15 every morning, only vehicles with special licenses could pass through the region with cost of $2, and these without it would be severely punished. Government departments set up an area of 6 square kilometers as “limited passage area". During the peak hours every morning, only vehicles with special licenses could pass through the region with cost of $2, and those without license would be severely punished. Since 1994, ALS has been implemented in full days. From 1995 to 1997, road toll was imposed for three highway roads in the city, and vehicles that were on the highway roads should show licenses during the rush hours every morning, $1.40 per license. In 1998, the Singapore government began to adopt road electronic toll collection system to replace Area License scheme in East Sea Park Avenue, which had been implemented in all highways and the CBD area by 1999. In addition to road toll, there are some other related expenses such as fuel oil tax imposed on motor vehicles.

3. Copenhagen

Copenhagen achieves management and guidance on reducing car use through creating a non-motor vehicle traffic travel environment. Copenhagen’s non-motor vehicle travel environment construction mainly includes following aspects:

1) Establishing pedestrian street. Copenhagen's first pedestrian street was established in 1962, which is Europe's longest non-motor vehicle street at present. Then other central cities also emulated this street and transformed the business area into a pedestrian street or a street giving

priority to walking and cycling. Currently, the number of streets without car travel in Copenhagen is six times as many as that of 1962. The city's pedestrian road network has become the world largest and most successful pedestrian road networks.

2） **Setting up bicycle city.** Copenhagen took a short bicycle rental program to facilitate the medium and short-distance travel between walking and urban rail transit and further guiding the reduction of car use. In addition, from the mid 1980s, Copenhagen began to restructure original motor vehicle roads and roadside parking area into bicycle lanes. Currently, the length of city's bike lanes hits over 300 km, while bike trips has increased by 65%.

3) Road network capacity management. Since 1970, the city traffic engineers have been working hard to control, through "congestion management" policy, the center of city road network capacity so as to adjust the use of cars.

4) Parking management. Copenhagen achieves parking management mainly through limiting the supply of parking facilities and parking charge. In the past few decades, the parking facilities supply in Copenhagen was decreased by 2% ~ 3% of each year. In addition, the parking fee in Copenhagen is constantly changing so as to ensure that the parking facilities can be rapidly turned over through price mechanism.

5) Tax policy. In Denmark, taxes that need to be paid on ownership of a private car are roughly three times as much as the cost of a car. At the same time, taxes imposed on the price are increased with the increase of vehicle weight and engine emissions growth in order to limit the purchase of large, gas-guzzling vehicles.

3.3.3 Traffic and Land Comprehensive Development

Due to the differences in resource conditions and development models, etc., the countries adopt different LVC strategies and means in different stages. Overall, the capture strategies can be roughly divided two types, tax/fee based and comprehensive development based. The specific means include: 1) Land lease. Local governments construct supporting infrastructure after land acquisition and then transfer them to developers, and the price difference, as the revenue of local governments, is used for infrastructure construction. China is the typical representative; 2) Development tax (fee). One kind is that land improvement and value added tax are imposed on the development projects for supporting infrastructure construction. The typical representatives include the UK and France; 3) Land pooling. The developers of undeveloped or disordered developed lands are encouraged to gather lands together and carry out concentrated development to a large number of scattered plots. The typical representative is India; 4) Joint development. Commercial residences and commercial districts are developed along the public transit lines, and its premium income is used for the subsidy for construction costs. The typical representatives are Japan and Hong Kong, China.

By a comparison of different LVC methods, it is not difficult to find that comprehensive development strategy is a very economic and effective way to promote the organic integration between transport system and urban functions and to realize the TOD planning concept. Also, it has more reference values for China that is in the current stage development and national conditions. In addition, in the process of promoting the comprehensive development of transport and land, there are two aspects worthy of government attention: one is the fund guarantee policy for land development and public transit construction and operation; second are the specific

development strategies and methods. Effective protection policy is the premise to ensure the implementation of coordinated planning, and the appropriate means of development are the core element of promoting the common development of industry, traffic and city and reflecting the characteristics of city.

Box 3-14 Cases of Traffic and Land Comprehensive Development Strategy Guarantee

1. Land Security Policy of Singapore

Singapore is a model of the government guaranteeing comprehensive land development through strict laws. As Singapore adopts a single-level direct government to control over the urban planning implementation process, the government investment occupies dominant position in the construction of urban infrastructure, residential, industrial projects and so on, which therefore can strictly control the land allocation and use. According to Singapore's Land Recycling Regulations in 1966, no matter based on what the purpose of the construction of the public (including the construction of new town), the government has the right to recycle the land. By impressments, the government of Singapore expropriates a large amount of land from private hands for construction land, which makes the government have the powerful control in land allocation and use, and effectively guarantees the land development and utilization strictly in accordance with the plan and without changes to ensure the land use finally meet the requirement of public transport services.

2. Japan's Fiscal and Taxation Security System for Rail Transit

The financing approaches of Japan for urban rail transit development chiefly include:

1) Government subsidies. ① Funds from the Development Bank of Japan: Such funds are given to the investors or operators of the rail transit lines that are recognized as necessary for easing traffic congestion and promoting urban development; ② Funds by local governments at all levels: in terms of the new subway lines, local governments generally arrange a certain proportion of funds from local financial revenue as the self-owned capital of the subway enterprises, and the proportion varies based on the ownership of these subway enterprises; ③ Subsidy for subway construction costs: A 5-year subsidy is offered to the metro lines constructed by corporations or public-owned subway enterprises from the year of construction, and the subsidy for subsidies for reconstruction works equal to 1/2 of that for new lines.④ Subsidy for rail transit lines in new urban district: It applies to the rail transit lines in new urban district built by public or quasi-public enterprises (the enterprise which accepts funds provided by local governments). Such subsidy is offered in 6 years from the year when subway operation begins; ⑤ Interest compensation for private railway line construction conducted by Japan Railway Construction Corporation: The private rail lines constructed by publicly owned corporations are transferred to private railway companies by way of equal principal and interest payment. The part with interest more than 5% will be equally shared by the state and local governments, and the interest compensation time is 25 years (or 15 years for rail transit lines in new urban districts).

2）Users' burden. The forms include two parts, namely specific urban railway construction fund and internal retention fund. In 1986, Japan enacted the Special Measures Act for Promoting Specific Urban Railway Construction, adding a part of the construction costs of multiple track projects and large-scale transformation projects to ticket as an amount of loss; the revenue increased was used to establish the tax-free Specific Urban Railway Construction Fund for the sake of project construction, and the limit of the fund might reached 50% of the recognized engineering costs. In 1994, amendments were made to the Special Measures Act for the sake of the integration of megalopolis passenger rail facilities, new line construction, old line transformation and multiple-track projects. The system can include part of construction costs into

the amount of loss, ensure construction capital in the form of tax-free and reduce project loan and relevant interest so as to cut down the operating expenses; when the construction is completed, an amount equal to the fund will be returned to ticket, and the increase of ticket price induced by the fund is only limited to the district of construction object and has no effect on the passengers who do not use the railway in the district. Furthermore, the system also make the retention fund of railway revenue or the internal retention fund of the special fund for depreciation of original cost as the construction fund, thus reducing and balancing the loan burden.

3) Beneficiaries' burden. In Japan, currently, no restoration system has been set for the development benefits, but similar system of beneficiaries' burden has been established. Such system includes: ① In terms of the development projects and land planning and reclamation projects in new residential blocks in the development areas where the railway lies, the new town developers' burden system requires the project implementers to provide the land for railway at the price of open ground and cover 1/2 of costs of the constructions beneath the formation level; ② Beneficiaries' burden system of the old urban planning law requires owners of the private ancestral lands along the Midosuji subway line in Osaka to bear 1/4 of the construction costs; ③ Regarding the corporation's subway stations and related buildings, the cost sharing system for the connection projects requires that owners of the buildings should share the project costs of the connection channels between the buildings and pathways.

4) Issuance of bonds. According to local financial law in Japan, subway and new urban railway constructions implemented by public subway enterprises are belong to the construction projects which are appropriated to issue bonds, and they can raise construction fund through issuing bonds. There are three kinds of local bonds which are used in Japan for urban rail transit construction: the enterprise development bonds issued for raising construction funds for public-owned subway and new urban railway; the traffic bonds issued by the Teito Rapid Transit Authority for raising construction funds; and the railway construction bonds issued by the Japan Railway Construction Corporation for financing its constructions.

5）Interest-free loan. After the Railway Maintenance Fund (now as the Transport Facility Maintenance Agency) was established, Japan began to use the fund, a special financial fund, to carry out interest-free loan for subway maintenance, construction of urban railway and double-track project of original lines and the loan amount equals to 40% of the related construction costs. The benefited projects must be subject to the agreement by the Minister of Land, Infrastructure and Transport and the Chancellor of the Exchequer, and the number of payment installments is subject to the nature of construction projects (new line construction or multiple track project).

6）Tax concessions. To encourage investment in urban railway undertaking, Japanese government has adopted many tax concession policies. Tax reform in 1962 involved the underground tunnel, turnout and security measures in metropolises in tax concession, and reduced the tax on interchange facilities; later, such measures were carried out as decreasing the assessment price of railway land and cutting down the fixed asset tax on various railway facilities. Again, tax reform in 1967 established a special repayment system for construction costs and a repayment reserve system for specific railway projects. Since 1983, fuel-efficient vehicles entered into the objects of specific repayment and tax deduction specified in corporate tax law, receiving such tax concession as decrease of fixed asset tax and so on. Additionally, Japan has adopted a variety of detailed and

more targeted tax concession measures for JR companies, special local transit line, fixed asset transfer of railway and so forth.

In addition, domestic and international experience shows that the different definitions on the scale of comprehensive development and the scope of planning influence directly affects the selection of specific development methods and means. For example, Japan implements city-wide traffic and land comprehensive development and bases on it for urban planning, thereby forming the development model of "**real estate development + commuting rails + station city**". On the one hand, comprehensive development is carried out in railway stations relying on railway passenger transport network, like, the Shinjuku Hub represented "Station City" complex construction; on the other hand, urban sub-center is vigorously develop the constructed while the commuting rail are built to connect the main urban area and a large number of jobs are offered around the railway hubs to ease urban functions by use of commuting railways. The typical representative is the Tama Garden City developed by Tokyo Corporation. For another example, Hong Kong pays more attentions to the comprehensive development of the areas along rail lines to promote the construction and operation of rail transit, but rail transit has a relatively small influence in the overall function layout and plot division of the city, therefore, Hong Kong chiefly advocates the development model of **"Rail Transit + Mixed Land Use".** In time of subway design and construction, MTR also obtained the right to develop the land of the properties above the subway and planned subway investment, development and construction and the line-side comprehensive land development. MTR pays land transfer fee to the government, and thereafter the subway company constructs and operates the subway, has property development over the subway independently and together with other developers, and earns profit through house sale and lease.

Box 3-15 Cases of Traffic and Land Comprehensive Development in Japan

In Japan, rail transport and real estate comprehensive development strategy is still a means of Japan's "Land Readjustment". The core of the planning approach lies in the combination between infrastructure and resident's plot adjustment. The size and position of the plots are adjusted through a precise calculation of the increase in the land value of each plot before and after project implementation to make it obtain equal rate of return, and part of investment revenue is used to balance the investment in infrastructure. The strategy was firstly adopted by Hankyu Railway Corporation in Osaka-Kyoto area in early 1920s. As this comprehensive development strategy achieved great success, it was widely adopted by railway companies in Tokyo and other places in Japan.

By the method of comprehensive development of railways and lands along the railways, railways will drive land development, which in turn will develop passenger source for railway passenger transport. A lot of subway companies have also developed into diversified industrial groups. Besides railway undertakings, they also get involved in such industries as: ground public transport, real estate, commerce, tourism, cultural facilities, recreational facilities, etc., as well as foreign investment. They have realized such a situation that railway as a main business promotes other concurrent businesses and those businesses in return supports the main business of railway. In the process of distributing of land uses, railway companies also pay special attention to attract all kinds of schools, health centers, post offices, libraries, fire stations and other government agencies in an extremely favorable manner. That is because that these organizations do not only increase the attractiveness of local real estate, but it can also provide passenger volume in off-peak

time for railways and effectively reduce motor vehicle traffic within the community.

The specific practice for the development of the areas along rail lines is: When rail transit companies conduct line planning, they will obtain government's commitments of retaining the development rights of the lands along subways so as to get the right to develop upper space of stations. Afterwards, rail transit companies are responsible for the preliminary overall planning and design work, and the selection of joint development partner in accordance with selected planning and design scheme; developers pay for land costs and build commercial buildings, residences, office buildings and other facilities with responsibility for their own profits and losses in line with the development standards defined by these companies. The profits obtained from the sale of property will be shared by these companies and the developers. And these companies receive benefits in the property development by the method of receiving cash in advance, sharing profits or assets etc. respectively.

Figure 3-3 Urban Development Pattern of Tokyo [17]

3.4 Summary

According to the advanced experience and lessons learned from failure experience of relevant regions and cities at home and abroad, several suggestions have been put forward as follows, which are combined with Chinese actual situations and development demands.

3.4.1 Creating a good basic environment for planning in the respects of systems and mechanisms, laws and regulations

1) Establishing a sound legal system for planning to provide the foundation for cooperative development

A comparison between the foreign legal system for planning and that of China, the functions and contents of Chinese planning legal system also have many deficiencies. Particularly, some respects need to add to define procedural rules and the relationship between responsibilities and rights of administrative body, to add normative contents of planning index. Such related laws as Land Law and Construction Law should also be further perfected. Moreover, the sound national basic law system must be regarded as the basis of establishing the law system for town planning management. For example, property law and administrative law have a great impact on establishing the law system for town planning management, the former defining the relationship between personal property right and public advantage, the latter standardizing executive powers

[17] Source: Internet

and administrative acts. Especially if legal system in the respects of procedural rules and the relationship between responsibilities and rights of related administrative body need to be perfected, it should rely on further development of related administrative system and legal construction to a great extent.

2) Perfecting the system and mechanism of compiling planning to improve the traffic impact and planning status

In the planning system of some foreign countries, transport and urban industrial pattern are all considerable factors of urban planning and land utilization planning, which directly impact on compiling plan, not passively adaptation; even if urban transport planning just as one sub-program of urban overall planning (or comprehensive planning), its decision-making process keeps peace with compiling urban planning. Their nuances are that transport planning more focuses on industrial operations, having more details and more specific arrangement for supported projects and fund plan.

The above mentioned phenomena are caused by the following reasons. Many countries write concrete procedures and working mechanism of urban planning into laws and regulations, and clearly stipulate that transport experts must be included to compile the urban planning. In addition, the transport planning must be integrated with urban function, and it should describe the selected positions of transport projects, included facilities, construction schedule, corresponding influence on economy, environment and transport, which are regarded as significant parts of the urban planning.

3) Shaping a special transport management district and establishing an effective coordination mechanism

The transport management district is divided in accordance with population or economic scale. The districts close in geographical location, large in population and serious in transport problems should are uniformly planned and managed. And then metropolis planning organizations are set up to overall manage the coordination work of the urban planning and to solve the connection problems of surrounding districts. International experience indicates that this is an effective way to cope with rapid expansion mechanization development and guide coordinated urban and traffic planning. Meanwhile, the corresponding administrative measures and planning guide developed for transport management districts ensure such respects as development goal, development mode and financial strategy to meet the requirements of urban-transport integrative development and urban sustainable development. They are also an important policy guarantee for coordinated urban and traffic planning.

3.4.2 Compiling planning from the perspective of integrative development in the respects of planning methods and contents

Establishing reasonable and effective planning goal system to ensure the mutual connection plans and the feasibility of scheme

In the planning system, foreign countries generally set planning goals in accordance with such levels as nation, area, province, district, city, area and street, and the planning goals are detailed and concrete gradually according to levels. We should establish a corresponding goal system with a same principle from national grand strategy to street project design. Moreover, the planning goal should adopt performance indicator, not construction goal. The reasons why performance indicator is regarded as the planning goal are as follows: firstly, it could specify the results and potential

impact of the planning scheme, which is benefit for different stakeholders taking part in the scheme assessment; secondly, it is benefit for national goal integrating with regional strategy goal. Compared with the construction goal, the performance indicator could predict the results more clearly, which is good for connecting various planning and ensure the coordination work; thirdly, it has a significant effect on enhancing process management and optimization adjustment timely by comparing expected results with actual results.

2) Deepening breadth and depth of traffic impact assessment to expand transport's impact on the urban planning

In foreign urban planning, TIE gets involved in the early stage, and traffic impact is also a very important part of the objectives of planning. On the other hand, TIE not just faces the industry. It not only considers the changes of the project on the surrounding road transport system but also considers the influence on urban development pattern, economic industrial layout, residents' travel structure, environmental quality, etc. Therefore, it has an important influence and guiding significance on the formation of urban planning schemes.

With the regard of specific means and methods, in the aspect of planning concept, foreign countries have a profound understanding of the impact of traffic on urban development and emphasize the guiding role of the layout of transport facilities in the pattern of urban development; in the aspect of impact evaluation procedure, the evaluation is throughout the whole process of pre-planning study, plan preparation and plan evaluation, and urban planning department is uniformly responsible for organizing impact evaluation and the planning department must contain transport experts; impact evaluation consist of the evaluation on the traffic impact of urban development projects and that on the urban development impact on transport projects, which are complementary and indispensable, and the analyses, very thorough and specific, are all data based quantitative analyses of the impacts in terms of urban economy, development and travel. The combined effects of these three aspects play a good promoting role in transiting planning concepts, improving the position of transport planning and enhancing the right to speak of transport in urban planning.

3) Combining planning theory research with practical operation to improve the level of planning technologies

Foreign countries attach great importance to the unity between theoretical study and practical operation. In urban and transport development process, through establishing special research fund, setting up discipline, etc., planning research is promoted to provide planning staff with technical support in the actual planning. In addition, a lot of integration research projects are established at the national and regional levels. Relevant experts studied how to implement different key policies in development vision from different angles on land use planning, zoning, highway and bus lines layout, lanes and sidewalks, bicycle facilitation facilities as well as other standards, set up sub-projects for different areas by taking small scale as foothold, provided fund and decision support for local community planning to promote integrated development of transport and urban in community, city and even large area. Meanwhile, the planning experience of pilot cities and regions also drive the coordinated city-traffic development of other areas and even the whole country.

The application combination of theoretical research and practical planning avoids the polarization of the research on coordinated urban and traffic planning. Corresponding mature theory research systems and specific application methods are available in terms of macroscopic planning

orientation and development strategy, microscopic implementation means and specific measures of planning concepts and microscopic statistical methods and planning models. Therefore, it has very important guidance and reference meaning for specific planning projects.

In addition, foreign countries also place great emphasis on the collection of basic data, form relevant statistical analysis system and conduct quantitative research on the interaction among land use, industrial structure and traffic system, make quantitative evaluation on the economic and social influence of traffic planning program, so as to make more accurate prediction and judgment on the future development trend and relevant demands and provide more reasonable and reliable theoretical basis for plan preparation.

4) Strengthening public participation and applying public opinions as an important feedback into the implementation of the planning scheme

Foreign countries form special public platforms and public participation mechanisms by laws. **Firstly, a fair and transparent planning team should be organized.** The urban planning department is responsible for compiling planning and the municipal government appoints and sets up directly a planning management committee. The committee should include related representative departments directly under municipal government (planning, transport, development and reform, environment, territory and so on), industry experts, all stakeholders related to the planning (the leaders of key enterprises, owner etc.) and representatives of the general public. The planning management committee as the planning adviser provides technologies to support the scheme and is responsible for coordinating all foreign affairs. We should pay attention to cooperation in all industries and ensure the scheme is fair and reasonable; **secondly, a record mechanism should be planned.** We should strengthen the process management aiming to check the planning record, which is good for supervising and implementing the planning in the later stage. The research and contents of the planning should be showed regularly. The public should be allowed to participate in discussions and make comments; **thirdly, the public should be allowed to participate in the whole process.** A special platform should be opened to listen to public opinions and collect public opinions through various ways in every stage, such as holding discussing meetings, research and discussion, open day and questionnaire survey; **fourthly, a accept mechanism should be shaped to screen the public opinions.** The planning management committee should collect and check the public opinions, then screen reasonable and feasible opinions and correspondingly adjust the planning scheme.

3.4.3 Ensuring the smooth implementation of planning scheme through system and policy support

1) Perfecting land reserve and trading system to guide the land development model oriented by public transport

In some foreign countries, land reserve system is an important policy guarantee to improve the government's ability to regulate the urban land market and optimize the allocation of land resources. The concrete measures are as follows:

Firstly, establishing an effective land reserve system and organization system. The concrete operation of the land reserve system involves a number of government functional departments, such as land, planning, involved, construction, municipal administration, and garden and civil air defense. The connected degree among every department relates directly to the operation cost, efficiency and risk of the land reserve system. Therefore, an effective organization system can

achieve the predicted goal of the land reserve system and strengthen the collaboration among departments like planning, land reserve center and land.

Secondly, defining land supply and trading system. According to the situation of infrastructure construction and market demands, land utilization information is sufficiently provided to the society, covering nature of land, traffic accessibility, future development, supported facilities, etc. Developers could obtain the concrete information of urban land development potential from land and resources authorities. Sufficient information and thorough competition ensure the maximum land efficiency. In addition, in terms of transition system, smooth and transparent trading and supervision mechanisms are necessary.

Thirdly, reserving the land within the scope of traffic impact in advance. According to the government's long-term urban planning, the land within the scope of transport influence is reserved in advance consciously, which reserves for the future development of public transport, creates a favorable environment for the development of public transport and also saves the cost of secondary development.

2) Taking more investment and financing measures in the constructing and operating processes of the public transport projects to promote the sustainable development of public transport

Firstly, transforming the increased value of the urban land into the construction funds of the transport. By levying "development tax/fee" and carrying out comprehensive development, the income from land value increase can directly transfer into transport construction funds, which ensures the sustainable sources and also makes the construction of transport infrastructure free from big changes due to or not due to the attention by government authorities or competent leaders.

