SECTOR ASSESSMENT (SUMMARY): TRANSPORT

Sector Road Map

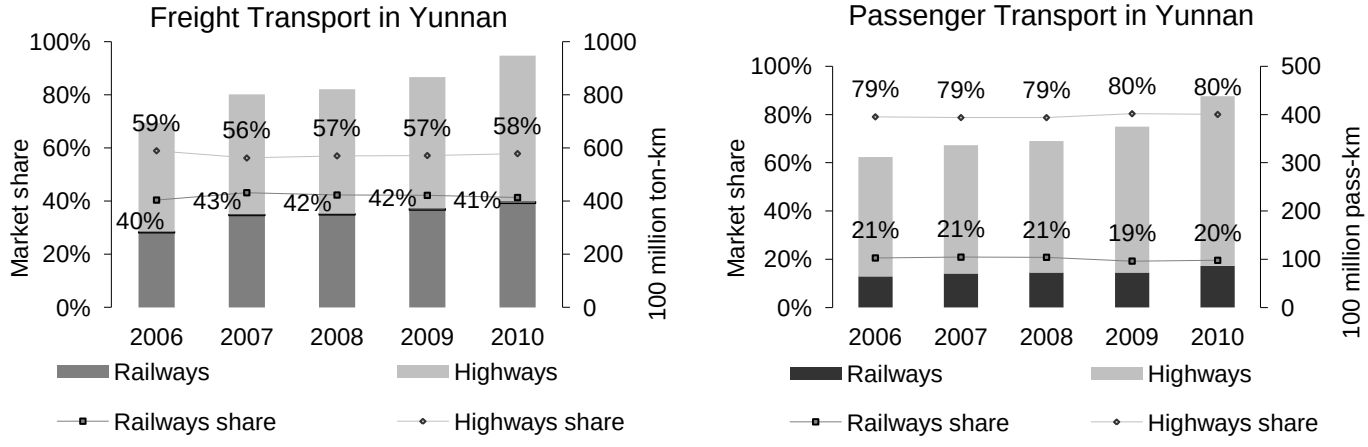
1. Sector Performance, Problems, and Opportunities

1. The transport sector has played an important role in the impressive rates of economic growth and poverty reduction in the People's Republic of China (PRC). Transport assets have expanded rapidly, with investments in transport averaging 5.4% of gross domestic product during 2006-2010 across the country and 10% in Yunnan Province. However, even these major investments have not kept pace with national demand, which has been growing at more than 10% a year. Moreover, the expansion of transports assets has also led to new challenges, fueling rapid urbanization, unprecedented growth in motorization, a rising number of traffic accidents, and a much greater need for effective asset management. Transport in the PRC must also become more sustainable and greener by reducing energy use and lowering carbon dioxide emissions.

2. Yunnan is a mountainous landlocked province of 394,000 square kilometers in the southwestern region of the PRC. Its population of 46 million (2010) includes 25 of the country's 56 officially recognized ethnic groups. It is the PRC's second least-developed province in terms of gross domestic product per capita, which at CNY18,957 in 2011 was roughly one-half of the national average and only one-fifth of Beijing's. It is fourth-least developed province in terms of the human development index, which stood at 0.710 in 2008.[1] Even though it shares 4,000 kilometers (km) of border with neighboring countries, Yunnan accounts for only 0.5% of the PRC's overall international trade.

3. **Transport sector.** Yunnan's mountainous terrain limits the potential for railways and inland waterways, and its transport system depends heavily on roads. In 2010, the province had 2,500 km of railways, 2,900 km of inland waterways, and 209,000 km of roads. Roads accounted for 58% for freight transport and 80% of passenger traffic (Figure 1), high percentages compared with the overall averages for the PRC of 31% and 54%, respectively.

Figure 1: Transport Demand Trends in Yunnan



pass-km = passenger kilometer, ton-km = ton kilometer.
Source: National Bureau of Statistics of China.

[1] The human development index is a composite statistic of life expectancy, education, and income indices that is published by the United Nations Development Programme.

