REFORMING THE FINANCING SYSTEM FOR THE ROAD SECTOR IN THE PEOPLE'S REPUBLIC OF CHINA

ASIAN DEVELOPMENT BANK

ADB

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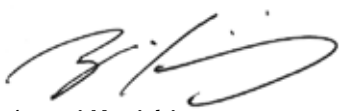
Foreword

The People's Republic of China (PRC), in 2009, effected a major change in its funding system for ordinary roads (roads other than expressways). It abolished a range of provincial and local government fees and charges and increased the central government tax on motor vehicle fuel, referred to as the Fuel Tax Reform. This reform stabilized and centralized the government revenues for the sector, but various problems and issues remain. The technical assistance project Financing Road Construction and Maintenance after the Fuel Tax Reform provides recommendations on key issues that the PRC should address to improve the sustainability of funding and delivery of programs in the road sector.

One major finding is that increased attention needs to be given to the maintenance of the expanding ordinary road network. Funding for road maintenance needs to be better managed and controlled so that the economic efficiency of managing road assets is improved, rather than allowing roads to deteriorate to the point of rehabilitation. A second critical issue is the need for better decision making, transparency, and accountability with regard to allocation and spending of national road funding. The centralization of funding under the Fuel Tax Reform helps to address both the aforementioned issues by changing the way the national road program is managed and implemented.

This report recommends the creation of a National Roads and Funding Administration and a central road trust fund with dedicated revenues; changes to roles and responsibilities of different levels of government for the various administrative categories in the road sector; formal cost-sharing arrangements between the central and the provincial and local governments; changes in the way central government funding for ordinary roads is planned, programmed, and allocated; and improved use of road asset and performance management information when deciding on funding needs and allocations. This report also includes options for increasing the funding available for ordinary roads, enabling the use of debt for capital investment in the road sector.

Implementing the recommendations will require changes in organizational structures and relationships, policies, and procedures. A detailed implementation strategy and a plan to accomplish these changes are provided, divided into short-term and longer-term activities. In addition, a pilot in selected provinces is proposed to test the elements of the recommendations before implementing change more broadly.



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This report was prepared by Craig Secrest and Allan Kennaird with support from the national consultant team from the Energy and Environmental Development Research Center.

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Abbreviations

ADB	Asian Development Bank
CAGR	compound annual growth rate
CPI	consumer price index
CNY	yuan
EU	European Union
FHWA	Federal Highway Administration (US)
GDP	gross domestic product
GPS	global positioning system
HTF	Highway Trust Fund (US)
LPG	liquefied petroleum gas
MOF	Ministry of Finance
MOT	Ministry of Transport
MQI	maintenance quality indicator
NDRC	National Development and Reform Commission
NPC	National People's Congress
NRFA	National Roads and Funding Administration
NZTA	New Zealand Transport Agency
OBU	on-board unit
OECD	Organisation for Economic Co-operation and Development
PIARC	Association Mondiale de la Route (World Road Association)
PRC	People's Republic of China
RMF	road maintenance fee
TPRI	Transport Planning and Research Institute
VPT	vehicle purchase tax (vehicle acquisition tax)

In this report, "$" refers to US dollars, unless otherwise stated.

Currency unit – yuan (CNY)

CNY 1 = $0.16
$1.00 = CNY6.3

Executive Summary

The People's Republic of China (PRC) implemented a Fuel Tax Reform in 2009 that made significant changes to the way the country funds and delivers its "ordinary road" program (the ordinary road system generally includes the various road classifications, excluding expressways). First, the reform abolished six types of fees charged for roads. Second, it removed authorization for future loan–toll initiatives on 630 Class II roads and established a schedule for annulling the existing tolls on Class II roads. Third, it introduced a series of increases in motor vehicle fuel tax to replace the abolished funding sources.

The Fuel Tax Reform was seen as an important public policy initiative that reflects the PRC's desire to address several important considerations such as reduction of emissions, tax equity, road transport efficiency, and pricing of oil products. Since its implementation, the Fuel Tax Reform has proven to be very effective by centralizing revenue collection and enhancing the ability of the central government to influence road planning and policy due to its new role as the main source of funding for ordinary roads.

In early 2011, the Asian Development Bank (ADB) funded a small-scale technical assistance project[1] (the Phase I study) to assess the initial results of the Fuel Tax Reform and to identify issues that the PRC should address to improve the sustainability of road sector financing and the delivery of its programs for ordinary roads. The key issues[2] were

(i) the lack of a mechanism to regularly adjust tax rates for inflation and other factors,
(ii) the need for additional revenues to meet planned ordinary road maintenance and construction targets,
(iii) use of debt for financing ordinary roads,
(iv) long-run feasibility of fuel taxes as a source of funding for roads,
(v) rationalization of roles and responsibilities of different levels of government,
(vi) the need for a new national-level programmatic approach to road development and management,
(vii) improved fund management and allocation processes,
(viii) the need for enhanced organizational capacity, and
(ix) development and application of performance management practices in the sector.

[1] ADB. 2011. *Technical Assistance to the PRC for Financing Road Construction and Maintenance after Fuel Tax Reform.* Manila.
[2] ADB. 2012. *Financing Road Construction and Maintenance after the Fuel Tax Reform.* Manila.

Building on the outputs of the Phase I study, this report presents policy recommendations to address each of these issues.

Current Road Targets, Needs, and Funding

Based on information used to develop the Twelfth Five-Year Plan, the PRC planned to add about 740,000 kilometers (km) of ordinary roads to the existing road network from 2011 to 2020, expanding it from roughly 4.0 million km in 2011 to 4.74 million km in 2020 (Table ES1). The new road development targets include investments in ordinary roads at all levels and reflect the objective of the PRC to ensure that by 2020, all townships and 90% of villages are accessible by paved roads.

Table ES1: Ordinary Road Development Targets (km '000)

	2011	2020 Target	Increase in Length
National roads	104	157	53
Provincial roads	267	350	83
Local roads	3,641	4,237	596
Total	**4,011**	**4,744**	**733**

Source: Authors' calculation.

The PRC will need to spend considerable resources over the next 10 years to achieve its aggressive targets with regard to ordinary road development and to adequately maintain the system. As shown in Table ES2, the estimated cost of the revised 2011–2020 ordinary road development targets, including national, provincial, and local roads, is CNY7.0 trillion. Maintenance of the system, including minor safety improvements to existing facilities, will cost an additional CNY3.8 trillion. To meet targets for road construction and to fully fund road maintenance, the country will require nearly CNY11.0 trillion over the next decade.

As a result of the Fuel Tax Reform, the PRC effectively centralized funding for roads and now has three primary national revenue sources for ordinary roads—the motor fuel tax, the vehicle purchase tax (VPT), and central government budget allocations. It is forecast that from 2011 to 2020, the motor fuel tax will provide CNY2.0 trillion in revenues and the VPT will provide CNY3.7 trillion, for a total of CNY5.7 trillion. While central government budget allocations for ordinary road investment are also typically provided, it is determined on an annual basis through the national budgeting process, varies widely from year to year, and is not included in the revenue forecast due to low predictability. The projected 10-year funding shortfall could exceed CNY5.0 trillion (Table ES2).

Table ES2: Ordinary Road Construction Plans and Maintenance Needs: 2011–2020 (CNY billion)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Construction Plans											
National roads	231	242	254	267	280	87	91	96	100	105	1,754
Provincial roads	257	270	283	297	312	232	243	256	268	282	2,701
Local roads	181	190	200	210	220	284	298	313	329	345	2,570
Subtotal	**669**	**702**	**737**	**774**	**813**	**603**	**633**	**664**	**698**	**733**	**7,025**
Maintenance Needs											
National	42	47	52	57	63	64	66	68	70	72	600
Provincial	71	79	87	96	106	110	119	129	140	152	1,090
Local	142	157	174	191	211	213	232	252	273	296	2,140
Subtotal	**255**	**283**	**313**	**345**	**379**	**387**	**417**	**449**	**483**	**520**	**3,830**
Total Expenditures	**924**	**985**	**1,050**	**1,119**	**1,192**	**990**	**1,050**	**1,113**	**1,181**	**1,253**	**10,855**
Revenues											
Fuel tax	128	144	160	176	192	208	224	240	256	274	2,002
Vehicle purchase tax	125	167	224	284	320	400	450	507	571	642	3,690
Total Revenues	**253**	**311**	**384**	**460**	**512**	**608**	**674**	**747**	**827**	**916**	**5,692**
Unfunded	**670**	**674**	**666**	**659**	**681**	**382**	**376**	**366**	**354**	**337**	**5,164**

Source: Authors' calculation.

Issues and Recommendations

It is important to note that there are significant interactions and interrelationships between the nine policy issues identified in the Phase I study:

(i) The amount of additional central versus provincial and local government funding required to meet expenditure needs estimates for the Twelfth Five-Year Plan and the later five-year plans depend on how costs are shared between the central and the provincial and local governments.

(ii) The approach to program management is linked to the roles and responsibilities of the different levels of government, financial structures and capacity, and goals and objectives.

(iii) The manner in which road funds are managed and allocated depends on how roles and responsibilities are assigned.

(iv) The required organizational capacity of the Ministry of Transport and other central government agencies is dependent on the other recommended changes.

(v) Performance management requirements interact with other tasks.

Due to these interactions and interdependencies, the following discussion of issues and recommendations is based on the assumption that the PRC will pursue further reforms to its ordinary road program through a comprehensive strategy rather than addressing issues in a one-off fashion.

Roles and Responsibilities

The Fuel Tax Reform essentially centralized the role of funding for ordinary roads, but few other changes were also made to the roles and responsibilities of the national, provincial, and local government agencies involved in the development and management of the ordinary road system of the PRC. To build on the success of the Fuel Tax Reform initiative, future reforms should include better definition of, and changes to, the roles and responsibilities at each level of government to improve transparency and to ensure adequate transport system performance. Specific issues that need to be addressed are as follows:

(i) There is no law or policy on management of roads, resulting in little national accountability for ensuring that technical standards are met.

(ii) Clarity is needed on how responsibilities for funding national, regional, and local priorities should be divided among different levels of government.

(iii) The management and allocation of national road funds lacks transparency and is not sufficiently connected with consideration of needs.

(iv) There has been an imbalance in the availability of funding for maintenance of some roads compared to others.

(v) Decisions on other recommended reforms in this report will drive the need for additional changes to road management roles and responsibilities.

The recommendations for addressing these issues center on creating an independent National Roads and Funding Administration (NRFA) with overall responsibility for the central government's road funding policy and administration of the national road program. Specific roles and responsibilities of the NRFA would include

(i) conducting oversight of the national road system and associated programs;

(ii) managing the central government road fund or trust account for ordinary roads, including monitoring, auditing, and reporting use of central funds for roads;

(iii) overseeing all aspects of national roads, including planning for operations, maintenance, and improvements (e.g., preparing the road sector component of five-year plans and maintaining asset management information), and management of expressways and toll concessions on national roads;

(iv) defining program categories, rules, standards, and processes to direct the administration of the central government road funding for construction and maintenance of roads;

(v) establishing cost-sharing arrangements with provincial and local governments, working with them to estimate and advocate funding needs for roads;

(vi) making arrangements with provincial government agencies (e.g., formally contracting with them) for operational management of national roads and execution of maintenance works on the roads; and

(vii) reporting road sector performance metrics, including for provincial and local government roads, based on information supplied by these governments.

In addition to creating the NRFA, the central government should make it clear that provincial governments are responsible for all aspects of provincial roads, and municipal and county governments are responsible for local roads in their respective areas. Furthermore, they should also make it known that provincial and local governments as always will continue to be responsible for a share of funding and for implementing maintenance works on their roads.

Program Approach

Prior to the reform, the ordinary road financing system provided limited opportunities for the central government to influence ordinary road programs and has arguably led to significant system deficiencies such as lack of road maintenance, misallocation of resources, and overinvestment in projects with low economic returns. Under the new financing structure of the reform, the central government is now able to more effectively control and direct the use of ordinary road funding to address system deficiencies. To do so, it is recommended that the central government implement program reforms in three key areas:

(i) **Policy-Level Program Changes.** This includes discontinuing untied allocations of fuel tax revenues to provincial agencies; incorporating road maintenance and rehabilitation needs in five-year plans; developing multiyear programs; creating separate programs for roadworks by province and by administrative category of road, giving priority to funding road maintenance; focusing on development of road asset management systems in all provinces; and making other changes to emphasize national ordinary road investment priorities.

(ii) **Specific Program Changes.** Defining funding categories and allocating funding accordingly for areas such as management, operations, routine maintenance, safety, rehabilitation, etc.

(iii) **Cost-Sharing Changes.** Establishing a cost-sharing structure for ordinary roads whereby works on national roads are funded 100% by the central government for both maintenance and improvement, maintenance on provincial and local roads is funded 70%–80% by the central government, and construction on provincial and local roads is funded 40%–60% by the central government.

Maintaining Purchasing Power

The current financial structure under the Fuel Tax Reform relies on three sources of funding for virtually all PRC spending on ordinary roads: central government budget allocations, the VPT, and motor vehicle fuel taxes. Central government funding is largely untied to a specific funding source and the VPT is a function of vehicle prices; thus, revenue levels are at least indirectly tied with inflation. Motor vehicle fuel taxes, however, are set at fixed rates per liter, and currently there is no process to determine how and when the rates should be changed, where to accommodate inflation, or other factors that influence needs. It is therefore recommended that the central government of the PRC establish a regular mechanism for adjusting fuel tax rates based on an assessment of needs, as well as define how needs will be determined and by whom.

New Revenue Sources

It is not certain that all of the planned road construction expenditures that have been identified by the PRC are high-priority investments that must be addressed in the next decade. But, it is clear that the current central government ordinary road-funding sources are inadequate to meet anything close to the level of investment that is planned while also maintaining the existing assets. Based on the evaluation of a broad set of alternatives, and direction from PRC road and finance officials, the following approaches are proposed to provide additional ordinary road funding:

(i) **Central Government.** Dedicate an increased percentage of fuel tax and VPT revenue to construction and maintenance of ordinary roads and/or increase the rates of the fuel tax and VPT, and annually allocate general budget to make up for any shortfall in central government funding.

(ii) **Provincial Governments.** Direct provincial governments to allocate the annual revenues from the new vehicle and vessel taxes to augment the provincial and local government share of road maintenance and construction costs in their respective road networks.[3]

Debt Financing

Through the Fuel Tax Reform, the central government essentially eliminated the ability of provincial and local governments to leverage local road sector revenues, which historically has been a key source of ordinary road funding for these jurisdictions. Without the ability to borrow, provincial and local road agencies are finding it increasingly difficult to meet the system expansion targets identified in the Twelfth Five-Year Plan and longer-term road development plans. On the contrary, there is clearly a need for the central government to maintain better control over provincial and local borrowing and to make sure debt proceeds are used effectively.

Before any of the identified options can be recommended or selected, the central government needs to first decide whether it wants to reestablish the ability of provincial and local governments to use debt for funding ordinary road activities in general and, if so, determine how this reintroduced capacity will be managed. Recommendations for doing so include a two-step approach:

(i) **Phase I.** The central government could issue debt on behalf of provincial and local road agencies, with debt service payments made by the recipient provincial or local government. The debt could be secured from a mix of (a) an agreed portion of future fuel tax payments and (b) local funding sources.

(ii) **Phase II.** Once the provincial and the local agencies have addressed their existing debt repayment challenges to the satisfaction of the central government, they would be allowed by the central government to issue debt for road construction backed by a local road-funding source.

[3] The National People's Congress enacted a law in February 2011 that authorizes provinces to impose taxes on various types of vehicles and vessels. The new law became effective on 1 January 2012 and established the minimum and maximum annual rates that can be charged for various classifications of vehicles, which are based on engine size for passenger cars and ton load for trucks and trailers.

Long-Term Funding

Although short-term prospects for the fuel tax are strong, there is clearly the possibility that the transition to electric and high fuel efficiency vehicles will eventually reduce fuel consumption and limit the sustainability of the fuel tax as the primary mechanism for financing ordinary roads in the PRC. Developed countries that use motor vehicle fuel taxes as a major source of road funding have begun to take this possibility as a fait accompli and have generally determined that either time-based fees or distance-based fees will one day need to supplant existing fuel taxes.

Based on the feedback received from PRC officials, it presently appears that there is limited interest in exploring a distance-based pricing option and there does not seem to be much concern about the long-term viability of the motor fuel tax. Nonetheless, long-term ordinary road-funding solutions will be needed in the PRC due to the increasing likelihood that technological change will reduce the use of taxed fuels in the future. It is therefore recommended that the PRC consider taking steps to move toward charging all road users fees for use of roads rather than funding road expenditure from taxes, and that the central government monitor international developments of distance-based road user fees, particularly the high-tech systems being developed and implemented in Germany, the Netherlands, Switzerland, and the United States.

Fund Allocation

Prior to the Fuel Tax Reform, the allocation of central government funding for ordinary roads was not a major policy consideration since provincial and local governments raised most of the funding to meet these needs through road maintenance fees and tolls. As part of initial implementation of the Fuel Tax Reform, the PRC established an interim funding allocation formula, but this approach has several potential shortcomings. In addition, the new centralized funding approach creates opportunities for the central government to use its new authority to better manage ordinary road programs. Associated recommendations include

(i) developing a needs-based process to allocate central government revenues to roadworks and associated activities, as far as data to allow this are available;

(ii) limiting central government funding for management and administration to a percentage of road maintenance and improvement expenditures, with provincial and local governments required to make up any difference;

(iii) using road asset management systems and information as an input to estimate maintenance and rehabilitation needs at the national level; and

(iv) providing multiyear allocations for major improvement projects and multiyear maintenance contracts.

Fund Management

While both the VPT and the motor fuel tax are intended to serve as direct sources of funding for road investment, the total amounts that are collected from these sources are not well recorded, and the relationship between what is collected and what is spent on roads is unclear. The lack of a well-defined accounting mechanism for road funding results in a lack of transparency and creates uncertainty about the level of funding that will be available. This, in turn, can impair the ability of provincial and local road agencies to plan

and implement their programs effectively, and may create barriers to leveraging centrally collected road revenues through the issuance of bank loans or bonds. To address these issues, it is recommended that the PRC establish an ordinary road trust fund with dedicated revenues from the motor fuel tax and the VPT.

Performance Management

While the PRC has established performance measurements for roads in selected areas, they are neither used at the national level to hold provincial and local road agencies accountable for how they use national ordinary road funding nor are they used to influence decisions about national investment priorities or allocation of resources. In light of the other reforms recommended in this report and the growing international focus on performance management in road program management, it is recommended that the PRC adopt a more performance-based approach to ordinary road program management that includes the development of standard performance measures to hold provincial and local governments accountable for their use of central government road funds. In the long term, it is recommended that the PRC move away from the current system which develops output targets (e.g., length of roads in kilometers) to one that is based on system performance targets.

Implementation Strategy and Plan

Implementation of the recommendations identified will likely take some time to accomplish and occur on an incremental and evolutionary basis. The PRC could undertake the proposed reforms through the following three steps:

(i) **Pilot Testing.** Select one or more provinces in which to conduct pilot testing of the recommendations to prove the practical application of draft laws, regulations, and policies, and to identify issues that need to be adjusted or refined before they are applied throughout the PRC.

(ii) **Short-Term Arrangements.** To ensure sustainability of the ordinary road network in the short term, funding for maintenance should be applied for that purpose and not diverted for further expansion of the network. Immediate steps that could be taken to help ensure this happens include determining road maintenance needs through rigorous analysis of asset management and other information; establishing a central government road trust fund and fund management approach, clearly defining the proportion of fuel tax revenues that will be dedicated to ordinary roads; and increasing the share of fuel tax and VPT revenues and/or central government budget allocations to meet the central government's share of road expenditures.

(iii) **Long-Term Arrangements.** In the long term, establish the NRFA statutorily as a separate central government agency, create a Central Road Trust Fund, and dedicate revenue to the Trust Fund (i.e., all VPT revenues and an appropriate proportion of fuel tax revenues). The NRFA would then contract relevant provincial road agencies, either through the provincial Department of Transport or directly, for operations, maintenance, and development of national roads, and establish agreements with provincial and local governments on requirements for funding of provincial and local roads.

CHAPTER 1

Introduction

1.1 Background

After years of study, the People's Republic of China (PRC) implemented the Fuel Tax Reform, effective from 1 January 2009. This reform included three key elements. First, the reform abolished the six types of fees charged for roads (including the road maintenance fees [RMFs]), passenger and freight surcharges, and the transport management fees) and the fees for waterway maintenance and management. Second, the reform removed authorization for future loan–toll initiatives on Class II roads, known as "government loan repayment toll roads," and established a schedule for annulling the existing tolls on this class of roads. Third, the reform introduced a series of motor vehicle fuel tax increases to replace the abolished funding sources.

The Fuel Tax Reform was seen as an important public policy initiative to implement a scientific approach in the road sector and reflects the desire of the PRC to address several important considerations such as emission reduction, tax equity, road transport efficiency, and the pricing of oil products. The imposition of the increased fuel taxes represents a milestone in the evolution of the approach of the PRC to financing road construction and maintenance. According to the government, the Fuel Tax Reform has improved revenue collection efficiency and enhanced the ability of the central government to influence road planning and policy.

In early 2011, the Asian Development Bank (ADB) funded a small-scale technical assistance (the Phase I study) to assess the initial result of the Fuel Tax Reform and identify issues that the PRC should address to enhance the effectiveness of the Fuel Tax Reform and improve the sustainability of financing and the delivery of programs for ordinary roads (roads other than expressways).

Key issues and findings from the Phase I study included the following:

(i) **Inflation.** The current fuel tax is set at a fixed rate per liter. Unless a mechanism is established to regularly adjust rates for inflation, fuel tax revenues will lose their purchasing power over time.

(ii) **New Revenues.** The current national road-funding sources are insufficient to maintain the road network and fund planned levels of construction. New or expanded funding sources are needed. Included in this issue is the lack of a local source of funding for roads since the implementation of the Fuel Tax Reform.

(iii) **Debt.** A major effect of the Fuel Tax Reform has been to eliminate the ability of provincial and local governments to use transportation fee–backed debt financing for the delivery of road projects. There are, however, places where the leveraging of transportation revenues may be prudent.

(iv) **Long-Run Feasibility.** The transition to alternative fuels and high-efficiency vehicles is likely to reduce fuel consumption and eventually limit the sustainability of depending on fuel tax.

(v) **Roles and Responsibilities.** The division of roles and responsibilities for each level of government needs to be clarified and potentially adjusted under the new centralized revenue collection scheme.

(vi) **Programmatic Approach.** The current approach to funding ordinary roads does not necessarily direct national resources to specific national goals and objectives.

(vii) **Fund Management and Allocation.** The current national road-funding sources are not explicitly dedicated to roads, nor is there an official, multiyear commitment of the funding that will be made available to provincial and local governments for road construction and maintenance.

(viii) **Organizational Capacity.** It is not clear whether the Ministry of Transport and other applicable central government agencies such as the Ministry of Finance have adequate staff and management systems required to effectively oversee and support a centralized road-funding program.

(ix) **Performance Management.** To fully and effectively manage implementation of the Fuel Tax Reform, some form of national performance targets and an associated performance management approach should be employed.

1.2 Objectives of This Study

The objectives of this study are to build on the findings from the previous study and to further explore the nine key issues identified in that project, develop policy recommendations to address the key issues, and provide a plan and guidance for implementing the recommendations.

CHAPTER 2

Current Situation

This chapter provides the context for the subsequent discussion on road program issues, options, and recommendations. It describes the current status of Fuel Tax Reform implementation; discusses road network expansion trends and plans; and presents an update of the revenue estimates, expenditure plans, and associated funding gap estimates developed for the Phase I study.

2.1 Current State of Reform

Since the 1980s, major improvements to the road system in the People's Republic of China (PRC) have been achieved through implementation of key road development programs such as the National Road System Program, the National Trunk Road Skeleton System Program, and the Rural Road Development Program. These programs were funded by a combination of central government funding from the Vehicle Purchase Tax (VPT), provincial and local dedicated revenues, and toll road initiatives.

The notice for implementing fuel price and tax reform (the Fuel Tax Reform) was issued by the State Council, effective from 1 January 2009, and it increased the rates of consumption taxes for refined oil products. This reform abolished the prior sources of provincial and local government revenues, required that tolls on Class II roads be removed, and provided replacement revenues from the increased fuel taxes. However, there is no specific mechanism in the regulations to increase the fuel tax rates. Consumption taxes are collected by the central government.

Fuel tax revenues are allocated by the Ministry of Finance (MOF) to each of the provincial governments in two parts: (i) replacement of the abolished user fees based on the percentage share of total revenues each province or applicable jurisdiction collected in 2007 through prior road-funding mechanisms; and (ii) a "subsidy" for increased demand. However, the new fuel tax distribution principle and process is not transparent, and it is difficult for the provinces to predict how much fuel tax they will receive for a financial year. A notice is provided showing the fuel tax to be allocated for the current year, but often this is not received until the end of the year, making it difficult to adjust the funding plan for the next year. In the northern area, the construction season is short due to weather and it can be difficult to use the funds. Provinces face withdrawal of fuel tax revenues if the allocated revenues are not spent, which means that the size of the capital program may need to be cut in the following year.

The use of fuel tax revenues varies between provinces, depending on their situation. Officially, all the provinces are supposed to evaluate maintenance demand first and direct fuel tax revenues to meet this demand. In practice, however, most provinces use some of the fuel tax revenues for construction if local revenues are insufficient to fund planned investments. Guangdong Province uses some of the fuel tax revenue for road improvements (construction) because it receives more fuel tax revenue than planned maintenance expenses. Henan Province uses much of the fuel tax revenue to pay interest on debt because the Class II tolls were abolished. In practice, there is little control or oversight on the use of fuel tax revenue allocations to provincial governments.

The VPT is a 10% surcharge on vehicle purchases (automobiles, motorcycles, electric vehicles, trailers, and farm-use vehicles). Revenues from the VPT are administered by the MOF and are mainly used for national and provincial trunk road construction, but they are also used to support other activities such as the water resource development fund and government vehicle fleet replacement.

By the end of June 2010, all provinces in the eastern and central regions had abolished tolls on their Class II roads. In the western region, the Chongqing municipality and two of the other 11 provinces (Guizhou and Yunnan) had completely abolished Class II road tolls, and Shaanxi Province had abolished some toll stations on their Class II roads. There is currently no clear plan for abolishing Class II toll roads in other western jurisdictions, but the Ministry of Transport (MOT) is currently evaluating the feasibility of abolishing all toll stations on both Class I and Class II roads nationwide. Both the MOT and the National Development and Reform Commission (NDRC) would like to present a specific timetable for cancellation of tolls on Class I and Class II roads, but progress depends on financial support from the MOF.