Secondly, emphasizing the joint development along the public transport lines. The railway transport projects could use the development model combined "railway with land" to create profitable conditions and attract the social investment, achieving the investment and financing diversities for the railway transport.

4. Frame Design for Synergy Policies of City's Transport Planning and Master Plan

Urban Planning Policy on the Coordination between Transport Planning and Urban Planning is the general rather than the narrow concept, including specific policies, executive methods, management measures, etc. Based on the thorough analysis of the current coordinated development of transport planning and urban-rural planning, this part will put forward the executive methods, management measures and policy advices for different stages of urban and transport planning from macro, meso and micro levels.

4.1 Macro Level Coordination Policy

The macro level mainly puts forward some interactive and coordinated development countermeasures for transport planning and urban planning from the stage of urban-rural master planning, outline planning and backbone transport network layout planning, and mainly includes constructing the overall intensive and compact urban pattern, realizing the mixed use of land, building the efficient and convenient public transport system, building the environment-friendly urban road network, reasonably organizing the urban functions of high-speed rail station area, promoting the integrated development of airport economic area industry, space and transport, and overall planning of port and city development.

4.1.1 Constructing the Overall Intensive and Compact Urban Pattern to Guide the Polycentric Urban Structure

In the early 20th century, the monocentric city was the main urban form prior to the rapid development of motorization; at present, many small and medium-sized cities are still in the monocentric form. In those cities, the population, industrial and commercial activities are highly concentrated in the central urban area, which inevitably produces the phenomena like high density of population and too many industrial enterprises in the central urban area, leading to the urban traffic jam, the crowded housing and infrastructures, as well as a series of urban environmental problems, and the sprawl of megacities.

To solve the problems of monocentric urban model, the governments of many countries and regions and the urban planning experts have put forward the polycentric urban regional development pattern to guide the evolution of metropolitan area to polycentric city and have formed the polycentric urban network structure model. For the megacities, the polycentric structure is a more reasonable choice than the monocentric structure in the performance of transport, ecology, housing, economy and so on.

From the perspective of transport, in a job-housing balanced polycentric structure, the residents in the outskirts can work in the nearby sub-center to reduce the commuting distance; at the same time, the commuting traffic to the main center is diverged, which relieves the traffic jam and increases the commuting speed, eventually improving the efficiency of commuting traffic.

From the perspective of ecology, the improvement of transport efficiency reduces the pollution of automobile exhaust gas to the polycentric city, and the residents can reach to the neighboring ecological open space more easily, and it is more advantageous to the urban disaster prevention and the heat island effect is also reduced.

From the perspective of housing, the rent curve of the polycentric city is a zigzag line, and it is obviously lower than the monocentric city with the same population size, which is conducive to improve the residents' housing affordability.

From the perspective of economy, the research of new economic geography shows that the factor mobility has both centripetal force and centrifugal force. When the urban size of monocentric city ingle-center structure reaches the maximum, the enterprise cost and the laborer living cost from traffic jam and land price rise will be gradually higher than the agglomeration economy benefit if the city continues to expand, leading to the centrifugal force of urban development, so as to form the polycentric structure in a larger area for the maximized benefits.

Therefore, the multilevel polycentric urban structure shall be built in the current space planning of metropolises in China and the intensive and compact land development shall be conducted centering on the different levels of centers. At the same time, the public transport accessibility and service levels between different centers shall be strengthened.

The urban centers consist of three levels, namely main center, sub-center and cluster center based on the level of public transport.

(1) The main center features the mixed use and the high density, serving as the regional employment center and business center. The minimum density of jobs for the area within 600 meters from/to the main center is 200 people per hectare; the density of registered inhabitants is 400 people per hectare.

In transport, the main center shall have two or more regional bus lines intersected; the main center of the megalopolis shall have the urban railway station of at least two track lines.

(2) The sub-center features more balanced high-density commercial and residential buildings. The minimum density of jobs for the area within 400 meters from/to the sub-center is 150 people per hectare; the lowest density of registered inhabitants is 300 people per hectare.

In transport, the sub-center shall be within the walking distance from/to a regional bus stop which has multiple shuttle bus routes intersected; the sub-center of the megalopolis shall have the urban railway station of at least one track line.

(3) The cluster center mainly includes the medium density residential buildings and perfect supporting services. The minimum density of jobs for the area within 400 meters from/to the cluster center is 50 people per hectare; the lowest density of registered inhabitants is 150 people per hectare.

In transport, the cluster center is usually near a regional bus stop (for example, within 500 meters); the cluster center of the megalopolis shall near the urban railway station (for example, within 500 meters).

4.1.2 Realizing the Mixed Use of Land and Advocating the Job-Housing Balance

Job and housing are the two basic elements of urban land use, and the spatial relation between them determines the characteristics and efficiency of urban transport to a large extent. Job-Housing Balance is a planning concept gradually formed by the urban planners in the struggle against the "urban diseases" including traffic jam. The basic connotation of job-housing balance

mans that within a given region scope, the number of laborer in residents is roughly equal to the number of jobs, and most residents can work nearby; the commuting traffic can be in walking, cycling or with other non-motor vehicles; even if with motor vehicles, the travel distance and time are relatively short in a reasonable range. In this way, the use of motor vehicles, especially cars, is reduced, thus the traffic jam and the air pollution are also reduced.

Since job-housing balance usually takes a certain region as the unit, the scale of the region is the key to the measurement. Some scholars conclude it into three different levels: macro, meso and micro. The macro level refers to the larger administrative units, such as county or city, with general higher degree of balance. Since the region scope is very big, however, even if it is balanced, the actual commuting distance may be very long. The micro level refers to the community and neighborhood with small region scope. Although the balance in this level can largely reduce the commuting distance, the commuting distance crossing out the region may be not far away. So the formulation of both macro and micro job-housing balance policy has greater limitations; most of the researches still focus on the meso level, that is, the region consisting of a given residential place or employment center and a reasonable commuting radius around it.

For domestic metropolises, how to strengthen the planning of mixed use land and promote the job-housing balance centering on the polycentric regions, CBD reconstruction and expansion, new towns and other areas has more realistic significances.

The strict single-function land planning may separate the urban functions and weaken the urban vitality, etc.; strengthening the mixed use of land and increasing the flexibility of land can increase the employment positions and service facilities of the residential land, thus improving the accessibility and reducing the energy consumption of travel. The mix of residential and commercial services for the urban land, and the mix of different social classes and ages in the residential areas shall be encouraged; the single-function and large-scale development and construction projects shall be avoided while the small-scale and mixed-use development pattern shall be encouraged.

On the one hand, the job-housing balance in short commuting distance shall be reached. The newly-built areas in the city shall establish a variety of large-capacity public transport links to strengthen the public transport accessibility in the employment center and ensure that the commuting distance between the employment center and residential area is in within 15km or 30 minutes of public transport. More job opportunities and the dispersed employment centers shall be created by promoting the development of commercial and office land, etc. in different areas; the coordinated development between the living and employment Space layout shall be promoted by increasing the residence supply near the employment center and other measures.

On the other hand, the job-housing balance in urban rail transport network shall be reached. For example, the job-housing balance for the area 1km within the rail transport station in the network shall be reached. Where no job-housing balance can be reached though the network analysis, the residential land shall be increased within the 40 minutes travel cycle of the urban rail transport by taking the employment center as the node, and more job opportunities shall be created within the 40 minutes travel cycle of the urban rail transport by taking the residential area as the node to realize the job-housing balance. (Note: No cities have issued the guidance on the job-housing balance of rail transit network, and the 40-minute travel ring can be adjusted according to the size

of city. The recommended range is 0.8 to 1.2 times of the average travel time)

4.1.3 Reasonable Layout of Hub and Surrounding Land to Expand the Urban Functions

(1) Reasonably Organizing the Urban Functions of the High-Speed Rail Station Area

The construction of high-speed rail station will bring rare development opportunities for a city or region, which will gather the urban population, increase the job opportunities and improve the accessibility of the city. These macro influences are actually realized by the reasonable organization of urban functions and space in high-speed rail station area, that is they are closely related to the spatial structure and functional characteristics of the station area. Therefore, the reasonable planning is the foundation of playing the pivotal role of the high-speed rail station and promoting the expansion of urban functions.

The spatial structure of high-speed rail station area has the obvious "circle" expanding characteristics, that is, it can be generally divided into three circles centering on the station as shown in Figure 4-1.

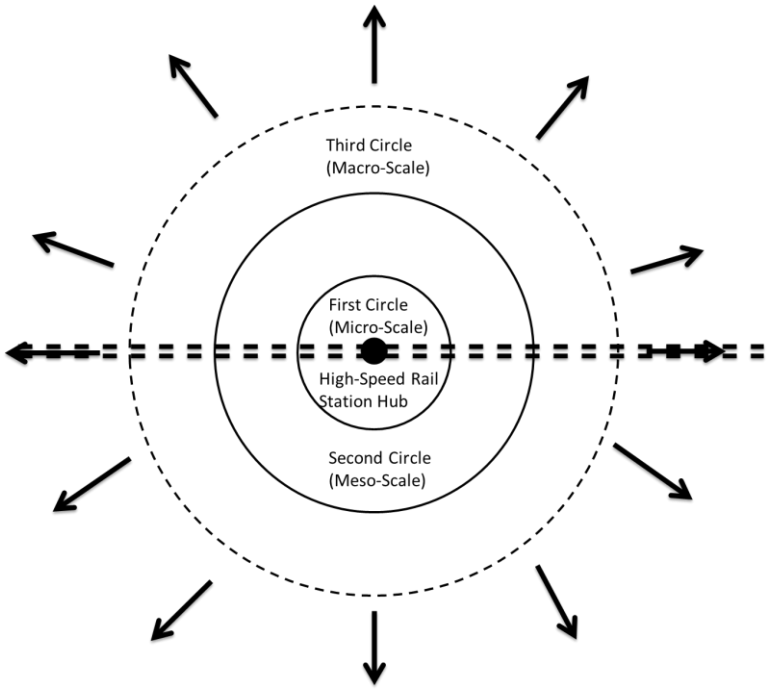


Figure 4-1 The Three-Circle Spatial Structure of High-Speed Rail Station Surrounding

The first circle is the service area including the traffic center. The traffic center includes the station, hub, square, subsidiary rooms, bus depots, urban rail transport station and other comprehensive transport facilities, providing all kinds of supporting services for the passengers. This area is the most basic functional area of the station in playing its roles, mainly serving the passengers whose activity characteristics and demands are most closely related with the station. Therefore, this area can be regarded as the "export-oriented" region supplementary to the station (the functions of serving for residents in the city are called "import-oriented" ones); in the space sense, the area

usually features high development intensity, high building density and intensive construction investment led by the new station.

The second circle is the expansion and supplementary to the functions of the first circle. With the increase of distance, the passenger population diffuses and the density reduces; the demand for a variety of supporting services also reduces; the relevance of all sorts of functions to the station also reduces gradually, serving mainly for passengers, also for urban residents; the functional organizations of the city transit from "export-oriented" to "import-oriented" ones.

In the third circle, the railway passenger number further reduces and they gradually integrate into every corner of the city; various activity characteristics and demands peculiar to the station passengers also change from "passenger" to "resident". By this time, the functional organizations of the city are not directly related to the station, but determined by the integrative factors like urban development goal or zoning.

The characteristics and planning priorities of each circle are as follows:

The scale of the first circle is 1-1.5 km^2, including traffic center, restaurant, hotel, tourism, commerce, information, office, etc. Such functions have the highest correlation with the pivotal role of the high-speed rail station; the land space and functional layout are maximally limited by the transport hub, thus the transport service area of the high-speed rail station. The space and functional layout have some certain "rigid" feature and the boundary can be defined easily. Therefore, this circle is the planning focus of the high-speed rail station hub in each city. The key points are the construction of the road transport network integrated with the city, the reasonable layout of the land functions associated with the station area, providing a variety of convenient, quick and comfortable services for passengers to the maximum extent.

The scale of the second circle is 3-5 km^2; it supplements the functions of the first circle and expands the related functions, including office, commercial, residential, even cultural, education and industrial land. The relevance of all kinds of functional lands to the station reduces, gradually transmits to the normal balance of urban functional organization, spatial structure and land use. This range is the direct driving area of the high-speed rail station hub. The key points are deciding the location and content of the extended station hub functions according to the specific situation of the cities, exerting the hub driving effect and paying attention to the cultivation of land economy.

The third circle is the indirect catalytic area. From the aspects like functional organization and spatial structure, its relevance with the high-speed rail station hub is weaker, already "restoring" to the normal urban functional structure, or it can be said that a variety of urban construction lands are not directly related to the station hub requirements. The third circle is relative to the first and second circles, and its significance does not lie in the accurate judgment of scale or boundary, but in the better understanding of the characteristics and functions of the first and second circles. Therefore, the third circle has the open boundary. The planning key points are coordinating the traffic organizations of the station area in wider range, improving the service efficiency of the station, keeping the overall layout and function coordination between the station area and the city to realize the strategic targets of improving the regional role of the city and expanding the radiation energy (see Figure 4-2).

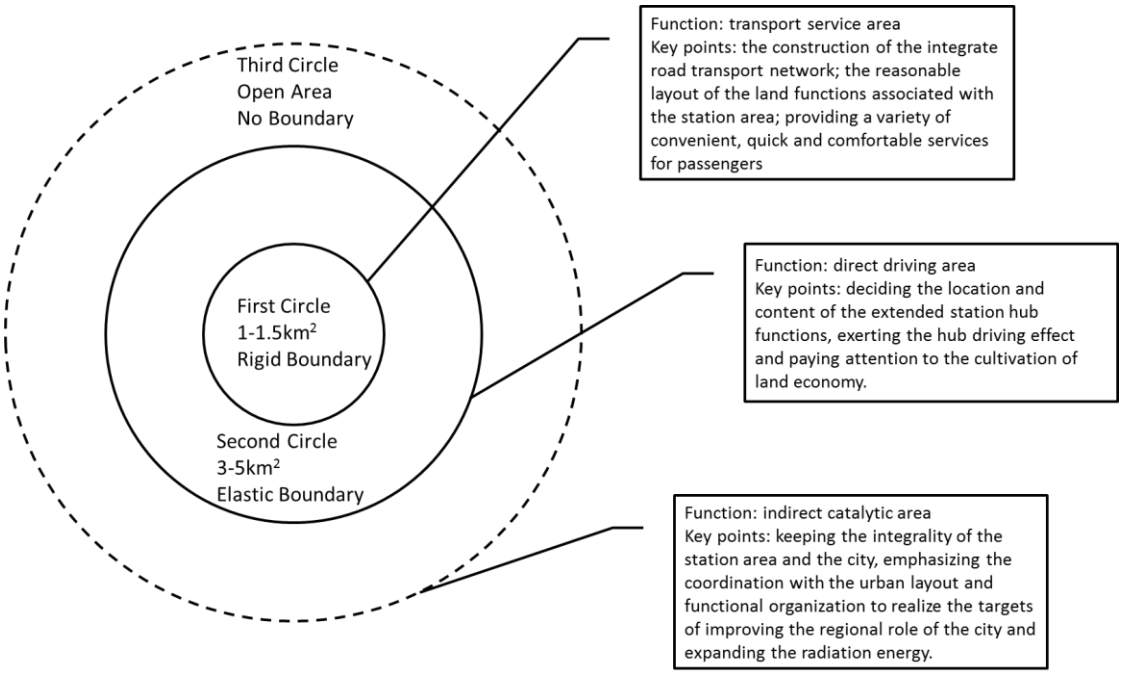


Figure 4-2 Functions and Planning Key Points of Each Circle

(2) Promoting the Integrated Development of Airport Economic area Industry, Space and Transport

How to respect the industry derivation of the airport economic area brought by its transport attribute, grasp the spatial extension characteristics of the industry, and provide the transport facilities compatible with the industry characteristics to effectively guide the favorable and independent spatial flow of the industry are urgent issues to be solved in the planning of airport economic area development under the new period. Therefore, the integrated planning of the airport economic area in coordination of the three elements, namely industry, space and transport is the catalyst effect of the airport as the strategic resource under the background of globalization, also the key to realize people's urbanization and fully stimulate the leading role of the market.

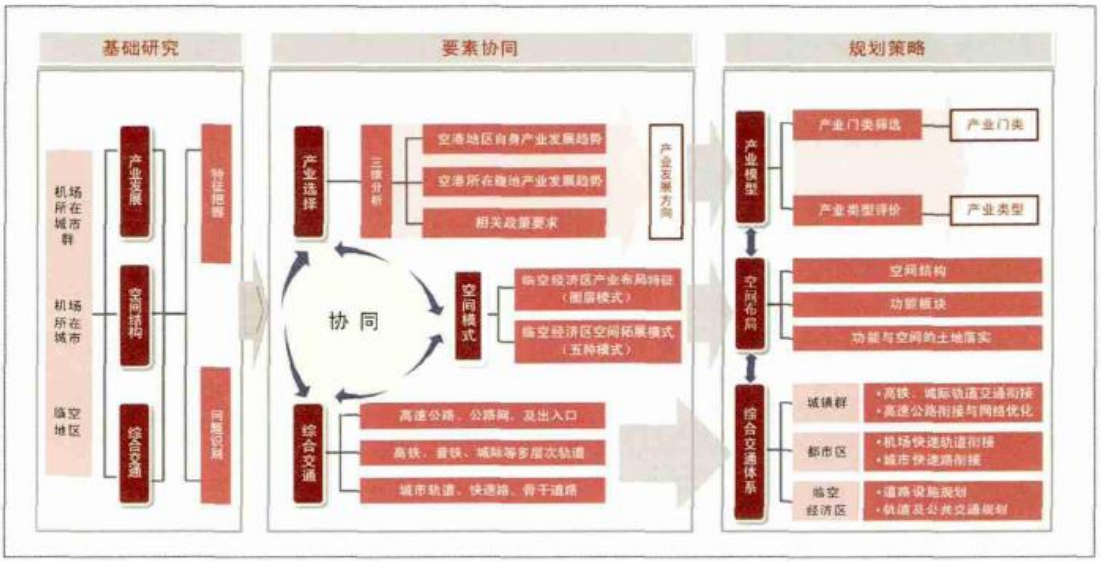
In order to promote the integrated development of industry, space and transport in the airport economic area, the collaborative planning system of industry, space and transport in the airport economic area shall be built from the following three aspects:

Firstly, the fundamental research shall be made. The characteristics of urban space, industry cluster and comprehensive transport of large airport hub, airport economic area, urban area and urban cluster shall be combed through spatial analysis; the regional, urban, internal and external connection problems shall be identified with the above collaborative planning theory of the three elements.

Secondly, the elements coordination shall be conducted. The regional differences and advantages of industrial agglomeration shall be identified with the dimensional analysis method to put forward the industry selection and location selection suggestions for the airport economic area; the airport economic area development model shall be determined and the regional strategic space nodes and land layout shall be put forward under the guidance of relative planning like urban

master planning; under the guidance of comprehensive transport system planning, the comprehensive transport system of the airport economic area shall be combed and the space layout of foreign comprehensive transport system and related hubs shall be planned, including the improvement of freeway and highway network, the adjustment of exit/entrance, the connection of multi-level rail system of high-speed rail, domestic rail and inter-city rail, and the planning of collecting and distributing system, etc.

Finally, the backbone transport network of the airport economic area shall be built. Through the collaborative analysis of functional structure, land layout and comprehensive transport backbone network, the traditional development mode taking road as the subject shall be changed to the public transport mode taking rail as the subject to organize the industry and space of airport economic area and to coordinate the relationship between the multi-level rail transport system and the airport economic area (as shown in Figure 4-3).



基础研究	Fundamental Research
机场所在城市群	Urban Cluster of the Airport
产业发展	Industry Development
特征把握	Grasping Characteristics
机场所在城市	City of the Airport
空间结构	Spatial Structure
临空区域	Airport Area
综合交通	Comprehensive Transport
问题识别	Problem Identification
要素协同	Elements Coordination
产业选择	Industry Selection

三维分析	Three-Dimensional Analysis
空港地区自身产业发展趋势	Industry Development Trend of the Airport Area
空港所在地产业发展趋势	Industry Development Trend of the Airport City
相关政策要求	Relevant Policy Requirements
产业发展方向	Industrial Development Direction
协同	Coordination
空间模式	Spatial Pattern
临空经济区产业布局特征（圈层模式）	Industry Layout Characteristics of the Airport Economic Area (Circle Pattern)
临空经济区空间拓展模式（五种模式）	Spatial Expansion Pattern of the Airport Economic Area (Five Modes)
综合交通	Comprehensive Transport
高速公路、公路网、及出入口	Freeway and Highway Network, Exit/Entrance
高铁、普铁及城铁等多层次轨道	Multi-Level Rail System of High-Speed Rail, Domestic Rail and Inter-City Rail
城市轨道、快速路、骨干道路	Urban Rail, Expressway and Backbone Road
规划策略	Planning Strategy
产业模型	Industrial Model
综合交通体系	Comprehensive Transport System
产业门类筛选	Industry Selection
产业门类	Industry Category
产业类型评价	Industry Type Evaluation
产业类型	Industry Type
空间布局	Space layout
空间结构	Spatial Structure
功能板块	Function Plate
功能与空间的土地落实	Land Implementation of Functions and Space
综合交通体系	Comprehensive Transport System
城镇群	Urban Cluster

高铁、城市轨道交通衔接 高速公路衔接与网络优化	Connection of High-Speed Rail and Urban Rail Transport
都市区	Urban Area
机场快速轨道衔接 城市快速路衔接	Airport Rapid Rail Connection Urban Expressway Connection
临空经济区	Airport Economic Area
道路设施规划 轨道及公共交通规划	Road Facilities Planning Rail and Public Transport Planning

Figure 4-3 The Technical Route of Airport Economic Area Development Planning under the Coordination of Industry, Space and Transport

(3) Overall Planning of Port and City Development

- Taking the Port and the City as An Organism for the Reasonable Layout and Orderly Development

First of all, a scientific understanding to the positioning of the port in the urban development is required. The port development shall focus on the current, but more the long-term and sustainable development, and shall keep the international and regional competitiveness of the traditional port functions and realize the overall and coordinative development through the port industrial upgrading and diversification. This requires the scientific planning and reasonable layout for the long-term development of the port and taking the port and the city as an organism to make properly advanced planning with a high starting point to adapt to the development of the city and closely cooperate with the urbanization process. In the planning, the overall operating environment of the port shall be considered and the coordinated development between the shipping industry and non-shipping industry of the urban waterfront areas shall be also fully considered.