4. **Trunk road network.** Yunnan's trunk roads are managed by the Yunnan Highway Administration Bureau (YHAB). This non-tolled network provides vital access to the 129 counties in the province and is an important link between rural roads and the province's expressways and urban center road networks. Although the trunk road network in Yunnan made up only 11% of the province's 215,000 km of roads in 2011, it included 45% of all roads with asphalt, concrete, or bituminous surfacing. The trunk road network currently consists of 24,000 km of roads, mainly national and provincial highways (76%). Only about 25% the trunk roads are rated class 2 or above (Table 1).

Table 1: Characteristics of the Trunk Road Network in Yunnan

(km)

Class/Surface	Total	National Highway	Provincial Highway	County Road
Class 1	227	116	98	12
Class 2	5,811	1,685	3,872	254
Class 3	5,962	1,486	2,904	1,572
Class 4	10,827	1,685	5,989	3,152
Unclassified	1,262	133	356	774
Total	**24,089**	**5,106**	**13,219**	**5,764**
Asphalt concrete	12,614	2,873	8,211	1,530
Cement concrete	236	73	32	131
Simple pavement	8,207	1,805	4,118	2,284
Cobblestone	764	204	287	273
Gravel/earthen	2,268	150	572	1,537
Total	**24,089**	**5,106**	**13,219**	**5,764**

km = kilometer.
Source: Yunnan Highway Administration Bureau.

5. **Road conditions.** The overall quality of Yunnan's trunk road network is poor, with 12% of the roads unpaved and 34% having only simple bituminous pavement. Traffic levels often far exceed design standards. Combined with the effects of frequent, extreme overloading, this has resulted in accelerated deterioration of the network. A road condition survey in 2011 (Table 2) found that only 37% of the trunk road pavement was in good or excellent condition and 31% was in very poor condition, based on the PRC's riding quality index.

Table 2: Yunnan Trunk Road Network Conditions

(%)

Condition Indicator	Excellent	Good	Fair	Poor	Very Poor
Pavement quality index	23.1	33.6	18.7	10.6	14.0
Riding quality index	12.2	24.8	19.1	13.0	30.9
Pavement condition index–distress	41.9	31.3	13.0	5.9	7.9

Source: Yunnan Science and Research Institute 2011 road condition survey.

6. The poor condition of the network is due in large part to original pavement designs that did not anticipate the large traffic volumes and heavy axle loads that have occurred. As a result, a large part the trunk network has failed and cannot be restored to or maintained in good condition. Complete reconstruction of pavement is necessary to rejuvenate the 44% of the network rated in poor or very poor condition. Inadequate maintenance to prevent degradation of newer pavement and reduce roughness only exacerbates the problem.

7. **Maintenance implementation.** The Yunnan Provincial Department of Transport is responsible for building and upgrading trunk roads, but the responsibility for maintaining the network lies with YHAB. YHAB has 16 prefecture-level general sections and 126 county maintenance sections that supervise maintenance work. All works are carried out with an in-house labor force of almost 15,000 through 294 maintenance stations and 124 equipment stations. Bidding occurs for

large maintenance works but only YHAB units can complete. In 2012, under a first project with Asian Development Bank (ADB) financing, YHAB introduced open bidding for trunk road rehabilitation.[2]

8. **Maintenance funding.** Funding for trunk road maintenance comes primarily from annual allocations by the provincial transport department, 80% of which is derived from a fuel tax. This is supplemented by other funding sources, particularly fines charged for overloading. The level of the fuel tax allocations to YHAB depends each year on the total fuel tax funding available and such other competing requirements as expenditures for upgrading and new construction. Before the introduction of the fuel tax in 2009, allocations came from a vehicle maintenance fee and grew by only 4% a year during 2001–2008. Since the fuel tax replaced the province's vehicle maintenance fee, the allocation to YHAB has grown by an average of 13% per year, which has reduced the maintenance budget deficit but is still too little to cover expenditures.