2.1.1 Historical Roadway Development

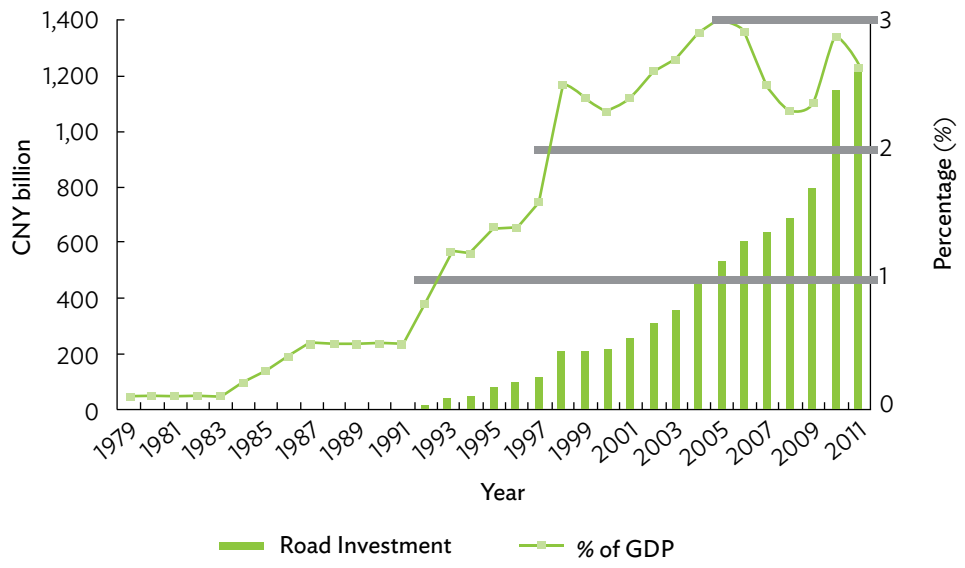
Investment in road improvements increased from CNY6 million in 1979 to CNY1,150 billion in 2010 as shown in Figure 2.1. Road investment reached 1% of gross domestic product (GDP) in 1993, 2% in 1998, and 3% in 2005.

Figure 2.2 shows that much of the increased road development investment between 2000 and 2010 was for expressways, but there was also a significant increase in investment for rural roads.

2.2 Recent and Planned Road Network Development

As shown in Figure 2.3, the road network in the PRC has increased significantly in recent years. The total length of formal roads in the PRC reached 4 million kilometers (km) by the end of 2010, which was 4.3 times that in 1979. Of this, 74,113 km are expressways and the rest are ordinary roads. The large increase shown between 2005 and 2006 resulted from roads that had not been formally recognized being added to the inventory.

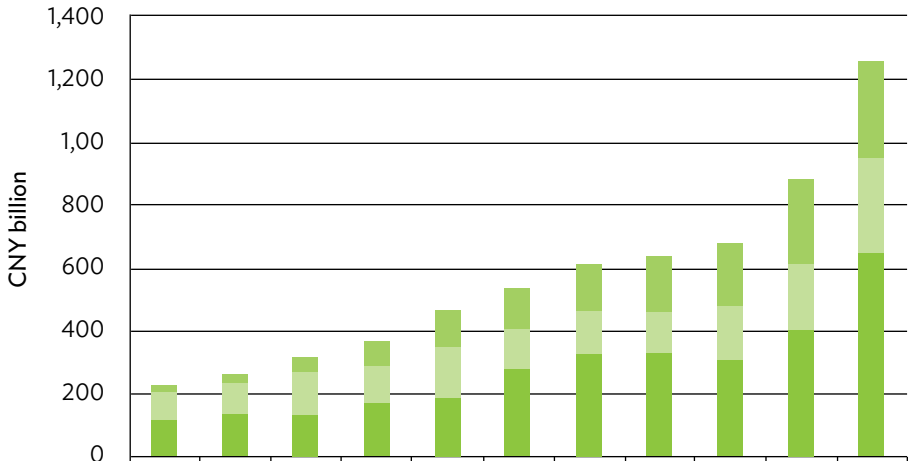
Figure 2.1: Total Road Development Investment



GDP = gross domestic product.

Source: Transport Planning and Research Institute, Ministry of Transport, People's Republic of China (PRC).

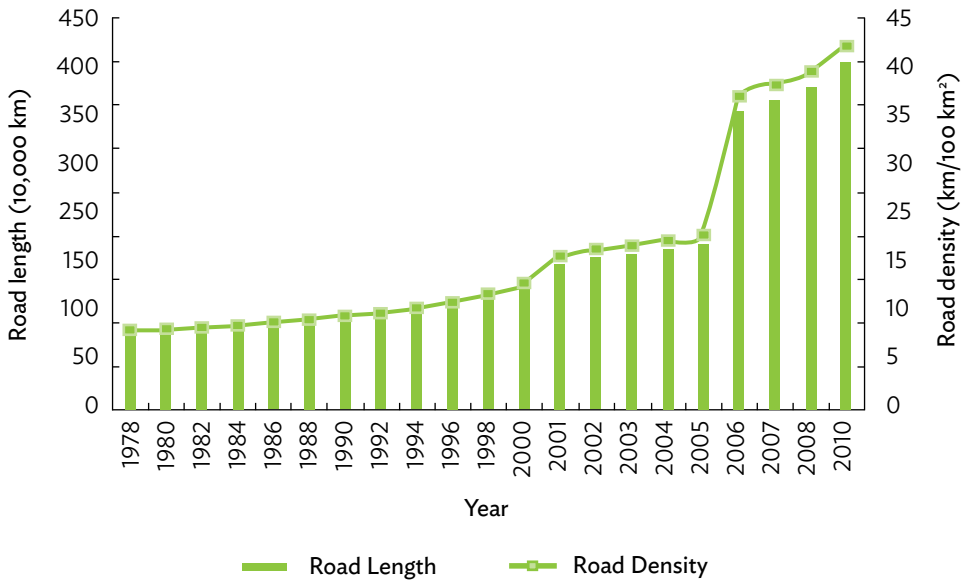
Figure 2.2: Road Development Investment by Type of Road



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Rural roads	30.7	35.8	49.5	81.7	124.2	139.9	159.7	183.6	205.2	276.0	310.0
Ordinary roads	83.7	94.8	137.2	116.9	157.0	123.1	128.7	130.9	169.8	210.0	300.0
Expressways	113.4	132.5	130.1	167.3	183.3	278.3	325.4	325.5	305.0	400.0	650.0

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

Figure 2.3: Change in Total Length of Roads and Road Density



km = kilometer.

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

Table 2.1 shows how the road network changed in terms of technical classification between 1979 and 2010 and the predicted change to 2020. The length of road in each class by province for 2010 is shown in Section A3.2.

Table 2.1: Change in Road Technical Classification

	1979		2010		2020 (Planned)	
Technical Classification	Length in 1,000 km	% of network	Length in 1,000 km	% of network	Length in 1,000 km	% of network
Expressways	0	0	74	2	160	3
Class I and Class II roads	12	1	373	10	700	14
Other classified roads	506	58	2,857	73	3,544	72
Unclassified roads	362	41	703	18	500	10
Other roads	150	17	1,918	48	0	0
Total roads	**880**		**4,008**		**4,904**	

km = kilometer.

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

For administrative purposes, roads are currently divided into six categories—national roads, provincial roads, county roads, township roads, special roads, and village roads. The length of road in each administrative category in each province for 2010 is shown in Section A3.1.

Table 2.2 shows the predicted change in the administrative categorization of the road network (including expressways) between 2010 and 2020; the decrease in unclassified and other roads is due to these being upgraded to higher classifications. Only the total length of roads is shown for 1979 because the national and provincial categorization was not used at that time.

Table 2.2: Change in Road Administrative Category

	1979		2010		2020 (Planned)	
Administrative Category	Length in 1,000 km	% of Network	Length in 1,000 km	% of Network	Length in 1,000 km	% of Network
National roads			164	4	272	6
Provincial roads			270	7	395	8
Local roads			3,574	89	4,237	86
Total roads	**880**	**100**	**4,008**	**100**	**4,904**	**100**

km = kilometer.

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

2.3 The Estimated Funding Gap

The Phase I study included estimates of the planned expenditures by the PRC on ordinary roads for the period 2010–2020, a forecast of the central government revenues likely to be available to meet these expenditures, and an estimate of the resulting "funding gap." The intent of this analysis was to provide a reasonable and defensible assessment of how well the current road financing approach of the PRC will meet their future road expenditure plans.

The Phase I findings indicate that the PRC is likely to face a large funding shortfall for ordinary roads. At the same time, several factors limited the accuracy, level of rigor, and appropriateness of the analysis in the Phase I study:

(i) Official system expansion targets associated with the Twelfth Five-Year Plan had not yet been determined; thus, expenditure estimates were based on adjustments to existing investment policies associated with the Tenth and Eleventh Five-Year Plans.

(ii) An inventory of current road conditions and associated maintenance expenditures was not yet available; thus, maintenance expenditure estimates were based on limited surveys of current system conditions.

(iii) The Fuel Tax Reform had only recently been implemented at the time of the study; thus, only limited information was available on both fuel tax revenue levels and the allocation of the resulting revenues for maintenance, debt service, and other uses.

(iv) The global financial crisis of 2008 and the PRC government's response likely created some short-term impacts on both revenues (fuel tax and the VPT) and government spending on roads, which influenced the ability to generate accurate long-term forecasts.

(v) Real data on key analysis elements, such as fuel consumption, revenue allocations, and expenditure estimates, were largely unavailable or poorly documented.

In light of these considerations, a more robust effort was made to forecast future expenditure needs, available revenues, and associated additional funding needs.[4] The following sections provide the findings from this review of expenditure and revenue.[5]

2.4 Road Network Development Targets

The Phase I study estimated that, under an unconstrained scenario, the PRC will seek to add about 850,000 km of ordinary roads to the existing road network, expanding it from roughly 4.0 million km in 2011 to 4.85 million km in 2020 (a baseline scenario identified a lower 2020 target of 4.3 million km).[6] Revised road network development targets are given in Section A1.1 based on the Twelfth Five-Year Plan, 2011–2015 and the planning adopted for later five-year plans. The revised targets indicate a slightly lower total ordinary road network length of 4.74 million km by 2020. As identified in Table 2.3, the revised targets also reflect a small shift in focus from national and provincial road expansion to rural road development. The new road development targets reflect the objective of the PRC to ensure that by 2020 all townships and 90% of villages are accessible by road.

Table 2.3: Phase I versus Revised Ordinary Road Network Development Targets (1,000 km)

		Phase I Study		Revised		
Administrative Category	2011	2020 Target	Increase	2020 Target	Increase	Change in Target
National roads	104	200	96	157	53	-43
Provincial roads	267	450	183	350	83	-100
Local roads	3,641	4,200	559	4,237	596	+37
Total	**4,012**	**4,850**	**839**	**4,744**	**732**	**-106**

km = kilometer.

Notes: (+) means an increase in the revised 2020 target compared with Phase I 2020 target.
(-) means a decrease in the revised 2020 target compared with Phase I 2020 target.

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

[4] The Phase I study referred to the difference between needs and the central government ordinary road revenues as the "funding gap." However, given that the cost-sharing responsibilities for system development and maintenance are currently undefined and the justification for expansion needs is undocumented, the difference between need and revenues is hereafter referred to as "additional funding required."

[5] For the purposes of comparing the Phase I study expenditure and revenue figures with more recent information and analyses, the time frame for the Phase I findings has been changed from 2010–2020 to 2011–2020; thus, long-term totals are different than what is in the Phase I study.

[6] The Phase I study also included a "Baseline Investment Scenario" that assessed road development demands that were in line with the pace of road development under the Tenth and Eleventh Five-Year Plans. Given the significantly higher targets in the Twelfth Five-Year Plan, the baseline scenario no longer seems relevant; thus, it is not discussed further in this section.

2.5 Revised Expenditure Estimates

2.5.1 Road Development Expenditures

Revised annual construction cost estimates for the period 2001–2020 are provided in Table 2.4 and are compared to the Phase I estimates in Table 2.5. Additional details on construction cost estimates are provided in Sections A1.2 and A1.3. The estimated cost of the revised 2011–2020 ordinary road development targets is CNY7.025 trillion, 21% higher than the Phase I estimate of CNY5.790 trillion. The higher cost is a reflection of increased costs to build new roads due to higher road development standards for all national and provincial roads, together with increased land acquisition, labor, and raw material costs.

Table 2.4: Revised Estimates of Planned Ordinary Road Construction Spending, 2011–2020 (CNY billion)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
National roads	231	242	254	267	280	87	91	96	100	105	1,754
Provincial roads	257	270	283	297	312	232	243	256	268	282	2,701
Local roads	181	190	200	210	220	284	298	313	329	345	2,570
Total	**669**	**702**	**737**	**774**	**812**	**603**	**632**	**665**	**697**	**732**	**7,025**

CNY = yuan, km = kilometer.

Key Assumptions:

- 5% annual average inflation.
- Expansion targets for all Class I roads and most Class II roads completed by 2015.
- Approximately 50% of Class IV roads upgraded to higher classes by 2020.
- Unit costs (CNY/km) for construction provided by the Transport Planning and Research Institute.

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

Table 2.5: Phase I versus Revised Ordinary Road Construction Spending, 2011–2020 (CNY billion)

			Difference	
	Phase I Estimates	Revised Estimates	Amount	%
National roads	1,258	1,754	+496	+39
Provincial roads	2,774	2,701	-73	-3
Local roads	1,758	2,570	+812	+46
Total	**5,790**	**7,025**	**+1,235**	**+82**
Annual average	579	703	+124	+21

CNY = yuan.

Notes: (+) means an increase from Phase I estimates.
(-) means a decrease from Phase I estimates.

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

2.5.2 Road Maintenance Expenditures

Revised annual road maintenance cost estimates for the period 2001–2020 are provided in Table 2.6 and are compared with the Phase I estimates given in Table 2.7. Additional

details on construction cost estimates are provided in Sections A1.4 and A1.5. The revised 10-year estimated maintenance expenditure totals CNY3.8 trillion, about 50% higher than the Phase I estimate of CNY2.5 trillion. The revised estimates reflect the results of recent actual road surveys as well as a better understanding of the unit costs associated with conducting different types of maintenance activities. In addition, the new estimates are based on a broader definition of "maintenance" that includes minor safety improvements to the existing facilities, such as better signage and road marking.

Table 2.6: Revised Estimates of Ordinary Road Maintenance Needs, 2011–2012 (CNY billion)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
National roads	42	47	52	57	63	64	66	68	70	72	600
Provincial roads	71	79	87	96	106	110	119	129	140	152	1,090
Local roads	142	157	174	191	211	213	232	252	273	296	2,140
Total	**255**	**283**	**313**	**344**	**380**	**387**	**417**	**449**	**483**	**520**	**3,830**

CNY = yuan, km = kilometer.

Key Assumptions:

- Unit costs (CNY/km) for maintenance provided by the Transport Planning and Research Institute.
- PRC officials only provided 5-year estimates of maintenance needs, by administrative categories. Annual figures are rough estimates derived from interpolation considering planned expansion and cost inflation estimates.

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

Table 2.7: Phase I versus Revised Ordinary Road Maintenance Expenditures, 2011–2020 (CNY billion)

			Difference	
	Phase I Estimates[a]	Revised Estimates	Amount	%
National roads	423	600	+177	+42
Provincial roads	727	1,090	+363	+50
Local roads	1,382	2,140	+758	+55
Total	**2,532**	**3,830**	**+1,298**	**+147**
Annual average	253	383	+130	+51

CNY = yuan.

Notes: (+) means an increase from Phase I estimates.
(-) means a decrease from Phase I estimates.

[a] Other engineering costs and system development costs in the Phase I report are prorated across the national, provincial, and local (rural) roads based on the share of road maintenance costs.

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

It should also be noted that during expansion of the road network, provincial and local governments have generally pursued quantity rather than quality of roads. There has not been a focus on maintenance and by 2020, it is estimated that much of the road network will require major repair or reconstruction. Annual maintenance costs beyond 2020 are thus expected to increase rapidly.

2.6 Revised Revenue Estimates

2.6.1 Existing Sources

The Fuel Tax Reform eliminated all dedicated provincial and local funding sources for ordinary roads, and removed tolls as a source of revenue on Class II roads in most provinces. The motor fuel tax now provides nearly half of the revenues the central government allocates to roads. The other major source of central government revenues for roads is the VPT. Central government budget allocations have also been provided in the past.

The annual funding allocations that the provincial and the local governments will receive from the fuel tax revenues of the central government are not expected to increase at the same pace as that of the expected growth in revenues from the now-eliminated road maintenance fees (RMFs) (footnote 2). In addition, removal of the RMFs and annulment of tolls on Class II roads have, in principle, eliminated the ability of the provincial and the local governments to finance improvements on ordinary roads through loans. Moreover, most revenues from the new fuel tax are intended to be used for ordinary road maintenance, yet these revenues are less than the projected ordinary road maintenance expenses.

Central government revenue forecasts for the period 2011–2020 are provided in Table 2.8[7] (Section A1.7) and comparisons to Phase I forecasts are summarized in Table 2.10 (details of the revised VPT estimate are provided in Table 2.9). The Phase I revenue forecast for this period was a total of CNY3.7 trillion, including CNY1.78 trillion in fuel tax revenues, CNY1.55 trillion in VPT revenues, and CNY0.53 trillion in general budget allocations. The revised revenue estimates, however, forecast combined revenues of CNY5.7 trillion (CNY2.0 trillion in fuel tax revenues and CNY3.7 trillion in VPT revenues) for the same period, reflecting a more than 50% increase in the total expected revenue.

Table 2.8: Revised Central Government Revenue Estimates, 2011–2020
(CNY billion)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Fuel tax	128	144	160	176	192	208	224	240	256	274	2,002
VPT	125	167	224	284	320	400	450	507	571	642	3,690
Total	**253**	**311**	**384**	**460**	**512**	**608**	**674**	**747**	**827**	**916**	**5,692**

CNY = yuan, VPT = vehicle purchase tax.

Key Assumption:

Compound annual growth rate for fuel tax revenue of 6.2% and diversion of 30% based on estimates provided by the Transport Planning and Research Institute.

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

[7] Note that fuel tax revenue estimates are based only on assumed growth in central government allocations from the fuel tax. Actual fuel tax revenue and fuel consumption data were not disclosed by the government.

Table 2.9: Vehicle Purchase Tax Forecast Details

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gross auto sales	18.7	20.6	22.6	24.9	27.4	29.6	31.9	34.5	37.3	40.2
Taxable sales	14.5	15.5	16.5	17.5	18.6	19.7	21.0	22.3	23.7	25.0
Average price/auto	157	161	166	172	177	184	190	196	203	210
Gross revenues	227	250	280	315	355	400	450	507	571	642
Diversion	(102)	(82)	(56)	(32)	(36)	(0)	(0) 0	(0) 0	(0) 0	(0)
Net revenues	**125**	**167**	**224**	**284**	**320**	**400**	**450**	**507**	**571**	**642**

Note: Auto sales are in yuan (CNY) millions, average price in CNY thousand, and revenues/diversion in CNY billion.

Key Assumptions:

(i) Compound annual growth rate (CAGR) for fuel tax revenue of 6.2% and diversion of 30% based on estimates provided by the Transport Planning and Research Institute.

(ii) CAGR for vehicle sales of 8.9% based on estimates from the China Automobile Manufacturers Association.

(iii) Of the total vehicle sales, 76% are light-duty vehicles and are subject to vehicle purchase tax (VPT) based on 2011 and 2012 ratios.
   a. Average price per vehicle grows at the forecasted consumer price index (2.7% in 2012, 3.1% in 2013, and 3.4% per annum after that) and VPT rate remains at 10% of vehicle price.

(iv) Diversion of the VPT to other purposes phased out between 2011 and 2015.

Source: ADB estimates.

Table 2.10: Phase I versus Revised Revenue Estimates, 2011–2020 (CNY billion)

Revenue Source	Phase I Estimates	Revised Estimates	Difference	
			Amount	%
Net fuel taxes	1,788	2,000	+214	+12
Net VPT	1,553	3,690	+2,137	+138
Government budget	369	0	-369	-100
Total	**3,710**	**5,690**	**+1,982**	**+50**

CNY = yuan, VPT = vehicle purchase tax.

Notes: (+) means an increase from Phase I estimates.
(-) means a decrease from Phase I estimates.

Source: ADB estimates.

Factors and assumptions that influence the revised revenue forecast include

(i) The Phase I assumption that general government budget revenues will continue to be provided were deemed to be inappropriate for forecasting revenues since they are determined on a year-to-year basis through the national budgeting process and are thus not an assured source of central government funding.

(ii) The Phase I study estimates for fuel tax revenues assumed that receipts would grow at 7% annually from 2011 to 2015 and 5.6% from 2016 to 2020, with 30% of funding diverted for debt service repayment and other uses such as waterways investment and transportation agency management. The revised estimates use an average annual growth rate of 8.6% over the 10-year period, with a slightly higher

diversion rate of 33% (10% for debt service and 23% for management and other nonordinary road purposes). It is important to note that the PRC does not publish data on fuel consumption and fuel tax revenues and there is no set policy on the share of fuel tax revenues that are allocated to ordinary roads each year; thus, estimates are highly speculative. Recent estimates developed by J.P. Morgan and HSBC, however, reflect gasoline and diesel consumption figures for 2011 that are consistent with this report's forecast and project that growth will be significantly higher than what was assumed in the Phase I report (as high as 12% annual growth in the short term).[8]

(iii) The Phase I study estimates for VPT revenues assumed that vehicle sales would grow at an annual rate of 10% through 2015 and 8% thereafter, and that average VPT revenues per vehicle sale would remain flat over the entire 2011–2020 period. The new VPT revenue estimate is based on an assumption that average annual passenger car sales will reach 25 million units by 2020, the average revenue per vehicle will increase at the same rate as the forecasted CPI (2.7% in 2012, 3.1% in 2013, and 3.4% per year thereafter), and that the diversion of VPT revenues to nonordinary road purposes will be reduced from 50% in 2011 to 20% by 2015, and would then be completely eliminated in 2016 and maintained thereafter at 20% through 2020.[9] The resulting revised estimates reflect higher gross VPT revenues of about CNY15 billion in the base year (2011), an annual growth rate for gross revenues of 9.7%, and gradual elimination of diversion.

2.7 Additional Funding Required

Additional revenue required to meet planned expenditures is presented in Table 2.11 and is compared to the Phase I estimates of expenditures and available central government revenues for 2011–2020 in Table 2.12. As shown, both total planned expenditures and anticipated revenues are significantly higher under the revised estimates; thus, the overall additional funding needed has increased from CNY4.609 trillion to CNY5.164 trillion.

Table 2.11: Additional Revenue Required to Meet Expenditures, 2011–2020
(CNY billion)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Total needs	924	985	1,050	1,119	1,192	990	1,050	1,113	1,181	1,253	10,855
Total revenues	253	311	384	460	512	608	674	747	827	916	5,692
Unfunded	**670**	**674**	**666**	**659**	**681**	**382**	**376**	**366**	**354**	**337**	**5,164**

CNY = yuan.

Source: ADB estimates.

[8] S.Y. Ling. 2012. Chinese Gasoline Demand to Grow by 12% in 2013 on Rising Vehicle Sale. *China Energy Forum*. 24 August. http://www.energychinaforum.com/news/66341.shtml

[9] CPI forecast from *Global Economy Watch/Projections,* PWC, London, UK, December 2012. http://www.pwc.co.uk/economic-services/global-economy-watch/gew-projections.jhtml; 2020 annual sales forecast based on average of estimates from multiple sources, adjusted to separate auto sales from total vehicle sales.

Table 2.12: Phase I versus Revised Estimates of Additional Funding, 2011–2020
(CNY billion)

	Expenditures	Revenues	Additional Funding Required
Phase I estimates	8,321	3,710	4,609
Revised estimates	10,855[a]	5,692	5,164
Difference	+2,534	+1,982	+555
Percent change	+30%	+53%	+12%

[a] No cost sharing.

Notes: (+) means an increase from Phase I estimates.
(-) means a decrease from Phase I estimates.

Source: ADB estimates.

2.7.1 Observations on Expenditure and Revenue Estimates

Both the Phase I and the revised expenditure and revenue estimates suffer from incomplete data and lack of documentation of assumptions. Specific examples are as follows:

(i) While the revised ordinary road development targets are based on figures developed for the Twelfth Five-Year Plan, only limited documentation is available on how the PRC determined and justified the associated road network expansion goals.

(ii) The maintenance cost estimates under the revised analysis are significantly higher, but they are based on general assumptions about average annual maintenance costs per kilometer of road since adequate data and systems are not available to calculate more accurately, reflecting actual system conditions or maintenance cycles for the different classes of road.

(iii) For maintenance and construction expenditures, consistent data that focused solely on the ordinary road network was often unavailable. Similarly, the application of inflation factors to various data sets was often difficult to discern, and it is not possible to guarantee that all expenditure estimates have been properly allocated.

(iv) The data and analyses associated with revenue forecasts are rough approximations due to the lack of official figures. With respect to motor fuel tax revenues, neither historical data nor future estimates of typical cost parameters such as annual fuel consumption, average vehicle fuel efficiency, or annual vehicle kilometers traveled were available from official sources. While there is better historical data related to VPT revenue estimates, and publicly available estimates from third-party sources were used to better estimate growth in vehicle sales and average VPT revenue per vehicle, the diversion of VPT revenues to nonordinary road purposes is determined through annual budgeting processes; thus, the assumption that diversions will be phased out by 2016 is not based on an official PRC policy.

As a result of these uncertainties, the estimated need for additional revenues is difficult to ascertain. Since actual revenues from fuel taxes and the VPT are not available, it is unclear if higher rates would be necessary if a larger percentage of actual revenues were dedicated to the road sector.

CHAPTER 3

International Experience on Funding Roads

The following section provides a description of selected international practices that are relevant to the 11 key issues identified in the Phase I study. Due to the unique nature of the policy-making approaches, budgeting and planning processes, and program delivery structures of the People's Republic of China (PRC), the applicability of these findings varied by issue. In some cases, identified options and recommendations are directly tied to identified best practices; in others, the international experience only provides a context and a starting point for developing proposed approaches that may work in the PRC context.

3.1 Division of Roles and Responsibilities

All countries provide some level of national government funding for roads, and national governments typically have lead responsibility for functions such as setting system-wide development and performance goals, establishing standards, determining planning processes, and coordinating roadway policies with broader social goals. In addition, the share of construction and maintenance costs covered by national governments tends to decrease as the function of the facilities becomes more local in nature. This section indicates broad differences in how national governments in developed countries influence transportation decision making at different levels.