- Overall Planning of Zone-Port Interaction to Promote the Interactive Economic Development of the City and the Port

The integrated combination of port, development zone and free trade zone creates conditions for the port to become a regional "logistics center of international trade and industry" and adds the "regional core port of international trade and industry" function to the port, which can speed up the port development and expand the port development space, thus has positive significance in adjusting the industrial structure of the city and promoting the international competitiveness of the city economy, and is also the very important advantage of promoting the interactive economic development of the city and the port.

- Planning of Large Capacity Collecting and Distributing System Focusing on the Construction of Grand Railway Corridor

After the economic agglomeration development, the port cities will vigorously expand the

development space while optimizing and upgrading the industrial structure; in a sense, the competitiveness of the urban sustainable development mainly depends on the scale and influence of the space. So, the port cities need to strengthen the closely contact with the inland areas. With the implementation of China's western development strategy and central rising strategy, the east-west-central economic interaction pattern is gradually forming in China; the processing industry gradually migrates to the inland, and the economic development of the inland area will put forward new freight transport demands to the ports. However, under the situation that land, environment and energy have become the main bottlenecks for the development of eastern China, the corridor construction shall focus on strengthening the large capacity railway and water transport with medium and long-haul transport technical and economic advantages to meet the needs of economic development trend, and satisfy the requirements of sustainable transport development. Especially for the areas mainly relying on the highway and railway in the port collecting and distributing (such as circum-Bohai-Sea, Fujian coastal and Beibu-Bay circling ports), the reinforcement of large capacity grand railway corridor is very important.

- Timely Adjusting the Port Functions to Promote the Coordinated Development of the Port and the City

The ports and cities shall determine the different functions according to their own characteristics and advantages to form the distinctive ports and port cities and realize the win-win cooperation and optimal utilization of resources via the differentiated development. At present, the port development in China is still in the port-centered industry agglomeration stage and the relationship between the port and the city is mainly the port agglomeration industry, which promotes the high speed development of the urban economy; the heavy chemical industry speeds up to gather in the coastal area and the processing industry centers concentrate in the Yangtze River Delta and the Pearl River Delta, which show that China's port, port-centered industry and urban economy are in the favorable interactive development stage. But from the long-term coordinated development requirements of city, port and port-centered industry, their further development is restricted by the urban development after the ports and port-centered industry reached the certain size, which also has a negative effect on the urban environment. Especially under the circumstance that land, energy, environment and other factors have become the bottlenecks for the economic development of the east coastal area, the development ideas of the port and port-centered industry in some large port cities need to be adjusted for the purpose of port-city coordinated development, including both scale adjustment and structure optimization.

4.1.4 Building the Efficient and Convenient Public Transport System

Greatly developing the public transport and improving the public transport attraction is the most fundamental means to ease traffic jams. In the 1960s and 1970s, Europe and Japan speeded up the construction of rail transport to deal with the automobile growth, and later, Seoul, Hong Kong and other cities also adopted this strategy. In these cities, public transport has become the first commuting choice of the residents in urban center, and the ratio of public transport by commuters in the morning and evening is up to 70% to 90%.

Tokyo has generally kept the construction speed of building 100km of subway for each addition of one million motor vehicles. Especially in the 1960s and 1970s, in order to improve the capital circle commuter speed, the government made the technological transformation on the original

urban railway and connected it with the urban rail transport line to increase the commuting speed of the capital circle. Now, Tokyo has formed the suburban railway network of more than 2000km with a daily passenger flow volume of over 30 million.

Seoul had the problem of rail transport construction lag in 1990s and the traffic jam was very serious. Later, Seoul speeded up the rail transport construction and an average of 24km rail transport line was built every year from 1995 to 2000. In July 2004, Seoul began to actively promote the reform of public transport by reintegrating the bus lines, building the central bus lanes, importing the vehicular GPS equipment and developing the new intelligent card charging system, etc.

The experience of foreign megacities shows that only the construction of rail-transit based efficient and convenient public transport system can ease the urban disease of traffic jam, bring the sustainable development to the city and build the livable city. At the macro level, therefore, the idea of public transport priority shall be integrated into the urban planning and transport planning. The public transport system shall be defined as the main mode of transport for the big cities; the dominant role of rail transit network in the public transit system shall be reinforced; the planning goal of public transport proportion for different administrative levels like the city, central city and new town shall be put forward; the public transport coverage rate shall be improved and the bus lane network shall be built.

In the new urban areas, the public transport corridor with large and medium traffic volume shall be regarded as the frame of urban development and endowed with the main functions of urban center; in the areas between the main public transport corridors, the land development intensity shall be controlled and endowed with the functions such as ecological green gallery and construction restricted area. In the old urban areas, the new public transport corridor with large and medium traffic volume shall be combined with the city's layout of main public centers, employment centers and residential centers.

Specifically, according to *the Circular of the General Office of the State Council of PRC on Strengthening Urban Rapid Rail Transit Construction Management*, at this stage, the cities developing subway should meet the following basic conditions: Local finance general budget revenue is above RMB 10 billion, GDP reach above RMB 100 billion, the urban population is above 3 million the one-way passenger flow of the planned lines reaches more than 30,000 people at per peak hour; the cities with light rail constructed should meet the following basic conditions: Local finance general budget revenue is above RMB 6 billion, GDP reach above RMB 60 billion, the urban population is above 1.5 million the one-way passenger flow of the planned lines reaches more than 10,000 people at per peak hour. As for the mega-cities with better economic conditions and more serious traffic congestion problems, priority supports should be offered to their urban rail transport projects. For other cities, it is recommended to develop the public transport systems with medium traffic volume (such as BRT and trams) and establish a public transport system featuring the rational division of labor and optimized layout of public transport systems with medium traffic volume and regular buses.

4.1.5 Building the Walking and Non-Motor Vehicles Environment-Friendly Urban Road Network

International experience shows that simply increasing the supply cannot fundamentally solve the traffic problems; the civilized travel consciousness and the conscious use of green travel mode are important factors to guarantee the unblocked urban road. Many foreign cities actively advocate the green travel, build the livable city and encourage the citizens to actively choose the green travel modes like cycling and walking.

The urban road network provides services not only for motor vehicles, but also for public transport, walking and non-motor vehicles. The walking and non-motor vehicles environment-friendly urban road network shall be built to encourage people to choose the green travel modes like walking and non-motor vehicles.

4.2 Coordination Policy at Meso Level

The current urban planning system mainly includes two spatial levels, namely urban-rural master plan and detailed planning; the detailed planning can be divided into legal regulatory detailed planning and constructional detailed planning, of which the regulatory detailed planning can be further divided into block level and plot level. The meso level mainly puts forward the policy on the coordinated development between transport planning and urban-rural planning from enhancing the land use efficiency; improving the public service facilities; strengthening the humanistic design of road transport planning; improving the urban greening, the setting of rail transport entrance; the reasonable layout of public parking lots.

4.2.1 Enhancing the Land Use Efficiency of Local Areas

(1) Encouraging Small Plot Development

The "small and dense" street network shall be formed by reducing the plot size, scientifically and reasonably dividing the plots, building the street network suitable for walking and cycling and forming the safe, communicable and vibrant urban street space.

There are two operating ways to reduce the plot size. Firstly, the adjacent small plots can be offered for sale together, but the by-passes between the plots shall be built according to the road cross-section and standard in the planning, and the scheme shall be published to the public; secondly, the land scale and road conditions of the development plot shall be comprehensively evaluated according to Shenzhen Urban Planning Standards and Guidelines (2014) in the form of floor area ratio correction to guide the development of small-scale block and the optimization of road conditions. The land scale shall be controlled and planned in accordance with the established standard scale of small plots (0.7 hectare for commercial land and 1 hectare for residential land). Where the standard scale is exceeded or not reached, the floor area ratio subtraction shall be made with a maximum of 0.12; the transport conditions of the plot surrounding can be divided into four categories, namely one frontage, two frontages, three frontages and surrounding frontage; for the surrounding roads with better transport conditions, the floor area ratio correction factor shall be also increased.

The recommended provisions are as follows:

• For the business development plots such as residential land and commercial and service facility land in the planning area, the proportion of plots less than 2.0 hectares (including 2.0 hectares) in the total plots shall not be less than 70%.

• The area of public service facilities and municipal infrastructures, such as school, hospital, water plant and sewage treatment plant, with specific land scale control requirements shall conform to relevant technical regulations.

(2) Creating the Diversity of Development Intensity through the Differentiation Setting of Floor area ratio

The diversity of development intensity shall be created through the differentiation setting of floor area ratio. High density is the key to low carbon city, but it is not enough. In order to avoid the urban congestion, the residential function shall be close to the bus stops and employment centers. The density shall also be determined according to the capacity of different transport modes. In general, the high floor area ratio shall be equipped with the high-intensity public transport service.

The development intensity shall be adjusted and distributed proportionally according to the public transport service ability to realize the differentiation of floor area ratio distribution in the planning area. For example, the floor area ratio for the area 0-150m to/from the urban railway station shall be greater than 2.5, and over 70% of the land shall be used for transport facilities, office and commercial buildings; the floor area ratio for the area 150-300m to/from the urban railway station shall be between 1.5 and 2.5, and the land shall be used for the mix of office buildings and residential buildings; the floor area ratio for the area 300-500m to/from the urban railway station shall be 1.5, and the land shall be used for residential buildings and public service facilities; the industrial land shall be located more than 500m from/to the urban railway station. See Table 4.1.

Table 4-1 Recommended Indexes for Volume Rate Difference

Distance	Volume Rate
0-150m from the rail station	>2.5
150m-300m from the rail station	1.5-2.5
300m-500m from the rail station	<1.5
Over 500m from the rail station	Industrial land

Figure 4-4 High-Density Developments Concentrated around the BRT Corridor (Guangzhou)[18]

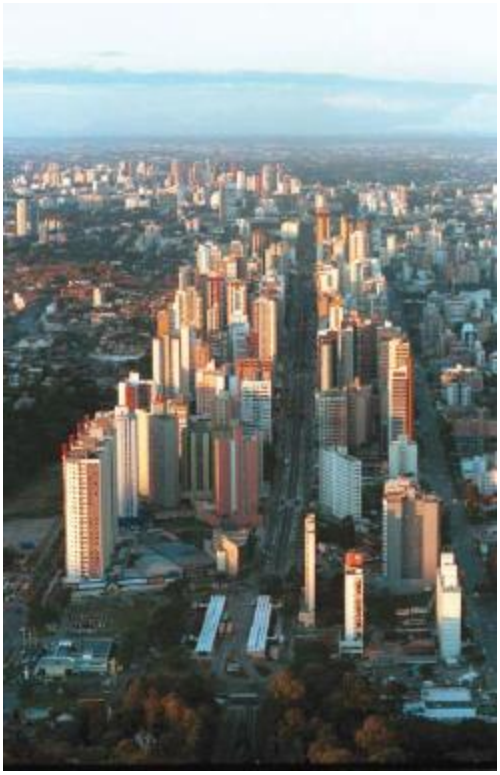


Figure 4-5 High-Rise Buildings Concentrated within 200m from/to the Public Transport

[18] Source: Beijing Municipal Institute of City Planning & Design. *Study on the Accounting System and Technical Guidelines for Low-carbon Planning of Beijing* [R].2014

System (Curitiba, Brazil)[19]

(3) Job-Housing Balance and Mixed Function

The land use in the planning area shall be diversified and mixed, avoiding the single land use pattern and guiding to "live, work and entertain nearby", thus reducing the external transport, and the energy consumption and carbon emission of family travel. The convenient retail and business services, and other mixed functions near the residential and office areas can bring vitality and community recognition to the area. The mix of residential and service functions shall be encouraged in block planning. The mix of different social and income levels, and ages shall be considered in the residential function. The commerce and service shall be arranged in the ground floor of the frontage buildings within walking distance to the residential and employment centers. The mix of residential, commercial and service functions can improve the vitality of the block. The mixed block with daily functional requirements shall be arranged near the employment center, and the mixed function of entertainment, services and commerce shall be arranged within walking distance of the employed population.

The recommended provisions are as follows:

- The residential positioning, layout and supporting facilities of the planning area shall match with the living demands of the local employment population.

- The Category F mixed-use shall be encouraged and the proportion of Category F mixed-use in the total development plots shall not be less than 50%.

- Commercial facilities and community level public service facilities shall be set along the street of the residential land.

(4) Differentiation Supply of Parking Lots

The parking partition principle shall be adopted and different parking indexes shall be allocated respectively according to the different levels of public transport service. The higher the public transport service, the fewer the parking index shall be to achieve the goal of controlling the parking supply, guiding the rational use of private cars and realizing the planning idea of low carbon travel.

The construction of underground parking lots shall be encouraged to control the area proportion of ground parking lots (for example: shall not be greater than 10%). Where the sky parking is built adjacent to the public space like public square and park, the commercial service facilities shall be provided on the ground floor adjacent to the public space.

4.2.2 Improving the Public Service Facilities

(1) Improving the Accessibility of Public Service Facilities

The shortest walking distance between the building entrance and the public service facilities in the planning area shall be realized. The community public service facilities include kindergarten, primary school, community health center, cultural activity center, small community commerce,

[19] Source: Beijing Municipal Institute of City Planning & Design. *Study on the Accounting System and Technical Guidelines for Low-carbon Planning of Beijing* [R].2014

post office, bank outlet, etc. At least 6 types of community public service facilities shall be built to meet the requirements of accessibility with a coverage rate of 100% within the service radius of 500m.

(2) Improving the Compatibility of Public Service Facilities

The plot compatibility rules shall be formulated for all kinds of public service facilities in the classes of allowing for use, not allowed for use, use only for the ground floor, conditional use, etc. to guide the detailed and reasonable layout of facilities, strengthen the accessibility and vitality of street space and improve the activeness, safety, convenience and vitality of the sidewalk.

The public service facilities and residential quarters shall have convenient walking and car transport connection as well as necessary barrier-free facilities. Although the education facilities like primary and secondary schools, kindergartens, and the medical facilities like general hospital, and some of the municipal facilities are necessary to the residential area, they are not required to be combined with the neighborhood center since these facilities do not have direct relationship with residents' daily public life. However, the convenient walking and car transport connection between these facilities and the neighborhood center shall be ensured.

4.2.3 Strengthening the Humanistic Design of Road Transport Planning

(1) Improving the Road Network Density

The road pattern of most cities in China is in the form of multi-ring roads with widened arterial roads and by-passes, which influences the safety and convenience of pedestrians and cyclists. The too broad street increases the crossing time of pedestrians and causes the excessive concentration of vehicles, also leads to the conflicted vehicle driving directions at the intersection. Because of the turning limitation of some street corners, the drivers have to detour and it is very inconvenient. Due to the lack of alternative routes, the processing capacity of traffic accidents is also greatly decreased. The increasing traffic jam seriously affects the efficiency of bus routes, which in turn reduces people's motivation of transferring to public transport by walking and cycling. Traffic jam, signal delay and traffic complexity are increased continuously, which directly reduce the use efficiency of the road. At the same time, the two-way traffic roads and the distant intersections also decrease the management efficiency of traffic lights.

The avocation of improving road network density and increasing the diversity of road cross section is consistent with the strategy of reducing the plot scale. If it is adopted, the large number of crossing traffic will be distributed on the parallel or smaller roads or one-way pair roads. All sidewalks and bikeways on the street will be protected and improved. The bus routes and the BRT system will have special lanes, and more transport options will be encouraged on the non-motor vehicle streets.

The share ratio of public transport in work commuting is more than 50% in New York's Manhattan, Bronx, Brooklyn, Queens and Staten Island and their road network density are respectively 15.1, 11.9, 11.9, 12.5, 7.4km/km^2, with an average of 11.4km/km^2. The road network density of Tokyo, Japan is 11.3km/km^2. The road layout of small plot and dense road network has been widely adopted, and ensuring the density of branch road network is critically important.

The road network density can be increased by improving the road network density index or

stipulating the distance between different grades of roads, for example: the road network density of the urban roads in the planning area shall be greater than 11.0 km/km^2; the distance of the crossing facilities for the residential roads shall not be more than 150m while the traffic roads not be more than 300m.

(2) Refining the Road Cross-Sectional Design

In addition to the road functions, traffic characteristics and control conditions, the favorable road ecological landscape and urban public space shall be also considered in the design of urban road cross-section to meet the diversified demands of people. The road cross-section generally consists of vehicular road, bus lane, bikeway, sidewalk, lane separator, facility belt, green belt, etc., which shall be able to meet the needs of users in various transport modes, and follow the priority principle of pedestrian → cyclist → bus passenger → car driver. Where there are street buildings and when conditions permit, the building setback line space outside the roadside strip shall also be incorporated into the road cross-section for integrated design.

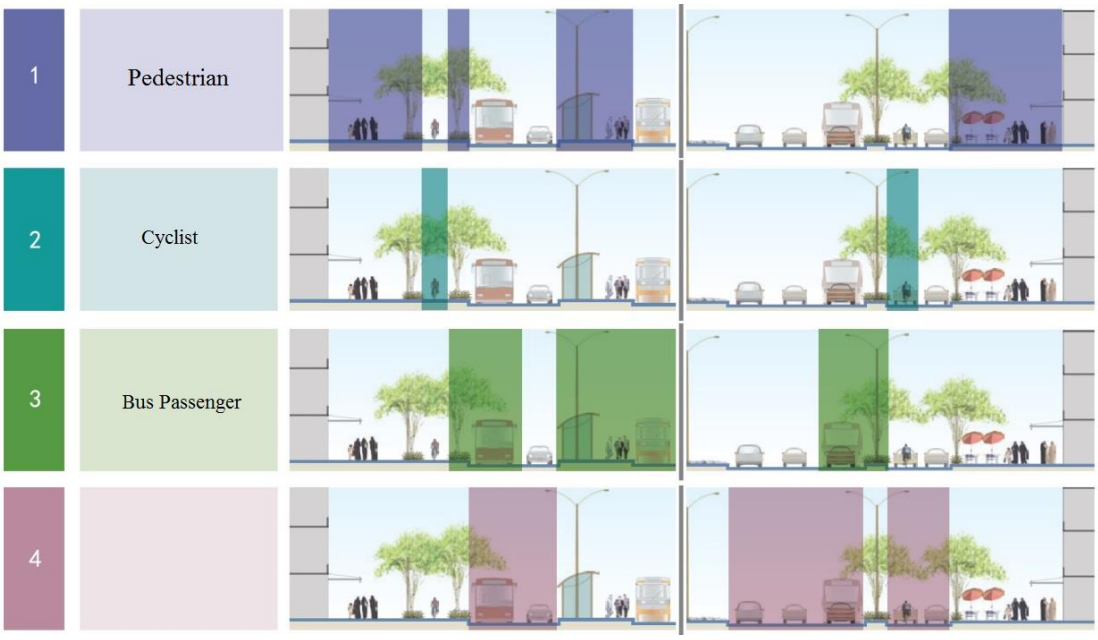


Figure 4-6 Priority of Road Cross-Section Meeting the Needs of Users in Various Transport Modes[20]

(3) Increasing the Bus Stop Coverage Rate

Comparing with bus route, bus stop is the more important measure to increase the bus travel proportion. The coverage rate of bus stops is important factor which determines the accessibility of public transport system; the high coverage rate increases the convenience of residents in taking public transport system, which is also the key to improve the public transport attraction.

The bus nodes shall be located within walking distance from/to residential, employment and service centers, and all residential and employment centers shall be within the 400m service radius of bus nodes and the 1km service radius of regional public transport nodes. The 500m radius of

[20] Source：Source: Beijing Municipal Institute of City Planning & Design. *Study on the Accounting System and Technical Guidelines for Low-carbon Planning of Beijing* [R].2014

bus stops shall cover 100% area of the planning area.

4.2.4 Improving the Setting of Rail Transport Entrance

The setting of rail transport entrance mainly includes the following aspects:

(1) The Volume and Quantity of Entrance.

Most rail transport in the big cities of China has 4 entrances at the four corners of the intersection, and some intersections limited by the space have less than 4 entrances while some have more than 4. Due to the limited quantity and the relatively big passenger flow volume of rail transport in big cities, every entrance has a large volume and as well as a large evacuation square.

Figure 4-7 The Subway Entrance of A Domestic City

Whereas the foreign cities, such as New York and Tokyo, one subway station often has more entrances, which disperses the passenger flow in and out of the station; every entrance has a small volume and no evacuation square is required, thus saving a lot of space.

(2) Connection between Entrances and Buildings

The plot development along the existing metro lines in the big cities in china has already matured, which limits the connection between commercial buildings and subway entrance; the planning of the lines to be built focuses on the traffic relief and ground development, with insufficient attention paid to the connection between subway entrances and buildings.

The connection between entrances and buildings mainly includes ground connection and underground connection.

For the ground connection, the subway entrances are directly linked to the second floor of the commercial buildings with the skywalk or the subway entrances are directly built within the commercial buildings. For the underground connection, the subway entrances are directly linked to the underground space of the commercial buildings or the subway entrances are directly built within the commercial buildings. Both modes require the coordination between the subway construction and development party and the commercial building development and construction party. MTR Corporation has better planned and constructed the combination of subway and commercial buildings. The coordination between the two parties in China is more difficult.