9. **Maintenance expenditure.** Total spending for maintenance in 2011 was CNY2,238 million. Of this budget, 66% was spent on salaries, bonuses, and pensions.[3] A further 9% went to management costs. Only 25% went to actual maintenance operations, including 17% for routine maintenance and only 7% for rehabilitation. Given this limitations, YHAB did not carry out any periodic maintenance. The in-house implementation of routine maintenance is proving inefficient, with one worker employed for every 2 km of road and the average cost of routine maintenance at about CNY70,000 ($10,000) per km, well above international levels.[4]

10. **Periodic maintenance and rehabilitation.** The focus on routine maintenance means that repairs mainly address pavement distress—visual surface defects—rather than pavement roughness—the bumps that damage the vehicles. The road condition pavement distress indicators are far better than those for pavement roughness (Table 2). The accelerated deterioration of older roads makes this routine maintenance inefficient, however, which leads to rapidly increasing roughness levels and costs. The limited budget allocated to rehabilitation means that the more significant defects and increasing roughness go largely unaddressed. In 2010, only 1.4% of the trunk road network was rehabilitated. In 2011, salary increases for YHAB staff caused this percentage to drop even further to 0.5%. In view of the average service life of a trunk road of 5–10 years, this percentage should be much higher. The PRC's Ministry of Transport stipulates that rehabilitation should be undertaken on 8% of the network and periodic maintenance on 5% of the network each year.

11. Simulations using the Highway Development and Management Model (HDM-4) software have shown that, without an increase in the share of fuel tax allocated to YHAB, the portion of the trunk road network considered to be in very poor condition would increase from 31% in 2011 to 40% in 2016 and 50% by 2021. To restore the entire network to good condition by 2021, YHAB would have to double its annual maintenance budget by 2021 (to CNY4,200 million) and use the additional resources for road rehabilitation.[5]

12. **Maintenance planning.** Because funding for periodic maintenance and rehabilitation is limited, effective planning and prioritization is needed to maximize its impact. Instead, allocation

[2] ADB. 2010. *Report and Recommendations to the President for the Yunnan Integrated Road Network Development Project.* Manila.

[3] About 21,000 retired staff members receive a pension from YHAB, and payments for this unfunded pension plan come mainly from the annual operational budget. These pension payments place an important limit on the funds available for trunk road maintenance.

[4] This includes costs of salaries, bonuses, pensions, materials, and equipment operation.

[5] Road Network Sustainability Analysis (available from the list of linked documents)

of funding has been ad hoc up to now, and most resources have gone to rehabilitate roads in very poor condition irrespective of their class or traffic volumes. Proper prioritization of works could increase the net present value of investments by 20%. This would require that priority be given to roads with high traffic volumes and to ensuring periodic maintenance of roads in fair condition. However, YHAB lacks the road asset management software that would allow it to conduct this analysis and determine the optimum allocation of its maintenance funding.

13. **Road safety.** The trunk road network also faces significant safety issues. Data from the PRC traffic police for 2008 and 2009 show that 66% of all serious road crashes and 63% of all road fatalities and injuries occur on the country's national and provincial highways. Accidents on Yunnan trunk roads in 2009 resulted in 180 fatalities. Although YHAB is carrying out some road safety measures, funding is inadequate, responsibilities are fragmented, and it does not employ any road safety specialists. YHAB and the traffic police collaborate very little on accident data, which makes an assessment of particular road safety needs and impacts difficult. As a result, periodic maintenance and rehabilitation work is not properly used as an opportunity to assess and improve safety. Many of the works fail to include even such basic safety features as pavement markings for traffic direction.

2. Government's Sector Strategy

14. Transport sector policy is guided by the PRC's 12th Five-Year Plan for 2011-2015, which extends the sustainable development agenda begun under 11th plan. Under the new plan, the government has increased its emphasis on green, low-carbon growth and coordinated urban and rural development, combined with improvements in basic public services. It aims to develop an integrated transport system that provides high-quality, efficient, and affordable transport services in a safe and environmentally sound manner. The government is expected to pursue reforms in the transport sector to make it more sustainable and greener under the 12th plan.

