Chapter 11
Sustainable Development of China's Road Transportation Infrastructure: Situation and Prospect

Jie Zhang, Kai Liu and Yurong Zhang

Abstract Along with the rapid development of the national economy, as well as the increasing of transportation on road, China's road traffic infrastructure faces major challenges. It has been already widely accepted that it is imperative to protect the environment in the process of road transportation infrastructure construction and further realize the sustainable development of the transportation infrastructure. In this paper, the current situation of China's road transportation infrastructure is analyzed; and the philosophy and connotation of the sustainable development of road transportation infrastructure is elaborated; at last, the corresponding countermeasures concerning the legal, fiscal and demonstration policies are provided.

Keywords Road traffic infrastructure · Sustainable development · Current situation · Policy countermeasure

11.1 Introduction

Since the twentieth century, the human beings have faced serious environment challenges, including that the resources are increasingly exhausted, ecological destruction and frequent accidents of all kinds of pollution. Therefore, the environmental problems have become one of the global problems which the human beings faced today, countries all over the world have set sustainable development

J. Zhang (✉) · K. Liu
School of Traffic and Transport, Beijing Jiaotong University, Beijing 100044, China
e-mail: zhangyr1988@126.com

Y. Zhang
School of Civil Engineering, Beijing Jiaotong University, Beijing 100044, China

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as a strategic target; claiming that in order to achieve the harmonious development between human beings and the environment, it is necessary to persist on the sustainable development.

Transportation infrastructure construction is the basic industry of national economy, and it is the support and guarantee for the development of economy and society. The level of transportation infrastructure construction development is directly related to the rate of national economic development. Non-sustainable of transport infrastructure will be a direct result of non-sustainable of urban economic development, environmental and social equity. At present, the Chinese government has been gradually increasing the intensity of investment in the road transportation infrastructure. In 1978, the China's highway mileage was only 890,000 km. However, by 2006, the China's highway mileage has reached 3.457 million km, which is over three times than that before the opening up. In 2008, the newly increased highway mileage of China reached 100,000 km, including 6,433 km expressway which reached 60,300 km, ranking the second longest expressway in the world. And the construction of road infrastructure investment increased by 2.4 % to 664.5 billion Yuan. However, there are still a lot of problems in the road transportation infrastructure of China. Although the road transportation infrastructure can promote the economic and social development, it still had a huge impact on the ecological environment. For example, in 2008, the annual carbon emission of China was about 5 billion tons. And the greenhouse gas emission accounted for about 10 % of the total national greenhouse gas emission. Besides, the construction of road transportation infrastructure will destroy the natural environment, landscape and water resources and cause the natural environment pollution around, especially in some fragile environmental areas. In addition, in recent years, the road accidents happened frequently in China, both in the construction phase and in the operation phase. Among these impacts, the road bridge accidents caused the largest damage, the most serious loss and the most severe social influence.

Therefore, we should establish the concept of circular economy, rely on technological progress and develop high efficiency and low energy consumption transport equipment and new technologies for traffic-related environmental protection. We should conserve resource, reduce energy consumption and protect the environment to build economical transport industry and get to clean transport and green transport, thus achieving sustainable development of road transportation infrastructure in our country.

11.2 The Status of China's Transportation Infrastructure

For a long time, the development of road traffic infrastructure in China shows a model that: Economic scale expansion→Traffic demand to expand→Passive increase of road infrastructure→Re-expansion of the economies→Stimulating traffic demand to expand. In China, with the sustained growth of urban industry

and the size of the population, it made the road transport needs growing, which led to the road transportation infrastructure in China relatively weak. It mainly reflected in the following points.

11.2.1 Road Transport Planning is Seriously Constrained by Land

The development of road transport infrastructure has been severely hampered, due to the land constraints. According to the Beijing's land use planning, in the year of 2010, the land for traffic is 434.7 km^2, only accounts for 13 % of the total construction land. In addition, the high cost of land use increased the cost of the transport infrastructure significantly. According to the related statistics, the average price of the land in Tokyo's main block is about 24,000 Yuan/m^2, while it is 34,330 Yuan/m^2 in Guangzhou.

11.2.2 The Lack of Comprehensive Consideration of Transport Infrastructure Planning

Currently, the irrationality of the road network structure is widespread in China, such as the proportion of low-grade highway is large, the road grade is low and the road function is not well defined, all of these making the traffic efficiency greatly reduced. In addition, in China, the rural highway construction task is heavy, and the rural highway maintenance is backward. Therefore, it's urgent to consider the integrated planning of rural transport infrastructure and the construction of custody mechanism.