In Germany, the federal government heads the development of the federal master plan, creates the country's overall transport policy framework, and is responsible for planning and financing construction and maintenance for federal roads. The Lander (State) and local governments also play a strong role in planning federal roads by suggesting projects and controlling many of the legal elements of project development. Lander governments are responsible for building and maintaining federal roads and planning state-level roads within their own jurisdiction; local governments are responsible for planning, financing, and delivering road programs in their own systems.

The Ministry of Land, Infrastructure, Transport and Tourism in Japan administers national expressways and some national roads, and sets all road charge rates and fees. Prefectures and major cities administer "subsidiary" national roads and state roads, and minor cities administer municipal roads.

In the United States (US), the Federal Highway Administration (FHWA) has stewardship of the National Highway System (primarily interstate highways, US routes, and most state routes), from construction of new highways, bridges, and tunnels to maintenance and preservation. The FHWA also provides federal financial assistance to state and local

governments for constructing, preserving, and improving public roads and highways, including within federally owned lands (e.g., national parks, forests, and wildlife refuges) and tribal lands. It establishes national policies; sets standards; implements federal fuel taxes and other user charges; creates planning practices for facilities eligible to receive federal funding; conducts research; and provides technical assistance to state, local, and federal partners. It also oversees projects using federal funds to ensure that requirements for project eligibility, contract administration, and construction standards are adhered to. State and local governments undertake the detailed planning, construction, maintenance, and management of the federal system and nonfederal roads.

The federal government in Australia is responsible for funding national highways, state governments for funding arterial roads, and local governments for funding local roads. However, the federal government encourages funding from state, territory, and local governments, and public–private partnerships to upgrade the national highway network, and requires state government funding contributions on parts of the network, especially for new links. For example, the Pacific Highway and the Calder Highway are now part of the national network, but new projects are being funded with equal contributions by the federal government and the state governments. State contributions (generally 20%) are required on some sections of the old network near major cities. In practice, the federal government and the state governments also contribute toward local road funding. National highways and main roads in the states are effectively the responsibility of the state governments. This includes implementation of works on national highways by contract. Australian states are now merging the state road agency and the road regulatory authority so as to have only one authority responsible for state roads.

In India, the central government, the Ministry of Road Transport and Highways, is responsible for formulating and administering policies for road transport, national highways, and transport research. While the ministry still manages some national highways, the National Highways Authority of India is entrusted to develop, maintain, and manage other national highways. The Planning Commission has various responsibilities for evaluation and examination of road proposals. The government is considering a proposal for setting up an Expressway Authority of India. State highways and major district and rural roads, which are managed by the respective state governments, are developed and maintained by various agencies in the states and union territories. In most states, the road management agency is still the public works department, although other agencies are being established, particularly to manage PPP schemes.

Management of the Strategic Road Network in the United Kingdom lies with the secretary of state, with system planning, operations, maintenance, and improvement conducted by the Highways England, the National Assembly in Wales, and the Scottish Executive in Scotland (national through routes). At the national level, the Department for Transport establishes transport strategy and policy that is then implemented by the executive agencies. Regional roads are delivered by the regional-level "government offices," and local governments provide, manage, and maintain local road networks. The national government funds the Strategic Road Network through the Highways England and provides funding through the Department for Transport to local transport authorities for local transport services and system improvements and maintenance.

There are essentially two levels of road management in New Zealand: (i) the government, which has assigned the mandate for regulating land transport, administering road user charges, making decisions on use of national government funds for roads, on public passenger transport, and managing the national highways to the NZ Transport Agency (NZTA); and (ii) local authorities (municipalities and district councils) that are responsible for managing all other public roads and public transport. Overall responsibility for road sector policy lies with the Minister of Transport assisted by the Ministry of Transport. The minister issues a government policy statement on land transport funding at least every 3 years. This document sets out the land transport funding priorities, objectives, and impacts that the government wishes to achieve. NZTA and local governments must take account of the policy statement when preparing their land transport programs. NZTA uses commercial agents to provide front counter services for vehicle registration and licensing and to operate the road user charges system.

3.2 Funding Sources

3.2.1 General Budget Allocations

A central government contribution to a road fund from general revenues is common, particularly in the early stages of establishing a fund before other sources of funding are fully developed. In more established road funds, a government contribution may still be made for specific activities required by government that are not a priority in terms of the mandate of the road-funding agency, or as an interim measure in lieu of increases in road user charges.

Where there are strong units of local government, it is common that the local government makes a contribution through charges levied on property owners toward the cost of providing and maintaining roads under its jurisdiction.

Examples of government contributions from general revenues to road funding are given in Table 3.1.

Table 3.1: General Budget Contributions to Road Funding

Country	Examples of General Budget Contributions
Australia	The Government of the State of Victoria, Australia, makes payments from its general budget to the Better Roads Victoria Trust Account along with the revenues from vehicle registration renewals.
India	Some state road funds in India receive budget support from central and state governments, for example, the state of Kerala.
Japan	A small percentage of road funding comes from general budget allocations.
Nepal	Of the revenue for the Road Maintenance Fund, 50%–60% is from the government general budget.
New Zealand	Central government has contributed 3% in 2008/2009, 5.2% in 2009/2010, and 5.7% in 2010/2011 of total revenue in the National Land Transport Fund, partly for specific activities that it considers should not be charged on road users and partly to make up for shortfalls in road user charge revenues. Local government provides, from general revenues, an average of 50% of the cost of maintaining and improving local roads. The remaining 50% is provided from the National Land Transport Fund.

continued on next page

Table 3.1 continued

Country	Examples of General Budget Contributions
Papua New Guinea	Central government has provided, from the development budget, 12% of the expected 2012 revenue to the Road Fund.
Sri Lanka	The government contributed $30 million in 2006, increasing by $4 million each year until 2010, from the general budget to the Road Maintenance Fund to make up for shortfalls in road user charge revenues.
United States	Congress allocated in excess of $70 billion from the general fund to surface transportation between 2008 and 2010. States fund some of their share of road costs from general budget revenues.

Source: ADB.

3.2.2 Road User Fees

Developed countries employ a range of road user fees. In some countries, such as in the United States, Japan, New Zealand, and (to a more limited extent) Germany, revenues from road user fees are dedicated for investment in transportation. Most European countries, along with Canada and Australia, impose fuel taxes and other road user charges, but revenues are treated as general purpose resources; national-level support for road investment is then provided through general budget accounts.

The most commonly imposed user fees are motor fuel charges, which nearly every country imposes. The current motor fuel taxes rates in the PRC are clearly at the low end of the spectrum when compared with rates in most developed countries (e.g., gas and diesel excise taxes in many European countries are three to four times the rates in the PRC). Other commonly imposed user charges include vehicle registration and other related fees, value-added tax (on motor fuels, vehicle sales, auto parts, etc.), vehicle/vehicle parts sales taxes, heavy vehicle surcharges, distance-based fees, and (in limited places) cordon pricing. The following is a more detailed discussion of road financing approaches in selected countries:

(i) **United States.** The United States relies heavily on motor fuel taxes to fund roadway investment; nearly 90% of the revenues in US Federal Highway Trust Fund (HTF) come from gasoline and diesel taxes. Other sources of dedicated funding include truck user fees in the form of a heavy vehicle use tax, a truck and trailer sales tax, and a truck tire tax.

State and local governments in the United States mobilize funding for highways from a variety of mechanisms, and approaches vary across jurisdictions. All states have their own fuel taxes that are imposed besides federal fuel taxes and are typically dedicated for transportation purposes. Many states also collect some form of vehicle registration fee that is dedicated for highways; other state-level highway funding sources include sales tax proceeds, bonds, and general budget allocations. In a few instances, surplus revenues from toll road operations are used to fund general road system development and maintenance activities. At the local level, very little roadway funding comes from user fees; most of it is allocated from general budgets and comes from sources such as property and general sales taxes.

(ii) **Germany.** Until the mid-1990s, Germany financed its highway and maintenance activities from the general federal budget. In 1995, Germany introduced time-related charges on heavy good vehicles (trucks of gross vehicle weight of 12 tons or more)

on its entire motorway system—these charges raise an average of €450 million (CNY4 billion) annually, which has been dedicated for road investment. In 2005, the heavy goods vehicle taxing program was expanded to levy distance-based fees, which currently generate an additional €4.4 billion (CNY40 billion) annually for road investment purposes. Germany also relies on public–private partnerships and tolling to pay for expansion of its expressway system.

(iii) **Japan.** The Central Government of Japan imposes an array of highway-user charges on various parties ranging from vehicle manufacturers and dealers, through consumption taxes, to the vehicle user, through vehicle fees and fuel taxes. Revenues from these charges are transferred from dedicated highway funding sources into a special account to support implementation of five-year plans. The sources of funding for road investment in Japan include dedicated user fees, toll revenues and toll-backed debt, and general budget appropriations.

3.3 Maintaining Purchasing Power

The concept of developing a mechanism to ensure that fuel excise taxes maintain their purchasing power is often discussed, but the record of developed countries actually doing anything about it is somewhat limited.

In the United States, national fuel tax rates are established by Congress and have not been increased since 1993. With regard to fuel taxes, "indexing" to inflation or converting to a sales tax approach is often proposed, but lawmakers have been unwilling to do so. At the state level (all states in the United States also impose their own fuel taxes in addition to federal taxes), fuel tax rate increases are also generally treated on an ad hoc basis, although a few states have either used limited indexing, which establishes a ceiling on the rate of increase in a given time period, or added a sales tax component to their fuel tax structure that provides a form of indirect indexing. Similar to the United States, Japan last increased its fuel tax rates in 1993, and efforts to increase the taxes have been met with stiff public and political opposition.

European countries have generally been willing to increase their fuel excise taxes more regularly, although most do so on an ad hoc basis. However, as most European countries impose a value-added tax on motor fuels, there is also a sales tax-like component that is sensitive (although not directly tied) to inflation. Moreover, both the United Kingdom and Germany have experimented with fuel tax indexing. The United Kingdom established an "escalator" in the 1990s, which adjusted fuel tax rates at 5% per year, but repealed the mechanism in 1999 in response to widespread public protests. Germany implemented an inflation-based adjustment in the late 1990s but repealed the approach after a few years over public concerns about the rapid increase in fuel prices.

There is currently no link between charges on road users and central government funding for roads in Australia. However, there is a link between that part of road expenditure that is attributed to heavy vehicles and the charges imposed on heavy vehicles. The charges for heavy vehicles consist of a combination of an annual registration charge collected by the states and territories and a road user charge on fuel collected by the central government.

The law for interstate transport provides a mechanism to adjust the annual registration charge and the amount of the fuel-based road user charge. The Federal Minister for Infrastructure and Transport has regularly issued determinations that have increased the fuel-based road user charge. The most recent determination, made in June 2011, increased the charge from A$0.22 per liter to A$0.23 per liter. This process does not change the price of fuel but reduces the fuel tax credit that transport operators and nonprofit bodies can claim.

In New Zealand, adjustment to central government funding for land transport activities is provided for in the law. The Minister for Transport is required to issue a government policy statement on land transport funding every 3 financial years, which guides the outcomes that the government wishes to achieve and links the amount of revenue that the government will raise from road users with the planned levels of expenditure. Revenue is raised from road users by fuel excise duty, road user charges, and motor vehicle registration and licensing fees. The current government policy statement includes the statement that the government will need to increase rates of fuel excise duty and road user charges during the first 3 years of the government policy statement by at least the rate of inflation. For 2012, the potential increase will be in the order of NZ$0.02 a liter and in 2013 the potential increase will be in the order of NZ$0.015 a liter. The increase took effect in July 2014, and another increase will be in June 2015.

3.4 Debt Financing

3.4.1 Use of Debt

International experiences appear to offer limited ideas on provincial and local road-related debt practices that are applicable to the circumstances prevalent in the PRC. In the United States, for example, state and local governments issue debt as they see fit and as their legislative bodies allow, using their own revenue sources to secure and repay debt; the US federal government has little oversight or involvement in these activities, other than providing tax advantages to lenders and debt holders. The main exception is a relatively small federal program[10] that provides loans or loan guarantees for high-profile highway and transit projects. States and local governments in the United States can also issue grant anticipation notes, where debt is secured and repaid with future federal apportionments.

3.4.2 Shadow Tolling

Shadow tolls are payments made by a road agency to a road facility operator (concessionaire) on the basis of actual traffic volumes and agreed rates. They may be used with both tolled and un-tolled roads. For tolled infrastructure, the toll necessary for the road facility operator to recover the investment, repay loans, cover operating costs, and provide a return on investment may be so high that it will significantly reduce the traffic volume using the facility. In this case, the road agency may agree to a reduced actual toll and make up for the shortfall by a shadow toll. An adjustment mechanism needs to be included so that the shadow toll ceases to exist when there is enough traffic to achieve the required financial return. A shadow toll component or guarantee may also be used with actual tolls in

[10] The US federal credit program is known as the Transportation Infrastructure Financing Investment Act or TIFIA.

situations where there is political instability, uncertain economic climate (which can reduce transport demand), or potential for construction of competing projects.

Shadow tolls also can be used totally in place of an actual toll being collected to save the cost of toll collection and the delay to traffic. This is most often used where existing roads are upgraded. A concessionaire provides capital for the upgrade, and operates and maintains the road for a long-term concession period. The road agency reimburses the concessionaire by way of a shadow toll.

There are often problems with traffic risk associated with use of shadow tolls. The risk of lower traffic is transferred to the private operator and the risk of higher traffic is assumed by the road agency. Also, it can be argued that shadow tolls are not efficient as they do not charge users for the actual cost of road use as direct toll charges do, for example, and, therefore, the demand management effect of an explicit toll is lost.

Portugal and Spain have used both actual and shadow tolls to finance both new infrastructure projects and improvements to existing highways. But the payment obligations of the governments under these contracts have increased so much that many concessions had or will have to be converted to user-paid tolls.

Annuity payment is a variation of shadow toll where the payment to the concessionaire is determined in absolute terms with no direct reference to usage of the roads by the vehicles. This approach removes the traffic risk from the agreement between the road agency and the concessionaire. The annuity scheme is a means of "borrowing" from the private sector for road development, wherein construction, long-term operations, and maintenance responsibilities are combined into a single arrangement.

Both shadow tolls and annuity payments require the road agency to find the revenue to make the payments. They are therefore not a means of financing roads, rather a means of repaying investment by other parties.

3.5 Long-Term Funding

Almost all countries continue to rely on fuel tax for at least part of the general funding for roads. Because these taxes are usually levied on a fixed price per liter basis, the rate needs to be increased periodically to keep pace with inflation, improved fuel efficiency, and road network expenditure needs. Increasing the fuel tax rate has become difficult politically in recent years, which has led some countries to investigate more sustainable forms of charging for road use.

Other considerations that have led to alternative systems of charging for road use, other than by a levy on vehicle fuel, include the costs incurred by heavy vehicles that are not fully recovered by a fuel levy, road congestion (which varies with location and time of day), and environmental costs that are not reflected well by a fuel levy.

Toll roads allow different prices depending on the type of vehicle, and in some cases on the time of day. A number of cities in developed countries (e.g., Bergen, Durham, London, Oslo, Singapore, and Stockholm) have implemented electronic road congestion pricing schemes.

The development of countrywide, distance-based pricing schemes is still in a fairly nascent state throughout the world. In recent years, a few developed countries have undertaken major national-level studies to explore options for addressing road spending needs. These include the US National Surface Transportation Infrastructure Financing Commission,[11] the German Pällmann Commission,[12] and the UK Eddington Study.[13] All three studies concluded that the long-term road network needs of their respective countries could best be met through a greater reliance on road pricing schemes that recover a larger percentage of road use costs, that is, including congestion and environmental costs.

Within the European Union (EU), Directive 1999/62/EC, as modified by Directive 2006/38/EC and by Directive 2011/76/EU, provides the legal basis for distance-related tolls and time-based user charges (vignettes) for heavy goods vehicles (above 3.5 tons). Belgium, Denmark, Luxembourg, the Netherlands, and Sweden have a common time-based system of user charges for heavy goods vehicles above 12 tons on highways and selected motorways called the Eurovignette system. This was launched as a paper system in 1995 and converted into an electronic system in October 2008.

From January 2005, Germany has levied distance-based fees on heavy goods vehicles with a maximum permissible gross laden weight of 12 tons and more on German motorways using an on-board unit (OBU) and a satellite-based system. The distance actually driven by the vehicle is used to calculate the road charge, which also varies according to road congestion and the environmental performance of the vehicle (Euro emission rating). Other European countries, including Poland, the Czech Republic, Austria, and Switzerland, have developed similar heavy vehicle distance charging systems, most of which use electronic tolling.

In Switzerland, the electronic, distance-based road user charging scheme for heavy vehicles was launched in 2001. Vehicles pay for distance traveled on all Swiss public roads, with the charge based on gross laden weight, Euro engine rating, and the distance traveled. Distance is measured by an OBU connected to the tachograph of the vehicle. To avoid fraud, which can result from interference with the tachograph signal, the reading is correlated with a global positioning system unit. A second-generation OBU with improved security and communications features was introduced on 1 January 2011.

There is no EU directive to govern charging private vehicles because the main concern is limiting barriers for road freight transport within the EU. Seven member states (Austria, Bulgaria, the Czech Republic, Hungary, Romania, Slovak Republic, and Slovenia) have time-based systems for private vehicles, with Belgium having announced its intention

[11] National Surface Transportation Infrastructure Financing Commission. 2009. *Paying Our Way: A New Framework for Transportation Finance.* Final report, February.

[12] Pällmann Commission. 2000. *Final Report of the Governmental Commission on Transport Infrastructure Financing.* Berlin: Minister for Transport, Building and Housing.

[13] S.R. Eddington. 2006. *The Eddington Transport Study: Main Report, Transport's Role in Sustaining the UK's Productivity and Competitiveness.* Great Britain H.M. Treasury and Great Britain Department for Transport, December.

to introduce such a system. A study on vignette systems had been conducted, and a communication had been issued by the EU providing guidance on vignettes for light private vehicles.[14]

The Netherlands has been one of the leading countries to explore distance-based charges for all road users on all roads. The Dutch have been planning to introduce a congestion pricing program that uses satellite technology to track every vehicle in the country and charge them per kilometer driven according to a flexible rate schedule. Initially, the program will cover commercial vehicles only, expanding over time to include all vehicles by 2018. The program is currently on hold due to strong public and interest group opposition.

The United States has begun to investigate distance-based pricing schemes, but is still in the process of conducting studies or developing and implementing pilot programs.[15] The State of Oregon has conducted the most comprehensive pilot program that assessed the viability of different technological approaches for implementing a state-wide pricing scheme. Alabama, New York, and Minnesota[16] have addressed various issues concerning vehicle miles of travel fees. While several other states, and even the US federal government, have talked about pricing as a long-term option for replacing the motor fuel tax, progress toward implementation has been minimal.

Since 1978, New Zealand has had a distance-based road user charging system for heavy vehicles, which uses hubodometers to measure the distance traveled for charging purposes.

3.6 Dedication of Road User Revenues

The approach to road funding is to charge road users a fee for service and to dedicate the resulting revenue to road expenditure, which benefits road users. Charging a toll for the use of a particular facility or section of the road network is the most direct way of doing this. However, currently available technology does not facilitate its use on all roads, and less direct ways of charging road users have to be used. The most common indirect methods involve levying charges at a national level on vehicles and the fuel that they use.

In Australia, the federal government has twice in the past hypothecated a share of fuel taxes for road expenditure purposes but since 1991 has provided road funding through the government budget process. Australian state governments are currently advocating reform of road funding and expenditure arrangements.

Brazil hypothecates some fuel tax revenue for transportation infrastructure expenditures and also transfers some of this revenue to the states and the municipalities.

In India, with the exception of road tolls and the central government tax on fuel, revenue from the various road-related taxes and charges is generally not hypothecated to the road

[14] European Commission. 2012. *Communication from the Commission on the Application of National Road Infrastructure Charges Levied on Light Private Vehicles.* (COM (2012) 199).

[15] National Cooperative Highway Research Program (NCHRP). 2010. *System Trials to Demonstrate Mileage-Based Road User Fees.* Project 20-24 (69A).

[16] Minnesota Department of Transportation. 2010. *Potential Benefits to the Freight Industry of Distance-Based Road User Fees.* Transport Research Synthesis TRS 1008.

sector but forms part of the general revenue. The central government tax on diesel and motor spirit is dedicated for the development and maintenance of national highways, state roads, and rural roads, and for the construction of overpasses and underpasses and other safety features at unmanned railway crossings.

Box 3.1: Earmarking

During the early 1950s, New Zealand, Japan, and the United States set up earmarked road funds based on the "user pays" principle. This involved earmarking certain road-related taxes and charges and depositing them into a special account, or road fund. The earmarked funds were higher than the previous allocations from the general budget and, since the funds were managed off-budget, they were subject to less stringent budget discipline. Many developing countries adopted this model in the 1970s and 1980s, while many Eastern European transition countries adopted it during the early 1990s. Apart from New Zealand (which restructured the road fund several times, most recently in 1996), the United States (which also restructured the road fund several times), and Japan (which is a special case), virtually all these road funds failed to deliver a secure and stable flow of funds for roads. They diverted funds away from other sectors, funds were poorly managed, and the added revenues were often not spent on roads. As a result, the ministries of finance, the International Monetary Fund, and donor organizations now oppose the establishment of such earmarked road funds.

If the revenues continue to be collected under the tax-making powers of the government, then the fee-for-service concept does constitute a form of earmarking. However, provided the revenues consist of charges related to road use, and the funds are proactively managed to strengthen financial discipline, most fiscal economists describe this as "benign" earmarking. It approximates closely to a user charging system, helps to improve allocation efficiency, and does not abstract revenues away from other sectors. On the contrary, if the legislation supporting the road fund describes the payments made by road users as a "road tariff"—and the money is no longer collected under the tax-making powers of the government—then the fee-for-service concept does not constitute earmarking.

When pressed to adopt earmarking, developing countries often resist, promising to do better within the existing budget processes of the government. Such promises give lenders little reason for optimism. The pledge of a government to provide adequate funds does not commit succeeding governments, and the many pressing calls on government general revenues make it a difficult pledge to keep. The evidence is that, without earmarking, there is only a small chance of developing countries consistently allocating sufficient revenues to meet road maintenance needs.

Source: World Bank website: http://web.worldbank.org/wbsite/external/topics/exttransport/extroadshighways
Asian Development Bank. 2003. *Roads Funds and Road Maintenance, an Asian Perspective.* Manila.

Japan has hypothecated gasoline tax for road purposes since 1954. This dedicated funding was extended to include a diesel tax (1956), liquefied petroleum gas (LPG) tax (1966), motor vehicle purchase tax (1968), and motor vehicle tonnage tax (1971). The Ministry of Finance has tried to transfer funds earmarked for road improvement to the general budget, but local governments with inadequate road infrastructure and car user groups strongly opposed these moves insisting that it is against the benefits-received principle of taxation, i.e., the individuals who receive the benefit of a good or service should pay the tax necessary to supply that good or service.

In New Zealand, all revenues from road user charges (after administration costs) have been dedicated for land transport purposes from the inception of the road user charging system in 1978. Historically, only a portion of the excise duties on motor vehicle fuel (gasoline, compressed natural gas [CNG], and LPG) was hypothecated for road-related purposes, but from July 2008 all of the excise duty on these fuels has been hypothecated to land transport activities. For gasoline, this is currently $0.39/liter (CNY2.5/liter). There is no excise duty on diesel because diesel-powered vehicles pay road user charges.

The United States has hypothecated fuel tax at the federal level for highway purposes since 1956. Truck user fees (heavy vehicle use tax, truck and trailer sales tax, and truck tire tax) have been added, although fuel taxes still provide about 90% of the revenue. The rate of dedicated fuel tax has been increased over the years but has not been increased since 1993. The current rate for gasoline and gasohol is $0.0486/liter (CNY0.31/liter) and for diesel, $0.0645/liter (CNY0.41/liter). Proceeds from fines and penalties imposed for violation of motor carrier safety requirements, and proceeds of certain penalties imposed by the Internal Revenue Code related to highway-user taxes, are also dedicated for highway purposes.

3.7 Road Programs

In Australia, the federal government provides funding for roads through two main programs—the Roads to Recovery Program and annual financial assistance grants. The Roads to Recovery Program provides tied funding directly to local councils, which are required to account for the use of funds against specific projects. Councils are required to match this funding with equal funding from their revenues. Annual financial assistance grants are untied to any specific purpose in the hands of the local government, allowing councils to spend the grants according to local priorities. The federal government also funds a black spot program for national highways as well as for local roads.

Highway construction and maintenance spending in Germany is determined by the Federal Transport Investment Plan, created by the Transport Ministry and approved by the German Parliament every 7–10 years. Funding decisions are then determined through multiyear programs. Federal allocations to state and local governments are based on the share of registered vehicles in each jurisdiction, with some adjustments made for city-states such as Berlin.

Japan prepares 5-year highway development plans, with the national government establishing national investment priorities and targets. National projects are selected through a programming process that includes cost–benefit analysis. Costs for toll road construction and maintenance are borne by expressway companies (national expressways), and costs for other roads are shared between the national government and the relevant subordinate government levels based on the type of facility.

The Government of India has a National Highway Development Program (NHDP) for upgrading national highways and for constructing new expressways. The NHDP is taken up under the five-year plans depending on resource availability. The government also has programs for improvement of state roads, state roads of economic importance, and interstate connectivity. Rural roads receive central government funding under a program primarily aimed at providing connectivity, by way of an all-weather road, to all habitations in rural areas.

Central government funding for roads in New Zealand is administered by the New Zealand Transport Agency (NZTA) mainly through the National Land Transport Program (NLTP). The NLTP is prepared every 3 years by the NZTA and covers all land transport activities funded by the central government, such as public transport services, road operations and maintenance, road improvements, and walking and cycling activities, for both the central government (state highways, road policing, research, and sector training) and local authorities (public transport, local roads, etc.). The NLTP provides 100% of the funding for national highways, an average of 50% for local roads, 50% for public passenger transport services and infrastructure, and 100% for road policing. Local authorities provide the remainder of the funding for local roads and public passenger transport. Local authorities sometimes carry out road projects outside of the NLTP. Local funding comes from local rates and other local sources such as developer contributions. New Zealand is currently the only country that allocates central government road maintenance funds on the basis of a standardized road asset management system. All road controlling authorities are required to maintain such a system.