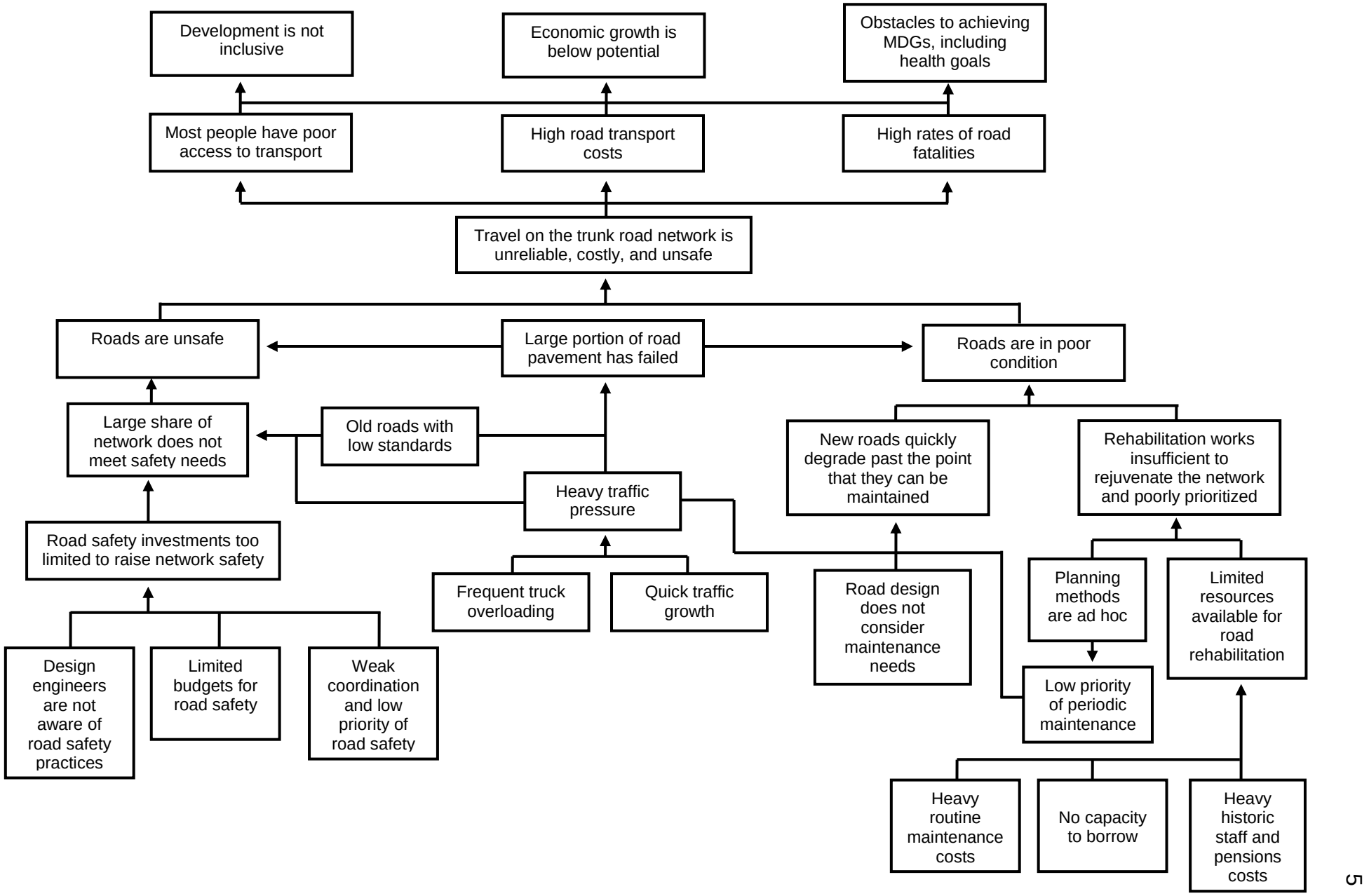
3. ADB Sector Experience and Assistance Program

15. ADB has been a key development partner in the PRC's transport sector since 1991. Through its Sustainable Transport Initiative Operational Plan approved in 2010, ADB established new strategic directions for its transport operations up to 2020.[6] The plan defines four new focus areas to be scaled up in future ADB operations—urban transport, response to climate change, cross-border transport and logistics, and road safety and social sustainability. In line with the initiative, ADB has phased out support for expressways and started diversifying its transport assistance into urban transport, inland waterways, and logistics. It has also taken steps to provide assistance to the road subsector for better road asset management and road safety.