4.2.5 Reasonable Layout of Public Parking Lots

With the acceleration of motorization process, the parking difficulty comes with the traffic jam. In

May 2010, the Ministry of Housing and Urban-Rural Development, the Ministry of Public Security and the National Development and Reform Commission jointly issued the Instructions on the Planning, Construction and Management of Urban Parking Facilities, which identified the important position of urban parking facilities construction in the urban comprehensive transport system, and required that all cities should strive to solve the problems of insufficient parking facilities, misappropriation of parking facilities and lag of parking management by adhering to the principles of resources saving and using, safe and smooth road transport, differentiation supply of facilities, parking demand management and high-tech leading.

At present, the functional orientation of the public parking lots in many big cities is mainly to make up for the lack of provided parking space of public buildings, mainly including: hospitals, schools, office buildings, theme parks, scenic parks, residential areas, administrative office buildings, sports venues, catering entertainment, commercial buildings, hubs, P&R parking lots and comprehensive service facilities, etc.

(1) The Crux of Parking Problem

The parking problem is mainly caused by:

- The excessively rapid growth of motor vehicles, leading to the short supply of parking facilities.

The growth rate of motor vehicles exceeds the planning expectation while the supply of supporting public parking facilities is far lower than the planning expectation, which leads to the huge contradiction between parking supply and demand.

From the comparison of motor vehicles ownership growth process between Beijing and Tokyo, it is not difficult to find that: Tokyo, also an international metropolis with a big population and little land, has a more rational and scientific growth process of motor vehicles ownership and the gradual decrease of its motor vehicles ownership growth provides a longer planning and construction period for the related infrastructure construction, so the contradiction between supply and demand resulted by the rapid growth is avoided. This shows that the irrational growth of motor vehicles ownership in Beijing is one of the key factors to the parking problem.

Table 4-2 Comparison of Motor Vehicles Ownership Growth Time between Beijing and Tokyo[21]

Duration (Year)	1 to 2 Million	2 to 3 Million	3 to 4 Million
Beijing	6.5	3.9	2.7
Tokyo	5	10	12

- The uneven distribution of social resources, leading to the short supply of parking resources in special nodes.

The uneven distribution of high quality medical and educational resources also creates the short of parking resources in special nodes. Beijing Children's Hospital, for example, attracts the sick children in Beijing, even the whole country because of its advantages in children's medical

[21] Source：Sorted by the research group in accordance with *Beijing Statistical Yearbook* and *Tokyo Statistical Yearbook*

resources, leading to the excessive demand of parking, and almost no land resource is avilable for the constuction of additional parking facilities due to the limited surrounding land.

- The imperfect planning, leading to the insufficient parking supply level.

The extensification and uniformization of the parking index system seriously affects the rationality and accuracy of space layout of the public parking lots. Based on the functional orientation of public parking lots (making up for the lack of provided parking space), the planning of public parking lots shall be made according to the gap of provided parking index of different building types in different areas. However, the extensification and uniformization of the parking index system also leads to the extensification and uniformization of the public parking supply whose prediction is based on the former, and the uniformity of public parking lots in space. Under the premise of the differentiation layout of urban space, the uniform planning of public parking lots certainly will lead to the strong differences of different areas in supply and demand, thus resulting the above phenomenon of parking resource shortage and waste.

(2) The Countermeasures of Public Parking Lots Planning

- Amending various parking indexes as soon as possible

The parking indexes shall be amended from meeting the parking demand and realizing the effect of "static against dynamic". On the one hand, the amendment is aimed at improving the residential parking index to avoid the new debt and reduce the burden of public parking lots; on the other hand, it is aimed at adjusting the existing parking index of public buildings by combining with the differentiation of current public parking use and the bearing capacity of other social resources in the area to lay the foundation for the accurate prediction of public parking demand and the reasonable space layout.

To achieve the above goals, the amendment principles of parking index shall be as follows:

■ The building classification shall be improved according to the national standard requirements;

■ The parking index shall be formulated differentially;

■ The residential parking index shall be further increased;

■ The public parking index shall be treated differentially according to the public transport service level.

- Optimizing the space layout of public parking lots

Through the analysis of current parking problems and the exploration of cruxes, the functional orientation and development strategy of public parking lots shall be put forward by combining with the amendment of parking index and the functional layout of urban land according to the principle of differential supply on the basis of present situation and using relevant domestic and foreign experiences for reference.

- Ensuring the synchronous construction of P&R parking lots with the public transport facilities

In consideration of the transport infrastructure orientation of P&R parking lots, the land shall be

obtained through free allocation and the construction fund shall be undertaken by the government. In the initial construction period of P&R, the passenger source is unstable and the price is relatively cheap, so its income is difficult to maintain the normal operation and it is suggested that the P&R shall be managed by the government at the initial construction period. With the stable passenger source of P&R, the government departments can introduce a series of encouraging and supporting measures to guide the enterprises to participate in the management. To achieve the transformation of private cars to public transport, it is recommended that the P&R parking lots shall be built synchronously with the rail transport or bus depots.

- Promoting the orderly and rational construction of public parking lots

The public parking lot has the functions of meeting the parking demand and realizing the effect of "static against dynamic", so it is orderly and rational and can create the best social benefit only when the two functions achieve the best combination. First of all, the urgency degree of the construction of public parking lots shall be classified; the public parking lots aimming at solving livelihood issues (for example: make up for the lack of basic parking space and the lack of hospital parking index) shall be built appropriately in the principles of sloving by the administrative district, sharing of basic parking and travel parking. The reasonable planning shall be made for other types of public parking lots and implemented cautiously.

- Reinforcing the construction of public parking lots in the surrounding of old residential area to lay the foundation for realizing "one car, one parking space"

Based on the principle of sloving by the administrative district and on the premise of seeking public willingness, the subdistrict offices of the old residential areas shall take the lead and cooperate with all relevant departments including the planning department to look for resources and implement the construction land of parking facilities in various ways, for example: combining with green lspace, municipal facilities, school playground and other types of land use. A combination of "government investment and users bearing" is suggested for the construction fund source, but the priority shall be given to government investment. The government investment is suggested in the construction of centralized parking building with planning land for parking lot and in the construction of underground parking lot with land for public welfare. For the complementary construction with the underground space of non-public welfare land, it is suggested that the simultaneous construction of some public parking lots with the development of ground buildings shall be determined in the planning stage.

- Accelerating the construction of public parking lots in specific areas like hospitals

Considering the specificity of hospitals, the parking demand shall be unconditionally met according to the principles of "people first" and "respect for life", and it shall be identified from two aspects, namely land supply pattern and construction fund source.

- Prudently treating the construction of other public parking lots

In addition, the construction of other public parking lots shall be treated prudently. As mentioned above, the public parking lots shall not only meet the parking demand, but also realize the effect of "static against dynamic". In other words, the supply level of public parking lots directly affects the size of dynamic traffic flow. If the construction of public parking lots is progressed blindly, the

traffic jam may be exacerbated.

4.3 Coordination Policy at Micro Level

The micro level mainly puts forward the policy on the coordination between transport planning and urban planning from constructional detailed planning and street design, mainly including the urban design guidelines on buildings along the roads, the integrated development of bus depots, the fine design of intersections and plot entrances, the improvement of sidewalk and bikeway shade rate.

4.3.1 Optimizing the Urban Design Guidelines on Buildings along the Roads

(1) Design Guidelines on Building Height

The building height influences the scale of the space environment, and the detailing of building height can effectively promote the formation of regional spatial characteristic and place spirit, increase the regional identification and strengthen the place cognition to form a positive street interface.

The detailing control of building height shall be determined according to the designed street width ratio, for example, controlling the height of the new and redeveloped buildings along the urban roads with the height-width ratio (building height/street width) of 1.5.

(2) Guidelines on the Frontage Commercial Development of Buildings

The design of frontage buildings along the roads can improve the pedestrians' walking environment and create the urban public space. Therefore, it is suggested that under the conditions allowed by the land use, the frontage ground floor of the buildings shall be used for commercial development and installed with wide glass windows, etc. for the interaction with pedestrians passing by.

(3) Connection between Buildings and Roads

The connection between building plot and urban road is mainly accomplished with the building entrance and the general backline area.

The setting of entrance affects the connection mode of plot, building and urban road network, and the convenience and security of using functional land.

The setting of entrance shall be comprehensively considered in a combination with the road network structure and land usage of surrounding areas and its location shall be determined by giving full consideration to the factors like bus depots and centralized parking buildings near the entrance and avoid the conflict with the crowded areas like bus depots.

The location of the pedestrian entrance shall correspond to the crossing facilities to guide the pedestrian streamline toward the bus stops or transfer hubs.

The individual buildings shall be encouraged to provide the high quality public space which is convenient for pedestrians crossing the street, strengthens the connection between two blocks or leads to important public facilities, such as parks, public buildings and stations.

To guarantee the normal operation of urban transport, the personal safety of pedestrians and the

use demand of specified area functions, the sections forbidden to vehicle entrances shall be designated.

The frontage buildings along the pedestrian street shall not build the vehicle entrances directly, and the traffic shall be jointly organized with the adjacent buildings through block internal secondary roads, squares, auxiliary roads and greenbelts.

4.3.2 Promoting the Fine Design of Intersections and Plot Entrances

Intersections and plot entrances are often the weakness points of walking and cycling conditions, and the key point is to strengthen the safety and convenience of crossing facilities.

(1) Priority shall be given to the safety and convenience of pedestrians and cyclists, and the level crossing shall be the first choice. The pedestrian and cyclist crossing shall be level and continuous without any obstacle, and the gentle slope shall be adopted in the elevation difference; the crossing facility shall be the shortest route expected by pedestrians and cyclists.

Figure 4-8 Gentle Slope Treatment for Elevation Difference in Pedestrian Crossing Facilities[22]

(2) The new or rebuilt residential roads shall not occupy the widened or channelized pedestrians and cyclists' space at the intersections and entrances; where the channelized lane is necessary to the traffic road, the narrowed lane shall be adopted and the width for the entrance driveway shall be between 2.8m and 3.0m, and shall not be more than 3.25m.

(3) The turning speed at the intersections shall be 15km/h; the turning radius for the corner kerb of intersections without bikeway shall be 10m, and 5m for the one with bikeway; the motor vehicle speed limit signs and other traffic speed bumps.

[22] Source：The Ministry of Housing and Urban-Rural Development of PRC. *Guidelines for Urban Walking and Cycling Transport System Planning and Design* [M]. 2013

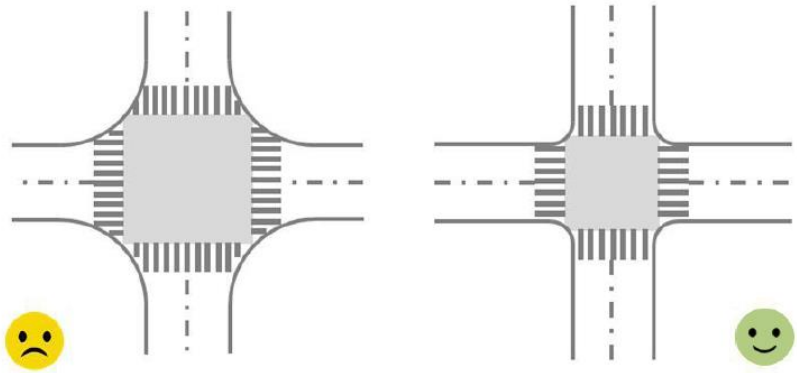


Figure 4-9 Intersection Corner Design Principles[23]

(4) When the pedestrian crossing length is more than 16m (excluding non-motor vehicle lane), the pedestrian crossing safety island shall be built near the lane separator or road axis, and the width of the island shall not be less than 2.0m, or at least 1.5m under difficult circumstances.

4.3.3 Improving the Shade Rate of Sidewalk and Bikeway

Shade tree building shall be strengthened along the urban roads, thus creating a favorable micro-climate and landscape for walking and cycling and enhancing comfort. It is encouraged to construct pedestrian and bicycle roads or the pedestrian streets with car access forbidden, in combination with urban water, mountains, greens, large commercial shopping areas and recreational and sports areas. In the waterfront space and parkland of the city, pedestrian and bicycle roads should be set to facilitate the residents' recreation, fitness and travel.

Figure 4-10 Shade of Sidewalk and Bikeway

Urban greenways should be planned in connection with urban waters and mountains, extended as much as possible to the urban center and interconnected with city parks, greens and public spaces, thus enriching and complementing the bicycle transport system and providing a good space environment for cycling and recreation.

[23] Source：The Ministry of Housing and Urban-Rural Development of PRC. *Guidelines for Urban Walking and Cycling Transport System Planning and Design* [M]. 2013

4.3.4 Strengthening the Integrated Development of Bus Depots

(1) Existing Problems of Bus Depot Planning and Construction

Bus depots mainly include hub station, initial and terminal stations, parking lot, maintenance workshop, etc. Different from the rapid development of bus vehicles and operation lines, the development of bus depots is obviously lagging, and the hub station has the most prominent problem.

- Difficult Land Use Control.

As the important urban infrastructure land, the bus depot land is controlled in different levels of planning. The initial and terminal stations, parking lot and maintenance workshop are generally located in the urban suburbs in the planning, so the land use is easy to control. However, in order to get the high traffic for the operation, the hub stations are usually located in the populated areas of the city. Considering from the perspective of urban economic development, the populated areas of the city with highly mixed use of land also have high investment and high land price, so the opportunity cost for the construction of public transport facilities is very high. In the comparison of developing public transport and economy, the governments often tend to the short-term urban economic benefits and give up the long-term social benefits of public transport. To coordinate with the land requirements of various economic development projects, the land for hub stations has to be changed or canceled, and the land use control is becoming increasingly difficult.

- Low Land Use Efficiency.

As the hub gathering many transport means and multiple bus routes, the hub station has favorable transport accessibility. Whereas the transfer area and parking area of traditional hub station are mostly large-scale outdoor yards, and the overall land utilization rate of the hub station is very low, which obviously does not match with its favorable transport accessibility, and is obviously lower than the surrounding lands. To some extent, the layout of traditional hub station is a waste of precious land resources in the populated areas of the city.

- Serious Construction Lag.

The construction of traditional hub stations is a public welfare work, and the investment is totally from the government, almost no social fund, and it is difficult to create benefits from the daily operation. The construction of traditional hub station is a long-term and systematic project, which is difficult to obtain immediate results for the improvement of traffic conditions. The attention paid by the government on hub stations is often inadequate, so its construction seriously lags behind the development demand of public transport. The construction of hub stations in the populated areas of the city is more difficult than other types of depots, thus the construction lag phenomenon is more serious.

- Poor Operation Performance.

At present, all kinds of bus depots and facilities are in severe shortage, so the existing hub stations often have to bear many functions irrelevant to transfer, such as parking, scheduling, maintenance, even refueling, thus various functions interfere with each other, which reduces the transfer efficiency and worsens the transfer environment. On the other hand, the passenger flow volume

attracted by the hub station and its favorable accessibility are very attractive to the enterprise involving in long-distance passenger transport, catering, accommodation, retailing, etc. Various functions irrelevant to public transport also gradually gather to the junction area; when there is no unified planning and effective management, this spontaneous mixed use development model will worsen the transport performance and urban landscape environment of the hub station area.

(2) Strategy of Integrated Planning of Bus Depots

Using the bus complex cases of cities at home and abroad for reference to change the traditional layout pattern of hub station and introduce the comprehensive development pattern combined with the hub station is one of the effective ways to solve a series of problems of hub stations at present.

The comprehensive development pattern of hub station refers to the joint design and construction of the public transport system and the development of one or more commercial activities including commerce, business office, hotel and residence for the hub station land, which not only make full use of the hub station's favorable accessibility, but also achieve the land value of the hub station. The social and economic benefits brought by the comprehensive development make it possible to build the hub station with social funds, which will effectively change the difficulty of bus depot construction, promote the development of public transport and reduce the economic burden of the government.

In particular practice, the combination with one or more commercial activities shall be determined according to the hub station's current situation, development requirements and surrounding conditions. Comparing with the construction pattern with single traffic function, the comprehensive development pattern of hub station can fully release the land value of depot land and realize the higher value return; its construction funds do not have to rely solely on the government, which can change the current serious construction lag of hub station with single traffic function. The development enterprises, however, often only pursue the maximum economic profits of the comprehensive development and ignore the transport function of the hub stations. Therefore, effective planning and control shall be made for the comprehensively developed hub station to achieve the win-win between traffic benefit and development benefit. In the planning and control of comprehensively developed hub stations, the appropriate traffic function, reasonable development scale and the best layout pattern shall be ensured to avoid the situation of strong commerce and weak transport.

5. Policies, Measures and Suggestions on Promoting Coordinated Transport and Urban Planning

In order to implement the means of coordinating transport planning and urban planning, the policy measures for ensuring the coordination between transport planning and urban planning are proposed mainly from four aspects, namely plan preparation, planning process control, planning management and guarantee policies.

5.1 Strengthening the Integrated Planning of Transport and Rural-Urban Development

5.1.1 Achieving Synchronized Compilation of Transport plans and Master Rural-Urban Plans

(1) Necessity of synchronized planning

Urban transport system and urban land use are mutually supported and restricted, with mutual feedbacks.

Firstly, urban land uses are the root of demand for urban transport, deciding the traffic sources, magnitude of traffic and modes of transport; different land use conditions require different modes of transport adapted to their needs. For example, high-intensity land uses require a high capacity public, while low intensity land uses lead to more freedom in choosing modes of transport. Secondly, urban transport systems support and affect urban land uses and related activities, and their actual performance is a factor in determining the spatial structure and development model of the city, thus affecting land use conditions. Especially, transport accessibility plays a decisive role in distribution of urban public activity spaces.

Synchronized planning helps ensure an effective balance between land use activities and transport capacity, and coordinated implementation of transport systems and distribution of urban functions and land uses.

(2) Approach to synchronized planning

In the process of integrated planning, professional coordination and dynamic feedback should be strengthened. On the one hand, planning with collaboration between the two specialties has no clearly-defined and independent activities for each specialty. At each stage of the planning process, land use planning and transport planning may have their own considerations; they should be closely combined through collaboration between the specialties. Their work serves as the basis of further activities of each other, so collaboration will reduce conflicts and improve work efficiency. On the other hand, the work program, integrated involves dynamic feedback before any plan is finally released. A plan should be drafted, tested, revised and re-tested with communication with transport planners and land user planners, and alternatives should be compared to produce the optimal land use and transport plan.

(3) Mechanisms of synchronized planning

- The System for compilation of transport plans and master plans

It is recommended that comprehensive transport system plans should be compiled in a synchronized manner with compilation of master plans. Urban rail transport network plans shall also be compiled if possible. The comprehensive urban transport system plans and urban rail

transport network plans shall be included in master rural-urban plans.

- Establishing a collective planning team and the coordination mechanism

A dedicated collective planning team is established to organize and coordinate all resources in a timely manner to create an atmosphere for close cooperation and participation.

A mechanism should be in place to coordinate relevant authorities for synchronizing land developments and transport works. In a region in a given period of time, the scale and intensity of land development should match the development of public transport. The land, funding and schedules for urban development and those for public transport should be compatible with each other and ascertained, and reflected in development plans for different stages.

- Equipping with multi-discipline professionals

Urban planning and transport planning overlap each other. Urban planners need to expand their scope of knowledge to understand the basic ideas in transport planning, while transport planners need to understand the functions and patterns in urban planning, and take the leading role of transport planning in urban planning when necessary.

-Enhancing the interaction between urban planning and transport planning

The specific indicators of land uses in urban plans should reflect the demand in transport plans. For example, urban land use plan should, in the first place, ensure that transport facilities have sufficient quantity and land. In areas where there is much travel demand (near transfer stations, for example), the layout of urban land should take into the needs of various transport and related facilities and the match between land development modes and transport facilities. Detailed plans for these areas should be prepared by land-use planners and transport planners together.

5.1.2 Tightening the Interlinked Revision to Transport Plans and Regulatory Detailed Plans

Coordination mechanics of regulatory detailed planning and transport planning effectively ensure synchronized land development and transport system development. Adjustments to sections of urban land use plans (such as changes to the nature or scale local land development) will affect the distribution of local transport demand, thereby affecting the normal and orderly operation of the whole urban transport system; similarly, adjustments to sections of urban transport plans (such as changes to alignment or location of stations) will affect the development of urban land and the efficiency of city operation. Therefore, it necessary to introduce and strengthen a the linkage mechanism for adjustment between urban regulatory detailed planning and transport planning, when partial changes have to be made to urban land use plans and transport plans due to various reasons.

- The impact on the transport system should be taken into consideration in adjustment of urban land use plans. For example, will the transport facilities be able to support the intensity of land development? Quantitative analysis and evaluation of traffic should be conducted before certain changes are made to land-use plans, to ensure the transport capacity; otherwise, the related transport system plans should be revised simultaneously to increase the capacity of the transport system.

- The impact on urban land development and utilization should be taken into consideration in adjustment to urban transport plans. For example, will the transport system still match the related land development and utilization. Land demand analysis should be conducted before any changes

(such as changes to the nature of roads or location of rail transport stations) are made to transport plans, to ensure that the transport system still matches the related land development and utilization; otherwise, the related land use plans should be revised simultaneously as necessary.

Without such coordination of adjustments, some areas or developments ignore the transport capacity within the areas or cities, by significantly increasing the intensity of land development and construction; to meet the demand for development in the short run, some areas downsize or delay the supply of transport facilities, or otherwise arbitrarily adjust land-use plans and transport plans, causing development of transport systems uncoordinated with land development.

In addition, within the framework of integrated urban transport planning, a link of preparing the overall transport design is added and a rolling adjustment mechanism is built. In the current traffic planning system, only the city's comprehensive transport planning corresponds with the urban master planning stage; in the regulatory detailed planning stage, there is not corresponding transport planning and design, which results in that the implementation difficulty of urban comprehensive transport planning after its preparation. Therefore, it is recommended that cities carry out regional transport design while carrying out regional controlled detailed planning, conduct rolling preparation with 2-3 years as a cycle, make detailed analysis and evaluation on the present construction of transport facilities in the region and proceed with detailed planning and design to the roads, rails, buses, parking and grade-separated pedestrian crossings, so as to improve the road network and traffic operation.