At the national level in the United States, the Federal Highway Administration (FHWA) develops need estimates and reports to Congress on the condition, performance, and future capital investment needs of highway and transit systems. The main national road program is the Federal-aid Highway Program, which provides federal funds for constructing and maintaining the national highway system (primarily interstate highways, US routes, and most state routes). The FHWA oversees projects using these funds to ensure that federal requirements for project eligibility, contract administration, and construction standards are adhered to. Congress then enacts multiyear highway funding acts based on this report and other considerations. States and metropolitan areas occasionally develop long-range plans that estimate needs and available revenues. The federal government establishes program categories that define how different types of funding can be spent with regard to the system (e.g., interstate versus other national roads) and/or functions (e.g., safety, congestion mitigation, or bridges). In general, the federal government only provides up to 80% of construction costs, including for major rehabilitation, reconstruction, and replacement of the national system and does not provide funds for general maintenance. With a few exceptions, state governments pay for all operating and maintenance activities on highways,

and state and local governments own all nonfederal roads, and for these roads, they plan and fund all improvements, operations, and maintenance.

3.8 Fund Management

Road funds have been, and are being, used in many countries to provide a transparent arrangement for managing road revenues and allocating funds for roads. The term "road fund" can apply to an arrangement ranging from a trust account set up within the accounts of the government by administrative order to an entity separate from government established by legislation.

India created a central road fund in 1930, which was revitalized in 2000. Some Indian states have road funds, and others are considering introducing such funds.

The United Kingdom had a road fund from 1920 until hypothecation of vehicle excise duty into the fund was ended in 1936, and the road fund was finally wound up in 1955.

Several countries, including the United States, Japan, and New Zealand, established road funds in response to the rapid expansion in demand for road transport in the post-World War II period.

The Japan Road Fund was created in 1954 to manage the hypothecated gasoline tax.

In New Zealand, the national road fund was created in 1953, but the arrangements had been restructured a number of times. The current fund is called the National Land Transport Fund (NLTF) and receives dedicated revenues from excise duty on motor vehicle fuel, charges on diesel-powered and heavy vehicles (road user charges), and vehicle registration and licensing fees. These revenues are paid into the central government treasury and credited to the NLTF. In 2009–2010 and 2010–2011, the central government also contributed from general revenues approximately 5% of the total NLTF. The NLTF is managed by the NZTA, a statutory entity with a board that makes independent decisions on allocating and investing funds from the NLTF in accordance with government policy. The NZTA also administers road user charges and vehicle registration and licensing, and monitors the road system and implementation of activities funded from the NLTF.

The United Kingdom had a road fund from 1920, but this was replaced in 1955 with a system of funding through government grants. The road fund was never fully used, returning a surplus each year, and became notorious for being used for other government purposes.

The US Federal Highway Trust Fund (HTF) was created in 1956 to fund construction of Interstate Highways and Defense Highways. The HTF paid for 90% of highway construction costs with the states required to pay the remaining 10%. The use of the fund has changed with the completion of the interstate highway system. A 1982 Act established a special mass transit account in the HTF to receive part of the motor fuel tax. Various acts since

then have diverted part of the fuel tax to the general fund of the treasury for deficit reduction and other purposes. During 2008, the fund required support of $8 billion from general federal revenues. This shortage was due to lower gas consumption as a result of the recession and higher gas prices. Further transfers of $7 billion in 2009 and $19.5 billion in 2010 were made. The dedicated revenues are paid to the federal treasury but are credited to the HTF.

The modern approach to road funds is to establish them by legislation with detailed accountability and management requirements. The fund is managed by a board with private sector expertise. In some cases, the majority of the board members are from the private sector—12 of the 27 road fund boards in Sub-Saharan Africa are constituted on these lines. In New Zealand, all board members are from the private sector.

3.9 Funding Allocation

Policy directions adopted by other countries for managing and allocating road funds are closely related with both how a country funds its road programs and the division of responsibilities between the different levels of government.

In Australia, the federal government allocates tied funding for roads to state governments and local councils according to a formula based on population and road length set by the Local Government Grants Commissions in each state. Councils are required to account for the funds against specific projects and are required to match the federal funding with equal funding from their own revenues. Annual financial assistance grants are also provided to local government. These have a general purpose component, which is distributed between the states and the territories according to population, and a local road component, which is distributed according to fixed historical shares. Both components of the grants are in the hands of the local government, allowing councils to spend the grants according to local priorities.

Federal allocations to state and local governments for highway construction and maintenance in Germany are based on the share of registered vehicles in each jurisdiction, with some adjustments made for "city-states" such as Berlin.

In Japan, 100% of the earmarked gasoline tax, 50% of the LPG tax, and 67% of the motor vehicle tonnage tax are used for roads by the national government. The remaining parts of the LPG tax and motor vehicle tonnage tax plus 100% of a local road tax (collected with the gasoline tax), the earmarked diesel tax, and motor vehicle purchase tax are allocated to local governments. National and local governments also provide road funding from general revenue sources.

Prior to the early 1990s, the US approach to allocation was largely based on need—the funding formulas and discretionary grants targeted expansion of the interstate system and in some instances favored states with low population densities. With the system now relatively complete, the allocation process has shifted to a focus on fairness and has become contentious. Complex formulas allocate nearly all national road funds to states

and, to a much more limited degree, local governments. These formulas vary by funding program but generally consider overall factors such as national system length, fuel and truck tax contributions, traffic volumes, and population, along with program-specific factors such as pollution levels and number of border crossings. In addition, the US program typically includes discretionary funding pools that are distributed by the Secretary of Transportation. A major criticism of the US approach is the lack of a relationship between allocations and performance—some argue that the approach provides little incentive for states to address national priorities. The US experience shows that a heavily formula-driven allocation approach also has its pitfalls.

In countries where road funding generally does not come from dedicated sources, for example, most European countries, allocations to subordinate levels of government are either incorporated into broad transfers or are based on a combination of needs, politics, and precedent. The experiences of these countries are less relevant to the PRC.

In countries where a national dedicated source of road funding exists and subordinate governments play a strong role in delivering roads programs, allocation approaches strive to balance consideration of national priorities and "fair share" (a jurisdiction getting back what it pays in). In Japan, this is accomplished by having a portion of fuel taxes allocated to local governments.

A lesson that can be drawn from almost all countries is that the allocation issue is never simple; strong arguments can be made to justify approaches that vary from emphasizing return of funding paid in, to allocations based solely on needs or central government priorities. While there does not appear to be any one "right" method for allocations, it is clear that approaches must strive to balance an emphasis on national goals and needs (and perhaps the need for subsidies in some areas), with considerations of fairness and equity.

3.10 Organizational Capacity

Developed countries vary widely in the roles and associated organizational capacity of their national government road agencies. Highways England is directly responsible for maintaining and improving the strategic road network in the United Kingdom and thus has a large technical staff. Conversely, the central government road agencies in the United States and Germany limit their role to policy development, funding, and oversight, and have a much smaller staff.

International experience shows that organizational arrangements, management skills, technical skills, and systems for road administration vary greatly across countries. This depends largely on the stage of development of a country, as illustrated in Table 3.2, and also on the size of the country and its government structure.

Management skills of road administration organizations trend toward management of modal integration and wider issues, and management of consultation and probity. Technical skills and systems trend toward transport system performance, planning, financial analysis, information technology, and traffic demand management.

Table 3.2: Road Administration Organization, Skills, and Systems

Stage of Development	Birth	Growth	Upgrading	Maturity
Organization	Large public works department	Separation of client and service deliverer	Road agency/ administration/ board	"Commercial" roads
Management systems	Maintenance management	Accounting, road inventory, traffic, and road condition	Financial management, information management, road asset, and performance management (road smoothness, capacity, safety)	Financial management, transportation modeling
Management skills	Resource mobilization	Management of contractual relationships and relationships with national issues	"Commercial" management, reorganization management and management of relationships with community issues	Management of modal integration and wider issues, management of consultation and probity
Technical skills	Basic engineering, maintenance workforce management	Highway engineering; road asset management; planning, programming, and prioritization of road activities; contract management	Use of performance indicators, economic analysis, environmental/ social analysis	Transport system performance, planning, financial analysis, information technology, traffic demand management
Private sector involvement	Low	Some consulting/ contracting	Design, construction, maintenance, road management, and financing	Long-term performance specified maintenance and public–private partnerships

Source: ADB.

3.11 Performance Measures and Systems

3.11.1 Results-Based Management

Orienting institutions on performance intends to make the administrations accountable for achieving certain targets, notably by rewarding or penalizing their leadership and staff on the results achieved at their level. It implies some decentralization of authority and stabilization of management, to give sufficient power and time to achieve results. It relies heavily on management tools such as monitoring indicators or retrospective evaluations. It seeks to foster a sense of ownership, urgency, and accountability while making individual performance more visible. While the move to results-based management involves generally the whole government, many elements could be introduced at the sector level. Box 3.2 describes the view in New Zealand on results-based management.

Box 3.2: What Is Results-Based Management? Views from New Zealand

Definition of results-based management. Results-based management (RBM) aims to provide "a government that works better and costs less." The transition toward an RBM system involves several major steps: (i) to question the role and the size of the state and define the services that should be publicly provided; (ii) to seek ways to provide the services and to meet the objectives at a lower cost in a more efficient way; (iii) to define objectives at government level, through strategic planning, and transform them into actions at the bottom level; and (iv) to set clear priorities in allocation of resources, from the highest to the lowest level of the administration.

RBM systems are based on a culture of accountability as opposed to a traditional culture of compliance. General accountability means that a large share of the administration can be held to account for what it has achieved, given its goals, priorities, and means. Increased accountability should be sought through (i) the delegation of responsibilities (managerial, financial, and technical) within clear limits—for instance, politicians pulling back from direct program management and higher levels of administration pulling back from micromanagement; (ii) the monitoring of performance of government, administrations, and individuals, generally through development of information systems; (iii) feedback of performance measurements into budgeting systems and/or strategic auditing systems; (iv) increase in the number of people that can be publicly held to account; and (v) development of scrutiny processes and of sanction/bonus regimes.

Results-based management implementation. At the macro/strategic level, the necessity to keep on meeting ambitious social goals while being constrained at the macro and fiscal levels is a primary motivation to switch toward RBM systems. The subsequent redefinition of the government can involve (i) a reduction of the role of the central state in the economy through the privatization of publicly owned companies and transfers to local governments; (ii) a redefinition of ministries to avoid conflicts of interests and superposition of powers; and (iii) a change of budget systems from an input-based system toward a service-/outputs-based system, generally through a change of the Public Finance Act, in order to identify the costs of the services and the expected outcomes—given a fixed budget. At the micro-sector level, RBM principles can be applied to obtain better value for money through a motivation of institutions on outcomes of policies (for instance road safety) rather than just on outputs. However, this does not systematically translate into an outcome-oriented budget system; rather than a penalization of the low-performing programs, the launch of central strategic audits is more widespread. At the bottom level, the RBM approach leads gradually to define service goals and monitoring systems in a way that involves directly the citizens who receive the services.

Source: Adapted from the speech delivered by Graham Scott, former Treasury Secretary of New Zealand, delivered in Brasilia on 27 March 2007.

3.11.2 Performance Indicators

Much work done internationally on the performance indicators for the road sector addresses, among other things, infrastructure condition; social, economic, health, and environmental outcomes; user satisfaction; and road agency deliverables. The Organisation for Economic Co-operation and Development (OECD) and World Road Association (PIARC) have each produced a framework.

3.11.2.1 Organisation for Economic Co-operation and Development

In 1997, the OECD Scientific Expert Group, IR7, suggested a set of performance indicators[17] for the road sector (Tables 3.3 and 3.4). The tables also show how these measures align with interest groups.

Table 3.3: Road Agency Performance Indicators Proposed by the OECD

PI No.	Indicator Name	Purpose/Description
PI 1	Average road user cost (car and truck)	To measure the average cost of running a medium car, a light diesel truck, and an articulated six-axle truck as determined from the Highway Development & Management model of the World Bank.
PI 2	Level of satisfaction (travel time)	To measure satisfaction regarding travel time and its reliability, and quality of road user information.
PI 3	Number of fatalities	To measure the fatal risk regarding all road users from a road traffic perspective and from a health perspective.
PI 4	Unprotected road user risk	To measure the fatal risk from a health perspective, based on the number of unprotected road user fatalities divided by the number of inhabitants.
PI 5	Environmental policy/ program	(Yes/no). To measure the extent and use of environmental policies and programs by road agencies. The indicator is based on the requirements of ISO 14001.
PI 6	Market research and customer feedback	(Yes/no). To measure the existence, extent, type, and success of market research processes.
PI 7	Long-term programs	(Yes/no). To measure whether the organization responsible for managing the road system has a long-term plan or program in place that is based on trade-off analysis among new construction, maintenance, and operations of the road system and that allocates available resources at the system level among these alternative strategies for achieving the goals of the system.
PI 8	Management systems for distribution of all resources	(Yes/no). To measure the existence of standard and robust management systems comprising • strategic planning and asset management planning, • economic evaluation, • implementation monitoring, and • review and audit procedures for the distribution of resources in the program development and management process.
PI 9	Quality management audit	(Yes/no). To measure the set up and use of a quality management system based on ISO 9000.
PI 10	Forecast values of road costs versus actual costs	To serve as an indicator for the ability of an organization in operational schedule and cost management.
PI 11	Overhead percentage	To measure the administrative (fixed) costs of road administration in relation to the total costs of road administration.

continued on next page

[17] OECD. 1997. *Performance Indicators for the Road Sector.* Road Transport Research.

Table 3.3 continued

PI No.	Indicator Name	Purpose/Description
PI 12	Value of assets	To establish the existence of standard and applicable methods to calculate and measure the value of assets of road infrastructure.
PI 13	Roughness (according to road class)	To rate road networks on the basis of user comfort.
PI 14	Condition of structures	To measure the percentage of engineering structures presenting important deteriorations.
PI 15	Satisfaction with road system condition	To establish standard and applicable processes for market surveys and customer feedback aimed at monitoring and measuring road user satisfaction with road system condition.

OECD = Organisation for Economic Co-operation and Development, PI = performance indicator.

Source: OECD. 1997. *Performance Indicators for the Road Sector.* Road Transport Research.

Table 3.4: Alignment of OECD Performance Indicators with Interest Groups

Dimension	Government	Perspective Road Administration	Road User
Accessibility/mobility	Average road user costs		Level of satisfaction
Safety	Number of fatalities		Unprotected road user risk
Environment		Environmental policy/ program	
Community		Market research and customer feedback	
Program development	Long-term programs	Management systems for distribution of all resources Quality management	
Program delivery		Forecast values of road costs versus actual costs Overhead percentage	
Program performance	Value of assets	Roughness Condition of structures	Satisfaction with road system condition

OECD = Organisation for Economic Co-operation and Development.

Source: OECD. 1997. *Performance Indicators for the Road Sector.* Road Transport Research.

An important observation of the 1997 OECD report was that road sector indicators should extend beyond just the interests of the road administration to include the long-term government vision for the transport sector and the interests of road users.

During 1997–1999, these performance indicators were field tested by road administrations in 15 countries.[18] One conclusion of this testing is that it is inappropriate to propose a common vision or common indicator target for all counties. However, there was consensus among participants that their administration had benefited from use of performance indicators.

3.11.2.2 World Road Association

World Road Association (PIARC) has produced a framework for road sector performance indicators that took account of work in Australia, the OECD, and the United States.[19] The framework proposed indicators and measures for

(i) economic outcomes,
(ii) social outcomes,
(iii) health outcomes,
(iv) environmental outcomes, and
(v) road authority delivery activities.

More recently, a PIARC report organized performance indicators into "drawers," which allows the users to develop their own system according to their specific needs.[20] The drawer includes advice on what to measure, how to measure, and recommendations for use. Examples are provided for indicators of safety; social, financial, environmental, and human resource sustainability; and information and travel time performance.

3.11.2.3 Australia

The association of Australian and New Zealand road transport and traffic authorities, Austroads, has done considerable research on road sector and subsector outcomes and measures in conjunction with road administrations and other stakeholders and has developed a coherent set of indicators covering all outcome areas.[21] For benchmarking to be valid, it is necessary that the measures use a standard methodology.

Austroads annually publishes road performance data for each of the Australian states and New Zealand on its website.[22] The website provides time series data for performance indicators in chart and table format and includes considerations in reading the data, qualifications for the data, and the methodologies used in obtaining the data. The following performance indicators are provided:

(i) Road safety
(ii) Registration and licensing
(iii) Road construction and maintenance

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18 OECD. 2001. *Performance Indicators for the Road Sector—Summary of the Field Tests.* http://www.internationaltransportforum.org/Pub/pdf/01PerformIndicE.pdf

19 PIARC Technical Committee on Performance of Road Administrations (C15). October 2004. *A Conceptual Performance Indicator Framework for the Road Sector.*

20 PIARC Technical Committee C4.1, 2008. *Integration of Performance Indicators.* Report 2008 R06.

21 Austroads is the association of Australian and New Zealand road transport and traffic authorities. Members are the six Australian states and two territory road transport and traffic authorities, the Department of Infrastructure and Transport, the Australian Local Government Association, and the NZTA; Austroads. 1996. *National Performance Indicators.* Report AP434/96.

22 Austroads website: http://algin.net/austroads/site/index.asp?id=4

(iv) Environmental
(v) Program/project assessment
(vi) Travel time
(vii) Lane occupancy rate
(viii) User cost distance
(ix) User satisfaction index
(x) Consumption of road transport, freight, and fuel

3.11.2.4 Canada

A recent Canadian report[23] provides a good summary of current Canadian and international practice. The report suggests the performance indicators for institutional policy objectives, and examples of implementation targets are shown in Table 3.5.

Table 3.5: Institutional Policy Objectives, Performance Indicators, and Examples of Implementation Targets

Policy Objectives	Performance Indicators	Implementation Targets
1. Quality of service to users	• Network level of service (smoothness, functionality, and utilization)—% good, fair, and poor • Provision of mobility (average travel speed by road class) • Annual user cost ($/km)	• Maintain 90% or greater of network in fair or better category (IRI ≤2) • Greater than 50% of speed limit (%) • Total user costs/total network km increase at no more than CPI
2. Safety goals	• Accident reductions (%)	• Reduction in fatalities and injuries by 1% or greater annually
3. Preservation of investment	• Asset value of road network ($)	• Increase (written down replacement cost) annually of 0.5% or greater
4. Productivity and efficiency	• Cost effectiveness of programs (ratio) • Annual turnover (%)	• 1% or greater annual increase • 5% or less annually
5. Cost recovery ($)	• Revenues	• Annual increase at no less than rate of inflation
6. Research and training	• Expenditures (% of budget)	• Annual commitment of 2.5% of total program budget
7. Communication with stakeholders	• Satisfaction survey sampling (%)	• Greater than 75% of respondents satisfied or very satisfied
8. Resource conservation and environmental protection	• Recycling of reclaimed materials (asphalt, concrete, etc.) (%) • Monitoring of emissions	• Maintain at 90% or greater • Maintain at levels <90% of standards
9. Bridges	• Remaining life (years) • Safety	• No bridge with remaining life less than 5 years • Comprehensive program of periodic inspections to identify any risk

CPI = consumer price index, IRI = international roughness index, km = kilometer.

Source: National Research Council Canada, Institute for Research in Construction. 2009. *NRCC-52692, Measurable Performance Indicators for Roads: Canadian and International Practice.*

[23] Institute for Research in Construction. 2009. *NRCC-52692: Measurable Performance Indicators for Roads: Canadian and International Practice.* National Research Council Canada.

3.11.2.5 New Zealand

In New Zealand, the Ministry of Transport maintains a transport monitoring indicator system,[24] which includes time series of the following indicators relating to road transport:

(i) Transport volume
(ii) Network reliability
(iii) Freight/transport industry
(iv) Access to the transport system
(v) Travel patterns
(vi) Safety and security
(vii) Public health
(viii) Infrastructure and investment
(ix) Environmental
(x) Transport price indices
(xi) GDP and population

As an example, the information available under transport volume for roads includes

Vehicle travel

(i) Vehicle kilometer traveled
(ii) Road vehicle kilometer traveled by vehicle type
(iii) Road vehicle kilometer traveled per capita
(iv) Road vehicle kilometer traveled in major urban areas
(v) Road heavy vehicle kilometer traveled by road type
(vi) Light fleet road vehicle kilometer traveled by engine size
(vii) Road vehicle kilometer traveled by fuel type.

Fleet information

(i) Vehicle fleet numbers
(ii) Total number of first registrations of road vehicles
(iii) Average age of fleet
(iv) Average engine size of the light passenger and commercial road fleet
(v) Light vehicle fleet by engine size
(vi) Road fleet by fuel type
(vii) Vehicle ownership per capita

[24] New Zealand Ministry of Transport. *Transport Indicators.* http://www.transport.govt.nz/ourwork/tmif/

The NZTA website[25] provides, among other things, a Road Network Condition Reporting Tool, which provides 10 years of road asset and financial performance data for each road controlling authority in New Zealand. The NZTA tool makes it possible to

(i) look at the annual road condition and vehicle kilometer of travel and cost data at national, regional, and local levels;

(ii) obtain a copy of the raw data in a spreadsheet; and

(iii) generate images of tables and graphs for use in a report.

[25] New Zealand Ministry of Transport. http://www.nzta.govt.nz

CHAPTER 4

Issues, Options, and Recommendations

This chapter provides recommendations for addressing the key issues facing the People's Republic of China (PRC) with respect to its ordinary road program. These findings are organized by issue area, and are presented using the structure illustrated in Figure 4.1.

Figure 4.1: Recommendation Development Process

Source: Authors.

4.1 Conceptual Framework

There are significant interactions between the identified policy issues:

(i) The amount of additional central versus provincial and local government funding required to meet the expenditure estimates for the Twelfth Five-Year Plan and the later five-year plans depends on how costs are shared between central and provincial and local governments, and the ability of provincial and local governments to fund their proposed share.

(ii) The appropriate approach to program management depends on the roles and responsibilities of the different levels of government, potential financial structures, financial capacity, goals, and objectives.

(iii) The manner in which road funds are managed and allocated depends on how roles and responsibilities are assigned, the new sources of revenue that are recommended, and the program approach used.

(iv) Performance management requirements interact with other tasks, including new revenue sources, debt financing, roles and responsibilities, the manner in which road funds are managed and allocated, and the program approach.

Because of these interactions and interdependencies, the following discussion on issues, options, and recommendations is based on the assumption that the PRC will pursue further

reforms to its ordinary road program through a comprehensive strategy that addresses multiple issues. Almost all of the recommendations are dependent on how roles and responsibilities for roads are assigned in the PRC and on the overall approach of the central government for delivering ordinary road programs; thus, these issues are covered first. Responsibilities and program delivery cannot be performed without adequate funding; hence, funding is addressed next, taking into account specific issues such as sustainability of current revenue sources, new revenue sources, use of debt, and long-term funding mechanisms. Finally, the section discusses issues associated with reform implementation, including funding allocation, fund management, and performance management.

4.2 Roles and Responsibilities

While the Fuel Tax Reform centralized funding for ordinary roads, few other changes were made to the roles and responsibilities of the national, provincial, and local government agencies involved in the development and management of the ordinary road system in the PRC. Provincial and local governments have maintained primary responsibility for planning, programming, and delivering works on these facilities (including ordinary national roads) and, as a result, appear free to use funds with little oversight or strings attached. In addition, current laws and regulations are inconsistent and unclear on the roles and responsibilities for management, administration, and implementation of roadworks and maintenance on the various categories of roads (national, provincial, county, and country), particularly in light of the new road-funding structure.

The roles and responsibilities for planning of national roads are reasonably well-defined, but to build on the success of the Fuel Tax Reform initiative, future reforms should include better definition of, and changes to, the roles and responsibilities at each level of government to improve transparency and to ensure adequate transport system performance. Specific issues are as follows:

(i) There is no law or policy on management of roads, including key areas such as inspection, investment-level decisions, and administration of road maintenance; provincial government agencies have assumed these roles by default. As a result, there is little national accountability for ensuring that technical standards are met.

(ii) Clarity is needed on how responsibilities for funding national, regional, and local road development priorities and maintenance should be divided among the different levels of government.

(iii) Inconsistency in planning, funding, and execution of roadworks has resulted in a significantly lower level of development of ordinary roads compared with expressways.

(iv) The management of road funds from the vehicle purchase tax (VPT) and the fuel tax (currently performed by the Ministry of Finance [MOF]) and associated decisions on how much of these revenues are to be allocated for expenditure on roads lack transparency and seem disconnected from the consideration of needs.

(v) There has been an imbalance in funding for the maintenance of some roads compared with others. Funding for maintenance on national and provincial

expressways and ordinary national roads has generally been sufficient in the past; on the contrary, some central government funding provided for ordinary county roads and rural roads has been insufficient, and there has been little or no funding available for ordinary provincial road maintenance.

4.2.1 Research Findings

Article 8 of the Highway Law of the PRC very broadly defines the general division of responsibilities for road program development, administration, and maintenance. The Ministry of Transport (MOT) is responsible for oversight of roadworks nationwide, establishes guidelines and sets standards for maintenance and construction of national roads, and provides technical assistance to provincial and local government road agencies. The following sections provide a more in-depth discussion on the current allocation of roles and responsibilities for key road program activities.

(i) **National Long-Range Planning.** The Highway Law of the PRC requires that road construction be included in the national economic and social development plan and stipulates that the state shall assist and support the development of road construction in minority areas, distant border areas, and poor areas. The law also defines key responsibilities and processes for developing and amending plans for national, provincial, county, and township roads. Detailed methods for planning road improvements and new roads are given in the Road Regulations of the PRC.

The PRC has three main road development (improvement) plans or programs:

a. National trunk road skeleton system development plan
b. National expressway network plan
c. Rural road development program

All the above national development plans and programs are reflected in the 5-year development plans of the PRC. The five-year plans identify key projects and their estimated costs, and provide criteria for identifying road improvement projects and funding approaches in each province. Projects are generally prioritized and selected based on available funding levels and the extent to which the project contributes to national objectives and provincial and local interests.

(ii) **National Capital Road Planning.** The development of road system investment plans is generally led by the MOT with varying roles performed by other central government entities, including approval of road system goals and targets for each five-year plan by the State Council. The MOT is responsible for mid- and long-term capital planning for the development of the national road network and associated road improvements, in conjunction with other relevant central government departments (particularly the National Development and Reform Commission [NDRC]), the provinces and autonomous regions, and the four cities directly under the central government.

