

Relationship between Traffic Impact Analysis and City Construction—A Case Study in Beijing

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Abstract: From 2004 to 2008, there were 1 179 construction projects experienced traffic impact analysis (TIA) in Beijing. To analyze the relationship between TIA and city construction, the paper summarizes the TIA project development trend and characteristics by project count and scale, geography position, and project type. The paper also analyzes the relationship between TIA and city infrastructure construction, especially the relationship with infrastructure construction investment, such as metro and urban road projects. Finally, the paper points out key issues and the problems existed in present work, such as the relationship between infrastructure construction and plan, road construction, and post project supervision. It also provides experiences for Beijing and other cities on TIA.

Key Words: traffic impact analysis; construction project; city construction; transport infrastructure investment

1 Introduction

As a common challenge in growing mega city around the world, the traffic problem has been puzzling Beijing's traffic planning and management authority along with the fast urbanization and motorization development in the past decade^[1,2]. To control traffic demand and reduce traffic congestion from the traffic source, Beijing launched the measure of traffic impact analysis (TIA) in 2001. In 2004, the city began to manage the measure more intensely, and got some achievement in adjusting and optimizing the scale of construction projects, and adding roads, public traffic stations and other infrastructures reasonably. All these measures have promoted the harmonious development of urban land use and transport. Looking back on the past years, some trend and characteristics can be seen in both the development of urban construction projects and the infrastructure construction. However, in the general view of harmonious urban development, there are still some points to be noted, reflected on, and improved in TIA measure^[3,4].

2 Basic characteristics of TIA projects

From 2004 to 2008, Beijing has conducted TIA on 1,179

construction projects, which demonstrated the following development trend and characteristics as indicated by statistical analysis on relevant data.

(1) The number and scale of TIA projects growing steadily

Table 1 lists the number of TIA projects and their building scale from 2004 to 2008. According to the table, TIA projects saw steady growth in 2005, with their number increasing only by 9, and building scale increasing by 1.44 million square meters from 2004. However, 2006 saw strong growth in both the number and scale, increasing by 24.17% and 37.11% respectively from 2004. In 2007, the increases were 22.27% and 75.99% respectively. Although the pace is slightly slowed in 2008, the building scale still maintained a relatively high level^[5].

Table 1 TIA project number and scale between from 2004 to 2008

Year	Number of projects	Building scale (10,000 m ²)
2004	211	3 940
2005	220	4 084
2006	262	5 402
2007	258	6 934
2008	228	5 801

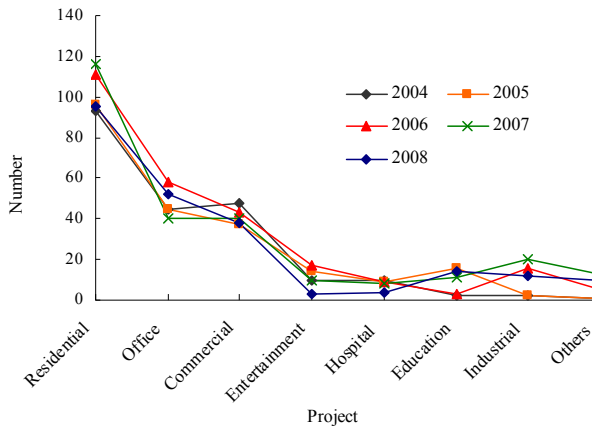


Fig. 1 TIA project amount by type from 2004 to 2008

Table 2 Each type TIA project ground area ration from 2004 to 2008 (%)

Project	2004	2005	2006	2007	2008
Residence	62.8	52.1	54.4	53.9	50.0
Office	10.5	12.5	12.6	11.5	24.4
Commercial	17.5	15.6	7.7	5.9	11.8
Culture and entertainment	7.4	3.3	13.5	0.9	0.5
Hospital	1.7	1.3	2.0	0.1	0.3
Education and research	0.2	11.5	2.1	16.2	5.2
Industry	0.1	3.4	7.2	10.9	6.6
Others	0.0	0.2	0.7	0.5	1.1
Total	100	100	100	100	100

