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**CHALLENGES FOR THE SUSTAINABLE
DEVELOPMENT OF ROAD SYSTEMS**

**ROAD SECTOR DEVELOPMENT PROGRAM AND
CHALLENGES**

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ABSTRACT:

The report outlines the road sector development in the past two decades and the National Expressway System development program as well as the institutional reform and application of advanced technology of pavement management system in road asset management and maintenance, including overload control, safety program and environmental protection measures in the road sector development. Also presented in the report are challenges arising from rapid urbanization development which demand more institutional reform and capacity building to improve land use and to achieve integrated transport system planning.

1. INTRODUCTION

Road transport has been developing rapidly for two decades in the People's Republic of China's along with its transition to a market economy. In the past ten years, total road mileage increased by 770000 km from 1157009 km in 1995 to 1930543 km in 2005; and Expressway mileage increased by about 39000 km from 2141km in 1995 to 41005 km in 2005. Passenger-km volume and freight ton-km volume shared by road increased from 14.6% to 20.8% and from 39.9% to 53.2% respectively over 1985 – 2005.

Table 1 - Classified Road Mileage in China

	Unit	2005	2001	2000	1995
Total mileage	1000 km	1,930	1,698	1,679	1,157
Expressway	1000 km	41	19	16	2
Class I	1000 km	38	25	25	9
Class II	1000 km	246	182	177	84
Class III	1000 km	344	308	305	207
Class IV	1000 km	921	800	791	606
Subtotal	1000 km	1,591	1,336	1,315	910
Substandard road	1000 km	338	362	364	246
National road	1000 km	133	121	119	110
Provincial road	1000 km	233	213	212	175
County road	1000 km	494	463	462	366
Rural road	1000 km	981	814	801	454
Accommodation road	1000 km	88	86	86	50

Investment in road development was CNY 548.5 billion in 2005, increased by 16.6% over the previous year. The investment for key road project, usually expressway and high-grade road, was CNY258.6 billion, increased by 47.8% over the previous year; that for county and rural road was CNY139.904 billion, increased by 12.6% over the previous year; and that for reconstruction was CNY150.0 billion, increased by 87.7% over the previous year.

Most of the fund for the road development in 2005 came from domestic bank loan, accounting for 38.2%, and self financing (mainly from road maintenance fee at provincial level) and other sources, accounting for 43.1%.

According to the development blue print set forth by the Central Government, by the year of 2020, the development target of a well-off society will be materialized with the GDP four times as many as that in 2000, with per capital GDP up to USD 3000. Great challenges still exist for road sector in China to meet with the increasing demands for a sustainable socio-economic development. Given the disparities in regional development in China, it is necessary to strengthen the economic cooperation between the eastern and the western regions and to develop a more efficient and effective transport system to support the movement of goods and people between the regions.

2. ROAD SECTOR DEVELOPMENT PROGRAM

2.1. National Expressway System development program

January 2005 the State Council of the P.R. China announced the National Expressway System Development Program with total mileage of 85000 km to be built in 30 years. The National Expressway System will be composed of 7 radiated routes from the capital of Beijing, 9 south-north routes and 18 east-west routes or known as “7918 network”, connecting all the cities with population over 200000, covering areas with population over one billion and GDP over 85%. After completion of the national expressway network, the average time access to the expressway system for the eastern areas is in half an hour, that for the midland areas is in one hour, and that for the western areas is in 2 hours.

The National Expressway System development program also includes 30 more connection sections between regions, connecting with 50 more railway hubs, 67 airway ports and 50 waterway ports. By the year of 2010 annual average investment to the national expressway system will be over CNY 140 – 150 billion for newly built 3000 km of expressway per year, and that over 2010 – 2020 will be CNY 100 billion.