The current planning approval process for improvements to national main roads (and for projects using foreign funds of $30 million and above) includes the following steps:

a. The MOT carries out the planning and naming for national roads.

b. Once the initial planning is complete, the MOT and the NDRC work together to define projects at the conceptual level and submit them to the State Council for approval.
c. After project planning is approved by the State Council, each region conducts feasibility investigations and determines the construction schedule, construction standards, and other requirements. Due to the scale of investment required for most road projects, the provincial development and reform commissions must obtain approval from the NDRC.
d. As part of its approval process, the NDRC considers the opinions of the transport industry. Specifically, the transport industry organizes experts to evaluate the scale and technical standards of the project and to recommend compensation rates according to national standards.
e. After the NDRC approves a project feasibility report, the applicable local government starts to collect funds and holds a local funds confirmation meeting. The MOF then provides an allocation from VPT revenues to the local government, depending on the progress of the project.

(iii) **National-Level Budgeting.** At the beginning of every year, the MOT is responsible for issuing an annual investment plan for national roads within each province. The MOF is then responsible for issuing an annual budget for road improvement projects on national roads based on this investment plan and, after the budget has been approved by the State Council, for transferring funds to project accounts from the Central Treasury account.

(iv) **Provincial Road Planning.** Provincial transport departments are the planning and funding bodies for provincial roads. They report to the central government indicating what is needed to meet the 5-year targets. They are responsible for preparing provincial road development plans in conjunction with the relevant local transport departments and submitting them to their respective provincial governments for approval. They also decide on how to use funds available for road maintenance.

Provincial highway bureaus are responsible for management and administration of both national and provincial roads, including part administration of expressways. They are the implementing agencies for improvements, operation, and maintenance works on these roads. Some provinces have established companies to manage expressways. In some provinces, farmers maintain rural (village) roads.

Provincial transport departments develop provincial road development plans for ordinary roads for approval by the provincial governments. Similarly, county-level transport departments prepare development plans for county and township roads for approval by their respective municipal and county governments. Stakeholder/public participation is a basic requirement for road planning at all levels and includes consultations between and among each of the relevant government departments (national, provincial, and local levels) depending on the focus of the planning. Provincial and local governments prepare 5-year development plans for their areas based on the longer-term plans. For road operations and maintenance, the MOT issues a 5-year guide for work in each of the provinces, but road operations and maintenance are not included in any five-year plans.

Provincial transport departments develop and issue annual plans for road maintenance. Most provincial road institutions compile road maintenance budgets according to length of road, number of staff, traffic volumes, and material costs. These funding requests are not generally based on an assessment of actual maintenance needs. For intermediate and major maintenance works, municipal highway bureaus are required to submit annual plans to provincial highway bureaus for examination and approval.

(v) **Rural Road Planning.** Transport departments at the county level are responsible for planning and submitting development plans for county and country (township and village) roads to the county government for approval. The responsibility for management and administration of county and rural roads varies across the country. The jurisdiction responsible for implementing works on rural roads differs depending on the type of work and is usually determined by the provincial transport department in consultation with provincial, municipal, and county highway bureaus. Generally, the municipal or county transport bureau is responsible for town and rural road projects.

(vi) **Relevant International Experience.** Findings from other countries, particularly from those with a three-tier system of government, such as Australia, Brazil, Germany, India, and the United States, offer the following lessons with respect to the roles and responsibilities for road management and funding in the PRC:

a. National governments typically have been responsible for functions such as setting system-wide development and performance goals, establishing standards, determining planning processes, and coordinating roadway policies with broader social goals.
b. Often, national governments have established a national highways authority/administration responsible for the national highways and for many of the road-related functions of the national government.
c. All countries provide some national government funding for roads, but the share of construction, maintenance, and operations costs covered by national governments tends to decrease as the function of the facilities becomes more local in nature.
d. National government agencies usually have a strong inspection and audit role with regard to the need for national government funding; expenditure of national funds, including the procurement methods used; compliance with technical standards; and performance of the road system.
e. State/provincial governments are usually responsible for building, maintaining, and managing national/federal highways, and for all functions related to state/provincial roads.
f. Local governments are usually responsible for planning, financing, and implementing road programs on local roads systems.
g. There is a trend toward combining road regulatory functions, for example, driver and vehicle licensing, with road management and works implementation functions at the state/provincial government level.

4.2.2 Policy Options

The following is a description of the policy options for changes to central, provincial, and municipal/local government roles and responsibilities for ordinary roads that were considered as part of the research and analysis process. Within each level of government,

the options are mutually exclusive, although they could be implemented in progression (e.g., Option 1a could be a preliminary step to implementing Option 1b, and then Option 1c). Options 2b and 3b could only be implemented if one of the central government options was implemented.

1) **Central Government Responsibilities.** Options for roles and responsibilities at the central government level need to take into account the potential for implementation of a programmatic approach, as well as any new provincial government funding sources and revisions to allocation practices and fund management. Accordingly, the following potential options were identified for redefining central government roles and responsibilities:
    - 1a. **Current Arrangements but with Expenditure Control.** Current MOT, MOF, and NDRC roles and responsibilities relating to road policy, planning, budget setting, funds management, funds disbursement, standards setting, technical guidance to lower levels of government, and monitoring and audit remain unchanged, except that the MOT be made responsible for defining and controlling how central government road funds, including those for maintenance, are spent at the provincial and local levels. The current arrangement of responsibilities would be clarified in laws and policies.
    - 1b. **New Bureau for Funding Roads.** A new bureau under the MOT or MOF was established to manage a central government road fund or trust account for ordinary roads. The new bureau would be responsible for defining program categories, rules, and standards; estimating and advocating funding needs; establishing cost-sharing arrangements; disbursing central government funds; monitoring and auditing use of the central funds; and reporting performance of ordinary roads. Provincial and local governments would continue to be responsible for their share of funding for works on their roads, and for implementing roadworks as at present.
    - 1c. **New National Roads and Funding Administration (NRFA).** This involves establishing a new central government agency, similar to the Civil Aviation Administration of the PRC, with responsibility for central government funding of roads and for oversight of national roads. The responsibilities of the agency would be as for Option 1b plus planning and oversight management for national roads. Implementation of works on national roads and operational management of the roads would be by formal arrangement with provincial government agencies. Toll concessions would still be operated by private sector or state-owned companies. Provincial and local governments would continue to have responsibility for their share of funding and for implementing roadworks as at present.

2) **Provincial Government Responsibilities.** Two options were identified for revising the future role and responsibilities of provincial governments:
    - 2a. **Changed Responsibility for Reporting.** Under this option, current provincial government roles and responsibilities for planning, programming, and priority setting for provincial roads; budgeting of

provincial government funds; management and disbursement of provincial government funds; technical guidance to lower levels of government; and monitoring and audit of provincial roads remain unchanged. This option makes provincial governments responsible for reporting achievement (physical works and financial expenditures) where central funds are used, and for reporting road performance information to the central government (MOT or central road agency).

2b. **Changed Responsibility for Requesting Funds and Reporting.** This option is as for Option"2a" but adds the responsibility to submit details of proposed works as part of a process for requesting central funds for provincial roads. This would apply for maintenance as well as improvement works. Reporting achievement (physical works and financial expenditure) would include all expenditures, not just where central funds are used.

3) **Municipal and County Government Responsibilities.** Two options were identified for revising the future role and responsibilities of lower-level governments:

3a. **Changed Responsibility for Reporting.** Under this option, current municipal and county government roles remain unchanged. This option makes these governments responsible for reporting achievement (physical works and financial expenditure) where central funds are used, and for reporting road performance information to the central government (MOT or central road agency).

3b. **Changed Responsibility for Requesting Funds and Reporting.** This option is as for Option 3a. Furthermore, municipal and county governments are responsible for submitting details of proposed works as part of a process for requesting central funds for maintenance as well as improvement works on local roads. Reporting achievement (physical works and financial expenditures) would include all expenditures, not just where central funds are used.

4.2.3 Recommendations

The policy recommendations for roles and responsibilities are based on the evaluation of options set out in Section A2.1. First and foremost, overall responsibility for national roads should be centralized and consolidated under a newly created NRFA (Option 1c). In addition, the central government should implement Options 2b and 3b, and clarify that provincial governments are responsible for all aspects of provincial roads, whereas municipal and county governments are responsible for local roads in their respective areas. This should include reporting on achievements and performance, developing requests and justifications for central government funding to support provincial and local road maintenance and construction initiatives, and continued responsibility for a share of funding and for implementing works on their roads.

4.3 Program Approach

Prior to the implementation of the Fuel Tax Reform, provincial and local governments primarily paid for ordinary road development and maintenance with revenues they raised themselves through road maintenance fees (RMFs), tolls, and associated borrowing. The central government provided a small share of funding for construction projects and little or no support for maintenance. This limited the ability of the central government to influence development and maintenance of the ordinary road network. While the central government could set targets and standards and issue directives, the lack of a strong financial role has prevented it from holding provincial and local governments accountable for maintaining facilities or making investments that aligned with national ordinary road development goals. This approach has arguably contributed to significant system deficiencies, including (footnote 2):

(i) poor pavement and bridge conditions in some areas, and a large backlog of much-needed maintenance, reconstruction, and upgrade work;
(ii) six prefecture cities, over 600 counties, some border crossing points, major tourist areas, and important townships not connected to the national road system;
(iii) capacity improvements needed on a large part of the ordinary road network; and
(iv) unbalanced road development across regions and a lack of rural road maintenance systems.

The abolition of the RMFs and tolls on Class II roads and the creation of the national motor fuel tax have changed the role of the central government from being a minor supporter of ordinary and rural road development to being the primary source of funding for the construction and maintenance of these facilities. This new and stronger role should enable the central government to have more control on the use of ordinary road funding to address system deficiencies, and provide a means to leverage national road funding to encourage ordinary road spending by provincial and local governments. To do so, the central government should address two key issues associated with its program approach:

(i) A clear and well-defined program management framework is needed to ensure that limited road resources are spent efficiently, effectively, and in accordance with national goals and priorities.
(ii) Clear policies need to be established that define the share of ordinary road costs that should be borne by different levels of government.

4.3.1 Research Findings

To date, the central government has done little under the Fuel Tax Reform from a programmatic perspective to better manage construction and maintenance of the ordinary road system. Anecdotal evidence suggests that provincial and local road agencies are not allocating much of their fuel tax allocations for maintenance, and there appears to be little accountability for not using the fuel tax revenues for their intended purpose (e.g., it was found that in some provinces, allocations for road maintenance are used to pay pensions for retired staff). Moreover, the Fuel Tax Reform has created a lack of clarity about the share of ordinary road funding that should be borne by different levels of government

for different types of road spending. This lack of clarity both makes it difficult to assess additional funding needs at different levels of government and creates barriers to effective planning and asset management.

The following is a list of specific findings that indicate the need for an improved program approach.

(i) **System Maintenance**

a. Road maintenance needs will significantly increase by 2020; these needs include large administration costs (personnel, including pension), which are more than 11% of total road maintenance costs.
b. MOT officials noted that the central government needs to accord a higher priority for road maintenance and encourage local governments to pay more attention to it.
c. Although the MOT issues a five-year guide for road operations and maintenance work in each of the provinces, operation and maintenance are not included in five-year plans.
d. Guidance for the use of road maintenance funding has been superseded by the Fuel Tax Reform, and there seems to be little accountability for ensuring that technical standards are met.
e. There is a lack of asset management systems for rural roads to assist in the preparation of rational programs for these roads.
f. There has been an imbalance in the availability of funding for maintenance of some roads compared with others. Funding for maintenance of national and provincial expressways and ordinary national roads has generally been sufficient, and some central government funding has also been provided for ordinary county roads and rural roads. However, funding has been insufficient for ordinary provincial roads. Even when such funding is provided, it is often unclear whether those funds have been used for maintenance.

(ii) **System Expansion**

a. Provincial and local governments have pursued quantity rather than quality in developing the road network.
b. There are currently limited means for the central government to direct investment in ordinary roads to follow national priorities.
c. Inconsistency in planning, funding, and execution of roadworks has resulted in a significantly lower level of development for ordinary roads compared with expressways.

(iii) **Cost Sharing**

a. Transport officials in the PRC have different opinions on the proportion of cost that should be provided by the central government. Most provincial transport departments propose that the central government increase its share of funding for national roads and provide sufficient subsidies for provincial ordinary roads. For example, Chongqing City suggests that the central government fund 90% of costs for national roads, not less than

33% for provincial roads, and provide no funding for rural roads after the needs for basic poverty alleviation are addressed.

b. Provincial government officials support the concept that they should apply to the central government for subsidies for projects on provincial roads in accordance with the central government requirements.

(iv) **Applicable International Experience.** Findings from other countries indicate that nearly all countries with three-tiered structures provide some national government funding for roads. An equal national/subordinate cost-sharing arrangement is common, as are variable funding shares based on the ownership and nature of a road facility, with the share of construction, maintenance, and operations costs covered by national governments tending to decrease as the function of the facilities becomes more local in nature. Often, central government funding for improvement works is tied to specific projects and/or specific needs through program structures for areas such as road safety, bridges, congestion mitigation, rural development, and connectivity.

4.3.2 Policy Options

Lessons from international experience and analysis of the needs and characteristics of the PRC road sector suggest that the PRC should consider moving toward a more programmatic approach, which includes establishing funding categories as well as defined cost-sharing responsibilities for different classes of roads. Such an approach would dedicate funding to specific purposes according to national goals associated with areas such as safety, operation and maintenance, and/or direct construction spending to certain categories of roads or other types of projects. There are different options for program form and detail, cost sharing, approval, oversight, and link to national, provincial, and local needs and priorities.

Options for improving the management of road investment by the central government were identified. It should be noted that none of the following options are mutually exclusive; in fact, Option 1 (cost sharing) and Option 4 (funding categories) should be a part of any program approach reforms (footnote 2):

(i) **Targeted Spending Share.** Involves cost sharing between central government, and provincial and local governments;

(ii) **Focus on Core Roads.** Involves focusing central government funding on a subset of ordinary roads, for example, national roads, with other roads wholly the responsibility of provincial and local governments;

(iii) **Needs-Based Maintenance Programs.** Involves rigorous use of asset management information to optimize maintenance and rehabilitation programs;

(iv) **Funding Categories.** Involves defining categories for central government funding with each category having directions about expenditure;

(v) **Varied Program Detail and Oversight.** According to the capability of provincial and local governments;

(vi) **Multiyear Programs.** In place of annual programs;

(vii) **Increased Direction from Central Government.** On priorities and qualifying criteria in five-year plans or associated guidelines with respect to maintenance on all roads, including national roads; and

(viii) **Special Purpose Programs.** Targeted funding for activities such as road safety, bridges, congestion mitigation, rural development, and connectivity.

4.3.3 Recommendations

The PRC should develop road sector funding programs and allocate road fund resources to meet national goals and priorities. The policy recommendations for program approach are based on the evaluation of options set out in Section A2.2 (an analysis of cost-sharing options is also included in Section A2.9 for documentation purposes). Specific recommendations, which combine several of the identified options, are identified below, organized by broad program changes, suggested program categories, and cost sharing.

(i) **Policy-Level Program Changes.** Establish needs-based approaches to maintenance (Option 3); develop multiyear programs for both maintenance and improvement works (Option 6); and require provincial, municipal, and county governments to submit details and justification for major projects when requesting central government funding for these projects (Option 7).

(ii) **Specific Program Changes.** Create separate programs for roadworks by administrative category of road and purpose (Option 4). Potential program categories could include management, operations, routine maintenance, road safety, emergency/natural disaster repair, periodic maintenance, road rehabilitation, replacement of structures, road reconstruction/upgrading, and rural development and connectivity.

(iii) **Cost-Sharing Changes.** The PRC should transition to the following cost-sharing structure for ordinary roads (Option 1; see Section A2.2.10 for analysis of options).

a. **Works on national roads.** Funded 100% by the central government for both maintenance and improvement.
b. **Maintenance on provincial and local roads.** Funded 60%–80% by the central government.
c. **Construction on provincial and local roads.** Funded 40%–60% by the central government.

These cost-sharing ratios should be adjusted to reflect the relative needs and financial ability of individual provincial and local authorities. This cost-sharing approach should be implemented by the new NRFA after discussion with provincial and local governments.

4.4 Maintaining Purchasing Power

The current financial structure under the Fuel Tax Reform relies on three sources of funding for virtually all PRC spending on ordinary roads: central government budget allocations,

the VPT, and motor vehicle fuel taxes. These funding sources offer varying degrees of protection against the loss of purchasing power relative to need due to inflation and other factors:

(i) Central government budget funding is determined on an annual basis through the national budgeting process. As such, annual funding levels are based on overall government resources, willingness to borrow, and the priority of road investment with respect to other government funding demands.

(ii) The level of funding provided by the VPT is a function of vehicle prices, the tax rate, and the number of vehicles purchased. Over the long term, VPT revenues should increase (at least indirectly) with inflation, because the tax levied is proportional of the purchase price.

(iii) Motor vehicle fuel taxes are set at fixed rates per liter, and there is currently no established process for determining how and when the rates should be changed. While annual total fuel tax revenues are likely to increase as vehicle travel expands, the costs of maintaining and expanding the system will likely grow faster due to inflation and expanding expenditure needs associated with more traffic, a bigger system, and aging infrastructure. At the same time, reduced fuel consumption from improved vehicle efficiency will lead to less tax revenues per kilometer traveled and may eventually reduce the viability of motor fuel taxes as a primary source for funding road investment.

4.4.1 Research Findings

A critical weakness of the existing structure for funding central government road spending is that it is not automatically responsive to changes in road investment needs arising from inflation, growing expansion requirements, and increasing maintenance demands. Based on the consumer price index (CPI) of the PRC, the current motor fuel tax (established in January 2009) has already lost more than 10% of purchasing power and, by 2020, will likely lose about 40%.[26]

Under the current laws governing the Fuel Tax Reform, there are no provisions for adjustments to fuel tax rates; thus, rate increases will presumably be determined through ad hoc decisions by the State Council, the MOF, and/or State Administration of Taxation. But as the experiences from other countries show, policy makers tend to be very reluctant to adjust fuel tax rates with sufficient regularity or in response to increased needs, and road programs that rely on revenues from ad valorem fuel taxes often suffer. If the PRC is to achieve a truly sustainable road program and the fuel tax is to remain a key source of funding for ordinary road maintenance, a policy is needed that facilitates regular adjustments to fuel tax rates and ensures road maintenance funding levels remain sufficient to meet needs.

While much of the discussion on maintaining purchasing power during the Phase I study focused on the need for fuel tax rates to adjust with inflation, it is important to note that inflation is not the sole barometer of potentially required rate changes. Instead, a fully sustainable funding source should be adjusted in response to total needs, which are a function of inflation, travel levels and demand, road system length and condition, funding responsibility (i.e., defined share of costs), as well as the anticipated tax yield, which is determined by demand for travel and vehicle fuel efficiency.

[26] Assuming an average annual CPI of 3.5%.

4.4.2 Policy Options

The objectives for policy options to address maintaining of purchasing power are twofold:

(i) establish a means to ensure that national motor vehicle fuel taxes provide adequate and sustainable funding to meet future needs and associated national government funding responsibilities for road maintenance; and

(ii) establish an adjustment approach that adheres to the "user pays" principle and is both predictable and politically viable.

Mechanisms for adjusting roadway user tax rates in the PRC could be accomplished through three options:

(i) **Indexing.** Tax rates could be tied to some measure of changes in spending needs. This could include inflation (e.g., increasing fuel tax rates each year by the CPI), economic growth (i.e., gross domestic product [GDP] growth), increases in travel demand, or the projected rate of growth that would have occurred under the six types of road fees.

(ii) **Needs-Based Adjustment.** Tax rates could be adjusted to meet all or a target percentage of roadway spending needs. For example, ordinary road maintenance needs surveys and development targets associated with the five-year plan development process of the PRC could become the basis for establishing a fuel tax rate adjustment schedule for the same period.

(iii) **Occasional Rate Adjustments.** The appropriate agencies/authorities could simply adjust the tax rates from time to time as they see fit, but not specifically linked to any policy triggers.

4.4.3 Recommendations

The PRC should establish a regular mechanism for adjusting fuel tax rates based on an assessment of needs (Option 2). The policy recommendations for maintaining purchasing power are based on the evaluation of options detailed in Section A2.3.

4.5 New Revenue Sources

It is not certain that all of the construction and maintenance expenditures identified in the analysis in Section 2.5 are high-priority investments that must be addressed in the next decade. However, it is clear that the central government ordinary road-funding sources are currently inadequate to meet anything close to the level of investment that is planned. Assuming that (i) most of the fuel tax revenues are reserved for maintenance; (ii) any maintenance shortfalls are addressed through increases in the fuels tax or new sources of revenue; and (iii) the cost responsibilities of the central government for construction are the same as those proposed for maintenance (100% for national roads, 80% for provincial and local roads), the central government would need to provide nearly CNY6 trillion in funding of ordinary road construction over the 2011–2020 period. This is significantly more than the CNY3.7 trillion in net ordinary road funding the VPT is expected to provide. Given the percentage increase that would be required in the VPT, or the amount of general budget allocation it would take to close this gap, it is evident that new, additional national road-funding sources will likely be required.

There is a strong preference by both central and provincial government officials involved in road programs to reestablish a mechanism that provincial and local governments can use to raise additional revenues for roads. However, MOF and NDRC officials appear to oppose the creation of new road-funding mechanisms at any level of government or increasing any existing tax rates.[27] In addition, several of the program management options that are being considered will not be viable if a provincial and local means for raising road funds is not established. Finally, a program funded solely by the central government can lead to inefficient and ineffective use of funds for the simple reason that provincial and local governments tend to care less how money is spent when it is not perceived as their own. Based on all of these considerations, the ongoing reform effort needs to seriously consider establishing a new funding source for roads at the provincial and local levels that can be used to supplement central government road funding.

4.5.1 Research Findings

(i) **Replacement of "Fees and Charges" with "Taxes."** The Fuel Tax Reform was a deliberate move by the PRC to replace special purpose fees and charges, such as the RMF, with a centrally administered consumption tax on refined oil products.

(ii) **Need for New Revenue Sources.** Table 2.11 shows the total amount of additional funding that would be needed to fully fund the target established for the Twelfth Five-Year Plan, 2011–2015 and the preliminary planning for the Thirteenth Five-Year Plan, 2016–2020 based on the current estimates of the central government net revenue likely to be available for ordinary roads. The funding shortfalls need to be met from additional central government revenues and/or provincial and local government revenues or reduced levels of spending on ordinary roads.

(iii) **National Legal Requirements/Process for Establishing New Taxes and Fees.** State entities that have the authority to formulate tax laws or tax policy include the National People's Congress (NPC) and its Standing Committee, the State Council, the MOF, and the State Administration of Taxation. New taxes are established through legislation enacted by the NPC. The State Council can approve changes to rates of existing taxes. General administrative regulations and rules concerning taxation are issued by the State Council, while detailed implementation rules and policies are issued by the MOF and the State Administration of Taxation.

The formulation of tax laws generally follows four steps: drafting by the MOF and the State Administration of Taxation; examination by the State Council; approval by the NPC; and promulgation by the MOF and the State Administration of Taxation. The steps for the formulation of tax administrative regulations and rules are planning, drafting, verification, and promulgation.

(iv) **Establishment of Taxes and Fees at the Provincial and Local Levels.** The authority for provincial and local governments in the PRC to impose taxes and fees must be expressly approved by the NPC and other relevant national bodies involved with tax policy. Once provincial and local tax authority is established at the national level within the framework of national tax laws and regulations, local tax regulations and rules are formulated by the People's Congress at the provincial

[27] Based on comments from NDRC and MOF officials given at the project Final Workshop held in Beijing in October 2012.

level and its Standing Committee, the People's Congress of Minority Nationality Autonomous Prefectures, and the People's Government at the provincial levels.

(v) **Consumption Tax on Motor Vehicles and Tires.** The PRC levies a consumption tax on motor vehicles at a rate of up to 40% depending on engine capacity and at a rate of 3% on motor vehicle tires (but neither tax is dedicated for road-related purposes).

(vi) **New Law on Motor Vehicle and Vessel Taxes.** The NPC enacted a law in February 2011 that authorizes provinces to impose taxes on various types of vehicles and vessels. The new law, which became effective on 1 January 2012, established the minimum and maximum annual rates that can be charged for various classifications of vehicles, i.e., based on engine size for passenger cars and ton-load for trucks and trailers. Other components of the law include (i) various exemptions for high-efficiency and alternative vehicles as well as for vehicles used for public transit and by the police/armed forces and (ii) the taxes that are to be collected annually by insurance institutions.

(vii) **Legal Action Required for Potential New Dedicated Road Funding Sources.** Based on PRC tax law, administrative practices, and the current political environment, most new tax options for funding roads would likely experience significant legal and institutional hurdles. These barriers are summarized in Table 4.1.

Table 4.1: Legal Requirements for Implementing Funding Options

Policy Option	Legal Requirement for Implementation
Increased fuel tax	• The State Council would need to approve revision of the tax rates for motor vehicle fuels in the Interim Regulations on Consumption Tax. • The State Administration of Taxation and the Ministry of Finance (MOF) would need to promulgate new rules to implement.
Sales tax on motor vehicle fuels	• The National People's Congress (NPC) would need to enact new legislation. • The State Council, State Administration of Taxation, and the MOF would need to promulgate rules to implement.
Heavy vehicle surcharge (fee)	• The NPC would need to revise the Highway Law. • The State Council, State Administration of Taxation, and the MOF would need to promulgate new fees ordinance.
Vehicle tire tax	• The NPC would need to approve revision of the consumption tax to dedicate the existing tire tax for roads and/or increase the rate of tax. • The State Council, State Administration of Taxation, and the MOF would need to promulgate rules to implement.
Vehicle taxes or fees	• If a tax is used, the NPC would need to revise the consumption tax to dedicate the existing motor vehicle tax for roads and/or increase the rate of tax. • If a fee is used, the NPC would need to revise the Highway Law. • The State Council, State Administration of Taxation, and the MOF would need to promulgate rules to implement the tax or a new fees ordinance.
Diversion of excess toll revenues	• The NPC would need to enact new legislation. • The State Council, State Administration of Taxation, and the MOF would need to promulgate rules to implement.
General budget allocations	• The NPC would need to approve the allocations. • The MOF would need to promulgate rules to implement.

Source: ADB.

(viii) **Opinions and Concerns on Funding Options.** Table 4.2 below summarizes opinions expressed by PRC road officials regarding the political and institutional viability of the seven road-funding options identified.