5.2 Strengthening the TIE Analysis in All Stages of Urban Planning

5.2.1 Proactive Traffic Impact Evaluation

Traffic impact evaluation (TIE) is a technical method used to reviews the impact of new traffic from developments on the surrounding transport system operation and develop appropriate measures counter the impact. It is intended to evaluate and analyze the scope and extent is to evaluate and analyze the scope and extent of the impact of new traffic from developments on the surrounding transport system, and propose schemes to relieve the traffic pressure, improve the transport conditions, and compensate affected areas while the level of service is maintained.

Traffic impact evaluation has attracted more and more attention from domestic traffic experts, along with the development in the discipline of traffic engineering and research of traffic problems. As early as in 1996, some domestic experts of urban transport planning advocated analysis of impact of land development on transport and inclusion of the impact evaluation in administration of land use and development at the annual urban planning conference. At the annual meeting of the Transport Planning Committee of the Urban Planning Society of China in 2001, domestic experts of urban transport specifically discussed traffic impact evaluation and call on implementation in cities and inclusion of it in urban plan review and approval.

As the relationship between urban land uses and transport becomes increasingly tense, the importance of traffic impact evaluation has been recognized in sustainable development of cities. Many large domestic cities have regulations guiding activities of traffic impact evaluation. For example, the Beijing Municipal Planning Commission, in October 2001, issued *the Circular on Implementation of Traffic Impact Evaluation with Certain New Development Projects*, which specifies the scope of application, key points in implementation of TIE, criteria and requirements of TIE. Nanjing released *the Rules on Preparation of Traffic Impact Analysis for Large*

Development Projects in Nanjing, and Guangzhou designates certain projects subject to TIE in its *Rules for Implementation of Urban Planning Administration*. Shanghai, Hebei, Jiangxi and other regions and cities have developed rules for implementation of TIE and relevant requirements.

In addition to these cities and regions, the Ministry of Public Security, and the Ministry of Construction also have acknowledged the importance of traffic impact analysis in solution of urban traffic problems. In implementation of the Smooth Traffic Program by cities across the country, the Ministry of Construction and the Ministry of Public Security required that TIE should be made a prerequisite for approval of development projects, and that the cities develop rules on preparation of traffic impact analysis improve its justification and make it standardized. In 2001, the National Urban Road Traffic Management Project Program includes TIE as a key criterion of evaluation.

As the history of local TIE practices, the earliest study on TIE was the one analyzing the traffic impact in Jing'an District, Shanghai in 1991. By following the TIE approach in the US, the study analyzed impact of the future development on traffic in Jing'an District as a sub-center on an assumptive basis. Since then, Chinese cities have been actively conduct TIE for some urban land developments based on their own needs of local development, while exploring theories about TIE. For example, the TIE for the Wangfujing business district and that for the Financial Street in Bejing safeguarded orderly development and guided healthy and sustainable development of the city.

5.2.2 Relationship between TIE and Urban Planning Permits

According to the Law on Urban and Rural Planning, the current procedures for urban planning administration encompass the Permission Notes for Site Selection (PNSS), the Construction Site Planning Permit (CSPP) and the Construction Project Planning Permit (CPPP). To include TIE in urban planning administration, its relationship with the permit documents has to be dealt with.

Technically, the design should have been completed for a construction project after issuance of the CSPP and before CPPP, serving a solid foundation for TIE with sufficient depth. However, as part of an administrative license, once the planning authority has provided for the key points in design, they are of legal force. At this stage, even if the TIE finds that the project would cause significant impact on the area, elements, it may only propose certain improvements, and recommendations on adjustment to the planning indictors can be hardly proposed and implemented. On the other hand, if it is free to change the key notes in design, even for improving the project and regional plan, it may reduce the credibility of the planning authority.

Thus, it is advisable to carry out TIE by stage based on the scale of construction projects. Section 3.0.5 of the Technical Standard for Construction Project Traffic Impact Evaluation requires that "traffic impact evaluation of construction projects should be conducted upon application for construction and/or site selection (including land transfer).For the first time, the ministerial standard specified the stages when TIE should be conducted. The relationship is illustrated in the figure below:

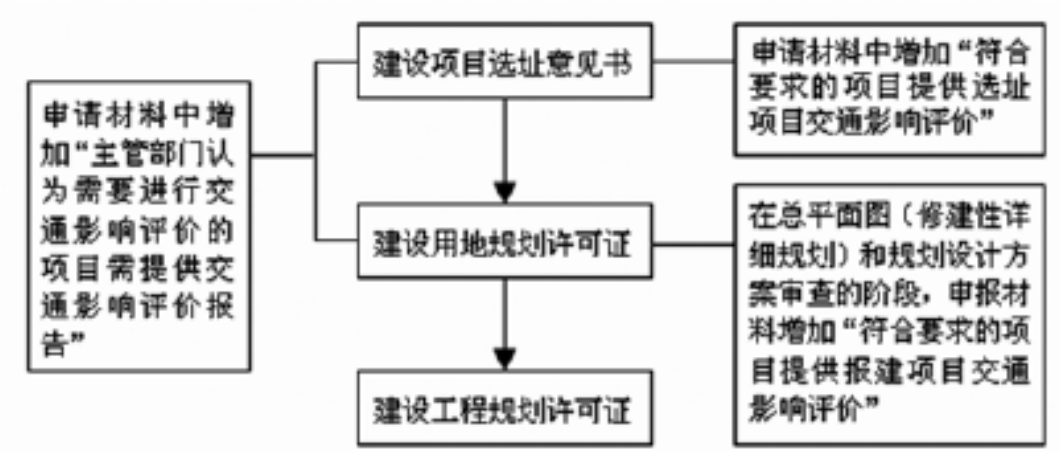


Figure 5-1 Relationship between TIE and urban planning permits[24]

At the sage of site selection, planning work has not begun, so TIE cannot achieve the desired depth and cannot evaluate internal transport facilities of the project. As a result, TIE should also be conducted upon application for construction, if the project meets the threshold for TIE at the site selection stage. Nonetheless, the two TIE focus on different aspects. The one upon site selection examines the impact of the overall project on external traffic, while the one upon construction selection mainly checks the internal traffic organization. If competent authorities find TIE is required for special projects involving adjustment of regulatory detailed plans, the project owners should engage transport consultants to do the TIE.

5.2.3 TIE in City Master Plans and Regulatory Detailed Plans

(1) Difficulties facing Traditional TIE

Currently, TIE for construction projects is conducted upon application for construction and/or site selection (including land transfer).TIE examines the nature, scale, location and impact on surrounding transport system of projects, and contributes to rational and coordinated land use and demand for transport. However, there are still many deficiencies, such as small extent of regulation, limited operability and varied constraints, significantly prejudicing the role of traditional TIE in traffic improvement and project implementation.

The following problems have been observed:

- Limited role of traditional TIE in improvement of the transport systems within the affected areas of projects

The main purpose of TIE for a construction project is to ensure smooth traffic within the direct affected area and within the related affected area. To achieve this, the items being evaluated, such as the scale, nature, functions, selected locations of the project, the percentage of modes of travel, entries for cargo and people, should be adjustable based on the extent of the project's impact on traffic. At the same time, the road network, transport facilities, traffic management measures and other established or proposed projects around the evaluated area should also be subject to adjustment based on TIE.

[24] Source：Liu Xingquan et al. The Study on TIE Operating Mechanism in City Planning. *Modern Urban Research*. 2011.2

The fact is that there is no room of adjustment to both categories of elements for traditional TIE. It is difficult to make improvement and adjustment to a construction project despite existence of significant impact on traffic. Projects requiring TIE are often ones attracting heavy people and vehicle flows.

- Limited role of TIE in traffic improvement and project implementation

The current TIE practices are causing confusion. Evaluators have limited options available for reducing the traffic, travel distance and impact on the level of service of surrounding transport facilities, because the nature, functions, scale, traffic characteristics, locations, construction period or time for completion have already determined, the road and traffic facilities are already in place, and the neighboring area has already been developed. Projects requiring TIE are often ones both generating and attracting heavy traffic, having significant impact on the urban social and economic development, and posing high requirements for neighboring road and traffic conditions, which makes TIE a tough task for such projects. For construction projects with such land and traffic conditions, though their impact on the neighboring traffic facilities is significant, the project owners could hardly accept changes to the function or scale of the project or relocation of the project as recommended by TIE. In most cases, there is no space for the owner to relocate the project, and the road and traffic facilities have been in place, so significant renovation is difficult. In such cases, recommendations from TIE for road network and traffic facility improvement can hardly or cannot be implemented at all due to involvement of wide road networks and traffic facilities.

Because of the above reasons, the TIE for many construction projects cannot be concluded in time as the project owners are reluctant to accept opinions of the evaluators, which delay commencement of construction on time. Even if projects are commenced despite of neglected evaluation, they often bring about considerable difficulties to the neighboring traffic and residents. TIE fall in the predicament that it cannot ensure smooth traffic either for the city or the construction project. The role of TIE becomes dwarfed, and many project owners resist TIE activities.

(2) TIE conducted advanced to detailed planning stage

TIE for many projects puts urban transport consultants in an "awkward" position. This "awkwardness" mainly derives from the project site and traffic environment, where there are too many constraints, so that the projects, particularly large-scale and important ones, give rise to significant impact on the traffic.

Even though the impact on traffic is minor at the early days of operation for some projects, the impact may become evident when the occupancy goes up and the background traffic increases gradually, considering that fact that the fast growing economy, living standard, and car population and use. It is difficult for urban transport consultants to propose measures addressing such significant impact on traffic.

The "awkwardness" could be saved much if TIE could be conducted at the stage of regulatory detailed plans. Instead of TIE for individual construction projects, TIE is conducted for a district at the regulatory detailed plan phase and relates the district to the zones in integrated transport system plan. There are three favorable conditions for TIE at this stage.

- In an area circled and not crossed by arteries, the projects are related to become project group. The internal traffic facilities of member projects complement each other and can be coordinated

for utilizing external traffic facilities to reduce entanglement.

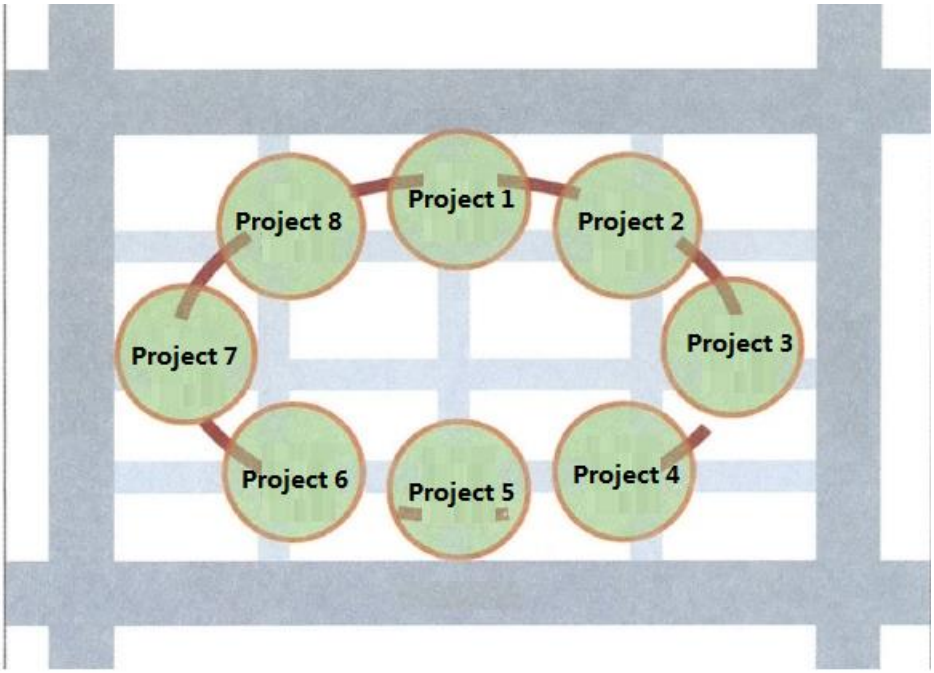


Figure 5-2 Creation of A Favorable Traffic Impact Area [25]

■ TIE helps reach balance between jobs, population and services with the area of construction projects, by keeping most of their travels to work, school, shop and other destinations within the evaluated district around the day. All these can be accessed by walking, cycling or minibuses, contributing to an easy and livable place.

■ Primary roads, branch roads, alleys are harmonized in design after TIE for the evaluated area, to link up traffic from the inside, be harmonized with external truck roads, and be connected to those in other districts, to form a urban daily life road system. In addition, multiple right turns on the internal roads may substitute for a right turn, thus reducing the impact on the truck ways.

(3) TIE throughout urban planning

■ TIE should be considered to districts when a master plan is prepared

When a master plan is prepared, coordinate the district division of the city and the traffic zone in transport planning, providing the basis for district division in the next phase, i.e. regulatory detailed plans. By taking into account traffic zones, TIE should optimize and coordinate the traffic sources, and traffic distribution and allocation, and provide the basis for development of transport facilities and ensure smooth project implementation and smooth traffic. TIE analyzes, anticipates and evaluates the impact on traffic after construction project planning and implementation, and proposes strategies and measures for prevention or mitigation of adverse effects. It is also necessary to set up ongoing tracking and monitoring and TIE mechanisms.

■ Rational allocation of road transport resources in preparation of regulatory detailed plans

Cities usually expand from the center outwards, so radial trunk roads have been developed. In the phase of regulatory detailed plan, attention should be paid to connection with these radial trunk roads. In the districts defined in regulatory detailed plans, branch roads may be identified as

[25] Source：Zheng Baoli et al. Study on the Forward Period Intervention of TIE. Vol29. No.7,2013.p21-25.

primary branch roads and secondary branch roads. Generally, primary branch roads are located near trunk roads with heavy traffic, and run roughly in parallel with trunk roads with heavy traffic, forming a network with connected secondary branch roads in the district as a light traffic system, diverting traffic from trunk roads with heavy traffic, and facilitating left turns at level crossings with trunk roads. In districts defined in regulatory detailed plans, specially attention should be paid to ensuring jobs available, target population, public service facilities, health care facilities, schools are coordinated and meet the demand of residents. Cross-district employment and residency should be minimized, and the district should reserve spaces for bus termini, bicycle parking and rental facilities, and other green transport.

5.3 Tightening the Coordinated Management of Traffic Planning and Urban & Rural Planning

5.3.1 Actively Promoting the Integration of "Multiple-Plan Integration" in Transport Planning

In April 2014, National Development and Reform Commission (NDRC) proposed at a press conference for the preparation of the 13th Five-Year Plan that the planning would actively promoted the reform of the planning systems at the city and county levels and explore the ways and methods that can achieve "Multiple-Plan Integration", thus achieving one plan and one blueprint for a city (county) and basing this to complete a blueprint. At the end of 2014, NDRC, the Ministry of Land and Resources (MLR), the Ministry of Environmental Protection and the Ministry of Housing and Urban-Rural Development jointly released *the Circular on the Pilots of "Multiple-Plan Integration" at City and County Level*, proposing such pilots in 28 cities and counties around China, but the Circular does not involve the transport sector and related transport planning.

Under the state's new urbanization strategy, transport planning maintains closer and closer liaison with transport planning, national economic and social development planning, land use overall planning and urban planning. The traditional separate transport planning, industrial planning and urban space planning are difficult to sustain. Such ideas as transport and land integration and TOD have gradually become a consensus, and the space planning that builds the coordination between such elements as traffic, industry and space will be the development trend of the future planning.

As for "Multiple-Plan Integration" at the national level, so far, national main functional area planning, urban and rural planning and land use overall planning have taken shape. The three comprehensive plans basically cover the most basic contents of land space, policies and management of development policies, urban layout and resource and environmental protection. It is recommended that the comprehensive transport system planning at the national level is included into the space planning, with highway, railway and civil aviation planning as the supplements to special planning. As for the "Multiple-Plan Integration" at the provincial and multiple levels, it is recommended to actively co-ordinate transport planning with the development goals, technical standards and space coordinates and related specifications of urban system, territorial development and other relevant planning.

5.3.2 Strengthening the Traffic Carrying Capacity Analysis in the Regulatory Control Stage

According to the specific spirit of "the state adopts advanced science and technologies to enhance

scientific urban planning and improve the effectiveness of urban and rural plan implementation and supervision management" that is clearly stated in the Article 10 of *the Urban and Rural Planning Law of the People's Republic o f China*, the specific provisions of *the Rules on Compilation and Approval of City and Town Detailed Regulatory Plans*, the consideration of urban traffic carrying capacity analysis as a kind of new quantitative analysis tool assisting urban planning's scientific decision making in environmental resources carrying capacity, is one of important bases affecting the determination of appropriate land development intensity, is favorable for the scientific, reasonable and fair optimization of urban spatial resources and complies with the basic connotation of urban planning. Therefore, it is recommended to determine the legal status of urban traffic carrying capacity analysis in such links as controlling detailed planning, dynamic maintenance and plan modification.

The urban traffic carrying capacity analysis facing the regulatory control stage belongs to a meso-level job and it the specific implementation and refinement of the development strategy detailed in the overall development stage. It can achieve a transfer from "blueprint style" planning to "procedural" planning of regulatory control, a transfer from "extensive" planning to "fine" planning, a transfer from "mainly qualitative" planning to the combination between "qualitative and quantitative" and a transfer from "binding" plan to "coordinated" plan.

5.3.3 Perfecting Cross-Department Coordination Mechanism

Urban planning and transport planning are administered by different authorities, which should be coordinated in determining the timing of land development and transport facility development.

Generally, land development and transport facility development are synchronized and coordinated in the long run in urban plans. However, urban development is a progressive and dynamic process, so land development and transport facility development should also be coordinated in implementation. In most cases, the development of subway and bus transport has stayed behind the development of land use. This kind of uncoordinated timing undoubtedly brings about worsening traffic conditions for some time for the cities. To avoid this situation, it is necessary to establish coordination mechanics between authorities for land development and transport facility development so as to synchronize the activities for land development and transport facility development. In a region in a given period of time, the scale of land development and population should match the development of public transport. The land, funding and schedules for urban development and those for public transport should be matched with each other and ascertained, and reflected in short-run development plans and annual land supply plans.

To this end, it is recommended to further optimize the setting of integrated transport management institution, establish the executive agencies for the uniform planning of railways, highways, waterways, aviation, postal services, urban rail transport (or establish the system for the joint operation of railways, highways, waterways, aviation, postal services, urban rail transport) and gradually solve the relevant unclear working procedures and unsmooth planning convergence during the advancement of integrated transport system in the long run.

5.3.4 Increasing Efforts in Implementation of Plans

It is recommended to, under the leadership of municipal governments, establish a coordination mechanism for public transport participated in by authorities for urban transport, development and

reform, public security, finance, land and resources, planning and other departments, clearly define responsibilities, carefully organize the implementation of transport and rural-urban plans. It is necessary to formulate annual implementation plans to ensure implementation.

5.4 Perfecting Guarantee Policies

5.4.1 Legislation

1) Establishing the legal status of urban comprehensive transport planning through legislation

The Law of the People's Republic of China on Road Traffic Safety has been amended for two times, respectively in 2007 and 2011 since its enactment in 2003. In addition, *the Code for Transport Planning on Urban Road, the Code for Design of Urban Road Engineering* and other industry standards and codes have been developed to guide the preparation of transport development frameworks, comprehensive transport plans, etc. There is no law or regulation specific to transport planning and its preparation. By analogy with *the Law of People's Republic of China on Urban and Rural Planning*, and *the Rules on Preparation of Urban Plans*, the legal status of urban comprehensive transport planning may be established by *the Law of People's Republic of China on Transport Planning* and *the Rules on Preparation of Transport Plans*.

(2) Enhancing the legal force of TIE

In recent years, a series of policy documents have been released by the central, provincial and municipal governments to enhance the role and force of TIE in administrative review and approval. For example:

(a) *The Guiding Opinions of the State Council on Prioritized Development of Urban Public Transport* (GF [2012] No. 64) requires implementation of TIE as a pre-condition of project implementation, and strict implementation of standards for support public transport facilities, to realize synchronized design, construction and acceptance.

(b) *The Ministry of Transport's Opinions on Implementation of The Guiding Opinions of the State Council on Prioritized Development of Urban Public Transport* (JYF [2013] No. 368) requires implementation of TIE. The document requires to "establish a TIE system and conduct TIE for proposed construction of airports, passenger railway stations, passenger waterway terminals, long-distance bus stations, residential areas, business districts and other large construction projects, to analyze, anticipate and evaluate the impact on traffic, proposes strategies and measures for prevention or mitigation of adverse effects, and requirements for supporting public transport facilities. According to the results of TIE, project owners shall implement standards supporting public transport facilities and ensure synchronized design, construction and acceptance of support facilities with the principal works.

(c) The Beijing Municipal Government released *the Opinions on Further Advancing the Science of Transport and Mitigating Traffic Congestion in Capital* (JZF [2010] No. 42), which requires inclusion TIE in review and approval of large construction projects with equal role with environmental impact evaluation, to realize coordinated development of the city and its transport.

(d) *The Beijing Municipal Government Work Report 2014* requires to “conduct population assessment, traffic evaluation and water resources evaluation for major plans, major policies, major projects”, and "enhance the role of TIE in streamlining review and approval procedure of investment projects, by enhancing TIE in preparation and adjustment of regulatory detailed plans,

conducting TIE review in land reserves hardening and class 1 development, and keeping TIE review upon public trading of land".

(e) The Beijing Municipal Development and Reform Commission, in *the Circular on Strengthening Administration of Real Estate Projects in the City* (JFG[2004] No. 560), requires strict control of new real estate projects within the Fourth Ring Road, for improving the urban environment. The commission requires justification of population density, FAR and transport upon initiation of projects, and transport shall have veto on initiation of projects.