(2) TIA projects moving to suburbs

The distribution of TIA projects in Beijing’s three administrative regions, namely the Four Inner Districts, the Near Suburb, and the Remote Suburb, in the past few years was as follows. From 2004 to 2005, urban construction projects were mostly situated in the Four Inner Districts and the Near Suburb. In 2004, the projects in the Four Inner Districts, Near Suburb, and Remote Suburb accounted for 36.0%, 60.2%, and 3.8% of the city total, respectively. In 2006, the focus of construction of development began moving towards the Remote Suburb at a fast pace until the number of distribution was so inverted that the Four Inner Districts, Near Suburb, and Remote Suburb accounted for 6.1%, 46.1%, and 47.8% of the city total number respectively in 2008. In only five years, the urban construction has become suburb-oriented.

(3) Residential projects maintaining a high percentage

Figure 1 depicts the building nature distribution of construction and development projects in the past few years. It indicates a consistent characteristic of development in terms of the number of construction projects from 2004 to 2008; that is, residential construction has been the hottest spot of construction and development, followed by office and commercial construction. Projects of culture and entertainment, hospitals, education, and scientific research only shared a little percentage.

Table 2 indicates a statistical analysis on projects of

different building natures from the aspect of the ground building scale from 2004 to 2008. According to figures in the table, each building ground area characteristic follows the similar development trend with the number of construction projects. In 2004, the scale of residential buildings accounted for 62.8% of that of all buildings. Although the percentage has dropped since then, it was still one half in 2008. Office buildings remained at approximately 11% from 2004 to 2007, but jumped to 24.4% in 2008.

3 Harmonious development of construction projects and transport infrastructure

The relationship and the harmony of development between urban transport construction and construction projects are analyzed from the aspects of preliminary infrastructure investment in urban transport and the completed urban roads after project completion.

3.1 Relationship between transport infrastructure investment and construction projects

Relevant statistics reveal that transport investment has increased by 247.71%, from RMB 10.9 billion in 2004 to RMB 37.9 billion in 2008, together with urban construction and development^[6]. According to Table 3, the transport infrastructure investment and the number and scale of construction projects generally kept an increasing trend from 2004 to 2007 in terms of the development characteristics. Similar to the increase of scale, the increase of investment was slightly higher than that of the number. In 2008, despite of the slightly weakened urban construction in the gloomy world economy, the investment still kept increasing.

3.2 Relationship between different types of transport infrastructure investment and construction projects

Figure 2 shows the relationships between the development trends of construction projects and urban roads, highways, and rails. In 2004, the investment in highways was RMB 4.3 billion, much more than that in urban roads and rails—RMB 2.2 billion and RMB 2.5 billion, respectively. According to Fig. 2, Beijing’s investment in urban roads was kept at about RMB 2.5 billion from 2004 to 2008. However, since the investment in rails and highways began to increase in 2005, they climbed to RMB 12.7 billion and RMB 16.9 billion respectively in 2008, nearly twice and three times as much as that in 2004.

Table 3 Transport Infrastructure investment and TIA project from 2004 to 2008

Year	Transport investment (RMB 0.1 billion)	Number of TIA projects	Building scale (100,000 m ²)
2004	109	211	394
2005	137	220	408
2006	267	262	540
2007	345	258	693
2008	379	228	580

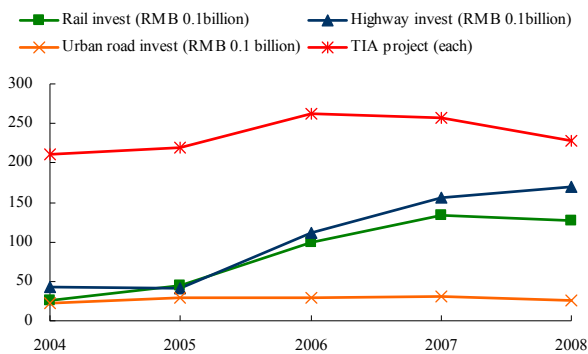


Fig. 2 Each type transport infrastructure invest and TIA project from 2004 to 2008

3.3 Distribution relationship between urban road construction and construction projects

A statistical analysis on the mileage and geographical location of completed urban roads reveals that: more than 40% of the roads were located at the northern near suburb from 2004 to 2008, and nearly 30% of them were located at the eastern urban area from 2007 to 2008; their percentage in the southern urban area did not exceed 17% in any year. A comparison with the geographical distribution of construction projects in the past few years indicates that the urban road construction has been much inconsistent with the construction projects. The areas with massive development of construction projects have not yet been sufficiently supported by urban road construction. The necessary coordination and communication between the two is still insufficient.