Table 4.2: Political and Institutional Implications of Funding Options

Policy Option	Political and Institutional Considerations
Increased fuel tax	• Concern about economic impacts of higher fuel prices • There would be few, if any, incremental implementation and administrative costs to the current system for fuel tax collection
Sales tax on motor vehicle fuels	• Could be viewed as duplicating the current consumption tax on motor vehicle fuels and collection methodologies • High costs to implement/administer if taxes are collected at retail outlets
Heavy vehicle surcharge (fee)	• Could be viewed as duplicating current vehicle and vessel taxes • Could be seen as reversing the recent government policy eliminating road maintenance fees • Would have a significant impact on heavy vehicle owners/operators • High costs to implement/administer due to new collection mechanisms
Vehicle tire tax	• Would be seen as earmarking taxes • There would be few, if any, incremental implementation and administrative costs over the current system
Vehicle taxes or fees	• If a tax, would be seen as earmarking taxes • If a fee, could be seen as reversing government policy that replaced road maintenance fees with taxes • If a fee, implementation and administration costs would be high due to the need to establish and manage new collection mechanisms
Diversion of excess toll revenues	• Users paying the tolls may become concerned that the funds are being sent elsewhere
General budget allocations	• Allocations could be seen as diverting funds from other sectors

Source: ADB.

(ix) **Relevant International Experiences.** Information on international experience relevant to new revenue sources for ordinary roads is limited to the small number of countries that have dedicated sources of road funding (i.e., the United States, Japan, Germany, and New Zealand). Key findings include the following:

a. The modern approach to road funding is to charge road users a fee for service and to dedicate the resulting revenue to road expenditure that benefits road users.
b. Where direct methods of charging for road use are implemented (e.g., tolling is not viable), the most common indirect methods of charging involve imposing a levy on vehicles and the fuel that they use.
c. Only a few countries hypothecate a portion of fuel tax and other taxes and dedicate road user charges for road-related expenditure purposes.
d. All of the selected countries continue to rely on vehicle fuel tax for at least part of the funding needed for roads, although the share of fuel tax revenues dedicated to roads varies.

e. Efforts to increase motor fuel taxes, whether to fund roads as a dedicated source or as a source of general government funding, almost universally meet with significant political resistance.
f. Most developed countries charge some form of vehicle registration fee, and many countries impose heavy vehicle surcharges.
g. Efforts to develop distance-based fees have been mixed at best. Germany has been able to do so for trucks, but initiatives to apply the concept to all vehicle travel have met with significant resistance.
h. The initiative in France to refinance its toll debt and extend tolling periods provides a model that could be applied in the PRC to leverage the current tolling structure to develop a supplementary source of funding.

4.5.2 Policy Options

Based on the assessment of a wide array of approaches the PRC could employ to raise additional revenues for ordinary road investment and maintenance, and based on inputs from ADB and PRC officials, the following were deemed to be the most viable options:

(i) **Increase the Motor Vehicle Fuel Consumption Tax.** The current central government consumption tax rates for motor vehicle fuel, and associated allocations to provincial and local governments, could simply be increased and dedicated to ordinary road construction and maintenance.

(ii) **Sales Tax on Motor Vehicle Fuels.** A tax imposed on the sale price of motor fuels (as opposed to a fixed rate per liter). Such a tax would likely need to be collected at the pump (as opposed to the refinery or major distribution points) and is more appropriate as a provincial and local funding source.

(iii) **Heavy Vehicle Surcharge.** An annual fee imposed on trucks over a certain vehicle weight as a means for recovering some or all associated additional road wear costs.

(iv) **Truck and/or Automobile Tire Tax.** A tax or fee imposed on the purchase of all new tires, either as a percentage of the sale price or as a fixed amount per tire. The tax could be applied to recently replaced tires or tires on new vehicles as well.

(v) **Vehicle Taxes or Fees.** To establish a funding source at the local level, the ceilings on the recently created vehicle and vessel taxes that provincial governments are allowed to impose on vehicle owners could be expanded. Alternatively, vehicle owners could be charged a new annual registration or related fee for their vehicles similar to the repealed RMF. Such a fee could be a flat amount, vary per the vehicle's value (also known as vehicle personal property tax), or be based on other factors such as vehicle weight/capacity and fuel efficiency.

(vi) **Diversion of Excess Toll Revenues.** To the extent that toll roads in the PRC are earning extra revenues (i.e., toll receipts beyond that needed to cover operations, maintenance, facility improvement, debt service, and profit costs), revenues could be diverted from toll authorities to fund ordinary roads. In addition, the toll period could be extended, tolls could be increased, or debt could be refinanced to provide additional, longer-term financial support for ordinary roads.

(vii) **General Budget Allocations.** As the PRC government has done in the past, the need for additional investment in ordinary roads could simply be provided through increased annual allocations from the central government budget.

4.5.3 Recommendations

The policy recommendations for new revenue sources for increasing road funding and addressing the current incapacity of provincial and local governments to raise own funding for roads are based on the evaluation of options detailed in Section A2.4. Assuming that the above policy options are accepted, the recommendations for new revenue sources for ordinary roads are the following:

(i) **Central Government.**

a. Dedicate an increased percentage of fuel tax and VPT revenue to ordinary roads and/or increase the rates of fuel tax and VPT (Options 1 and 3) so that the central government can meet its agreed share of costs for ordinary roads.
b. Annually allocate general budget funding for ordinary roads to make up any shortfall in the central government funding (Option 7).

(ii) **Provincial Governments.** Direct provincial governments to allocate the annual revenues from the new vehicle and vessel taxes that are associated with road use (i.e., taxes on all items except ships) to assist with financing the provincial and local governments' share of road maintenance and construction costs on their respective road networks (Option 5).

4.6 Debt Financing

Historically, the use of debt to finance ordinary road program spending largely occurred at the discretion of provincial and local governments and was done through bank loans as opposed to the issuance of bonds. To a large extent, bank loans were treated as a source of general funding for road programs; thus, proceeds were used not only for capital investment but also to fund maintenance, operations, and debt service. Provincial and local governments also tended to pay down little or any of their debt principal (i.e., debt service payments strictly covered accruing interest and loans were repeatedly rolled over into new debt or principal repayment terms were extended). As a result, the amount of total outstanding debt has increased rapidly.

Despite the dearth of publicly available information about the total amount of outstanding debt associated with financing ordinary roads, anecdotal evidence suggests that provincial and local road debt has been poorly managed, and many provincial and local governments are struggling to meet just interest payments with the special funds provided by the central government for this purpose. In addition, road-related debt is only part of a much bigger issue concerning the overall indebtedness levels of provincial and local governments in the PRC. Although central government debt has remained relatively stable, local government debt levels increased tenfold from 1998 to 2008, and almost doubled from 2008 to 2010. There is significant concern that provincial and local governments do not have adequate long-term revenue sources to service their debt and that some form of debt restructuring or central government bailout may be necessary.

Through the Fuel Tax Reform, the central government essentially eliminated the ability of provincial and local governments to leverage ordinary road funding. Tolls on Class II roads and the RMFs were the primary means through which bank loans were secured, but national laws and regulations prohibit provincial and local governments from leveraging the national motor fuels tax allocations that replaced the tolls and RMFs. Without the ability to borrow, provincial and local road agencies are finding it difficult to meet the system expansion targets identified in the Twelfth Five-Year Plan and longer-term road development plans.

4.6.1 Research Findings

The following sections discuss key considerations that should influence future policies on debt financing for ordinary roads.

(i) **Current Provincial and Local Government Financial Health.** Total outstanding provincial and local government debt in the PRC (all sectors) was estimated to be between CNY9.8 trillion and CNY19.6 trillion in 2013.[28] This reflects a debt–GDP ratio of between 16.4% and 32.8% for just provincial and local debt. Much of this debt has been incurred in the past several years. The growth rate of local government debt in 2009 was 61.9%. The rapid accumulation of debt in the past 3 years is mainly due to the CNY4 trillion stimulus plan, which essentially required provincial and local governments to borrow to match central government funds to invest in infrastructure projects. Provincial and local governments are now struggling to repay this debt.

(ii) **Legal Considerations.** There are four laws and regulations in the PRC that establish the legal framework for the use of debt by provincial and local governments.

a. **Budget Law of the PRC and Related Regulations.** This law stipulates that local debt liabilities are not to be listed in the local budget. It also stipulates that unless expressly granted authority by the State Council, local governments may not issue government bonds.
b. **Guaranty Law of the PRC and Related Regulations.** This identifies that national government agencies cannot guarantee debt issuance (with the exception of foreign government or international economic organization loans approved by the State Council).
c. **Notice of State Council on Strengthening Administration of Local Government Financing Platform Companies and Related Issues.** This stipulates that unless specific authority is granted by the State Council, local governments cannot use central government grants and allocations to help secure loans for "financing platform companies."
d. **Notice of the Ministry of Finance on Normalization of Local Government Debt and Guarantee Practices.** This reinforces that it is a violation of the national law for local governments to issue bonds or other guaranty agreements, for example, guaranty, commitment, and consolation letters, or to otherwise provide security, debt service, and buyback service to other institutions and companies.

[28] S. Rabinovitch. 2013. China Local Authority Debt 'Out of Control'. *Financial Times*. April. http://www.ft.com/intl/cms/s/0/adb07bbe-a655-11e2-8bd2-00144feabdc0.html#axzz2U3zFUoUz

(iii) **The Role of the Central Government.** The role of the central government in road-related debt issuance varies by the type of debt and the use of proceeds. For bank loans to provincial and local governments, the central government has no role other than stipulating that national government grants and allocations cannot be pledged to secure debt or to pay associated debt service. For national debts, the central government issues and secures the debt on behalf of provincial and local governments, effectively reloans the debt proceeds to provincial and local governments, collects the associated debt service from them, pays debt service, and conducts appropriate loan audit and oversight activities. Finally, the central government also issues national bonds to raise revenues that are then allocated by formula to provincial and local governments as general budget funds for roads—the central government controls the amount of funds that are borrowed and allocated for this purpose.

(iv) **Transparency Challenges.** The practices followed by commercial banks in the PRC related to issuing bank loans to provincial and local governments have included very limited due diligence research on the capacity of entities to service debt and little auditing of the use of debt proceeds and indebtedness levels.

(v) **Use of Shadow Tolling.** The PRC has experimented with shadow tolling, a form of debt financing, mainly for municipal road infrastructure where tolling is deemed unsuitable. For example, in 2004, Hangzhou City (the largest city of Zhejiang Province) invited foreign investors to develop the Wensheng Expressway by upgrading an important urban road across the city's main area. The overall length of the project was 34.5 kilometers, and the total budget was CNY5.7 billion. A foreign investor was responsible for establishing a company and financing the engineering and construction cost of the project in return for a 20-year operating concession with repayment of investment by way of shadow tolling. Shadow tolling is also being used for a road and bridge in Chengdu, the capital of Sichuan Province. The municipal finance department makes the shadow toll payments.

(vi) **Recent Developments.** The central government is currently undertaking an initiative to tighten management of local government debt and strictly regulate new borrowing to guard against fiscal risks. At this time, it is not clear what new rules or requirements will emerge from this effort, but they will likely have direct impacts on possible approaches for enabling future borrowing by local governments for roads.

(vii) **Applicable International Experience.** International practices with respect to management of local debt, whether specifically for road investment or for general purposes, vary widely depending on the form and nature of government, taxation approaches, historical practices, and political considerations. There is a general trend toward devolving more decision-making powers to borrow at the local level provided local authorities comply with limits and standards, which are then coordinated and handled by a regional or national public organization. Examples of controls central governments impose on local borrowing include

   a. establishing debt limits and/or debt service levels based on assets and revenues; restricting the type of funding streams that can be leveraged; creating requirements to gain approval from a central authority, either for general borrowing levels or for specific initiatives; and independent

audit of financial health standards that must be met before borrowing can proceed;
b. restrictions on types of borrowing, for example, limited to bank loans, bonds, debentures, etc., and on the source of borrowings, such as regional bond banks;
c. the need for referendum approval from voters and/or property owners and/or resolutions of council before approval can be sought;
d. requirements to have separate operating and capital budgets and/or other forms of financial planning;
e. restrictions on the type of expenditure financed from borrowing, for example, only capital investment; and
f. increased accounting and reporting requirements, and use of sanctions for violating rules and standards.

4.6.2 Policy Options

Debt financing is widely viewed as a practical and effective means for funding large public capital projects. Since completed projects can provide significant economic benefits, it often makes sense to advance or accelerate projects with borrowing and repay the associated debt while the benefits of the investment are accruing. Given the speed of economic development in the PRC and the huge need for road system expansion to accommodate it, there is arguably a place for debt financing as a tool to support faster delivery of ordinary road programs.

There are several approaches the PRC could take to enable borrowing for roads, yet ensure that debt usage is managed in a productive and responsible manner. Objectives or considerations that should drive the development of a new initiative for use of debt for road financing include the following:

(i) **Cost Implications.** The level of additional costs associated with borrowing, both in terms of issuance costs and ongoing interest, should be both minimized and less than the benefits received by accelerating projects and programs.

(ii) **Use of Debt Proceeds.** Debt should only be allowed for capital projects that meet certain criteria (e.g., a positive benefit–cost ratio, major capital improvements, and alignment with national goals).

(iii) **Sustainability.** The amount of road-related debt a jurisdiction can issue should be limited by the capacity of the entity to service the debt with a well-defined and reliable revenue source. Borrowing levels should be managed to ensure debt and other obligations (e.g., meeting maintenance and operations spending needs on a pay-as-you-go basis) can be met under conservative estimates of future revenues.

(iv) **Transparency and Control.** The level of road-related debt amassed by provincial or local government, the debt terms, and the use of debt proceeds should all be clear and open as possible to ensure debt levels are conservative, terms are reasonable and fair, and funds are being used wisely. In addition, the central government must be able to maintain an adequate level of control over borrowing to ensure it is used prudently and that provincial and local debt practices are aligned with broader national policies associated with government indebtedness.

The specific options the PRC could pursue with respect to allowing and facilitating debt use for ordinary roads are generally not mutually exclusive; instead, they present a range of considerations that could be implemented individually or in combination and fall into two areas—approaches to control debt levels/use and debt structure considerations.

1) **Means of Securing and Repaying Debt.** These options relate to the sources of funding that could be pledged to secure loans.
    - 1a. **National Funds.** The central government could allow provincial and/or local governments to pledge and use future national road-funding allocations from the motor fuels tax, the VPT, or a new funding source.
    - 1b. **New Provincial and Local Sources.** If a new provincial and local ordinary road-funding source is established, the central government could allow leveraging of some or all of the resulting proceeds.

2) **Debt Management Mechanisms.** These are potential policies, regulations, or approaches the central government could establish to help control and manage the renewed use of provincial and local borrowing for roads.
    - 2a. **Central Issuance.** Rather than allowing provincial and local governments to borrow directly from banks as they did prior to the Fuel Tax Reform, the central government could build from its newly emerging program to issue "local government bonds" on behalf of provincial and local governments. Such an approach would enable the central government to more closely control and monitor debt levels and debt proceeds use and increase the level of due diligence associated with loan approval. It also could lead to more favorable interest rates and borrowing terms.
    - 2b. **Borrowing Caps.** The central government could allow provincial and/or local governments to issue debt for roads, but only within certain parameters, such as limitations on the ratio of total debt or annual debt service to annual available resources (either central government allocations, local funds, or a combination of both).
    - 2c. **Designated Purpose and Requirements.** The central government could place restrictions on the use of provincial and/or local government debt issuance for roads, such as only allowing proceeds to be used for specific types of capital investments (e.g., bridges and high-cost segments) or for projects that exceed a prescribed level.

3) **Financing Structures.** These are policies, programs, and approaches that could be established in conjunction with renewal of provincial and local debt issuance capabilities:
    - 3a. **Loan Terms and Prepayment Requirements.** The central government could establish new policies and requirements associated with the terms for bank loans and local government bonds for provincial and local ordinary road financing to (i) increase the level of due diligence lenders or underwriters must perform and make available and (ii) establish debt servicing terms that require principal to be repaid within a designated timeframe.
    - 3b. **Credit Assistance.** The central government could provide provincial and local governments with various forms of credit assistance ranging

from lines of credit and credit guarantees to direct loans. Such a program could help reduce borrowing costs as well as improve the ability of the central government to increase transparency and to enforce controls on provincial and local borrowing levels.

3c. **Shadow Tolling.** The central government could effectively reestablish the capacity for provincial and local governments to finance ordinary road investments through the authorization of shadow tolling schemes whereby road improvements could be privately financed, with the private partner compensated based on future traffic levels (this approach would require establishment of a provincial and local funding source, or authorization to use central government funds to make shadow toll payments). Similarly, private partner compensation could be paid in the form of a simple availability payment without linking the amount paid to traffic levels.

4.6.3 Recommendations

Evaluation of options for reintroducing local borrowing capacity in a sustainable and responsible manner is set out in Section A2.5.

Before any of the identified options can be recommended or selected, the central government needs to first decide whether it wants to reestablish the ability of provincial and local governments to use debt for funding ordinary road activities in general and, if so, determine how this reintroduced capacity will be managed (e.g., through creation of debt ceilings, allowable debt service ratios, and debt monitoring/reporting mechanisms). These questions, however, go well beyond issues associated with road financing policy and are thus not addressed in this report. In the event the central government does decide to re-allow provincial and local governments to use debt for road investment, it is recommended that the central government do so through a two-step approach:

(i) **Phase I.** The central government should issue debt on behalf of provincial and local road agencies, with debt service payments made by the recipient provincial or local government. The debt could be secured from a mix of (i) an agreed portion of future fuel tax payments and (ii) local funding sources. A provincial or local government that failed to meet its debt service obligations could be sanctioned by not being given all or a portion of future central government road funding.

(ii) **Phase II.** Once the central government is satisfied with the provincial and the local agencies with regard to addressing their existing debt repayment challenges, the central government could allow provincial and local governments to issue debt for road construction backed by a local road-funding source, such as revenues from a dedicated motor vehicle and vessel tax increase.

Shadow Tolling. While PRC officials have expressed considerable interest in expanding the use of shadow tolling, at least some of this interest appears to be based on misperceptions that shadow tolling can generate revenues for roadworks. In reality, shadow tolling is only relevant for the purpose of paying back an external financier where external finance is needed to meet a peak in demand for construction and upgrading of the road network. Any implementation of shadow tolling or private sector financing through availability payments should thus be conducted in accordance with the two phases already discussed.

4.7 Long-Term Funding

Although the short-term prospects for the fuel tax are strong, there is clearly the possibility that the transition to electric and high-efficiency vehicles will eventually reduce fuel consumption and limit the sustainability of the fuel tax as a revenue source. Developed countries that use motor vehicle fuel taxes as a major source of road funding have begun to take this possibility as a fait accompli and have generally determined that either time-based fees or distance-based fees will one day need to supplant existing fuel taxes if they are to have sustainable long-term road programs.

It is currently unknown how quickly vehicle owners will switch to high-efficiency or alternative fuel vehicles, but many road-funding experts throughout the world think it will happen quicker and sooner than was thought just a few years ago. To prepare for this shift, the PRC needs to explore options for replacing or progressively augmenting the motor fuel tax and determine what actions, if any, it should begin taking today to prepare for the future.

4.7.1 Research Findings

The relevant research on the long-term funding issues was largely limited to identifying progress that foreign countries are making in developing distance-based options as a replacement for motor fuel taxes. Key findings include the following:

(i) A number of countries in Europe have implemented distance-based charges for heavy vehicles using an on-board unit (OBU) and global positioning system (GPS) technologies. In most cases, this only applies to motorways or selected routes, but in Switzerland, charges apply to travel on all public roads. Other European countries have implemented time-based charges (known as vignettes) either for heavy vehicles only or for all vehicles. Time-based charges do not require an OBU.

(ii) The United States has begun to investigate distance-based pricing schemes but is still in the process of conducting studies or developing and implementing pilot programs.

(iii) New Zealand has had a distance-based road user charging system for heavy vehicles since 1978 that uses mechanical hubodometers to measure the distance traveled for charging purposes. From 1 January 2010, approved electronic distance recorders can be used as an alternative to hubodometers and paper road user charge licenses, on a voluntary basis. An electronic distance recorder collects information from a GPS signal and from internal vehicle sensors (e.g., an accelerometer and a derivative of wheel revolutions). These data streams are then cross-checked by the unit to ensure accurate measurement of the distance traveled by the vehicle. Electronic distance recorders are connected to the server of an electronic service provider and are able to send and receive vehicle and license information by secure electronic means.

Transitioning from a fuel tax to distance-based fees or time-based fees, depending on how they are implemented, could take significant time. For distance-based fees, vehicles would need to be equipped with GPS units or a similar OBU technology. It could thus take several years before the vehicle fleet of a country would have sufficient penetration of GPS units

to enable implementation of a distance-based fee system, and for other support functions to be fully established. On the other hand, there are low-technology options that could be implemented more quickly.

4.7.2 Policy Options

The PRC could consider a range of approaches to replacing or supplementing its current reliance on motor vehicle fuel taxes as a primary source of road funding. These approaches would include the following:

(i) **Low-Tech Distance-Based Fees.** The PRC could opt to implement fairly rudimentary approaches to distance-based charges that require limited lead time to implement. Examples include an annual "odometer tax" that simply charges users a flat fee per kilometer driven or truck fees that require trucking firms to report and pay for their individual usage based on their distance traveled for a given trip (this could also be imposed as a weight–distance charge).

(ii) **High-Tech Distance-Based Fees.** The PRC could opt to go in the direction of countries such as Germany, the Netherlands (planned, but not yet implemented), Switzerland, and the United States (exploring options), and develop a charging system that tracks actual vehicle travel and imposes distance fees potentially by facility and time of day.

(iii) **Alternative Sources.** The PRC could opt to establish some other form of user charge to replace or supplement the motor vehicle fuel tax that is not necessarily linked to the distance traveled, such as time-based vehicle charges or driver registration/licensing fees.

4.7.3 Recommendations

Based on the feedback received from PRC officials, it appears there is neither any interest in exploring a distance-based pricing option at this time nor any concern about the long-term viability of the motor fuel tax. The identified options were thus not evaluated further. Nonetheless, long-term ordinary road-funding solutions will be needed in the PRC due to an increasing likelihood of technological change reducing the use of taxed fuels in the future. To prevent the long-run decline of revenue, the basis for implementing new funding sources should be developed over the next several years. It is therefore recommended that the PRC consider taking steps to move toward charging all road users fees for use of roads rather than funding road expenditure from taxes, and that the central government monitor international developments of distance-based road user fees, particularly the high-tech systems being developed and implemented in Germany, the Netherlands, Switzerland, and the United States.

4.8 Fund Allocation

Prior to the Fuel Tax Reform, the allocation of central government funding for ordinary roads was not a major policy consideration since provincial and local governments raised most of the funding to meet these needs themselves through the RMFs and tolls. However, now that the central government is the primary source of funding for ordinary roads, the methodology used to determine the allocation is now critical, both to maintain a reasonable

level of transparency and to facilitate sound road program planning by provincial and local governments.

As part of the initial implementation of the Fuel Tax Reform, the PRC established an interim funding allocation formula (described in the following section). There are several critical issues concerning this interim allocation approach that need to be addressed:

(i) The fuel tax "baseline allocation" is providing insufficient funding for road maintenance in some provinces and funding in excess of needs in other provinces.
(ii) The current formula is likely to change the relative distribution between provinces, which could create inequities by favoring provinces with higher population densities.
(iii) The current formula for the allocation of "extra" funding is heavily influenced by fuel consumption. However, such an approach could create disincentives for provincial and local governments to support central government environmental and energy policies.
(iv) The current institutional and funding arrangements cannot fundamentally improve efficiency and sustainability because there is no reward and punishment system linked with fund distribution. A typical example is that deterioration of road and bridge conditions can be rewarded with funding for reconstruction of the road or bridge.

Based on the goals of the Fuel Tax Reform, any revisions to the current allocation approach will need to provide provincial and local jurisdictions with a fair return of the fuel tax and VPT revenues they generate (and any future dedicated road user charges), and provide rural areas in the western provinces of the PRC with adequate funding to address road development needs. They also will need to ensure that the central government has the ability to direct resources toward national-level priorities for connectivity, access, and other considerations, and establish a methodology that is transparent and provides predictable and stable allocation levels.

4.8.1 Research Findings

Central government funding that is allocated to provincial and local governments for ordinary roads includes revenues from the motor fuel tax and VPT, as well as appropriations from the general budget. General budget revenues are typically designated for specific projects; thus, a formal mechanism for allocating these funds is not applicable. The focus of funding allocation approach should therefore be on motor fuel tax and VPT revenues. The following are research findings that are relevant to the development of a recommended approach:

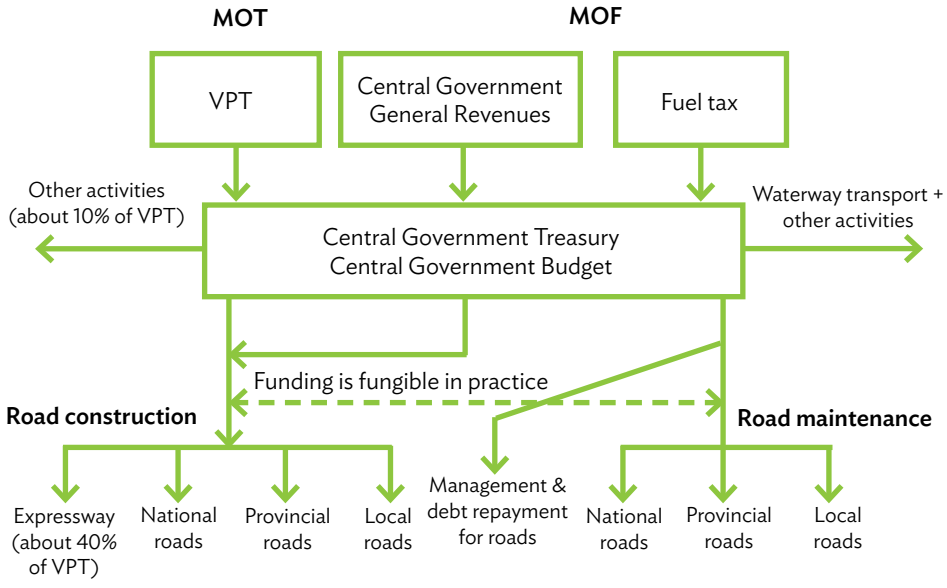
(i) **Fund Administration.** Annual spending on roads is approved by the National People's Congress (NPC) as part of the central government budget process. The MOF then administers distribution of the fuel tax revenues and the MOT administers distribution and use of VPT revenues.
(ii) **Current Allocation Process.** The current fuel tax allocation formula is intended to reimburse jurisdictions for revenue lost as a result of elimination

of previous funding mechanisms, and also to provide an added allocation for increased demand. It thus focuses strictly on allocations of fuel tax revenues. The methodology uses a "baseline allocation" to ensure provincial and local governments receive as much funding from the fuel tax as they raised for road maintenance and construction prior to the reform. The "baseline allocation" is the percentage share of total revenues each province or jurisdiction collected in 2007 (the base year) through prior road-funding mechanisms, for example, the RMF and passenger/freight fees, increased by 10%. The total annual baseline allocation is CNY153 billion. The "added allocation" is based on factors such as fuel consumption, road and waterway length, road density, and system conditions.