2.2. Road sector development target over 2006 - 2010

Total road mileage will reach 2.3 million km by the end of 2010, including 65000km of expressway, 45000km of Class I and Class II roads, 1.8 million km of county and rural roads, with total newly built road of 380000km including newly built Class II road of 130000km and newly built expressway of 24000km. Newly built and reconstructed rural road will be 1.2 million km over 2006 – 2010. 100 percent of the townships and administrative villages will have motorized access by road, 95 percent of the townships and 80 percent of the administrative villages will connected with bitumen (cement) paved roads. There will be regular bus service for all the townships and administrative villages in the eastern region and the economically developed Midland area; for 99% of the townships in the economically developing Midland area and the western regions; for 95% of the administrative villages in the economically developing Midland area and the western regions.

2.3. Rural Road Development Program

Rural roads in this report refer to county roads, town roads and village roads. Total mileage of rural roads accounts for about 76% of the total highway mileage in China. In the current regulations, county roads refer to roads with political and economic significance, connecting counties, counties and towns in the county. Town roads refer to those serving for production and daily life of the farmers in towns and villages, connecting towns and towns to the outside world. In the Highway Law of the PRC, there is no definition of village road. For a long time, village roads are thought to be those used by local villagers and the mileage of village roads was not included in the highway statistics. In 2000 the Ministry of Communications (MOC) launched second survey of national highway system and defined the village road as the roads built by manpower with subgrade width of 4.5m at least, not included in town road and county categories, connecting villages and the villages to the outside world. The village roads and relevant statistics in this report are based on this definition.

Table2 - Rural Road Mileage in China (Unit: 1000 km)

Year	Total	County road	Town road	Village road
1996	848	378	469	-
1997	880	379	500	-
1998	920	383	536	-
1999	987	398	589	-
2000	2195	406	623	1165
2001	1277	463	813	-
2002	2535	471	865	1198
2004	1424	479	945	
2005	3056	494	981	1581

By the end of 2005, total mileage of county and town roads reached 1476000km. The proportions of towns and villages with motorized road access increased from 91.5% and 65.8% in 1978 to 99.81% and 94.3% in 2005 respectively. There were 75 towns and 38426 administration villages with no motorized road access in 2005.

To develop the rural economy and to increase farmers' income, in 2002 the State planned to invest CNY50 billion in the construction of rural roads in three years, including CNY15 billion of state treasury bonds and CNY15 – 20 billion of vehicle purchase tax revenue from the MOC. In addition, the MOC planned to invest CNY30 – 40 billion of vehicle purchase tax revenue in five years for county/town roads construction so as to further mobilize local governments' initiatives in building rural roads. In fact total investment in rural road development reached CNY151.3 billion in 2006, increased by 8% over the previous year, with the fund from vehicle purchase tax revenue increased by 43%. A total of 32500 km of newly built and reconstructed rural roads were accomplished in 2006.

Rural Road Development Program in the 11th Five-Year Plan Period (2006 – 2010):

According to the "National Rural Road Development Program" made by the MOC, over the year of 2006 – 2010 a total of 1.2 million km of rural road will be newly built and reconstructed to improve and enhance the road with bitumen pavement and cement pavement. By the year of 2010, almost all of the towns and administration villages will have motorized road access; and the county/town roads will be up to high or sub-high type pavement roads. By the year of 2020, all the towns and administration villages will have regular bus service.

2.4. Regional road network planning and priority

To promote coordinated transport development, among the northeast old industrial base, the Bohai Bay-rim area, the Changjiang River (Yangtze) Delta area, the Pan-Zhujiang (Pearl River) Delta area, the Midland area and the Western Regions, regional road development programs have been accomplished and coordinated transport development is one of the priorities of the MOC and the other priority areas including:

- to facilitate urban and rural area transport;
- to support rural and minority nationality areas' road development;
- to improve road transport efficiency and service quality;
- to promote modernization of transport vehicles;
- to strengthen safety and emergency response system;
- to speed up information technology application;
- to implement technological innovation and human resource development;
- to develop resource conservative transport system, to improve the efficiency of resource use in transport sector.