11.2.3 The Lack of Comprehensive Management Mechanism of Transport Infrastructure

There are still serious traces of the planned economy in our transportation infrastructure management. Owing to the lack of full consideration of the repair and maintenance in the operation period of infrastructure, a lot of infrastructure deterioration problems and greatly reduced the structure life.

In the face of the current status of our urban transport infrastructure, some scholars carried out some related researches for sustainable development in China's transportation infrastructure. In 1998, Xiong Yongjun discussed the relationship between the transport and sustainable economic development from a perspective of sustainable economic development and held that "the traffic

development is closely related to the implementation of the strategy of sustainable development" (Xiong and Xiong 1999). In 1999, Zhu Zhongbin pointed out that an important criterion to measure the sustainable transport is whether the transport system could maintain long-term dynamic social net income or welfare maximum (Zhu 1999). In 2001, Chen Qian analyzed the negative impact of transportation infrastructure on the land and resources and suggested to eliminate the impact of transportation from three aspects of the economic policy, legal management and publicity and education (Chen and Wang 2001). In 2006, Zhou Jun, who analyzed the structure of the urban transport infrastructure and its collaborative relationship with the city and internal rules, proposed the integration mode of the sustainable development of urban transport infrastructure (Zhou and Liu 2005).

In addition, some academic activities related to the traffic sustainable development have been carried out, such as Asia-Pacific conference of the sustainable development on traffic and environmental technology, Sustainable Development Strategy and Construction Forum on urban rail transit of China, etc., various types of traffic engineering journals and newspapers such as Chinese Journal of Highway, Chinese Journal of Engineering and Management of Road Traffic have been published. These academic activities have greatly attracted industry experts and scholars, they communicate and discuss on the environment and sustainable development issues in the transport industry, and they promote new theories and new results published.

11.3 The Concept and Connotation of the Sustainable Development of Transportation Infrastructure

11.3.1 The Concept of Sustainable Development of Transportation Infrastructure

In 1987, a report named submitted "Our Common Future" by the World Environment and Development Commission (WCED) put forward a widely accepted definition of sustainable development, i.e. 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development 1987).

Sustainable development of the transport is put forward under the sustainable development theory based on the fact that there are unsustainable factors in the existing transportation system, therefore, the focus of traffic sustainable development is: how to realize the harmonious development of the economy, society and ecology as well as the transportation department's own development according to the basic requirements of sustainability. As a result, we should understand the basic connotation of sustainable transport from the following three aspects.

(1) **Economic sustainable development of transport**
Transport system as a subsystem of the socio-economic system, whose sustainable development is an important part of sustainable social and economic development. The traditional mode of transport development is unsustainable, mainly displays in the discordance among the transportation system supply capacity, resource consumption, environmental and ecological protection with the requirement of economic sustainable development.
Therefore, the economic sustainable development of traffic should include two meanings. First, in the view of the relationship between transport and national economic, the transport system should meet the demand of economic and social development, i.e. the traffic system should coordinate with the national economic and social development; Second, in the view of the internal transport system, it is necessary to realize the transportation efficiency, i.e. the sustainability of the economy of the transport system. The transport system should be ensured that it can improve the people's material condition, provide an economic traffic which can meet the continuous changing needs, pursuit the traffic economic benefits, and achieve the benign circulation of the traffic assets.

(2) **Social sustainable development of transportation**
Traffic social sustainable, i.e., make full use of transportation functions to eliminate poverty, adjust and improve the social justice, and at the same time, all the society members can share the benefits of transport development equally.
To achieve sustainable social development of the transport, we must change our values. i.e. we must shift from the traditional concept of the simple pursuit of the quantity expansion to the new concept of sustainable development which lays emphasis on the comprehensive benefits and the long-term impact; we must shift from the traffic consumption concept of the individual's desire to the public interest; we must shift from the traffic management of a single decentralization to the bilateral control which equally emphasis on the source and flow.

(3) **Ecologically sustainable development of transport**
Ecologically sustainable development of the transportation, which called for promoting the construction and development of transportation systems, meanwhile emphasizing on the protection of the ecological environment and development and utilization of resources reasonably (mainly refer to the non-renewable resources); emphasizing on the expansion of the road network and channel, and at the same time paying attention to the supervision of the transport system, ensuring that the traffic, environment and ecology keep coordination and compatible relationship. Besides, it is necessary to minimize the negative impact of transport development on the environment and ecology, especially the negative impact on the human life and health.