There does not appear to be any uniform statistics, by province or other jurisdiction, to calculate the "added allocation" under the current fuel tax allocation formula. Also, there are unbalanced road development and road conditions between regions and the current fuel tax allocation methodology does not address this. The current central government funding arrangement for roads is illustrated in Figure 4.2.

(iii) **Motor Fuel Tax Revenues.** Fuel taxes are part of the wider domestic consumption tax and are not shown separately in the central government accounts. Fuel tax revenue is intended to be used for road maintenance, management, and debt repayment. Information on these revenues is not explicitly published; rather, it is included in reporting on the wider domestic consumption tax. About 35% of the

Figure 4.2: Current Central Government Funding Arrangements



MOF = Ministry of Finance, MOT = Ministry of Transport, VPT = vehicle purchase tax.

Source: ADB.

Figure 4.3: Vehicle Fuel Tax Revenue Allocation Formula

Fuel tax revenue allocated = baseline allocation + added allocation

Baseline allocation = 2007 revenue × (1 + 10%)

Added allocation (AA) = oil product consumption subsidy (OPCS)
+ road maintenance and construction subsidy (RMCS)
+ navigational channel maintenance subsidy (NCMS)

- **OPCS** = national total AA × 60% × percent share of total national consumption of oil products
- **RMCS** = national total AA × percent share of total national user taxes in base year × (percent of total national road length × 20% + local road density index × 15% + local condition factor index × 5%)
- **NCMS** = national total AA × percent share of total national [water] user taxes in base year × percent of national navigation channel length × 40%

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

fuel tax revenue is used for debt servicing and management, and this includes the CNY26 billion that is distributed annually for debt repayment. Fuel tax revenues are allocated by the MOF to each of the provinces, and to the four cities directly under the central government. The current funding allocation methodology is shown in Figure 4.3 (footnote 2).

(iv) **VPT Revenues.** Revenue from the VPT is mainly intended for construction of national roads, and about 10% of VPT revenue is used for other purposes. VPT revenue is deposited into the central government treasury and maintained under an explicit MOT heading in the central government accounts. This revenue is allocated to provincial governments mainly for construction of national roads, with about 40% spent on expressways. There is some control on the use of VPT revenue because it is mostly used for identified construction projects, which have a rigorous approval process. Some VPT revenue has also been provided for improvements on country (village) roads. Use of VPT revenue is shown in Table 4.3.

Table 4.3: Use of Vehicle Purchase Tax (CNY billion)

	Tenth Plan (2001–2005)		Eleventh Plan (2006–2010)		2011		2012	
Road Category	Amount	%	Amount	%	Amount	%	Amount	%
Expressways	122	58	186	39	102	45	82	33
National/ provisional roads	31	14	56	12	57	25	90	36
Local roads	51	24	162	34	67	30	78	31
Others	8	4	69	15				
Total	**212**	**100**	**473**	**100**	**226**	**100**	**250**	**100**

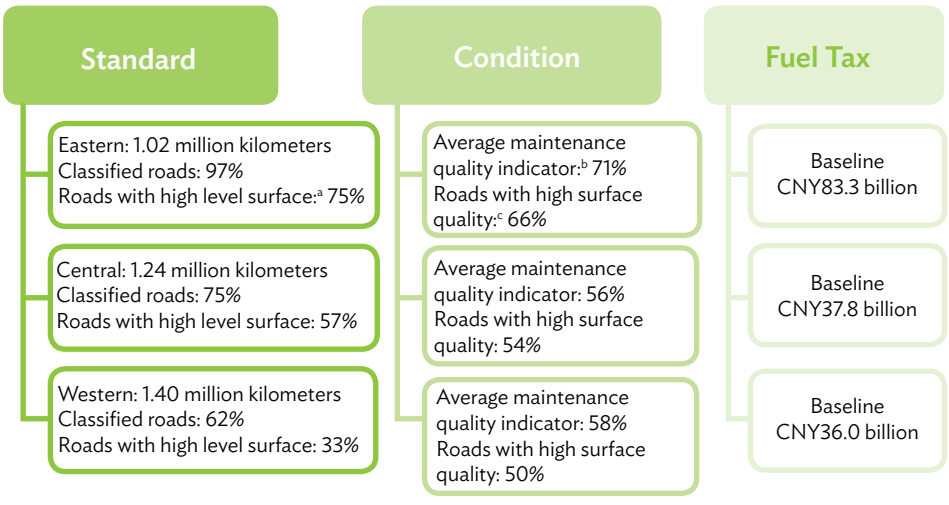
Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

(v) **Use of Allocated Revenues.** There are no firm rules on how central government fuel tax allocations are to be spent. They are essentially treated as untied grants. The part of the fuel tax that replaces the RMF and the part that allows for increased maintenance costs should be used only for road maintenance and management, and the part that reimburses displaced toll station revenue should be used for road management and construction. In practice, however, provincial departments of finance often decide that the first use of fuel tax revenue is, in fact, to service debt. The annual amount of fuel tax revenue allocated for servicing debt from eliminated tolls on Class II roads is CNY26 billion. After that, the provincial and local road agencies decide on the amounts needed for management and then decide on the roads to be maintained.

Total fuel tax revenue in 2010 was estimated to be about CNY180 billion, of which about 35% was spent on debt servicing and management. Therefore, only about CNY117 billion of fuel tax revenue was available for road maintenance in 2010. Budget information from a sample of provinces indicates that much less than this is actually being spent on road maintenance. In addition, there is currently no transparency or accountability about collection of fuel tax revenues by the MOF and the actual allocation and use of fuel tax revenues.

(vi) **Regional Allocation Differences.** Data on both road conditions and funding allocations show significant disparities in investment and road quality between different regions in the PRC. These differences are illustrated in Figure 4.4.

Figure 4.4: Differences between Regions



[a] Asphalt or cement concrete pavement.
[b] See Section 4.10.1 for the definition of Maintenance Quality Indicator.
[c] Road technical condition "good" or "very good."

Source: Transport Planning and Research Institute, Ministry of Transport, PRC.

(vii) **International Experience.** The approaches other countries with multitiered systems use to allocate national road funding are difficult to relate to the PRC given the differences in funding structures, policy-making processes, and transparency requirements. In countries where road funding does not come from dedicated sources, allocations to subordinate governments are typically either incorporated into broad transfers or are based on a combination of needs, politics, and precedent. In countries where a national dedicated source of road funding exists and subordinate governments play a strong role in delivering roads programs, allocation approaches strive to balance national priorities and a jurisdiction getting back what is collected in that area.

(viii) **Opinions on Allocation Approaches.** National, provincial, and local PRC officials express a wide range of views about how funding allocation should be reformed. Most agree that the PRC needs to improve the funding allocation process for ordinary road revenues. Some noted that the baseline fuel tax distribution should be increased for undeveloped areas such as the western region. Others suggested that to prevent misuse of funds, the central government should establish a project approval process and allocate funds to approved projects.

4.8.2 Policy Options

There are at least six options for central government allocation of funds for roads. It should be noted that some of these options are not mutually exclusive (footnote 2):

(i) **Current Formula.** Continue to use the interim allocation formula established as part of the Fuel Tax Reform.

(ii) **Prior-Year Consideration.** Link future funding to how a jurisdiction spent money in the prior year, for example,the actual expenditure in the previous year plus an increment to allow for changed needs.

(iii) **Consistent Baseline Share.** Involves maintaining a target percentage split between funding allocated through the "baseline" and "added" components of the current formula, thus ensuring that slower growing provinces do not end up with little or none of the "added" funding.

(iv) **Improved Formula Emphasis.** Involves adjusting the allocation formula to better emphasize national goals and priorities, system performance or other factors, for example, as reflected in the five-year plan.

(v) **Needs-Based Allocations.** Allocate funding to defined projects or work categories on the basis of rationally justified needs, and tie allocations for management and administration to the size of maintenance and improvement expenditures.

(vi) **Multiyear Allocations.** For some activities, for example, improvement projects with duration of more than 1 year, and multiyear maintenance contracts.

4.8.3 Recommendations

The allocation of transportation funds generally requires some form of formula or rules. Based on lessons from national and international experience and analysis of the needs and characteristics of the PRC road sector, it is recommended that the PRC adopt a

combination of needs-based allocations (Option 5) and multiyear allocations (Option 6). An evaluation of the option is provided in Section A2.6.

4.9 Fund Management

While both the VPT and the motor fuel tax are intended to serve as direct sources of funding for road investment, the total amounts that are collected from these sources are not well recorded and the relationship between what is collected and what is spent on roads is unclear. Revenues from both sources are deposited into the general treasury of the central government of the PRC, and annual spending on roads is approved by the NPC as part of the central government budget process (footnote 2).The distribution of fuel tax revenues is then approved by the MOT, while spending associated with VPT revenues is administrated by the MOF.

The lack of a well-defined accounting mechanism leads to a lack of transparency about the degree to which fuel tax and VPT revenues are allocated for their intended purposes. It also creates uncertainty about the level of funding that will be available for distribution. This lack of transparency and certainty has generated concerns among provincial and local government officials that they will not receive sufficient resources to fulfill plans and meet demand for improvements, maintenance, and debt repayment. It also has made construction planning and effective asset management more difficult. This, in turn, can impair the ability of provincial and local road agencies to plan and implement their programs effectively, and may create barriers to leveraging centrally collected road revenues through the issuance of bank loans or bonds.

To address these issues, a more transparent and predictable mechanism is needed to account for and manage the collection of the VPT and motor fuel tax revenues.

4.9.1 Research Findings

The following is a summary of applicable research and analysis findings from the Phase II study:

1) **Statutory Provisions.** The national statutes that deal with construction and maintenance funding are included in Articles 21 and 36 of the Highway Law of the PRC, but are vague about the management of road-related revenues beyond saying that taxes collected as road maintenance funds (i.e., motor fuel taxes) must be used on road maintenance and reconstruction.
2) **Current Management and Reporting.** Figures on fuel tax revenues are not published separately but are imbedded in information about the wider domestic consumption tax and are thus not publicly available. There does not appear to be any uniform statistics, by province or other jurisdiction, to calculate the "added allocation" under the current fuel tax allocation formula. There are no trust funds or similar financial arrangements for ordinary road funding at a local level.
3) **Opinions about Fund Management Approaches.** PRC officials expressed mixed opinions about the creation of a specific road fund. Central government officials,

particularly those from the MOF, did not feel creation of a trust fund-type mechanism would be beneficial. Provincial and local roads officials, however, were more in favor of the concept and expected that a stand-alone fund, managed by a "high-level committee," would strengthen monitoring, quality checking, and auditing of national road revenues, and help ensure that funds are used effectively and as intended.

4) **Applicable International Experience.** The modern approach to road funds is to establish them by legislation with detailed transparency, accountability, and management requirements that are performed by a board with private sector expertise. Several countries have created some form of road fund to establish a transparent arrangement for managing dedicated road revenues and allocating funds for roads. These funds often receive allocations of general budget monies. Even in countries that have dedicated national road-funding sources such as the United States, Japan, Australia, Brazil, and Germany, general fund revenues are often appropriated when dedicated funding sources prove insufficient.

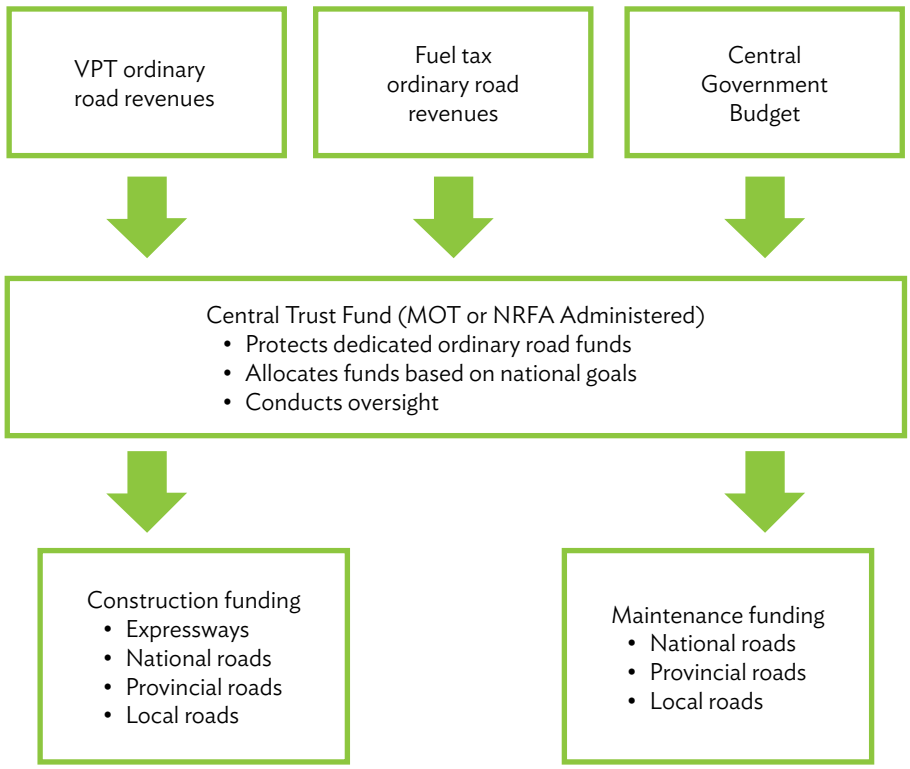
4.9.2 Policy Options

Three policy options for improving the fund management for the road sector were identified and evaluated (footnote 2):

1) **Increase Transparency.** Maintain the current arrangements for collecting, accounting for, and disbursing road funding, but establish more transparent accounting and reporting practices and formalize cost-sharing arrangements.
2) **Establish a Trust Fund.** Create a central road trust fund with dedicated revenues and establish policies and procedures for managing the fund and the road-funding activities. Such an approach would dedicate specific revenue sources to a designated fund, require definition about how the fund would be managed, require linkages to policies about how funds could be used, and identify cost-sharing roles between different levels of government.
3) **Establish a Central Road Fund and Board.** Create a statutory administration in law responsible for managing central government revenues dedicated for roads and approving and managing expenditure of those revenues. The sources of revenue that are dedicated to the road fund and utilization of the fund would be the same as that described for the trust fund. The main difference under this option is that the road fund and board would be established in law as statutorily independent from government ministries and departments (i.e., managed by the NRFA). The objectives and functions of the road fund and board, composition and appointment of the board, utilization, and accountability and transparency provisions would be specified in law.

Under Options 2 and 3, a fixed proportion of the VPT and fuel taxes would be dedicated to the trust fund together with any appropriations from the central government budget. (It is not unreasonable that some share of these revenue sources might go to nonordinary road purposes.) Other sources of revenue could be added to the trust fund (e.g., state loans; revenue from national toll roads in excess of that needed for debt repayment, operations, and maintenance; and any other new, centrally collected road-related fees and charges).

Figure 4.5: Central Trust Fund Arrangement



MOT = Ministry of Transport, NRFA = National Roads and Funding Administration, VPT = vehicle purchase tax.

Source: ADB.

The central trust fund would provide funding to roads and activities as proposed under the program approach options in Section 3.3 of this report. Central government funding for servicing provincial and local government debt would be administered outside the trust fund, and would continue to be administered by the MOF. A potential trust fund arrangement for the current sources of revenue is illustrated in Figure 4.5.

4.9.3 Recommendations

The policy recommendation is to improve the transparency of current road fund accounting (Option 1) in the short term and to move a central trust fund controlled by an independent board, such as the NRFA, in the longer term. An evaluation of the option is provided in Section A2.7.

4.10 Performance Management

While the PRC has established performance measurement for roads in selected areas, they are not used at the national level to hold provincial and local road agencies accountable for how they use national ordinary road funding, nor are they used to influence decisions about national investment priorities or allocation of resources. In light of both the other reforms recommended in this report and the growing international focus on performance management in road programs, the PRC should consider building from its current performance measurement activities to establish performance targets for various road program considerations, and integrating consideration of performance into other parts of the ongoing Fuel Tax Reform.

Performance management is an essential component of the other changes proposed in this report. It requires that performance indicators and targets be established, measured, and reported for considerations such as

(i) the different elements of the road system, for example, physical features and conditions for pavements, bridges;
(ii) road system performance, for example, safety, congestion and capacity, preservation;
(iii) program administration, for example, road treatments and costs, administrative costs, on-time and on-cost project delivery;
(iv) road sector funding, for example, trust fund expenditures compared with needs and income; and
(v) achievement of investment objectives, such as, return on investment, achievement of distributional targets, regional equity.

The Fuel Tax Reform offers an opportunity to introduce improved performance management practices along with the other changes being considered. Performance metrics will thus be needed to implement the policy reform recommendations and to ensure that a sustainable, equitable, and transparent road financing system is established in the PRC.

4.10.1 Research Findings

The use of performance management approaches appears to be in a nascent stage in the PRC. Rules are available relating to the inspection and condition of road infrastructure, which include public notification of major defects, but there is currently no reward and punishment system linked to the use of central government road funds. Key research findings with respect to better integration of performance management into the administration of the ordinary road program in the PRC include the following:

(i) **Applicable Requirements.** In 2002, the MOT published traffic statistics regulations to be implemented on 1 January 2003. Article 25 of these regulations requires provincial governments to develop a comprehensive statistical information publishing system. In addition, provincial and local departments of traffic and administration are required to organize, investigate, and publish statistical information. If provincial data overlaps with data from the central government statistical institution, publication is negotiated between the

organizations. Local government agencies are instructed to develop road programs and plans based on the result of road condition assessment, and to actively implement preventive maintenance.

(ii) **Road Statistics.** Provincial governments are developing a comprehensive statistical information publishing system and have established road maintenance and inspection institutions. System inventory data are available on the length of road in each category and class, and by surface type for each province and major city. Further data on the length and condition of roads in each category and class, and by surface type for each province and major city are provided in Section A3.3 of this report.

(iii) **Inspection and Monitoring.** Road and bridge conditions are regulated by "road safety and protection rules." Under these rules, the road administrative institution and road operating corporations are required to supervise and periodically evaluate the condition of roads, bridges, and tunnels to ensure a suitable technical condition. Where facilities do not meet the requirements, the public as well as the public security division of the traffic management department are to be informed, and the facilities are to be repaired.

Road condition is determined in accordance with "Highway Performance Assessment Standards." Condition involves four parts of the road: (i) pavement; (ii) subgrade; (iii) bridge, tunnel, and culvert; and (iv) facility. Pavement condition includes road damage, roughness, rutting, skid resistance, and structural strength, of which structural strength is assessed by sampling. An inspection vehicle is used to measure the two main indicators: road damage and road roughness. Road technical condition is standardized by the Maintenance Quality Indicator (MQI).[29] Indicators use a scale from 0 to 100. Road technical condition is classified to five degrees based on MQI score: very good (≥90), good (≥80), fair (≥70), poor (≥60), very poor (<60).

Inspection vehicles are used to measure road damage and smoothness on paved roads. Review and monitoring of central government-funded projects is performed by inspection and audit departments at the central and provincial levels using systems established by the central government. The condition of national and provincial arterial roads is assessed using an inspection vehicle, but the condition of rural roads is assessed visually by local maintenance agencies. Rural road maintenance systems are generally lacking.

Currently, each province has established road maintenance and inspection institutions, but provincial road departments tend to have different inspection methods for national, provincial, and county roads. Some national and provincial roads are inspected and maintained one or two times a year. For county roads, inspections are developed at the province, city, county, and country levels. Province- and city-level inspection cannot be less than once per year, county-level inspection cannot be less than once per season, and county-level inspection should not be less than once per month.

[29] The MQI incorporates several subindicators, including Pavement Quality Performance Index (combining Pavement Surface Condition Index, Riding Quality Index, Rutting Depth Index, Skidding Resistance Index, and Pavement Structure Strength Index); Subgrade Condition Index; Bridge Tunnel and Culvert Condition Index; and Traffic-Facility Condition Index.

(iv) **Performance Targets.** Provincial highway bureaus issue performance targets for road maintenance works, establish evaluation criteria, and conduct annual inspections of maintenance needs. Provincial transport departments monitor rural road maintenance works, but there does not appear to be significant rigor in these efforts or much accountability for poor performance.

(v) **Applicable International Experiences.** Much work has been done internationally on performance indicators for the road sector. There is movement internationally toward outcome indicators related to investment levels and also indicators of agency performance, rather than just indicators of output.

4.10.2 Policy Options

Performance indicators and targets need to be practical and measurable within the PRC context, and it should be recognized that implementing performance indicators and targets, and reporting for ordinary roads will take time and will be an incremental process. There are options considered to improve performance management in the PRC and these are not mutually exclusive:

(i) **Road Inventory and Condition.** Monitor road length, road condition, bridge condition, etc., by road classification, road type, and jurisdiction.

(ii) **Traffic and Safety.** Monitor traffic volumes, traffic type, congestion, safety, etc., by road classification and jurisdiction.

(iii) **Program Delivery.** Monitor road treatments and costs; administrative costs; on-time and on-cost project delivery; program effect, for example, return on investment, achievement of distributional goals, regional equity (both before and after).

(iv) **Balance Scorecard.** Report on road system and program delivery.

(v) **Social Measures.** Integrate measures of user satisfaction, connectivity, economic development, health, and environment indicators for road transport.

4.10.3 Recommendations

The policy recommendation for performance management is to incorporate all of the Options (1–5) into a comprehensive performance management approach. The evaluation of options is set out in Section A2.8.

CHAPTER 5

Implementation Strategy and Plan

The long-term vision of the combined recommendations in Chapter 4 is to transform the national, provincial, and local government road programs of the People's Republic of China (PRC) so that they are financially sustainable, address national road development and maintenance goals, are accountable, and promote sound road program management. This vision represents a significant change from the current approach of the PRC to management and funding of ordinary roads; thus, it should be recognized that the entire reform likely cannot be achieved all at once. Instead, intermediate transitional arrangements will be needed to initiate changes that both improve ordinary road program and lay the groundwork for broader policy and process changes. This section provides guidance for first implementing transitional arrangements, followed by long-term reforms, and finally proposing an approach for pilot testing the recommendations.

5.1 Transitional Arrangements

Programmatic fund allocation mechanisms should be put in place as soon as possible to guarantee sufficient funding for ordinary road system maintenance and to ensure that this funding is not diverted for further development of the network. Short-term steps needed to accomplish this include the following:

(i) Discontinue untied allocations of fuel tax revenues to provincial agencies.

(ii) Clarify that overall responsibility for national roads lies with the central government, with management and works supervision contracted to provincial agencies. Similarly, clarify that provincial governments are responsible for provincial roads and that local governments are responsible for local roads, with technical assistance provided from higher levels, as required.

(iii) Determine road maintenance needs through rigorous application of asset management best practices; include assessment of road maintenance and rehabilitation needs in five-year plans; and give priority to funding road maintenance before constructing new roads.

(iv) Establish a central government road trust fund through statute or administrative decree that can receive dedicated road funds as well as general fund contributions. As appropriate, determine interim responsibilities for managing the fund and allocating resources (e.g., a board comprised of the Ministry of Transport [MOT], Ministry of Finance [MOF], and National Development and Reform Commission [NDRC] representatives), and define a financially constrained process for defining

road expansion needs. Establish requirements for financial management and reporting of trust fund activities (either statutorily or administratively, as appropriate).

(v) Create separate programs for roadworks by broad work categories and administrative category of road (e.g., national roads, provincial roads, local roads) and develop multiyear programs for both maintenance and improvement works (dependent on a source of funding separate from government budgets).

(vi) Develop a needs-based process to allocate central government revenues for ordinary road maintenance and expansion; limit central government funding for management (personnel and associated costs) to a percentage of road maintenance and improvement expenditures, with provincial and local governments required to make up any difference. Use national economic evaluation of costs and benefits to justify major road improvements for funding allocation purposes.

(vii) Clearly define the proportion of fuel tax revenues that will be dedicated to ordinary roads (this excludes payment to provinces for debt repayment, which would continue to be made directly to provincial and local governments by the MOF), increase the share of fuel tax and vehicle purchase tax (VPT) revenues dedicated to the road sector and/or increase central government budget allocations to meet the share of road expenditures of the central government, and deposit all associated revenues into the central road trust fund.

(viii) Conduct an in-depth analysis of the ability of the provincial and local government to meet specific shares of road expenditures. Continue MOF administration of central government funding for servicing provincial and local government debt.

(ix) Establish parameters that limit the use of centrally issued debt for selected high-priority road projects.

(x) Create a structured program and a reasonable cost-sharing approach to meet reasonable road maintenance needs.

(xi) Begin to conduct performance measurement and reporting for all major roads and expenditures.

(xii) Fund and account for pension costs separately from road maintenance expenditures.

(xiii) Address technical abilities of provincial and local governments by requiring the higher levels of government to provide special assistance, where needed.

5.2 Long-Term Reforms

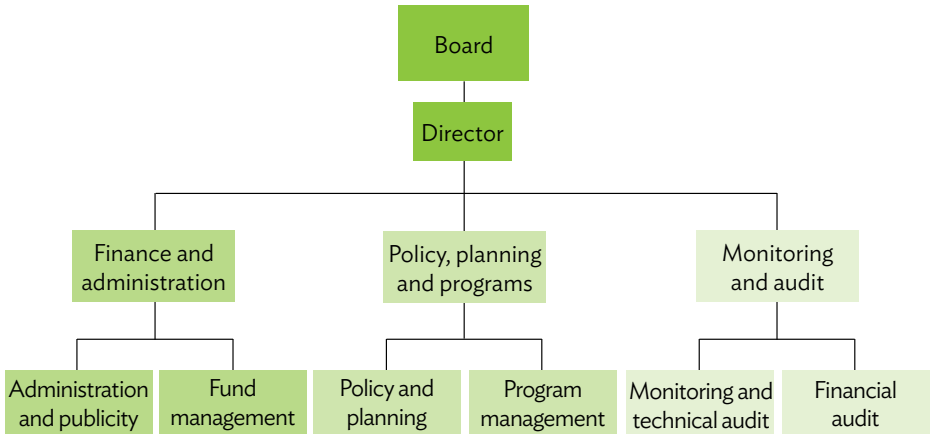
The cornerstone of the proposed long-term reforms for the ordinary road program of the PRC is the establishment of the National Roads and Funding Administration (NRFA) as a separate central government agency and the creation of a central road trust fund with dedicated revenue sources. The NRFA should manage the central road trust fund (including recommending adjustments to revenue levels); conduct national-level roadway system planning and oversight; determine cost-sharing responsibilities for subordinate levels of government; contract with provincial and local agencies for operations,

maintenance, and development of national roads; and establish agreements with provincial and local governments on requirements for funding provincial and local roads. Key steps and action that will be needed to transition to this new approach are described below.