Table 3 - MOC Road Sector Main Target Indicators over 2006 – 2010

Indicators	Targets
Class II road (km)	450000
Share of Class II road in National Trunk Road (%)	80
Eastern region (%)	95
Midland area (%)	87
Western region (%)	65
Share of Class II road in Provincial Trunk Road (%)	65
Eastern region (%)	80
Midland area (%)	75
Western region (%)	50
High-type pavement in National & Provincial trunk road (%)	97
Eastern region (%)	100
Midland area (%)	98
Western region (%)	90
National & Provincial trunk road pavement in good condition (%)	88
Expressway in good condition (%)	95
Road in good condition national average (%)	76
Annual recovery of flood damaged National & Provincial trunk road (%)	95

3. ROAD ASSET MANAGEMENT BY EFFECTIVE MAINTENANCE, OVERLOAD CONTROL AND SAFETY PROGRAM

3.1. Road asset management and maintenance

With fast growth of traffic on national/provincial trunk roads, there are more and more pressure on road administration agencies. The pavement condition is deteriorating rapidly with more demand for maintenance work; on the other hand, the road users are expecting the road sector to provide better service and to reduce road work that may induce traffic congestion. Many years experience showed that traditional methods would not work to solve the complex road maintenance problem. The overall goal of road maintenance is to prolong the service life of road pavement and to make the major and rehabilitation maintenance cycle longer and to reduce the time of lane occupation caused by road work.

To make more effective use of the road system, China is undergoing market oriented institutional reform of the road maintenance system combined with modern maintenance technology. The CPMS developed by the Research Institute of Highway provides a series of technology for scientific analysis and decision-making for the preventive maintenance work, including the pavement condition fast inspection method, equipment, evaluation criterion and analysis software. The most important function of the CPMS is to make right and timely decisions on the implementation of proper preventive maintenance activities before the pavement deterioration rapidly happened, so as to restore the pavement performance in time and in cost effective way.

3.2. Overload control

The road sector in China suffered great amount of costs of road damage from overloading, despite the weight limit specified by the Highway Law. To reduce the damage cost and

make more effective use of the road asset, there are about a total of 4700 weight and size enforcement and unloading stations across the country, of which 2772 stations are set on the trunk road. There are great difference in terms of layout standards and the operation of the enforcement stations, and quite amount of the stations are simple and temporarily set. The efficiency of these stations is questioned and the MOC is going to standardize the layout and operation of the enforcement stations. A study project commissioned by the MOC was completed concerning the Layout Planning of the Weight and Size Enforcement Stations in July 2005.

Three types of weight and size enforcement stations are going to be established, combined with such IT screen technology as by-pass, pre-pass and green-light WIM (Weighing In Motion) system. Two schemes are recommended, one is the scheme of 650 enforcement stations, one is 450 enforcement stations, to replace the existing system and to achieve higher efficiency of the enforcement system. Pilot and demonstration project was recommended in terms of both hardware and software system followed by dissemination and application of the weight and size enforcement system. Overloading control information system and long term measures are also recommended.

3.3. Highway Safety Enhancement Project

The MOC launched “Highway Safety Enhancement Project” for national and provincial highways in 2004, by following the advanced concepts and best practice in other countries and setting forth the guidelines of “Safe, Economical, Environment-friendly, and Effective” for HSEP, including the concepts of economic safety, forgive design, flexible design, traffic calming, culture/landscape integration, safety audit, roadside safety design, and speed control, combined with innovative and integrated approach to find out safety measures suitable to local conditions. The safety measures of roadside clear zone, accident forecast, accident-prone section judgment, speed coherence analysis, and illusion 3D markings have been used in road engineering design. Some new products have been developed and applied in safety protection facilities, including:

- Solar-energy traffic safety facilities
- Whole-course video monitoring system based on GSM wireless transmission
- Automatic traffic accident identification system
- Guardrail simulation test platform
- Highway traffic meteorological early-warning system.