11.3.2 Connotation of Sustainable Development of Transport Infrastructure

Transportation infrastructure system is accompanied by the development of economic systems, social systems and environmental systems, therefore, the development of transport infrastructure must also meet the need for economic and social development at present and in the future, improve resource utilization efficiency, improve the environmental quality, realize the coordination development among transport and economic, society and environment. In the meantime, it is urgent to enhance the security and stability of the transportation system. The basic pattern of the sustainable development of transport infrastructure systems is shown in Fig. 11.1.

In this integrated model, firstly, transport infrastructure system acts as the core part, and then gradually spread to form a stable system including economic, social, and environmental system elements which associated with the transport infrastructure system. Secondly, the structural elements associated with the transport infrastructure of economic, social and environmental systems act as carriers, gathered into a coherent system, and then through the continuous exchange of the elements, a coordinated whole is formed. This integrated structure mentioned above in essence is the basic mode of sustainable development of transportation infrastructure system. This development model will directly promote the economic progress healthily and steadily, and then forma sustainable development situation, finally promote the coordinated development of economy, society and environment.

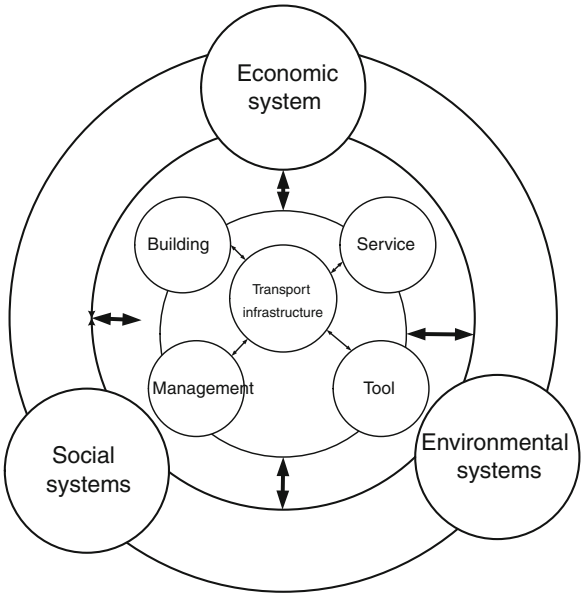

Fig. 11.1 The integrated model of transportation infrastructure sustainable development

11.4 Some Measures of the Transport Infrastructure Sustainable Development

The focus of transport development in future is to expand the capacity, optimize the structure, improve the quality, improve the service, guarantee the safety and protect the environment, which is a very difficult task. To achieve the sustainable development of transport infrastructure, on the one hand, the development of transport infrastructure must meet China's economic and social development needs, and lay the material foundation for sustained, healthy and rapid economic society development; on the other hand, the development of transport infrastructure must adapt to environmental capacity and resources reserves. Therefore, this article puts forward several countermeasures of the sustainable development of transport infrastructure in China.

(1) **Update the laws and regulations of transportation infrastructure, then further strengthen the management of environment protection**
In order to promote the sustainable development of the transport infrastructure, the Ministry of Transportation (MOT) has issued a series of laws and regulations, for example "Traffic construction project environmental protection management regulations" (Ministry of communications of the people's Republic of China 2003)," Specifications for Environmental Impact Assessment of Highways"(JTGB03 2006), and " Design Specifications of Highway Environmental Protection" (JTGB04 2010), etc. However, the related standards with the sustainable traffic infrastructure are very limited, there is no description of the design, construction and acceptance specifications about road greening, landscape protection, noise control. Therefore, we should further improve the transportation infrastructure sustainable construction laws and regulations to provide the basis for promoting the sustainable development of the transport infrastructure.

(2) **Improve operational marketization of the transport infrastructure**
Improving the traffic infrastructure marketization helps to create and enhance the value of the transportation infrastructure, and guarantee the normal repair maintenance costs of the transportation infrastructure, so as to achieve the purpose of capital circulation, which is conducive to perfect the regulation of further attract more capital into.

(3) **Increase the propaganda of sustainable development of the transport infrastructure**
Propaganda work is an important means of improving public realization to sustainable development of transport infrastructure, through the use of the media publicity, technical training, the seminar will be held, can effectively improve the social awareness and supervision.

11.5 Conclusion

In view of the present situation and existing problems of China's highway transportation infrastructure development, we should be aware that if we want to achieve highway traffic infrastructures' sustainable development, we must change the traditional traffic models, carry out an integrated transportation infrastructure planning to ease the pressure of resource and environment. The saving transportation industry must be established to improve the quality of transport services, and make the integration of transport to come true, improve the people's living standards and the competitiveness of the national economy. Related industry management must be strengthened to ensure that the transportation infrastructure quality in the design and construction.

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