3.4 Mode of urban construction and the development of transport infrastructures

In view of their development trend, urban construction had been generally separated from transport infrastructures before TIA was conducted, as a result of many factors such as the management scheme, industry separation, and lack of transport awareness. Such infrastructures had always been less developed than the urban construction and development. Typical cases were the large residential communities like Huilongguan, Tiantongyuan, and Wangjing developed in the previous years in Beijing.

Since 2004, TIA has helped many social industries further understand transport in urban construction and development. Especially, the continuously increasing investment in road construction and rail transport has improved traffic reachability and public transport convenience throughout the city in recent years. However, the construction in some construction projects has not yet been matched by their surrounding urban roads. In some areas, urban roads are less developed than the construction, or only some high-grade primary arteries have been constructed, or the land for low-grade roads has been used for other purposes. The transport infrastructure constructions in the massive

developments at the Mapo region of Shunyi District and the New Town of Tongzhou District are of these cases. Therefore, it will be a long-term task to enhance people's transport awareness and to promote the construction and development to be closely related and synchronously implemented with transport infrastructures.

4 Reflecting on TIA in urban construction

In view of TIA's support for the preliminary planning of urban construction and development in the past few years, some successful aspects and weakness can be summarized from the above development characteristics of urban construction and the transport infrastructure construction. In addition, some issues of mechanism, procedure, and techniques still affect the TIA effects in particular work and should be considered and addressed^[7].

4.1 Relationship with transport infrastructure

In the past few years, TIA's contribution to the construction of urban transport infrastructures included nearly 23 km of new urban expressway, more than 200 km of new artery roads, and 84 km of new rails. This has helped to "pay back historical debts" of transport infrastructures and encourage harmonious development between urban transport and land use.

In addition to helping to increase the overall traffic capacity of the city, TIA also produces measures to improve roads for particular construction projects. When a project is being conducted, TIA requires its undertaker to take over land for urban road construction, so that the project will have basic travel conditions. This is generally feasible for new projects in the urban area. However, some projects being developed are surrounded by immature road networks which consist of few completed and planned roads, especially in new towns such as Kangzhuang region of Daxing District. In such a case, access to external regions will not be available even if all roads surrounding the projects are completed. Therefore, to ensure external access after the project completion, some roads connected to completed arteries should be built together with the projects, in addition to taking over land and constructing the roads as planned.

4.2 Interface with relevant urban plans

The master city plan and the controlling detailed plans are important basis of TIA. However, the relevant plans of some regions are continuously and dynamically adjusted in the current environment. This not only puzzles but also creates opportunities to TIA. In particular work, it is important to handle TIA's relationship with urban planning in the following two aspects to ensure TIA functionality.

(1) Standing on constructive detailed plans

TIA is mostly carried out in the stage of controlling detailed planning, where the planned road networks become "ultimate" and hard to implement. For example, the grade proportion and

density of road networks planned for some projects submitted for TIA seemed good but impracticable at Xinjiekou area of Xicheng District and Lianxiang Bridge area in Zhongguancun region.

Therefore, TIA should be more profoundly carried out on the stage of constructive detailed planning to identify the line locations and the type of planned roads. Only in this way can we determine how a construction project can impact surrounding roads and thereby provide practicable guidelines to the project.

(2) Interfacing with greenbelt plans

In recent years, greenbelts are accommodating more construction and development projects, which, as investigated, are mostly for residence but few for office buildings. In greenbelts, weak transport infrastructures and sparse roads are planned. But in the construction and development, transport cannot carry the high-intensity development. For example, after many residential buildings were developed at Chengshousi area of Fengtai District, the traffic congestion at surroundings is becoming more serious. In response to this situation, transport facilities should be built in support of greenbelts being planned, constructed, and developed. This is the only functional way to ensure travels in greenbelts.