The MOC input a total of CNY30 million to conduct research and development activities for road traffic safety technology and set forth over ten safety related standards and regulations including the HSEP Technical Guide. By the end of 2005, more than CNY6.5 billion have been invested to implement HSEP for China’s low-level highways, and nearly 210,000 places with hidden dangers have been eliminated. HSEP has substantially reduced the occurrence of big, serious accidents. According to the statistics, the fatalities of road traffic accidents decreased by over 5,000 annually for three consecutive years; the fatalities per 10,000 vehicles decreased from 10.8 in 2003 to 7.6 in 2005. HSEP has achieved excellent economical and social effect and has become a long-term safety action.

4. ROAD SECTOR ENVIRONMENTAL PROTECTION

During the process of rapid economic development, many environmental problems that have haunted developed countries in different phases of their 100-year-long industrialization have occurred in China all at the same time. The conflict between environment and development is becoming ever more prominent. In order to protect and improve the environment, China is embarking on a way of sustainable development by integrating environmental protection with economic development, establishing a resource saving and environmentally friendly society, to materialize the harmony between humans and nature. At present all the road construction project should go through the procedure of EIA system. Taking into consideration of the possible environmental impact caused by road sector development, forecast and assessment should be made of the impact and effective prevention or mitigation measures should be proposed, which have become important parts of the EIA for road engineering project. After completion of the engineering work, inspection and acceptance shall be carried out strictly in accordance with the EIA report and the requirements included in the report review and approval document. A number R&D projects have been accomplished in related to road sector environment protection, as well as the development of relevant standard, specifications and protection measures combined with pilot and demonstration projects. The technical guidelines of the Highway Traffic Noise Control Technical Guidelines have been incorporated in the EIA Specifications for Highway Construction Project (JTG B03—2006) in 2006.

4.1. Basic System for Environment Management

In accordance with the basic principles provided in the environmental protection law, taking into account of the political, economic and cultural features, the following management system should be followed when environmental management is implemented in China.

- Land use planning system;
- Environmental impact assessment system;
- “Santongshi” system (“Three simultaneous” i.e. installations for the prevention and control of pollution at a construction project must be designed, built and commissioned together with the principal part of the project)
- License system;
- Pollutants disposal charge system.

Figure 1 shows the relationship between the capital construction procedures and the environmental management procedures in China.

4.2. Basic contents of EIA

An idea complete EIA procedure should meet with the following requirements:

- Applicable to all the projects with possible conspicuous impact on environment, and capable of identifying and assessing or evaluating all the possible conspicuous impacts.
- To conduct comparisons of various alternative schemes, management technology, and the pollution mitigation measures.
- To clearly compile the environmental assessment statement, to allow both experts and layman understand the features and importance of the possible impact.

- To go through public participation procedures to solicit opinions and comments from broad general public, and to go through strict administrative review procedures.
- To be able to provide decision-makers in time with effective information.