Shanghai, Shenzhen, Guangzhou and many other cities also issued policy documents for strengthening the implementation of TIE. These policy documents have greatly promoted TIE activities. Traffic impact evaluation has yet to be made statutory for it to work as environmental impact evaluation does in review and approval procedures.

To implement the strategy of sustainable development, prevent adverse effects on the environment due to planning and construction of projects, and promote the coordinated development of economy, society and environment, the Standing Committee of the Ninth National People's Congress at its thirtieth meeting on October 28 2002 amended and ratified *the Law of the People's Republic of China on Environmental Impact Evaluation*, which was to be implemented from September 1, 2003. It is recommended that the transport authorities also actively promote the enactment of the *Law of the People's Republic of China on Traffic Impact Evaluation* to establish the legal status of TIE.

5.4.2 Implementing TOD Development Strategy

The scientific development concept is followed to further implement the strategies giving priority to public transport, establish the dominant position of public transport in urban passenger transport by improving the attractiveness and competitiveness of public transport and sizing the opportunity brought about by the Public Transport City Demonstration Project, harmonize development of public transport and other modes of passenger transport and different means of public transport for healthy and sustainable development of the cities.

5.4.3 Adding Efforts in Comprehensive Urban Transport Planning

After the state entrusted the Ministry of Transport to prepare comprehensive transport planning, the transport authorities at all levels continuously carried out relevant researches and issued some comprehensive transport plans at regional, provincial and municipal levels to guide the development of the comprehensive transport development of various regions. Seen from the urban comprehensive transport planning, it is still at an early and exploratory stage and facing many problems and difficulties. On the one hand, China lacks relevant regulations on integrated transport planning, resulting in lack of legal status, weak guidance and restraint, unclear planning subject and workflow as well as unclear relation with single transport mode planning and economic, urban and land planning; on the other hand, the regions have different understandings of the positioning, contents, focuses and methods of comprehensive transport planning function and some core technical problems are failed to be solved. We recommend the Ministry of Transport to proceed with related basic researches as soon as possible and research and issue related preparation methods, technical guidelines to strengthen the guidance of urban comprehensive transport planning. Local transport authorities should add the efforts in comprehensive transport planning, proactively dock with urban planning, do a good join in

convergence, strive for the supports by municipal government and have good planning and collaboration.

5.4.4 Perfecting Investment and Financing Mechanisms for Transport

It is recommended to revise and complete schemes for definition of authority in the transport sector, establish the accountability system and administration system corresponding to authority, and drive availability of the organization, staffing and safeguards for performance of duties according to the requirements given by the central government for reforms of finance and taxation and for definition of authority.

It is necessary to enhance support with local government funding for transport projects in public interests and harmonize the development of regional and other levels of the transport network. The possibility of set up a transport infrastructure fund should be studied to be linked to the GDP. Based on international practices, the investment in transport infrastructure should be no less than 5% of GDP and covered by the budgets of all levels of government. The sources of funding for transport infrastructure can be expanded by relying on government funding complemented with funds from the private sector and donations. Financing channels should be expanded by encouraging and guiding private capital in transport infrastructure.

Mechanisms should be in place for participation of private capital in transport development. For profitable transport projects, it is possible to promote PPP financing and attract private capital through concessions, integrated land development and other possible measures. For transport projects with low profits, such as public transport, participation of private capital may be encouraged through purchase of service by the government as well as special funding, investment subsidizing, guarantor subsidies, discount loan interests, etc.

6. TOD Policies

The concepts and development model of TOD in foreign cities have experienced years of theoretical studies and practices, and there are also many successful cases, for example, Copenhagen of Denmark. Over the past decade, many cities have started to pay attention to TOD application in China, such as Beijing and Shenzhen, and begun to explore the study on the TOD adaptability model in China. On the basis of summarizing the domestic and foreign classic cases, this chapter proposes the special policies on the TOD model development in China.

6.1 Basic Recognition on TOD

6.1.1 Basic Concepts

TOD pattern reflects the basic evolution from motor vehicle based unsustainable urbanization to a new model. During this process, urban form and land use are tightly combined with efficient, low-impact and people-oriented urban transport mode (mainly public transport, walking and cycling and other public transport).

TOD development has two main objectives: first, to reduce road accidents; second, to effectively alleviate road congestion and maintain the sustainable development of urban transport.

6.1.2 Focal Points of Foreign TOD Implementation

In foreign countries, TOD mainly serves as an evaluation, recognition and policy guidance tool for the planning and design of integrated transport and land use. Its main roles include:

- Assessing the walking easiness, cycling friendliness and bus priority in completed urban development projects;
- Assessing the project status in evaluation stage and design stage to identify gaps and the opportunities for improvement;
- Assessing existing station areas or station area plans to identify the opportunities for improvement and investment;
- Serving as the policy guidance for urban planning, transport planning, land use, urban design and parking.

Specifically speaking, the five aspects below are very important for the consideration of TOD implementation plan:

(1) Livable Community

The good development concepts on traffic guidance can provide all benefits related to livable community: Without use of automobiles, people can go everywhere, high-density building layout and mixed land use are easier to improve traffic convenience, such kind of development also will produce fewer greenhouse gas emissions, such more active lifestyles as walking and cycling are advocated, and values are created for companies, local government, transport departments and residents. This development responds to the concern about the 21st century, as it is conducive to promoting the sustainable development of environment and economy. In addition, public transport is provided to be able to produce value-captured and make reinvestment in the community, as

because it focuses on the development of commercial activities and allows, to some extent, the tax base for value acquisition policy.

(2) Station Area Planning

Station area planning is conceptual or specific to the areas near the transport stations or transport corridors. The contents covered by this planning is somewhat different from that of TOD planning, but they have laid the foundation, including zoning, design standards, parking requirements, public transport access information and the flow of bicycles and pedestrians.

The most effective plan contains a clear time frame and implementation strategies, for example, the investment plans with clear capital sources or the plans on infrastructure improvement. Station area planning is mostly appropriate for the moment of TOD advocacy, i.e. the time with large ground parking lots or other underutilized lands, but is not so useful for the development of the areas with certain limited scope. Detailed station area planning is particularly important for high-priority site planning.

(3) Right Sizing and Shared Parking

The parking mission designed for single land use overestimates the development of the parking demand near public transport and undermines the higher-value use of land. Usually, the setting of local parking standards is based on the travel occurrence and parking forecast by the Institute of Transport Engineering. The model of Institute of Transport Engineering is built on the basis that the parking spaces in suburbs are usually cheap and sufficient, the surrounding low-density use makes travel by car necessary. The reduction on parking demands can increase the feasibility of mixed income and mixed-use development, and from the perspective of design, it, in a large part, determines whether there are spaces for retail, childcare or other non-residential uses. Parking policy is very important for creating vitality and facilitates the travelers to share the streetscape, parks and high-quality public spaces in mixed use areas, because it, to a very big content, determines whether a community is compact and walkable. Public parking space is a valuable tool, as it provides a more cost-effective use of parking resources and vacates lands for high-value purposes. Creative station planning and landscape will enhance the development vigor, attraction and value. The parking management policy on shared parking lot allows the parking lot to be shared by a lot of users, because most parking spaces only use a part of time, and many parking facilities, including unused parking spaces, all follow the predicted using mode of each day, each week and each year. For example, an office building complex can effectively share parking facilities with restaurants or theaters, because the office area needs a large number of parking spaces on weekdays, while restaurants and theaters require a large number of parking spaces in the evenings and on weekends. Therefore, it is estimated that the total number of parking spaces can be reduced by 40%-60%.

(4) Land Consolidation and Joint Development

When developing pedestrian-friendly public transport oriented community, land acquisition is a challenge. The communities around the station are often expanded, and sometimes such expansion is unfriendly to public transport and may produce some vacant or underused lots, so the developable part of the station is relatively small, can not be integrated and belongs to any owner. Special TOD projects require large station, and large stations will reduce construction costs and ensure staged expansion, thus maximizing the profits. For these reasons, some local governments use their power to acquire land for stations and then sell or donate land to the development team.

The power of land acquisition provides leverage to the public institutions, so that they have a greater say. Many innovative technologies for land acquisition and financing are adopted, including infrastructure investment planning and land acquisition planning. Land acquisition or land bank funds in many cities require careful consideration, so as to ensure the lands are payable around the early purchased stations and along the transport corridors. Of course, land acquisition is impaired. For instance, property owners are reluctant to sell their property or have unrealistic expectations on the present value of their assets. Therefore, the speculative boom will always accompany the building process of the entire public transit line. In addition, site collection, planning, zoning, mapping and approval acquisition need a very long period of time, and there are also the legal issues concerning land acquisition. Many developers are not able to deal with long-term or even medium-term land acquisition and development rights, and this is why the help from public institutions is often necessary.

Generally, bus companies and cities can not create transport-oriented communities only relying on themselves, thus producing high passenger capacity and achieving their public goals. They are unlikely to have enough lands to create real promotion projects at the stations, and the real estate sector may lack the necessary personnel and resources. However, cities and many public transport departments all take the PPP model. Research shows that public transport can make the land around the station produce significant value. The biggest value of land development is to gain significant income from long-term land lease, rental or sale, increased property and operating taxes and fare revenue, as well as to provide more revenues, including parking charges and business license fees. All of these revenues can be used to improve the communities near stations, which is a cost-effective way that can ensure higher passenger flow volume, far more than the construction of expensive parking structure or providing feeder bus services.

(5) Public-Private Partnership(PPP)

Public-private partnership (PPP) is a contractual agreement between public agencies (federal, state or local) and the entities of public sector. With providing services or development for public interests as the common target, it fully utilizes the technologies and assets of both parties. PPP model is particularly effective in the use of private investment in TOD development. It is more flexible than comprehensive development and needs no public land. In this process, the local government helps collect or re-divide land and obtain grants from the federal government to fund environmental remediation. If local government provides kind match, substituted charges and private investment can also be used. In the process of achieving development goals, local government can reduce three risks in the development process by cooperating with developers: First, developing community station area plan to reduce the creation risk of community and developers; second, reducing construction risk through the priority inspection services to TOD and contractor review; third, providing lower-cost loans by cooperating with local banks for commercial and multi-family construction, usually a class of very expensive debts.

6.2 Overview of TOD Development in China

To a great extent, the theoretical studies and practice of TOD in China are still in the initial stage, lacking complete planning theories and methods and mature cases. This is related to the stages of

the urban constructions and transport infrastructure construction in China. Moreover, it is a long process from planning to implementation and then to evaluation and can not be accomplished at a single blow. Below, the communities around the urban bus stations in China are taken as examples to discuss its difference and distance with TOD community and point out the problems that should be avoided in the future planning and construction.

6.2.1 Basic Problems

1) Urban development uncoordinated with public transport development

By the end of the 20th century, the construction of a group of urban centers of China had achieved fruitful results, city appearance changing rapidly and urban road infrastructure developing swiftly. The development of public transport, especially mass-capacity public transport system, obviously lags behind the travel needs of residents, and the capacity of facilities is inadequate.

In early 2000s, with the deterioration of metropolitan traffic congestion and air quality, the development of public transport got more and more attentions. For instance, the length of Beijing's rail network has exceeded 500 km, several cities has begun running BRT systems, etc. The construction of these public transport facilities greatly improved traffic supply but played a very limited role in the transfer of the car travel model. Summarizing the reasons, we can find that, on the one hand, public transport development maintains a weak correlation with land use layout and development density and plays a limited role; on the other hand, the public transport system itself is not at a high level of service and maintains no close tie with other modes of transport, like transfer inconvenience, "the last kilometer" issues.

In addition, with the further accelerated urbanization in China, a growing number of large and medium cities are interested in the development of new urban areas. The transport facilities between the built-up areas and new district development focus on highways or roads. The dominant mode of transport is still car-based, causing serious traffic congestion. Some areas have planned rail or BRT systems, but the construction time is later than land development. The two have a poor convergence in time of construction timing.

(2) TAD and TOD

One of the characteristics of TOD is that it will result in a high-strength land development near the station, but not all high-strength land developments near the station belong to TOD. The difference between TAD (Transit Adjacent Development) and TOD lies in that the lack of liaison of internal design or the improper land use constitution results in the failure to improve bus attractiveness or the value of the development near the station. Such development mode utilizes the orienting function of rail transit construction on land development, thus losing the feedback support of high-strength land development to public transport. In China, the developments near the stations that become prosperous with rail transit construction mostly belong to TAD. In addition to the sole pursuit of commercial interests, the fundamental reason is the lack of an overall consideration to the land development around the station.

Beijing Wudaokou Station is taken as an example, as shown in Figure 6-1. The station is on Beijing Subway Line 13. In the past five years, it eyed a rapid development and increasing prosperity, and the commercial, office, cultural, entertainment and residential lands around the station soared, so it has a big potential to become a TOD community. However, due to the lack of an unified planning for the composition and layout of various natures of land and the poor continuity between facilities, it actually continues the low-density spread of traditional mixed

development of Chinese cities and plays no an obvious role in promoting public transport. Therefore, it is only simple development near bus station instead of a TOD community. In addition, such a development model will bring greater impact on road traffic, and the commercial activities on the street have caused poor accesses to the roads with big traffic volume in this region. These roads with relatively big traffic volume also bring very big safety risks to the crowd gathered.

Figure 6-1 Land Development Situation around Wudaokou Railway Station

(3) Single form of land development

In the urbanization process of big cities, due to expanding population and industry, it becomes an inevitable trend to expand to the suburbs. How to gradually guide the orderly emigration and re-integration through the construction of rail transit network is one of problems to be resolved. One of problems that are easy to appear during practice is the single form of large tracts arising from improper industry aggregation effect and construction timing during a given period.

Beijing Huilongguan is taken as an example. The total land area of Huilongguan Community is about 9 square kilometers, including 7.6 square kilometers for planned construction and about 3.75 square kilometers for residence. The total construction area is 8.5 million square meters, including 5.8 million square meters of residential floor area. However, by the end of 2004, the development of public service facilities had far lagged behind the residential development, resulting in extremely simple community functions, only for residence. Out of the needs for work, recreation, medical care and education, local residents have to leave the "sleeping city" to seek satisfaction in urban center. This has exacerbated people's strictness in travel time and direction, thus causing traffic jams in peak hours and the resource wastes in day time.

(4) Unfriendly community transport environment

From the perspective of TOD theory, the building of transport oriented land use pattern needs a start at macro (city) and micro (community) levels, and the further harmonization of public transport and community planning is an important foundation for the development of public transport.

From the above analysis, the design integration between the plot functions during planning and the pedestrian environment in the area and the connection with urban public transport are the aspects that need the highest attention in the microscopic design of TOD community.

(5) Imperfect investment and financing mechanism

Large-scale public transport infrastructure projects can bring the land development along transport lines very good returns and contains huge business opportunities in the development process. The form of PPP can accelerate the construction of tracks and high-quality public transport facilities, while turning part of proceeds into the funds for project construction, operation and maintenance. Currently, the TOD projects implemented in some cities can not achieve such result. If the developer is the main body of implementation, the government can not get value-added part of land revenue, and if tracks or public enterprises are the main body of development, there is a disadvantage of low efficiency and over high cost. Therefore, which model is introduced to promote the investment and financing of TOD projects is one of important issues for the TOD implementation in China.

(6) No support to TOD development by existing planning

In the current urban planning, the density and intensity of land development has a weak correlation with the layout of public transport facilities, and the traditional model is still followed, with the nature of the land and intensity indicators set in accordance with road facility standards. In the preparation process of regulatory detailed plan, there is a lack of quantized means for traffic carrying capacity to evaluate the reasonableness of land layout and intensity distribution, thus resulting in serious traffic congestion after the construction of a lot of lands. The TIE before project implementation can not fundamentally change and adjust the land nature and development indicators determined by regulatory detailed plan.

6.2.2 Exploration on TOD Development in China

The introduction of TOD theory in China is relatively late. Although, in recent years, the theoretical studies on TOD are becoming more and more popular in China and many experts and scholars also are attempting to summarize a TOD road suitable for China's urban development, due to the late start and inadequate concerns about the coordination between public transport and land use, many cities still adopt demand following theory, which can not play the role of public transport in influencing urban form. Some large cities have begun to notice the adoption of TOD theory and made good attempts.

(1) TOD pilot area design

In order to extract a more sustainable city model from the existing city planning, there is a need to adopt new methods of land use and urban planning to cooperate with corresponding urban traffic network in avoiding the past model of "super large block+ single land use".

The new planning methods comprise the following four steps:

- At the level of overall urban planning, the types of land use and the level of public transport services are based to specify potential bus pilot area;
- Inside the bus pilot area, three different types of mixed use centers are divided, and the development density of these centers matches with their public transit service levels;
- Road system is modified to build a urban road network more suitable for walking, cycling and public transport;

- New small block regulation methods are adopted to create walkable environment together with detailed land use and urban design standards.

Firstly, at the level of overall planning, the TOD districts suitable for walking and mixed use are divided. These TOD districts have the street systems suitable for walking, cycling and bus use and also set the minimum value of population and job density. In TOD districts, the areas close to large bus stations have higher development intensity and land use standards to strengthen the investment in public infrastructure. In a TOD district, there are a total of three types of centers, including main centers, sub-centers and group centers. The land use strength and degree of mixing of each kind of center all depend on the level of bus service.

Secondly, at the regulatory level, TOD district will be redesigned and adopt the street network more suitable for walking and the land use system constituting of small blocks. The setting of urban design indicators regard small block as the unit. The specific job categories, building types and residential types within the district determined by the general plan are implemented among small blocks at the regulatory level.

(2) Transport-oriented rail transit planning system

Phase I of Shenzhen Subway Project follows the design pattern of traditional rail transit planning, i.e. directly transiting to engineering design from network planning, with focus on the feasibility of project construction. In the case that the preliminary design has been completed, the planning department has a strong intervention: according to the development pattern of the land along the rail lines, the positions of 15 stations are adjusted and partial layout optimization is carried out to station entrances, feeder bus facilities and pedestrian connection system and underground space development of the areas around stations. However, such intervention has missed the best coordination time, and the urban and transport planning adjustment along rail lines are in a passive position and the extent and scope of amendment is limited, so the development of the comprehensive benefits of rail transport is difficult to be fully realized.

To avoid that Phase II has the problems in Phase I and fully embody the concept of TOD model, Shenzhen adjusted rail transit planning and design process in the third round of transport comprehensive management work brief beginning the year of 2002. According to the “Three Phases and Five Levels” urban planning system of Shenzhen, TOD rail transit planning and design system is established, as shown in Figure 6-2. Different rail transport planning and design levels are adopted to closely coordinate with urban planning level system and guide the rail transit engineering design in corresponding stages: at the macro level, the coordination focuses on the relation between rail transit network and comprehensive traffic hub layout and urban development strategy, structure and layout; at the meso level, the urban planning and traffic planning along the rail lines are adjusted and optimized, and the combination among rail line selection, land form and transport corridors is implemented; at the micro level, the combination among station position, the layout of entrances and the lands and transport facilities around the stations are implemented. Through the planning and design at different levels, firstly, the close collaboration between rail transit network, comprehensive transport hub layout and urban space development strategy is ensured, making rail transit an important support condition for integrated urban development on the level of the whole area; secondly, a benign interaction produces among urban planning, transport planning and rail transit projects, so as to promote the close combination between rail transit and the land use along the rail lines as well as intensive land use, drive the formation of the

urban comprehensive transport model with rail transport as the backbone and promote the perfection of municipal infrastructure and the harmonization among construction standards.

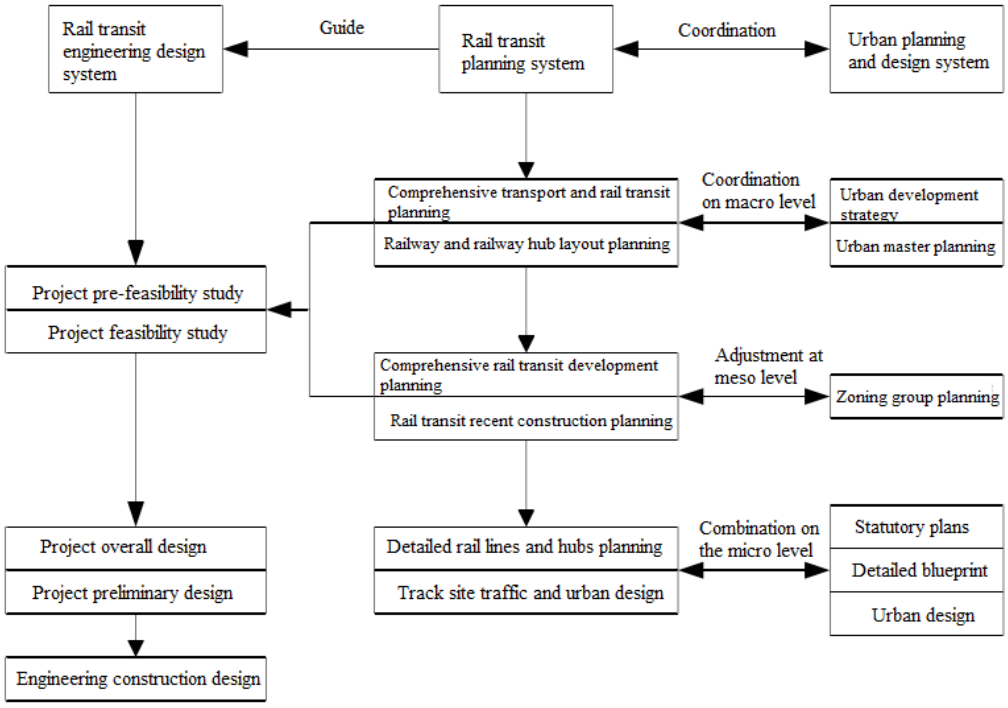


Figure 6-2 Transport-oriented Rail Transit Planning and Design System of Shenzhen

(3) Joint development model

Joint development is a type of real estate development. It is closely linked with public transport services and station facilities relying on the market activities and regional interests provided by transport facilities. Joint development not only refers to the actual construction behavior based on public and private cooperation but also includes the close cooperation between two parties, so a written contract is needed to regulate the behaviors of each party, i.e. stipulating the powers, responsibilities and interests among private interest groups, competent transport institutions and state-owned groups. In China, Guangzhou takes the lead in exploring the model of joint development. Drawing on the successful experience of Hong Kong MTR and in consideration of the national conditions and economic system of China, it allocates some plots to subway companies along subway lines to subway companies for property development to raise construction capital for Metro Line 1. In the perspective of co-development model, Guangzhou Metro Corporation obtains the development right to the property development plots along the line and then enters into cooperation contract with the developers to establish a project cooperation company for joint development. The income from property development is shared in the agreed manner. The earnings obtained by the subway company are used for party of subway construction costs. Specifically, the subway co-development models of Guangzhou include two types, namely joint development and independent development. The former refers to that Guangzhou Metro Corporation and the developers make joint investment in subway property construction, with the earnings from property development shared pro rata. The latter refers to that Guangzhou Metro Corporation lets the land use right of the plots along subway lines to the developers to collect land transfer fee, and then the developers conduct independent developments, with the development proceeds mainly obtained by the developers.