4.3 Development modes of road transport in new towns

For decades, road layout in Beijing's urban area has been characterized by "wide but sparse roads" as affected by the old central city and the protection of historic relics during the course of development. The urban road density is far lower than the average of mega cities around the world. In addition, the city has more roads for pass-through but less for collection. This layout has been one of the major reasons that reduce the overall capacity of urban roads and ignite many traffic problems.

It should be said that the current road layout and its particular transport result in Beijing's urban area should be a typical lesson to guide the development of new towns, where many problems of road planning and designing in the urban area should be avoided. But at present, the development mode of roads in the urban area is still copied by some new towns such as Tongzhou and Shunyi. Some regions go even further. For example, branch roads planned for Mapo region are apparently insufficient. From such a development trend, it can be expected that new towns will repeat the traffic congestion of the urban area in the near future. To avoid further evolution of such a situation, new towns should establish a road transport layout suitable to their sustainable development by examining the particular condition, improving their road plans, optimizing grade proportion, increasing the density of roads especially branches, and adopting reasonable TIA comments.

4.4 Parking on urban roads

As required by some relevant construction plan and urged

by TIA, new residential communities should be constructed together with planned surrounding urban roads, the land for which should be taken over by the undertaker of the communities. However, these urban roads, when completed, become free parking lots of some completed residential communities such as those near Datun Road of Chaoyang District because: (i) the estate developers deliberately told the public that such urban roads are those within residential communities on the early stage; (ii) residents dislike any urban road in their communities because it will affect their living; (iii) residents do not want to park their motor vehicles in charged parking lots of communities. In such a situation, it becomes rather difficult for the relevant governmental departments to accept these urban roads, which often require coordination among multiple parties before being returned to the city. Therefore, to avoid such parking on urban roads, different parties should jointly present their understanding and supports, including the proper publicizing by estate developers and immediate intervention by governmental departments of inspection and acceptance. This can help to release the function of roads after residential communities are completed and improve the microscopic circulation systems of regional transport. Only in this way can TIA-recommended measures be implemented.

4.5 Post-project supervision and evaluation of TIA-recommended measures

To ensure convenient travels to and from some construction projects after they have been completed, TIA often proposes some particular measures to construct roads and public transport stations in the same period, which are considered as the prerequisites of the project construction and development. However, investigation on some completed projects in the past few years indicates that the necessary measures provided for by TIA have not been completely implemented during the final execution of the projects. This is the case with the additional access roads expressly required by TIA of Henan Village Project of Shunyi District and the Oriental Garden (Dongfangyayuan) Project of Chaoyang District.

This uncovers some defects of mechanism and system throughout the procedure of urban construction and development, which result in partial disengagement between the preliminary planning and the implementation of construction projects. The preliminarily specified measures are continuously weakened or overlooked in the construction. In addition, the implementation result of the projects has not been punctually reflected to the preliminary work. This is why post-project supervision and evaluation become necessary to ensure generally coordinated planning and construction, to plan and guide the construction, to provide constructional feedback to the plan, and to take successive measures appropriate to the local conditions.

5 Conclusions

In recent years, Beijing's TIA has helped coordinate the relationship between urban transport and land use. Especially, TIA measure, as one of the duties of Beijing Municipal Committee of Transport, has played an important role in improving the surrounding transport condition of construction projects and promoting the construction of urban transport infrastructures on the preliminary planning stage of such projects since 2004. However, the TIA measure is inevitably to interface and collide with related parties during their execution in the fast urbanization and motorization of mega cities. Therefore, TIA in urban construction should have a well handled interface with transport infrastructure construction and relevant plans. In addition, it should identify development mode of road transport in new towns, and coordinate among related parties to avoid parking on urban roads. The TIA measure should be supervised and evaluated after the projects have been completed. In addition to accumulating TIA experiences, we should escalate its position from the aspects of government system and mechanism. Moreover, we should communicate and coordinate with all relevant parties and strengthen the trade management, so that the leading role of transport can be maintained. If we do so, the harmonious transport construction will become a driving force for the sound development of the city.

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