16. Under its country partnership strategy for the PRC for 2011–2015, ADB will promote inclusive growth and environmental sustainability by helping develop a more efficient, safe, green, and sustainable transport system.[7] In the road sector, ADB will help (i) develop more effective ways of integrating planning, financing, and execution in road upgrading, rehabilitation, and maintenance; (ii) prepare long-term as well as annual road network rehabilitation and maintenance plans; (iii) develop sustainable financing arrangements; (iv) accelerate sector reforms to promote market-based mechanisms in road maintenance; (v) reduce overloading; and (vi) promote transport efficiency.

[6] ADB. 2010. *Sustainable Transport Initiative Operational Plan*. Manila.
[7] ADB. 2012. *Country Partnership Strategy for the People's Republic of China, 2011–2015*. Manila.

PROBLEM TREE



Sector Results Framework (Transport, 2011-2015)

Country Sector Outcomes		Country Sector Outputs		ADB Sector Operations	
Outcomes with ADB Contribution	**Indicators with Targets and Baselines**	**Outputs with ADB Contribution**	**Indicators with Incremental Targets**	**Planned and Ongoing ADB Interventions**	**Main Outputs Expected from ADB Contributions**
More efficient, safer, inclusive, and sustainable movement of people and goods in the PRC	Rail traffic for passenger increases by 4% per annum, from 876 billion passenger-km in 2010 Rail traffic for freight increases by 5% per annum, from 2,733 billion ton-km in 2010 Energy consumption in railway per unit of traffic reduced by 5% from 2010 to 2015, from 4.94 tons of standard coal equivalent per million ton-km in 2010 Inland waterway traffic for freight grows by 1% per annum for freight traffic, from 433 billion ton-km in 2009 In areas supported by ADB urban transport projects, public transport ridership increases by 5% from 2010 to 2015 In areas supported by ADB road projects, the road accident fatality rate per vehicle-km and per 100,000 population in 2015 is 10% lower than in 2010	Integrated, low-carbon transport system expanded, improved, managed, and maintained	Rail route network increased from 91,000 km in 2010 to about 120,000 km by 2015, including 45,000 km of a high-speed (over 200 km per hour) railway network 42 national comprehensive transport hubs developed by 2015 High class (class III and above) inland waterway network increased from 10,000 km in 2010 to over 13,000 km by 2015 In areas supported by ADB projects, new bus rapid system in operation by 2015 (baseline: zero) In provinces supported by ADB road projects and TA, increased financing for road maintenance by project completion from the current level	**Planned key activity areas** Lending operations with a total investment of $2.35 billion (2011-2015) in rail transport, especially regional or subregional link; inland waterway transport; urban transport; road asset management; rural transport; and road, rail, and inland waterway safety. **Pipeline projects** (2012-2015, total $2.35 billion): - Railways ($800 million); - Road ($830 million); - Urban transport ($520 million); and - Inland waterways ($200 million). Nonlending programs in fuel tax reforms, low-carbon urban transport, intermodal logistics, energy efficiency, and safety, etc. Knowledge products based on TA findings and policy notes aimed at supporting government policymaking. **Ongoing projects** 27 projects totaling $6.851 billion at the end of 2011.	**Pipeline projects** - The first bus rapid transit system operational in Lanzhou - The first inland waterway project in Hunan province; - The first cross-border railway project in Yunnan Province; - The first road asset management system financed by ADB established in Yunnan and operational; and - About 650 km of ordinary roads rehabilitated and operational. **Ongoing projects** - About 1,947 km of new railways built; - About 121 km of urban roads upgraded in Xi'an and Lanzhou; - About 1,883 km of expressways built; - About 3,881 km of local roads rehabilitated; and - About 1,308 km of rural roads built or rehabilitated.

ADB=Asian Development Bank, GDP=gross domestic product, km=kilometer, PRC=People's Republic of China, and TA=technical assistance.
Source: Asian Development Bank Estimates