Nanjing's subway construction also adopts the joint development model. Nanjing Metro Real Estate Co., Ltd. is responsible for the land development and management along the subway lines. When the civil engineering of Nanjing Subway Line 1 was basically completed, the impact of subway construction on the value addition of the land along the line was evident, and five plots also had relatively big price increases. Nanjing Subway Construction Headquarters, through Nanjing land reserve center, had timely open sale to the five plots, and Nanjing Metro Real Estate Company participated in all the bids, with the net income from the land auction (after deducting the cost of demolition) hitting RMB 548 million. These gains have been used as capital investment for subway construction by the government. Nanjing Metro Real Estate Company won the bid of small plots for property development for RMB 370 billion. It is expected that substantial revenue will be transferred into the subway construction.

Tale 6-1 Joint Subway Development Models of Beijing and Shanghai

City	Models of Joint Development
Beijing	Subway company and developers conduct joint development, and the completed subway malls introduce brand chains on the basis of rental.
Shanghai	Subway company and developers jointly develop subway malls. These malls are operated chiefly on the basis of entire lease facing funds and institutional investment, supplemented by the rental of the individual investors.

As a complex system engineering involving transport, urban planning, real estate development and other aspects, joint development covers such links as investment, operation and management, and concerning government departments (municipal government, planning department and transport department), citizens and developers and needs a set of practical and effective mechanisms and procedures of joint development. Here, a joint development process is given in combination with the institutional context of China:

- Establishment of such agencies as competent agencies and implementing agencies of joint development. Since joint development is a behavior involving the government, enterprises and other groups, a specialized government department is needed for management. This role is crucial, and its function is to have an all-round coordination for the construction of transport system and real estate development.

- Research on regional economy and real estate market. Before proceeding with joint development plan, survey must be carried out to the status quo, land utilization status and public resources of urban areas.

- Formulation of joint development plan. Detailed plan is developed, and government departments and developers are committed to all the efforts for plan achievement, thus the completion of all the joint development details in the entire development plan can be promoted.

- Acquisition of land. After the joint development plan is determined, the competent joint development institution obtains the right to develop and operate the lands along the lines from the government and then transfers it to the joint development body for development.

- Selection of development models and programs. Joint development companies select different modes of land development for different plots, such as self-development, cooperative development and transfer-oriented development. With the regard to the lands needing self-development, the property types suitable for development should be determined, such as

parking lots, shopping centers, restaurants and entertainment, housing, etc., or a combination thereof.

- Setting of development timing. Joint development companies determine the most suitable development opportunities based on the information fed back by the joint development authorities and the regional real estate situation.

- Joint development company's participation in the plots of the lands along the lines. That is to participate in the development of the lands along the lines in the form of self or cooperative development; the development with land transferred to real estate development companies, supervision and coordination should be conducted to other developers.

From the current status of China, the land reserve and acquisition mechanism for joint development, joint development planning system, joint development beneficiary return mechanism and the policy incentives encouraging developers to participate in joint development are the barriers facing the joint development of rail transit and surrounding regions. We recommend drawing on the experience from the joint development of Hong Kong. See Box 6.

Box 6-1 Major Experience from Hong Kong's Joint Development

1. Guarantee for joint development implementation by relevant laws and regulations. In 1975, the HK Government promulgated Hong Kong Mass Transit Railway Corporation Ordinance. The document endowed the HK MTR Corporation with the right to obtain the land for the property development along the rail, thus ensuring that HK MTR Corporation can get many benefits generated by joint development. These laws and regulations are the basis ensuring the implementation of joint development.

2. The integrated planning and development of rail transport and the surrounding area. When conducting approval through railway planning, the HK Government leases the land suitable for property development along the rail transit line to HK MTR Corporation so as to promote the implementation of the joint development. The development of the properties over the railways makes rail transit attract more passengers, bringing the two with corresponding interests.

3. HK MTR Corporation's personal involvement in diversified operation. In time of rail transit construction, HK MTR Corporation develops and manages the properties over or near the railway, thus ensuring directly benefit from the real estate development. In addition, HK MTR Corporation also operates the commercial and advertising in the stations to gain diverse benefits and providing additional funds for rail transit construction.

4. "Lease not sale" of the surrounding properties This makes HK MTR Corporation own unified management right to these properties, which is more conducive to property operation and ensures rail transit to fully enjoy the benefits from properties.

5. Coordination in the timing of development. In time of rail transit construction, the properties over the railway are planned as the commercial center in the region, coupled with high-density residences and greens for rest. Moreover, the construction of auxiliary facilities is conducted simultaneously, making rail transit construction more coherent with the surrounding land use.

6. Guide on people's use of rail transit. In Hong Kong, most of office buildings are about 200m form the subway stations. Through the meticulous design of overpasses and underground

walkways, a good environment for walking is created, the sense of distance reduced, people's reliance on rail transit guided, the use of rail transport increased and ticket revenue ensured.

6.3 TOD Policies of China

Foreign TOD researches and practices focus more on, how, at the community level around public transport stations, to propel community residents to more use of public transport, improve non-motorized transport environment and carry out comprehensive development to solve the inadequate funds for public facilities construction, operation and maintenance. The TOD implementation on the above community level can very well promote the development of public transport. But for the large cities in China, the formation of some good TOD communities also needs to seek support and guarantee from meso and macro aspects, making the entire cities develop in TOD mode in China to construct the cities on the rail transit of TOD cities. The implementation of TOD mode in China also needs to consider the existing plan preparation stage, planning management procedure, implementing measures, etc., therefore, its implementation in China focuses on three considerations, namely planning technology system, planning management methods and tools and supporting policies.

6.3.1 TOD Technical Criteria

(1) Public transport corridors oriented urban development

Urban spatial morphology and transport development is closely related. The road transport oriented cities are quite different from public transport oriented cities. The development mode of the former caused a lot of problems in the past decades, such as traffic congestion and air quality deterioration. Many cities have realized the problems above and begun to pay attention to TOD. Many cities face urban renewal and new district development. It is the most basic norm of TOD to plan land utilization layout and carry out land difference density development with public transport corridors as the axis. Specifically including the following points:

- Combination between old town transformation and public transport system improvement;
- New areas are connected to the built-up areas via mass-capacity public transport system;
- New land development is arranged around public transport stations as much as possible, and intensive use of land is encouraged;
- The basic planning conditions of jobs-housing balance of public transport corridor are satisfied.

(2) Development of high-quality public transport system

During the 13th National Five-Year Plan period, the process of urbanization continues to accelerate. According to *the National New Urbanization Plan (2014-2020)*, in the next five years, the urban population will grow more than 10 million annually, which is a huge challenge for the development of public transport from the perspective of demands and total amount. In addition, some major cities in China have introduced measures on limiting the use and purchase of motor vehicles, and some potential car buyers put forward higher requirements for the quality of public transport service. High-quality public transport system should pay attention to the following points in the planning and design:

- Integrity of public transport system

Public transport system covers many forms of public transport, including subway, light rail, tram, bus rapid transit, ordinary buses, trolleys, etc. Meanwhile, there are a variety of organizational models, such as customized buses, shuttling buses and community buses. Different forms of public transport have different technical characteristics and play different roles in system. Rail and bus rapid transit chiefly serve long-distance, large-volume traffic demands, and customized buses mainly serve the commuting among residence and employment locations. Shuttle and community buses solve more the segmented feeder transport problem.

- Public transport system should adapt to urban spatial scales, land form and stage of development

In larger cities with relatively large spatial scale, due to the relevant long distance between the residence place and workplaces, residents' travel shows a significant stratification and grading in demand for public transport system, highlights the mixed use of direct arrival type and transfer type and gives consideration to travel convenience and low costs. Small-sized cities organize passenger flow mostly by the direct arrival network forms converging major passenger distribution points.

- Hub integrates lands and all modes of transport to build integrated land transport system

Traditional land for transport facilities bear only one traffic transfer function, and modern transport facilities require a combination with land development, making the position of transport hub, as the destination of activity, able to play the efficacy of land and favorable for the site selection of transport hub in the passenger concentrated areas. Transport hub itself focuses on a variety of transport modes, especially external transport hub, for instance airports, railway stations and highway bus terminal, to promote the zero transfer of various ways at the hub position, which is favorable for the improvement of the overall efficiency of the public transport system and its attractiveness.

- Strengthening bus priority development guarantee

It is a fundamental work to determine the dominant role of public transport and the key to provide high quality public transport system that bus priority is reflected and implemented in the aspects of policy, land, finance and right of way to maintain the stabile and efficient operation of public transport sector.

(3) Urban density is determined according to the capacity of public transport

The layout and scale of urban functions must consider the service capacity of public transport. In plan preparation process, full consideration should be given to the feedback of transport, especially public transport, on land development, with public transport service capacity as an important indicator determining the density of urban development. Attention should be paid to the following points:

- Major functional areas of the city is consistent with the layout of main public transport facilities;
- Large hub building adapts to the surrounding land development, and transport is combined with urban services;
- The land development density around public transport stations should be higher than that in other areas;

- The determination of land ploy ratio indicator should consider the measurement of traffic carrying capacity. Public transport capacity is one of the important indicators

(4) Function mixed land development

Function mixed land development is to mix the lands of multiple natures together so as to form relatively compact mixed development form in a block/plot and even on different floors and reduce the distance of transport. Urban complex is a representative of current function mixed land development. In terms of specific implementation, attention should be paid to improving land compatibility regulations, setting function mixed land and reserving appropriate elasticity in the regulatory detailed planning stage. For instance, the F-class lands in Beijing cover the residence and office functions.

(5) Increasing the density of road network

Seen from the road network spacing realized in Chinese cities currently, the distance averages at over 300 meters at most of crosses, and the enclosed land area is also too large, which is not conducive to the improvement of the road network traffic efficiency and the use of non-motorized transport. In the regulatory plan preparation phase, the road network density should be further improved, with the spacing at crosses maintained at about 150-200 meters, while ensuring the planning implementation of branches.

6.3.2 Implementation Framework of TOD

China is very different from the Western developed countries in the stages of economic and social development. The urbanization process and huge traffic demands in large Chinese cities increases the complexity of TOD strategy research in China. Based on an analysis on TOD status, problem and implementation situation, the TOD strategy adapting to China's situation is proposed.

(1) TOD implementation bodies strengthen coordination and regulation functions

Foreign TOD experience shows that the attention, effective coordination and supervision of government departments are the key to the successful implementation and expected benefits achievement of TOD. TOD implementing agencies in China can rely on public transport priority development leading group, urban rail transit planning and construction leading group or specially established TOD integrated management organ. The main responsibilities of the agency include:

- Participating in the opinion seeking and approval, determining urban spatial morphology and functional layout based on TOD mode and embodying TOD concept in the statutory planning;

- Organizing the preparation of rail transport related special planning as an effective complement to the statutory planning, enhancing the control and guidance of statutory planning to TOD areas and guiding the development and construction in the station areas with TOD idea;

- Taking in charge of the joint development activities in the station areas and developing the implementation methods for joint development. Putting forward specific development programs and models, and organizing the planning and design of joint development projects;

- Being responsible for the development of TOD related technical guidelines, implementing rules and other technical and managerial regulations, and clarifying management basis, the responsibilities of the participating entities and the contents of the work in each stage.

(2) Establishing TOD guided planning, approval and feedback mechanisms

Revision is made to the review procedures and methods of urban overall planning and specific planning, and the regulatory principle and guiding strategy of TOD planning and design is

regarded as an important basis for review and included into relevant evaluation system of planning results; full consideration is given to the feedback of urban comprehensive transport planning and special bus planning on the coordinated development between transport and land utilization. The approval basis for construction planning and land use permit is adjusted, and the regulatory indicators in *the TOD Planning Technical Guide* are regarded as the management approval basis of the construction projects in the surrounding areas of mass-capacity public transit stations, so as to make the planning management better serve TOD. Moreover, these indicators are regarded as a part of land utilization contract to restrict construction development activities. The municipal government reserves the lands among rail transit lines in accordance with *the Recent Construction Plan for Rail Transit*, prepares *the Plan on Land Control of Rail Transit Stations* or *the Land Planning and Design around Stations* in accordance with *the Plan on Urban Rail Transit Construction* and conducts plot refinement based on TOD principle to determine the land scale, development strength and land nature in line of TOD requirements. Based on the need, on the premise of maintaining the overall planned land use layout, adjustment is conducted to local regulatory detailed planning to ensure that relevant control targets can facilitate the implementation and effectiveness of TOD projects.

(3) Boosting the TOD development around the stations

TOD Planning Guide is prepared to determine the objects, scope, technical content and indicator system of TOD planning. TOD planning should follow the principles below: ① Compactness; ② mixed; ③ accessibility; ④ humanity; ⑤ diversity and specialization; ⑥ fairness. Government-led joint development and construction mode is implemented. Government, developers, bus companies and land reserve institutions are included into the joint development mechanism to achieve the comprehensive coordination of multi-site profits, the effective control of land development and the rational guidance of construction investment. To ensure joint development, appropriate implementation measures should be developed, including the regulations on the joint development planning management, land management, return of earnings and the rights and obligations of the participating entities of joint development.

(4) Perfecting the supporting policies on TOD development

- Improving traffic planning and implementation effectiveness, and strengthening planning coordination and feedback

The hierarchy and stages of urban transport planning are strengthened. With the regard to the contents of transport planning at different levels, the implementation effectiveness is enhanced through an inclusion into statutory planning or forming the special planning of overall planning.

- Strengthening the efforts to control land, and perfecting land reserve mechanism

Long-term mechanism is established and implemented for the rapid response and scientific regulation of land control. Land reserve and development plan should meet urban economic development planning and land planning, increase government's efforts in reserve land and give priority to the development of idle lands, with land reserve tilted to new towns and rail transit area. When necessary, the government can reclaim the right to develop the lands along high-capacity public transport lines to prevent the disorderly development of these areas.

- Speeding up the reform of urban construction investment and financing system

Fully play is given to the basic role of market resource allocation to establish the dominant position of enterprises in the investment in operating municipal utilities. The policy environment

favorable for the rational flow of market factors is created to boost the diversified investors, diversified ways of investment and market-based project implementation of urban infrastructure construction.

- Establishing flexible planning incentives mechanism

In TOD area, floor area ratio incentives can be introduced to attract developers to invest in public facilities, promote the simultaneous development of housing and infrastructure, create a pleasant public space and achieve a relatively orderly high-density development. The cities should have an in-depth study on "under what conditions, to what extent and what degree of award is given", and make affirmation and quantification in the actual planning implementation management.

- Perfecting relevant policies, regulations and technical standards

The legislation and standardization of TOD policy are gradually advanced to ensure scientific and operable guiding strategies; Amendments are made to *the Rules on the Review of Urban Overall Planning* to embody the development principles of TOD; *The Urban Planning Approach* is revised to deepen the contents of regulatory detailed planning, develop uniform technical measures and fundamentally address the specific technical issues involving TOD; *The Urban Planning Approach* clearly states that in the cities with rail transit construction planning, regulatory detailed plan must be prepared for rail transit lines and stations to ensure the legal efforts of TOD planning elements; amendments are made to *the Code for Classification of Urban Land Use and Planning Standards of Development Land* to tighten the control over plots and street blocks and enhance the guidance on mixed land development; The cities refine *the Technical Requirements on Urban Planning and Management* to establish the planning indicator system suitable their features.

- Enhancing public involvement in planning

During plan preparation and approval, the top-down and bottom-up interaction, balance and cooperation are promoted among various powers, and various interest groups and all aspects (governments, departments, social organizations, businesses, residents, etc.) in cities are encouraged to and allowed have dialogues via network, hearings and seminars and participate in the early stages of planning and planning review comments.

7. Transport Planning and Urban Planning Coordination Evaluation Index System

After the preparation of the preliminary urban plan and transport plan, it is necessary to have a technical evaluation on the coordination between urban planning and transport planning (i.e. whether to coordinate and the degree of coordination). If they are not coordinated or the coordination is not enough, further amendment and improvement should be conducted to urban plan and transport plan. Then another round of coordination evaluation is conducted. If the requirements can still not be satisfied, the process above should be repeated until satisfaction. This dynamic process allows urban plan and transport plan mutual check and test, thus effectively ensuring the coordination urban land use and transport system in the planning stage. Therefore, we recommend that the evaluation on the coordination between urban planning and transport planning is regarded as one of important links of the coordinated preparation of urban plan and transport plan and included into the system of planning means and methods. On the basis of proposing traffic planning and urban planning coordination policies in Chapter 4, we built the transport planning and urban planning coordination Evaluation Indexes system to make a reasonable judgment on the usefulness of the policy.

7.1 Structure of Evaluation System

One of the criteria to measure whether land plan is coordinated with transport plan is to examine whether it is helpful for the achievement of the development objectives of the area or the city after combined land and transport plan is implemented. Therefore, the establishment of the indicator system is closely related to the objectives of urban development.

Three core objectives of urban development include:

- to promote intensive land development
- to improve the efficiency and service levels of transport system
- to ensure environmental quality

Based on the above objectives, macro, meso and micro evaluation systems are established, as shown below.

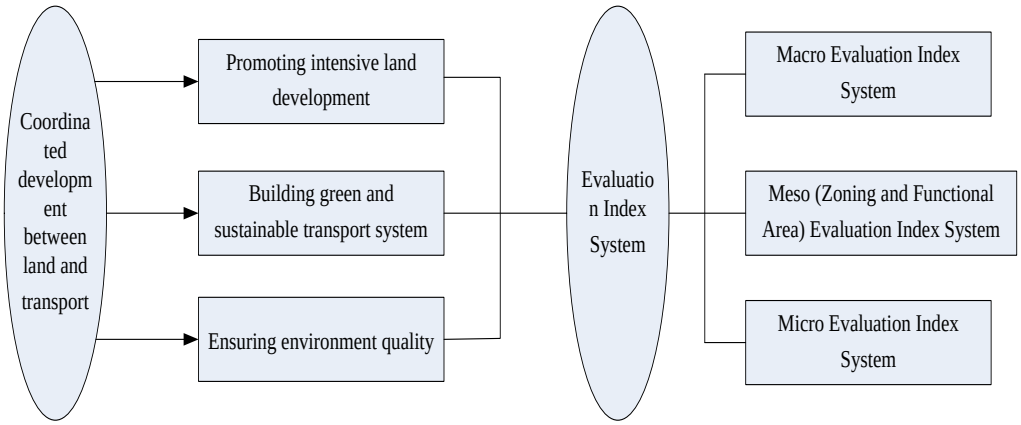


Figure 7-1 Structure of Evaluation Index System[26]

[26]Source：Beijing Municipal Institute of City Planning & Design. Synergic Development between City's Land use and Transport [R]. China Architecture & Building Press. 2009

7.2 Study on Coordination Evaluation Index System

When building the coordination evaluation system of urban planning and transport planning, the building of the following Evaluation Index Systems are referred to:

7.2.1 Study on Low-Carbon Eco-City Indicator System

With the development of urbanization, modern cities begin to pay more attention to the coordination between urban development and environment, so the low-carbon, environment-friendly and sustainable urban development path becomes one of the objectives of urban development. Corresponding to it is the low-carbon, environment-friendly and sustainable system. Therefore, the study on the urban planning indicators and transport planning indicators has an important reference value to this research.

(1) Harbin's low-carbon eco-city indicator system

Harbin's low-carbon eco-city indicator system is based on the principle of "low-carbon, environment-friendly, integrated and coordinated", and its design is divided into objective level, thematic level and indicator level.

Table 7-1 Harbin's Low-Carbon Eco-City Indicator System[27]

Regulatory Indicators						
No.		Objective Level	Thematic Level	Indicator Level	Unit	Targeted value(2030)
1	Low Carbon Indicator	Carbon Emission Reduction	Urban Space	Population Density	People/km2	8000
2				Average Access (One-Way) Time in the Region	Minute	≤30
3			Industry Development	Proportion of Tertiary Industry in GDB	%	≥85
4				Density of Carbon Emission	(Ton/Hac)	≤100
5				Intensity of Industrial Carbon Emission	Ton CO_2/100 million yuan	≤10000

[27] Source: Sorted by the research group

6			Transport	Public Transport Share Ratio	%	≥50
7				Walking Share Ratio	%	≥20
8				Share Ratio of Rail and BRT System in Public Transport	%	≥40
9			Infrastructure	Urban Central Heating Penetration	%	100
10				Harmless Treatment Rate of Urban Solid Waste	%	100
11				CHP Proportion	%	≥85
12			Energy Utilization	Energy Consumption Unit GDP	EZZ/10,000 yuan	≤0.6
13				The Proportion of Clean Energy	%	≥50
14			Green Building	Green Building Compliance Rate of New Area Construction	%	≥70
15		Carbon Sequestration	Ecological Environment	Green Coverage of Built-up Area	%	≥42

16				Per Capita Public Green Area	%	≥12

Among Harbin's low-carbon eco indicators, the indicators of urban space include population density and average access time; the travel indicators include public transport share ratio, walking share ratio, share ratio of rail and BRT system in public transport, etc.