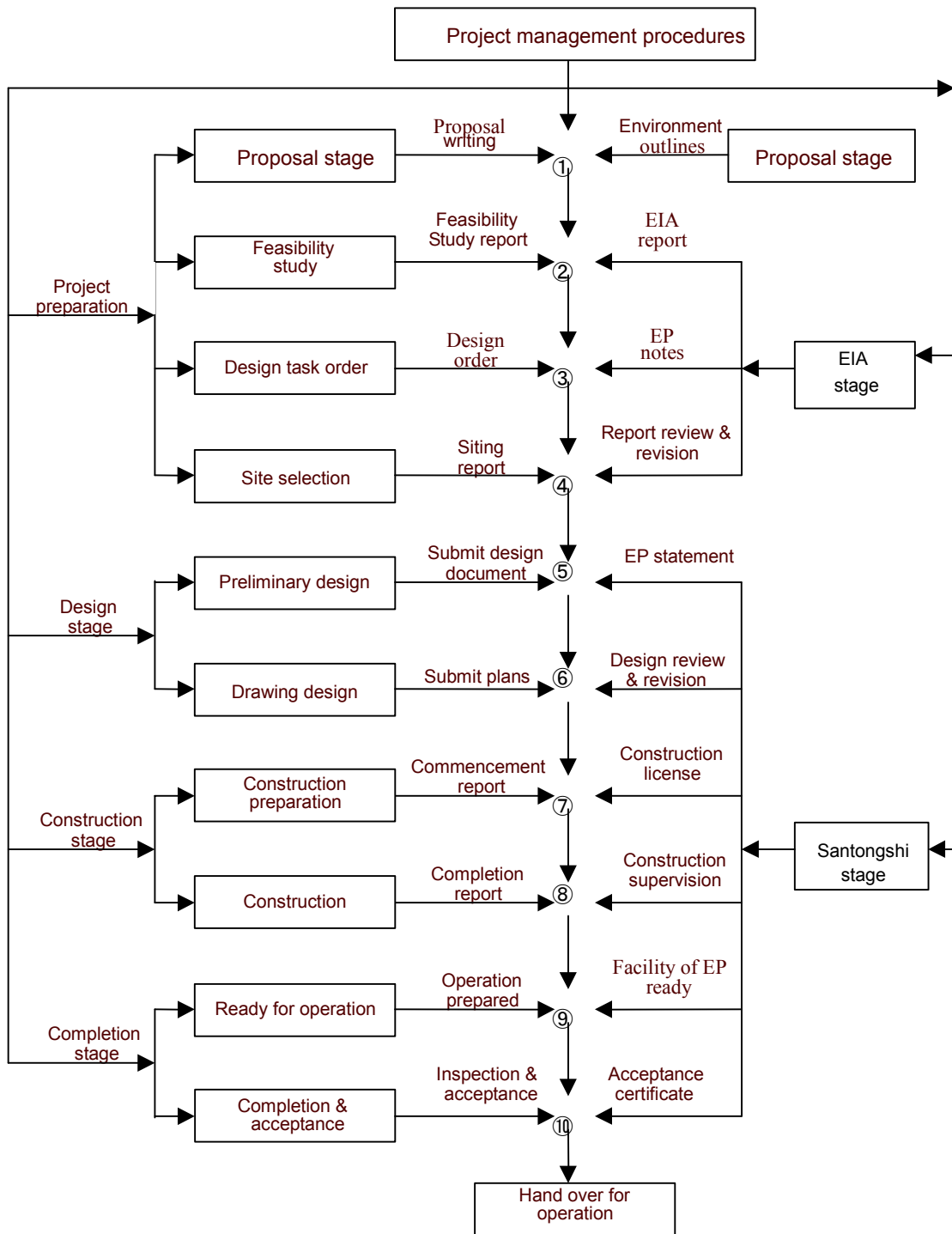


Figure 1 - Capital Construction Project & Environmental Management in China

5. CHALLENGES AHEAD

To accommodate the increasing demands in the future as it grows and evolves into a market economy, China is still facing great challenges and needs to find ways to diminish or remove the constraints, which either directly affect the availability and efficient utilization of resources, or affect the use of the road system and the services provided. Most constraints have a strong institutional component, and some involve standards and rules concerning government functions and market mechanism in regard to effective resource utilization.

To meet the challenges ahead, the MOC is going to implement sustainable development strategy, by focusing on three fields: (1) road transport and land use planning; (2) road transport management, restructuring the traditional road transport sector into modern service industry; and (3) energy efficiency environmental protection in the road sector. To implement and materialize the goal of sustainable development strategy, it is necessary and imperative for the government to strengthen capacity building and institutional reform with participation of all the stakeholders in the process of the relevant decision-making and implementation of the action plans for a more prosperous future and sustainable development.

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