(2) Zoning Planning of Rizhao International Ocean City

The plan covers the indicator system of Rizhao International Ocean City and highlights such concepts as ecological protection and restoration, resource conservation and reuse, social harmony, green consumption and low carbon emissions. The indicators are as follows:

Table 7-2 Indicator System of Rizhao International Ocean City[28]

Level of Indicator	No.	Secondary Indicator	Unit	Target Value
Good Natural Environment	1	Environment and Air Quality in the Area	Day	The number of days better than or equal to secondary standard ≥310 days / year (equivalent to 85% of the year); The number of days when SO_2 and NOx is equal to primary standard≥155 days / year (equivalent to 50% of the number of days reaching secondary standard)
	2	Surface Water Environment Quality in the Area	%	100
	3	Water Environment Quality Compliance Rate Near the Sea	%	100
	4	Tap Water Compliance Rate	%	100
	5	Functional Area Noise Compliance Rate	%	100
	6	Energy Consumption of Unit GDP	TCE/10,000 yuan	1.4
	7	Surface Carbon Discharge Density of Unit GDP	T-G/million dollars	150
	8	Net Loss of Natural Wetland		0

[28] Source: Sorted by the research group

Coordinated Artificial Environmental	9	Proportion of Green Building	%	100
	10	Native Plants Index		≥0.7
	11	Per Capita Public Green	m^2/ person	12
Healthy Lifestyle	12	Daily Per Capita Water Consumption	Liter/ person	120
	13	Daily Per Capita Waste Generation	g/person/day	800
	14	**Ratio of Green Travel**	%	50
	15	Garbage Recycling Rate	%	60
	16	**Proportion of Residence Area with Free Recreational and Sports Facilities within the Scope of 500m**	**%**	**100**
	17	Hazardous Waste and Garbage Harmless Treatment Rate	%	100
	18	Rate of Barrier-Free Facilities	%	100
	19	Municipal Pipe Network Penetration	%	100
	20	Allowance Based Public Housing Rate	%	30
Efficient and Booming Economy	21	Per Capita GDP	10,000 yuan/Person	3
	22	Rate of Renewable Energy USe	%	15
	23	Non-traditional Water Resources Utilization	%	30
	24	Full-time Equivalent of Scientists and Engineers	%	0.5
	25	**Jobs-Housing Balance Index**	%	50
	26	Proportion of Science and Technology	%	7

		Education Expenses in GDP		

(3) Outline of Guangzhou City's Low-carbon City Construction Planning

Guangzhou's low-carbon city construction indicator system includes 6 aspects and 45 specific indicators, as shown below:

Table 7-3 Guangzhou's Low-Carbon City Construction Indicator System[29]

No.	Key Aspects	Index	Unit	Present Value (2010)	Target Value		Index Property
					2015	2020	
1	Carbon dioxide emission	Total amount of carbon dioxide emission from energy activities	10,000 tons/year	13853	18000	22000	Guiding
2		Carbon dioxide emission intensity of unit GDP	10,000 yuan/ton	2.5(2005) 1.8(2010)	Down 32% from 2005	Down 40% from 2005	Guiding
3		Carbon dioxide emission from energy utilization per capita	Ton/person/year	10.75	12	13	Guiding
4		Department carbon emission structure (proportion)	Production: construction: transport	5:03:02	5:03:02	3:04:03	Guiding
5	Industry development	The proportion of the third industry increment in GDP	%	61	65	70	Guiding
6		The proportion of new energy and environment –friendly industry's gross output in gross industrial output	%	2.5	2.9	3.1	Guiding
7		The proportion of high-tech industry increment in total industry increment	%	35.3	40	43.8	Guiding
8		Above-designated-size industrial enterprises' clean production	%		25	50	Regulatory

[29] Source: Sorted by the research group

		reviewing rate					
9	Space layout	Municipal land utilization intensity	%		24		Guiding
10		Land output rate	%		Up 50%	Up 100%	Guiding
11		Construction land area per capital	Square meter		120	110	Guiding
12		Construction land size	Square kilometer		1740		Regulatory
13	Transport	The proportion of carbon emission by transport in total carbon discharge by energy activities	%	20	18	16	Guiding
14		Carbon emission by transport per capital	Ton	2.4	2.2	1.9	Guiding
15		Rail transit network mileage	Kilometer	236	521	800	Guiding
16		The proportion of urban non-motor transport in whole traffic means	%	38	39	40	Guiding
17		The proportion of urban public transport in motorized traffic means	%	60	62	65	Guiding
18	Energy resources	Energy consumption of unit GDP	10,000 yuan/ton standard coal	0.621	0.50	Up to national and provincial level	Regulatory
19		The proportion of renewable resources in whole energy structure	%	0	3	10	Guiding
20		The proportion of natural gas in energy structure	%	6.5	15	25	Guiding
21		The proportion of power provided by distributive energy system in total	%	0	10	20	Guiding

		power supply					
22		Urban residents' daily water consumption per capita	L/d. cap	226		220	Guiding
23		Industrial water recycling rate	%	60		91	Guiding

(4) Low-carbon Practice of Haiyan County of Zhejiang Province

Specific controls are put forward to such indicators as the land use of coastal new city, energy use, green building, biodiversity and green transport.

Table 7-4 Indicator System of the Low-carbon Ecological Demonstrative Urban Area of Haiyan County of Zhejiang Province[30]

No.	Indicator	Assessment Criteria	Coastal New Area of Haiyan			Remark
			Status Quo Value	Recent Planning Value	Long-term Planning Value	
I. Compact mixed land use model						
1	Population density on the land for the construction of new town (10,000 people / sq km)	≥1	0.12	1	1.2	
2	Gross floor area ratio of the built-up areas	≥1.1	≥0.6	≥1.1	≥1.2	
3	Jobs-housing balance index	≥50%	---	≥50%	≥60%	
4	Average commuting distance (km)	≤3	≤3	≤3	≤3	
II. Resource conservation and recycling						
1	Proportion of renewable energy (using scale)	≥20%	0.3%	≥20%	≥25%	
2	Non-traditional water sources (reclaimed water utilization rate)	≥20%	0.1%	≥20%	≥25%	
3	Per capita water consumption (liter/person/day)	Lower than the lower limit of the national standards of similar areas	≥160	≤230	≤230	
4	Urban life garbage harmless treatment rate	100%	80%	100%	100%	

[30] Source: Sorted by the research group

III. Green building						
1	Proportion of green building	≥80%	≥60%	80%	90%	
IV. Biodiversity						
1	Net loss of natural wetland and other ecological conservation areas	≤10%	≤1.2%	≤10%	≤10%	
2	Native plants index	≥0.7	≥0.7	≥0.8	≥0.8	
3	Integrated species index (species diversity index)	≥0.5	≥0.6	≥0.7	≥0.7	
4	Green rate	≥30%	≥21%	≥30%	≥35	
V. Green traffic						
1	Proportion of green travel	≥65%	≥65%	≥70%	≥75%	
2	Reasonable road network density, block length (m)	≤180		≤180m	≤180 m	
3	Proportion of triple and quadri-carriageway roads convenient for safe bike travel	≥60%	≥40%	≥60%	≥60%	
VI. Refusal of industrial projects with high energy consumption and high emission						
1	With specific policies prohibiting Category-III industrial land			Without Category-III industrial land	Without Category-III industrial land	
2	Proportion of Category-II industrial land in industrial land	≤30%		Without Category-II industrial land	Without Category-II industrial land	

(5) Beijing's Low-Carbon Urban Morphology Study Indicator System

The low-carbon urban morphology study of Beijing, a series of indicator systems are put forward, including:

- City Level

The main indicators include:

- Population density
- Average travel distances of different modes of transport
- Road linear density (road length / total city area)

- Neighborhood Level

The main indicators include:

- Intersection density (intersection quantity/ total neighborhood area)
- School accessibility (number and percentage of the residents within 500 meters of the school)
- Bus station accessibility (number and percentage of the residents within 500 meters of the bus station)
- Neighborhood total floor area ratio (total floor area / neighborhood land area, including municipal facilities)

- Block Level

The main indicators include:

- Intersection spacing
- Mixed use (Simpson index based on commercial, residential and office area ratios)
- Blocks' total floor area ratio
- Block building density

7.2.2 LEED ND Indicator System

LEED ND evaluation system consists of five major parts, namely Smart Location & Linkage, Neighborhood Patten & Design, Green Infrastructure & Buildings, Innovation & Design Process and Regional Priority Credit. LEED ND is a strongly operational evaluation system and makes evaluation on a certain area in accordance with the requirements of *the Reference Guide*. First, the area should meet the necessary conditions of each evaluation section and then each item is scored to complete evaluation. The point for each item is different, and the total score is 110 points. After the scoring for each section, a total score of 40-49 is for the entry-level, 50-50 for the Silver level, 60-79 for the Gold level and 80 or more for the Platinum level.

What worth a reference for the project is mainly the indicator system of the second part Neighborhood Patten & Design, including:

(1) Walkable Streets

The indicators include:

- Building concession distance
- Distance of building entrances from sidewalk
- Glazing ratio of the ground apartment for commercial use of near-road buildings
- Maximum no-door / window distance of near-road buildings
- Sidewalk width
- Aspect ratio of building to street
- Road design speed

- Proportion of the entrances/exits of motor vehicles across the sidewalks (exceeding no 10%)

(2) Compact Development

The indicators include:

- Population density
- Floor area ratio

(3) Mixed Land Use

The indicators include:

- Mixing degree (more different uses, more mixed uses)
- Proportion of mixed land use

(4) Community Mixed with Different Income Stratums

The indicators include:

- Sympson index
- Proportion of low-rent housing
- Proportion of affordable housing

(5) Reducing Motor Vehicle Parking

The indicators include:

- Motor vehicle parking spaces construction index
- Bicycle parking construction index

(6) Road Network

The indicators include:

- Intersection space

(7) Bus Station Facilities

The indicators include:

- Shelters
- Seat
- Timetable
- Roadmap
- Bicycle racks
- Lighting

(8)TDM

The indicators include:

- Private car VMT
- Preferential bus policies
- Special vehicle services (such as the special vehicles provided by shopping malls, supermarkets, etc.)
- Carpool policy

(9) Accessibility of public space

The indicators include:

- Land ratio of such public spaces as squares and parks
- Distance walking to public space

(10) Accessibility of Recreation Facilities

The indicators include:

- Proportion of the land for such recreation facilities as swimming pool and playground;
- Distance walking to recreational facilities

(11) Availability and Unified Design of Facilities

The indicators include:

- Diversified housing types to meet the various needs
- Barrier-free facilities

(12) Public Participation and Improvement of Community

The indicators include:

- Public participation in community planning and transformation

(13) Local Agriculture

The indicators include:

- Average small garden area for each household
- Community agriculture

(14) Road Greening

The indicators include:

- Ratio of roads with greening
- Road green coverage

(15) Community schools

The indicators include:

- School facility construction indicator;
- Campus area (the area is not too large, the number should be more, dispersed layout)

7.2.3 Summary

According to their population size, level of economic development and the situation of transport infrastructure construction, the cities can establish appropriate synergy evaluation system. From the above studies on low-carbon eco-city index system studies and LEED ND indicator systems, the indicators that are worth the reference and can be incorporated into urban planning and transport planning synergy Evaluation Index System include but are not limited to:

Indicators at macro level (city level):

- Population density (residential population density, employed population density)
- Per capita travel time
- Accessibility between city groups
- Proportion of different transport modes
- Road network density / road network line density
- Rail transit network mileage
- Ground public transport network mileage
- Preferential public transport policies
- Private car VMT
- Public participation

Indicators at meso level (neighborhood level):

- Neighborhood total floor area ratio (total floor area / neighborhood land area, including municipal facilities)
- Mixed land use (sympson index)
- Proportion of mixed land use
- Jobs-housing balance index /employment-housing balance index / ratio of employed population to living population
- Residential units diversification to meet various needs
- Ratio of land for public space including squares and parks
- Distance walking to public space
- Proportion of the land for such recreation facilities as swimming pool and playground;
- Distance walking to recreational facilities

- Intersection density (intersection quantity / total neighborhood area) / intersection spacing
- School accessibility (number and percentage of the residents within 500 meters of the school)
- Bus station accessibility (number and percentage of the residents within 500 meters of the bus station)
- Motor vehicle parking spaces construction index
- Bicycle parking construction index
- Are there public participation in community planning and transformation

Indicators at micro level (block level):

- Aspect ratio of building to street
- Building concession distance
- Proportion of buildings with ground apartment for commercial use among all near-road buildings
- Glazing ratio of the ground apartment for commercial use of near-road buildings
- Distance of building entrances from sidewalk
- Maximum no-door / window distance of near-road buildings
- Sidewalk width
- Proportion of the entrances/exits of motor vehicles across the sidewalks (exceeding no 10%)
- Barrier-free facilities
- Proportion of triple and quadri-carriageway roads in bikeways with physical isolation
- Width of non-motorized vehicles lanes
- Ratio of road subject to greening
- Road green coverage

7.3 Macro Evaluation Index System

Macroscopic Evaluation Index System is used to evaluate the space strategy program and transport development strategy program of urban development in overall planning.

Macroscopic evaluation valuation indicators establish macroscopic Evaluation Index System from a total of seven aspects, namely total land development, format layout, development strength, transport accessibility, high efficiency, energy conservation and environmental protection, as shown in Table 7-5.

Table 7-5 Macro Evaluation Index System[31]

[31] Source: Drawn by the research group

		Representation of Land and Traffic Coordination	Indicator
Degree of Land Intensification	Total Consumption	Saving land use, avoiding outward expansion, less land demand for transport construction and building development	● Population density (residential population density, employed population density)
	Layout of Business Pattern	Rational distribution, mixed development, favorable for rational urban growth, good public transport accessibility	● Per capita commuting trip distance / per capita travel time ● Bus travel share rate ● Bike travel share rate ● Walking share rate
	Development Strength	High-density and high-strength development, need for high-capacity public transport support, encouraging TOD development model	● The proportion of land for construction of backbone transit (rail and BRT) network 800-meter coverage ● Bus travel share rate
Efficiency and Service Level of Transport System	Smooth	The city / district traffic running smoothly, fewer delays, rational layout of land development, proper strength	● Proportion of congested parts on expressways and trunk roads ● Road network density / density of road network line ● Mileage of rail transit network ● Mileage of ground public transport network
	Efficient	Time: the tidal nature of urban travel direction decreases, multi-center layout	● Uneven coefficient on the city's main radiation channels
		Space: the ability of transport infrastructure fully utilized, plenty of customers, high-density development around mass transit	● The proportion of land for construction of backbone transit (rail and BRT) network 800-meter coverage ● Bus travel share rate
Environmental Quality	Saving sources	Less occupation of farmland, less land consumption, less demand for added transport facilities	● Population density
	Protecting	Less emissions of air	● Per capita kilometers per

	environment	pollutants, less land consumption for transport facilities, reduced emissions	vehicle / private car VMT
Other Policies			● Availability of preferential public transport policies ● Availability of public participation

7.4 Meso Evaluation Index System

Micro Evaluation Index System covers meso region and meso functional area. Zoning may correspond to the central city or a new town; functional area corresponds to the areas divided in new towns. On the premise of being in line with the macro-level objectives, in combination with the operability and regional location on the meso level, meso Evaluation Indexes are put forward.

7.4.1 Meso Region Indicator System

On the premise of meeting the city's overall development goal, any meso region (new town, central city, etc.) evaluation system needs to consider the position of meso region in city and the own development characteristics of the region.

According to the trends of urban economic development and the orientation of regional linkage, a comprehensive analysis is made to the geographic conditions, development foundation and the carrying capacity of resources and environment of each new city. At the meso level, the representation of land and transport coordination needs more detailed considerations on the operating level. For instance, the traffic pattern should consider walking and cycling. Consideration should be given to the elements of urban design, and supporting public buildings in terms of land development. See Table 7-6 for meso Evaluation Index System.

Table 7-6 Meso Region Evaluation Index System[32]

	Representation of land and transport coordination	Indicators
Degree of Land Intensification	Saving land use, avoiding outward expansion, less land demand for transport construction	● Population density ● Neighborhood total floor area ratio (total floor area / neighborhood land area, including municipal facilities)
	High-density and high-strength development, need for high-capacity public transport support, encouraging TOD development model	● The proportion of land for construction of backbone transit (rail and BRT) network 800-meter coverage
	Decreased tidal nature of travel direction decreases, complete inner land development function of the district,	● Mixed land use (sympson index); ● Proportion of mixed land use ● Jobs-housing balance index

[32] Source: Drawn by the research group

	complete facilities	/employment-housing balance index / ratio of employed population to living population ● Residential units diversification to meet various needs ● Ratio of land for public space including squares and parks ● Proportion of the land for such recreation facilities as swimming pool and playground; ● Level of service of main outwards roads
Efficiency and Service Level of Transport System	Smooth traffic running in the entire region, small interference by through traffic, less delays, rational layout of internal land development, proper strength	● Ratio of congested sections of trunk roads to those of secondary ● Average travel time between main functional centers
	Mixed development in the region, rational distribution and rational growth of various business forms, good transport accessibility and good walking and non-motorized travel	● Bus travel share rate ● Non-motorized vehicle travel rate ● Distance walking to public space ● Distance walking to recreation facilities ● School accessibility (number and percentage of the residents within 500 meters of the school) ● Bus station accessibility (number and percentage of the residents within 500 meters of the bus station) ● Intersection density (intersection quantity / total neighborhood area) / intersection spacing ● Motor vehicle parking spaces construction index ● Bicycle parking construction index
	Convenient external transport convergence, convenient hub transfer, good accessibility, and complementation between internal land development inside an external function	● Level of service of external main roads ● The proportion of land for construction of backbone transit (rail and BRT) network 800-meter coverage
Environmental Quality	Less occupation of farmland, less land consumption, less demand for added	● Population density

	transport facilities	
	Less emissions of air pollutants, less land consumption for transport facilities, less waster gas emissions from the vehicles on it	● Per capita kilometers per vehicle / private car VMT
Other Policies		● Availability of public participation in district planning and transformation

7.4.2 Meso Functional Area Indicator System

Meso functional area should respond to an area with its own typical features as shown below:

- Clear functional orientation (such as residence, commerce, industry, tourism, etc.);
- The boundary of the functional area is separated by trunk roads, highways or rivers;
- Floor area ratio and building height are the planning elements.

The functional area itself has a major function. The different functional features of different functional areas, like living area, commercial area, cultural area and industrial area, decide that the functional area evaluation indicator can reflect the characteristics of various functional areas. As the size of functional area is smaller than that of meso region, jobs-balance is of small significance, but some urban design indicators are able to well reflect its features. Therefore, in combination with the studies on macro indicator system and meso region system, we form the meso functional area indicator system on the basis of the features of functional areas. Table 7-7 details the Evaluation Indexes of meso functional areas.

Table 7-7 Meso Functional Area Evaluation Index System [33]

	Representation of land and transport coordination	Indicators
Degree of Land Intensification	Avoiding single block development, and encouraging mixed land use, rational growth	● Proportion of lands of non main function nature ● Neighborhood total floor area ratio (total floor area / neighborhood land area, including municipal facilities)
	High-density and high-strength development, need for high-capacity public transport support, encouraging TOD development model	● The proportion of land for construction of backbone transit (rail and BRT) network 800-meter coverage
	Avoiding “yard-type” development, and promoting the “micro circulation” system of functional areas	● Average intersection spacing
Efficiency and Service Level of Transport System	Mixed development in the region, rational distribution and rational growth of various business forms, good transport accessibility and good walking	● Share rate of the residents’ green travel ● Share rate of the employed population’s green travel

[33] Source: Drawn by the research group

	and non-motorized travel	● Distance walking to public space ● Distance walking to recreation facilities ● Bus station accessibility (number and percentage of the residents within 500 meters of the bus station) ● Motor vehicle parking spaces construction index ● Bicycle parking construction index
	Smooth traffic at main external entrances, small interference by through traffic, good accessibility, complementation between land development and external functions in the area	● Level of service of external main roads
	Smooth traffic running in the entire region, small interference by through traffic, less delays; rational layout of internal land development, proper strength	● Proportion of congested roads
Environmental Quality	Less emissions of air pollutants, less land consumption for transport facilities, less waster gas emissions from the vehicles on it	● Share rate of the residents' green travel ● Share rate of the employed population's green travel ● Proportion of congested roads
Other Policies		● Availability of public participation in district planning and transformation

7.5 Micro Evaluation Index System

Micro Evaluation Index System focuses on block. At the block level, there is no need to consider population size, jobs-housing balance and other macro and meso factors, but coordination between better urban design and transport design.

Table 7-8 Micro Evaluation Index System [34]

	Representation of land and transport coordination	Indicators
Friendliness of near-road streets to pedestrians	Good interaction and coordination between buildings and roads, creating a walkable environment.	● Aspect ratio of building to street ● Building concession distance ● Proportion of buildings with ground apartment for commercial use among all near-road buildings

[34] Source: Drawn by the research group

		● Glazing ratio of the ground apartment for commercial use of near-road buildings ● Distance of building entrances from sidewalk ● Maximum no-door / window distance of near-road buildings
Friendliness of roads to pedestrians and bikes	Ensure the road of road sidewalk, non-motorized lanes, reducing interference and encroachment by other facilities.	● Sidewalk width ● Proportion of the entrances/exits of motor vehicles across the sidewalks (exceeding no 10%) ● Barrier-free facilities ● Proportion of triple and quadri-carriageway roads in bikeways with physical isolation ● Width of non-motorized vehicle lane
Environmental Quality	Less emissions of air pollutants, less land consumption for transport facilities, less waster gas emissions from the vehicles on it	● Ratio of road subject to greening ● Road green coverage
Other Policies		● Availability of public participation in district planning and transformation

[i] https://www.federalregister.gov/articles/2002/07/08/02-16998/designation-of-transportation-management-areas