5.2.1 Creation of the National Roads and Funding Administration

The NRFA should be created with the organizational structure depicted in Figure 5.1, or something close to it, with a governing board comprising suitably qualified persons. The organization itself should be sufficiently staffed, presumably through transferring some staff from existing similar positions in the MOT and MOF, to ensure it has the capabilities and capacity to carry out all needed functions.

Figure 5.1: Proposed NRFA Organizational Structure



NRFA = National Roads and Funding Administration.

Source: ADB.

5.2.2 NRFA Procedures and Systems

The NRFA should establish procedures and systems for financial management (including management of the central road trust fund); program management and funds allocation; management information; and road asset and performance management (inventory, traffic, condition, capacity, safety). The systems would support a high-efficiency, results-oriented management approach and ensure timely decision making. Some of these systems would likely be transferred from the MOT.

5.2.3 Planning, Programming, and Funding

An important part of the NRFA initiative will be to revise the way that ordinary road development and maintenance are planned and managed. First, the NRFA should include revising the process for developing the ordinary road component of five-year plans to

ensure that development targets and all maintenance needs can be fully funded from central, provincial, and local government road revenue sources. Second, the NRFA should create a program structure and rules that restrict the use of funds so that priority is given to maintenance and rehabilitation of existing facilities. Programs should be structured into broad work categories and include works to address road safety, bridges, capacity (including congestion), rural development, and connectivity. NRFA funding then would be based on rigorous assessment of needs, and central government funding for ordinary roads would be increased. Third, the NRFA should develop a clear approach and policies for defining the cost-sharing responsibilities of provincial and local governments with respect to operations, maintenance, and development of provincial and local roads, taking into account their ability to raise revenue.

5.2.4 Provincial and Local Government Funding

As part of reform implementation, provincial and local governments would be authorized to raise funding for roads through revenue mechanisms that relate to road use in their respective jurisdictions (e.g., annual fees for vehicle registration), in addition to land or business-based taxes, in order to meet their share of road expenditure responsibilities.

5.2.5 Use of Debt

The central government should establish laws, rules, and mechanisms as needed for directing, monitoring, and enforcing provincial and local road debt programs. This should include requirements that debt only be used for capital investment; that debt-funded projects show a positive return on investment (including consideration of all debt-related costs); and that agencies may only use debt if they can prove they have the financial means to adequately maintain and operate the resulting facility. Key implementation steps would be to define the types of projects eligible for debt use and to establish analytical methodologies for quantifying project return on investment and providing operation and maintenance capacity.

5.3 Pilot Tests

5.3.1 Objective of Pilot Tests

The objectives of pilot testing the recommendations in selected provinces are to prove the practical application of draft laws, regulations, and policies, and to identify elements that need to be adjusted or refined before they are applied throughout the PRC.

5.3.2 Scope of Pilot Tests

To minimize the amount of change needed, the pilot should seek to test selected elements of the recommendations, particularly those associated with improving program management and provincial agency performance. Specific areas that should be addressed by the pilot include the following:

(i) Formal contractual arrangements for management and works on national roads.

(ii) Annual road maintenance funding tied to needs assessment.

(iii) Formal cost-sharing arrangements between central government and provincial and local governments as defined in Section 4.3.

(iv) Program funding categories for central government allocations based on the recommendations in Section 4.3.

(v) Making multiyear funding commitments by the central government for vehicle purchase tax (VPT) and fuel tax revenue allocations.

(vi) Providing supplemental funding from the central government general budget to the extent that additional central government maintenance funding is needed beyond that provided through existing allocation formula.

(vii) Allowing the provinces to increase their vehicle and vessel taxes and dedicating the resulting revenues to road maintenance and construction.

(viii) Establishing performance monitoring and reporting by provinces.

(ix) Funding and technical assistance, as appropriate, to assist the province in developing needed organizational capacity, systems, etc.

5.3.3 Pilot Test Arrangements

A joint MOF–MOT–NDRC committee should be established to oversee the pilot tests, including arrangements for allocating of central government funds for ordinary roads. The committee should be serviced by MOT staff with support, as necessary, from MOF and NDRC staff.

5.3.4 Provinces for Pilot Testing

For purposes of pilot testing, a province should be selected where implementation hurdles would be minimized and findings would be highly applicable to other provinces. Zhejiang Province is recommended since it has a relatively high level of economic development with relatively sophisticated road management practices that could readily serve as a test bed for the proposed reforms. One or more other provinces should also be selected to represent the range of conditions in the PRC. Characteristics of provinces that should be considered for pilot programs include

(i) access to adequate road-funding sources, that is, able, or nearly able, to sustain needed investment and address maintenance needs through existing central government and provincial funding sources;

(ii) management systems and performance data should be robust;

(iii) road network conditions should be reasonably good; and

(iv) be generally supportive of the recommendations in this report.

5.4 Implementation Road Map

To engender understanding of the proposed changes and obtain buy-in from various stakeholders, a committee should be established to guide the reform effort. This committee must be provided with sufficient resources to implement the changes and must be empowered to act within rules agreed by the State Council (or lower level of central

government, if that is appropriate). The following are the suggested steps this committee will need to implement or oversee.

5.4.1 Implementing Pilot Tests

The following steps are recommended for implementing the pilot tests:

(i) Establish a committee of MOF, MOT, and NDRC directors to oversee implementation of the recommended reforms and allocation of funds to programs for the selected provinces.

(ii) Assign MOT staff and staff from other central government agencies, as necessary, to prepare and manage the pilot tests.

(iii) Prepare proposal documentation (and submit to State Council for consideration, if necessary).

(iv) Update information on road network length, road condition, and traffic in the selected provinces, including targets for network development, divided by road administrative category.

(v) Collect all available information from asset management systems and other sources, as necessary, to rigorously assess maintenance needs for ordinary roads in the selected provinces, divided by road administrative category.

(vi) Collect information on fuel tax and VPT allocations to the selected provinces, and the type of works (or administration) that these allocations have been used for, or are intended to be used for.

(vii) Determine the ability of the provincial and local governments to fund a share of works on ordinary roads in the selected provinces.

(viii) Enable the provinces to directly collect sufficient revenue to allow them to fund their share of roadworks.

(ix) Prepare and implement formal arrangements for road network management and works on national roads, including programming, approval of works, and reporting.

(x) Prepare and implement formal arrangements for funding for provincial and local roads, including programming, cost sharing, and reporting.

(xi) Implement the new arrangements and central government funding for ordinary roads in the selected provinces.

(xii) Evaluate, report, and adjust the pilot tests, as necessary, during the test period.

(xiii) Evaluate the pilot tests in conjunction with the provincial and local governments involved at the end of the test period, and adjust the arrangements, as necessary, for application to other provinces.

5.4.2 Implementing Short-Term and Transitional Arrangements

Short-term implementation steps and strategy need to be compatible with the long-term strategy. The steps necessary to implement the short-term arrangements are the following:

(i) Prepare updated documentation for consideration of the State Council, if necessary.

(ii) Prepare a notice of interim measures for (a) establishing a central road trust fund; (b) payment of fuel tax revenues, VPT revenues, and central government budget allocations into the trust fund; (c) administration of the trust fund; and (d) the allocation of trust fund monies for maintenance and improvement of ordinary roads.

(iii) Establish a committee of MOF, MOT, and NDRC directors to oversee management of the central road trust fund and the allocation of funds to programs and provinces.

(iv) Establish an interim Bureau of Roads within the MOT to administer the central road trust fund, programs, and allocations from the trust fund, and take oversight of all national roads.

(v) Establish the central road trust fund by statute or administrative decree.

(vi) Prepare revenue payment, accounting, and management procedures for the central road trust fund.

(vii) Prepare procedures for a structured program approach with performance reporting.

(viii) Collect detailed information from asset management systems and other sources, as necessary, to assess maintenance needs for ordinary roads in each province, divided by road administrative category.

(ix) Review funding needs for ordinary roads for the Twelfth Five-Year Plan and subsequent five-year plans.

(x) Implement dedicated central government revenue for ordinary roads as recommended in Section 4.5.

(xi) Work with provincial governments to implement provincial and local funding sources for roads (annual vehicle registration fees are recommended).

(xii) Negotiate new funding and cost-sharing arrangements with each province according to their specific needs and levels of development.

(xiii) Implement changed programming and funding procedures as recommended in Sections 4.2 and 4.8.

(xiv) Progressively implement performance management and reporting procedures as recommended in Section 4.10.

5.4.3 Implementing Long-Term Institutional Change

The long-term vision is to establish the NRFA as an independent road sector planning, management, and financing agency. The committee noted above should be responsible for establishing the NRFA and the associated management and funding arrangements for ordinary roads. Key steps to be taken by the committee are the following:

(i) Prepare a document outlining the long-term proposals for State Council consideration, including a draft law and associated regulations for establishment of an NRFA.

(ii) Manage the process to deliver the draft law and regulations to the State Council, enact the law, and approve the regulations.

(iii) Arrange adequate funding for establishing the NRFA.

(iv) Manage appointment of members of the NRFA Board, and service the board until the director and staff are appointed.

(v) Prepare the organizational design and staffing, regional presence, and outsourcing needed for efficient and effective performance of the functions of the NRFA.

(vi) Prepare position descriptions for the director and senior managers.

(vii) Prepare employment terms and conditions, and obtain approval from the appropriate central government ministry.

(viii) Prepare draft contracts/agreements with provincial road agencies.

(ix) Advertise positions for director and senior managers.

(x) Review existing capabilities in the MOT, MOF, and NDRC, and identify deficiencies and required additional needs.

(xi) Determine the timing and process for transfer of any MOT, MOF, and NDRC staff to positions in the NRFA, together with associated assets.

(xii) Make arrangements for accommodation for the NFRA.

(xiii) Prepare draft internal policies and procedures for the NRFA.

(xiv) Design and document new systems with a timeline for implementation—management information, financial management, program management, personnel, and administration.

(xv) Prepare delegations for the director and senior managers.

After the director is identified, he or she should guide the subsequent establishment activities. The NRFA Board should appoint the director once the enabling legislation has been enacted and the board has been appointed, and the director should employ the senior managers and other staff. The director and senior managers need to then

(i) prepare a corporate plan and statement of intent,

(ii) prepare position descriptions for the staff,

(iii) prepare delegations for managers and provincial road agencies,

(iv) prepare a training program,

(v) implement new systems for the NRFA,

(vi) develop an audit strategy and plan,

(vii) prepare and deliver publicity and public disclosure requirements for the new NRFA, and

(viii) take over central government funding and oversight of national roads.

5.4.4 Definition of Provisions and Terms

Provisions and terms that need to be defined in statute, regulation, and/or policy include

(i) MOT responsibilities for oversight of road funding and road network performance;

(ii) NRFA functions and requirements (longer term);

(iii) responsibilities for each administrative category of roads;

(iv) responsibilities for technical assistance to lower levels of government for road asset management, roadworks preparation, etc.;

(v) formalized cost sharing for road expenditures;
(vi) dedication of VPT and motor vehicle fuel tax revenues for road expenditures;
(vii) rules for the central road trust fund, including policies and procedures for managing the trust fund and allocating funding to provincial and local road agencies;
(viii) process for adjustment of fuel tax rates;
(ix) rules for use of debt and repayment;
(x) assessment of road maintenance needs, including review and update of the "Guidelines for Budgeting of Highway Maintenance";
(xi) programming of roadworks, including definition of the type of works in each work category, and rules for multiyear programming;
(xii) rules on the use of central government funding for management and pension payments; and
(xiii) responsibilities of road agencies for monitoring and reporting of road condition, road performance, and program delivery.

5.5 Training

5.5.1 Short Term

Initially, the committee and staff responsible for managing the central road trust fund will need training on development and management of a programmatic approach to funding ordinary roads. Provincial transport department staff and staff of other appropriate provincial and local agencies will need similar training. Initially, this will be implemented in the provinces selected for the pilot tests but will be extended to all provinces as the new approach is rolled out.

5.5.2 Long Term

The NRFA Board will require training on corporate governance, including board responsibilities compared with management responsibilities. NRFA staff would be trained on administration, human resource, financial management, program management, and performance management systems and procedures.

5.6 Future Research and Analysis Needs

As mentioned in several places in this report, the ability to conduct meaningful analysis of the future funding needs of the PRC is significantly limited by lack of data and detailed information regarding their expenditures needs, revenues, liabilities, and decision-making

processes such as funding allocation and budgeting. Future studies looking at the ordinary road program of the PRC would greatly benefit from the following:

(i) historical revenues by source (i.e., fuel taxes, VPT, general fund allocations, provincial and local funds), including gross and net proceeds for ordinary roads along with information on the extent and purpose of diverted funds;

(ii) comprehensive data on road-related debt (balances, annual repayments, terms, etc.) at all levels of government;

(iii) historical information on fuel consumption, vehicle purchase data, etc.;

(iv) full documentation of the current system inventory and conditions by administrative category and classification, by province;

(v) revenue forecasts for all ordinary road-funding sources, including all assumptions with regard to growth rates in fuel consumption and vehicle purchases, average purchase prices by vehicle category, diversions, etc.;

(vi) historical data and forecasts of central government funding allocations, by province and local government;

(vii) historical construction, maintenance, and management spending by administrative category, road category, and province;

(viii) year-by-year estimates of future ordinary road maintenance spending needs (for the next 10 years) by administrative category, road category, and province, including documentation of methodology, applicable system data, and assumptions with respect to unit costs, deterioration rates, and standards; and

(ix) estimates of future ordinary road expansion needs (for the next 10 years) by administrative category, road category, and province, including documentation of methodology, applicable system data, and assumptions with respect to unit costs and standards.

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Table A 1.1: Road Network Development Targets

Road Lengths (1,000 kilometers)							Increase						Increase		
	2010	2011	2012	2013	2014	2015	2010–2015	2016	2017	2018	2019	2020	2015–2020	2025	2030
National Roads - expressways	63.1	70	78	85	93	100	37	103	106	109	112	115	15	130	140
National Roads - ordinary roads	100.9	104	108	111	115	118	17	126	134	141	149	157	39	196	240
Provincial Roads - expressways	11.0	16	21	25	30	35	24	37	39	41	43	45	10	50	60
Provincial Roads - ordinary roads	258.8	267	274	282	290	298	39	308	319	329	340	350	53	408	460
Local Roads	3,574.3	3,641	3,707	3,773	3,839	3,906	331	3,972	4,038	4,104	4,171	4,237	332	4,569	4,900
Total	4,008.2	4,098	4,187	4,277	4,366	4,456	448	4,546	4,635	4,725	4,814	4,904	448	5,352	5,800

Comparison of Ordinary Road Target Lengths (1,000 kilometers)							Increase						Increase
	2010	2011	2012	2013	2014	2015	2010–2015	2016	2017	2018	2019	2020	2015–2020
National Roads													
Phase 1 Report	106	115	125	134	144	153	47	162	172	181	191	200	47
New Estimates	101	104	108	111	115	118	17	126	134	141	149	157	39
Difference	(5)	(11)	(17)	(23)	(29)	(35)	(30)	(36)	(38)	(40)	(42)	(43)	(8)
Provincial Roads													
Phase 1 Report	270	288	306	324	342	360	90	378	396	414	432	450	90
New Estimates	259	267	274	282	290	298	39	308	319	329	340	350	53
Difference	(11)	(21)	(32)	(42)	(52)	(63)	(51)	(70)	(78)	(85)	(93)	(100)	(38)
Local Roads													
Phase 1 Report													
County	540	556	572	588	604	620	80	636	652	668	684	700	80
Township	1,060	1,084	1,108	1,132	1,156	1,180	120	1,204	1,228	1,252	1,276	1,300	120
Village	1,900	1,930	1,960	1,990	2,020	2,050	150	2,080	2,110	2,140	2,170	2,200	150
Phase 1 Report Total	3,500	3,570	3,640	3,710	3,780	3,850	350	3,920	3,990	4,060	4,130	4,200	350
New Estimate (Total)	3,574	3,641	3,707	3,773	3,839	3,906	331	3,972	4,038	4,104	4,171	4,237	332
Difference	74	71	67	63	59	56	(19)	52	48	44	41	37	(19)
Total													
Phase 1 Report	3,876	3,973	4,071	4,168	4,266	4,363	487	4,460	4,558	4,655	4,753	4,850	487
New Estimates	3,934	4,011	4,089	4,166	4,244	4,321	387	4,406	4,490	4,575	4,659	4,744	423
Difference	58	38	18	(2)	(22)	(42)	(100)	(54)	(68)	(80)	(94)	(106)	(64)

( ) = negative.

Source: Authors' calculation.

Table A1.2: Revised Ordinary Road Construction Cost Calculations

Road Lengths (1,000 kilometers)						Change						Change
	2011	2012	2013	2014	2015	2010–2015	2016	2017	2018	2019	2020	2015–2020
Class 1	76	87	98	109	120	56	120	120	120	120	120	-
Class 2	347	385	423	462	500	191	516	532	548	564	580	80
Class 3	571	753	936	1,118	1,301	913	1,510	1,718	1,927	2,135	2,344	1,043
Class 4	2,336	2,202	2,068	1,934	1,800	(669)	1,680	1,560	1,440	1,320	1,200	(600)
No Class	683	662	641	621	600	(104)	580	560	540	520	500	(100)
Total	**4,011**	**4,089**	**4,166**	**4,244**	**4,321**	**387**	**4,406**	**4,490**	**4,575**	**4,659**	**4,744**	**423**
Expansion/Upgrade Length (1,000 kilometers)												
	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020
Class 1	11	11	11	11	11	56	-	-	-	-	-	-
Class 2	38	38	38	38	38	191	16	16	16	16	16	80
Class 3	183	183	183	183	183	913	209	209	209	209	209	1,043
Class 4	-	-	-	-	-	-	-	-	-	-	-	-
No Class	-	-	-	-	-	-	-	-	-	-	-	-
Total	**232**	**232**	**232**	**232**	**232**	**1,160**	**225**	**225**	**225**	**225**	**225**	**1,123**
Construction and Upgrade Cost per Kilometer (CNY million)												
	2011	2012	2013	2014	2015		2016	2017	2018	2019	2020	
Class 1	10.0	10.5	11.0	11.6	12.1		12.8	13.4	14.1	14.8	15.5	
Class 2	6.0	6.3	6.6	6.9	7.2		7.6	8.0	8.4	8.8	9.2	
Class 3	1.8	1.9	2.0	2.1	2.2		2.3	2.4	2.5	2.7	2.8	
Class 4	1.1	1.1	1.2	1.2	1.3		1.3	1.4	1.5	1.6	1.6	
No Class												
Total												
Annual Construction Cost (CNY million)												
	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020
Class 1	111	117	122	129	135	614	-	-	-	-	-	-
Class 2	228	239	251	264	277	1,258	122	128	134	141	148	672
Class 3	330	346	364	382	401	1,823	481	505	530	557	585	2,658
Class 4	-	-	-	-	-	-	-	-	-	-	-	-
No Class	-	-	-	-	-	-	-	-	-	-	-	-
Total	**669**	**702**	**737**	**774**	**813**	**3,695**	**603**	**633**	**664**	**698**	**733**	**3,330**

– = not applicable.

Notes: Average annual inflation = 4%; unit cost data provided by the Transport Planning and Research Institute.

Source: Authors' calculation.

Table A1.3: Phase I versus New Road Construction Cost Estimates

Road Construction Expenditure Needs (CNY billion)															
	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030
National Roads - expressways	75	205	334	464	594	723	2,320	64	64	64	64	64	321	42	14
National Roads - ordinary roads	40	231	242	254	267	280	1,275	87	91	96	100	105	479	458	386
Provincial Roads - expressways	60	79	97	116	135	153	580	24	24	24	24	24	119	18	6
Provincial Roads- ordinary roads	174	257	270	283	297	312	1,420	232	243	256	268	282	1,281	1,382	1,594
Local Roads	66	181	190	200	210	220	1,000	284	298	313	329	345	1,570	1,675	1,743
Total	**415**	**952**	**1,134**	**1,317**	**1,502**	**1,689**	**6,595**	**691**	**721**	**752**	**786**	**821**	**3,770**	**3,575**	**3,743**
Comparison of Ordinary Road Construction Needs (CNY billion)															
National Roads															
Phase 1 Unconstrained	95	100	105	110	116	122	553	128	134	141	148	155	706		
Phase 1 Baseline Growth	38	40	42	44	46	49	221	51	54	56	59	62	281		
New Estimates	40	231	242	254	267	280	1,275	87	91	96	100	105	479		
Provincial Roads															
Phase 1 Unconstrained	210	221	232	243	255	268	1,218	281	296	310	326	342	1,555		
Phase 1 Baseline Growth	168	176	185	195	204	214	975	225	236	248	261	274	1,244		
New Estimates	174	257	270	283	297	312	1,420	232	243	256	268	282	1,281		
Local Roads															
Phase 1 Unconstrained	133	140	147	154	162	170	772	178	187	197	207	217	986		
Phase 1 Baseline Growth	63	66	69	73	76	80	363	84	88	93	97	102	464		
New Estimates	66	181	190	200	210	220	1,000	284	298	313	329	345	1,570		

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Table A1.3 continued

Comparison of Ordinary Road Construction Needs (CNY billion)															
	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030
Total															
Phase 1 Unconstrained	438	460	483	508	533	560	2,543	588	187	648	680	714	3,246		
Phase 1 Baseline Growth	269	282	296	311	327	343	1,558	360	378	397	417	438	1,989		
New Estimate	280	669	702	737	774	813	3,695	603	633	664	698	733	3,330		
Difference in Ordinary Road Construction Needs: New Estimate - Phase 1 Estimate (CNY billion)															
National Roads															
Phase 1 Unconstrained	(55)	131	137	144	151	159	722	(41)	(43)	(45)	(47)	(50)	(227)		
Phase 1 Baseline Growth	2	191	200	210	221	232	1,055	36	37	39	41	43	197		
Provincial Roads															
Phase 1 Unconstrained	(36)	36	38	40	42	44	202	(50)	(52)	(55)	(57)	(60)	(274)		
Phase 1 Baseline Growth	6	81	85	89	93	98	445	7	7	7	8	8	37		
Local Roads															
Phase 1 Unconstrained	(67)	41	43	45	48	50	228	106	111	117	122	129	584		
Phase 1 Baseline Growth	3	115	121	127	133	140	637	200	210	221	232	243	1,106		
Total															
Phase 1 Unconstrained	(159)	209	219	230	241	253	1,152	15	445	17	18	18	84		
Phase 1 Baseline Growth	11	387	406	426	448	470	2,137	243	255	268	281	295	1,341		

( ) = negative.

Source: Authors' calculation.

Table A1.4: Revised Ordinary Road Maintenance Cost Calculations

Road Lengths (1,000 kilometers)						Change						Change
	2011	2012	2013	2014	2015	2010–2015	2016	2017	2018	2019	2020	2015–2020
Class 1	76	87	98	109	120	56	120	120	120	120	120	-
Class 2	347	385	423	462	500	191	516	532	548	564	580	80
Class 3	571	753	936	1,118	1,301	913	1,510	1,718	1,927	2,135	2,344	1,043
Class 4	2,336	2,202	2,068	1,934	1,800	(669)	1,680	1,560	1,440	1,320	1,200	(600)
No Class	683	662	641	621	600	(104)	580	560	540	520	500	(100)
Total	**4,011**	**4,089**	**4,166**	**4,244**	**4,321**	**387**	**4,406**	**4,490**	**4,575**	**4,659**	**4,744**	**423**
Network Average Maintenance Cost per Kilometer (CNY million)							0.92					
	2011	2012	2013	2014	2015		2016	2017	2018	2019	2020	
Class 1	0.21	0.22	0.23	0.24	0.26		0.25	0.26	0.27	0.29	0.30	
Class 2	0.15	0.15	0.16	0.17	0.18		0.17	0.18	0.19	0.20	0.21	
Class 3	0.08	0.08	0.08	0.09	0.09		0.09	0.09	0.10	0.10	0.11	
Class 4	0.05	0.06	0.06	0.06	0.06		0.06	0.06	0.07	0.07	0.07	
No Class	0.03	0.03	0.03	0.04	0.04		0.04	0.04	0.04	0.04	0.04	
Annual Maintenance Cost (CNY billion)												
	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020
Class 1	16	19	23	26	31	115	30	31	33	34	36	164
Class 2	51	59	69	79	89	347	89	96	104	113	122	524
Class 3	44	61	79	100	122	405	136	163	192	223	257	972
Class 4	123	121	120	118	115	596	104	101	98	94	90	487
No Class	22	22	22	23	23	111	21	22	22	22	22	110
Total	**255**	**283**	**313**	**345**	**379**	**1,574**	**380**	**413**	**449**	**487**	**527**	**2,256**

Notes: Average annual inflation = 4%; unit cost data provided by the Transport Planning and Research Institute.

Source: Authors' calculation.

Table A1.5: Phase I versus New Road Maintenance Cost Estimates

Road Maintenance Expenditure Needs (CNY billion)														
	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030
National Roads - ordinary roads	42	47	52	57	63	260	57	62	68	73	79	340	430	550
Provincial Roads- ordinary roads	71	79	87	96	106	440	110	119	129	140	152	650	890	1,200
Local Roads	142	157	174	191	211	874	213	232	252	273	296	1,266	1,800	2,500
Total	**255**	**283**	**313**	**345**	**379**	**1,574**	**380**	**413**	**449**	**487**	**527**	**2,256**	**3,120**	**4,250**
Comparison of Ordinary Road Maintenance Needs (CNY billion)														
National Roads														
Phase 1 Unconstrained	18	21	24	27	30	119	33	37	41	45	50	205		
Phase 1 Baseline Growth	17	18	19	20	21	95	22	23	25	26	27	123		
New Estimates	42	47	52	57	63	260	57	62	68	73	79	340		
Provincial Roads														
Phase 1 Unconstrained	34	38	42	47	52	212	57	63	69	75	82	346		
Phase 1 Baseline Growth	35	39	44	49	55	222	61	68	75	83	92	380		
New Estimates	71	79	87	96	106	440	110	119	129	140	152	650		
Local Roads														
Phase 1 Unconstrained	76	81	87	94	101	439	108	116	124	133	142	623		
Phase 1 Baseline Growth	75	79	83	88	93	418	98	104	110	116	123	551		
New Estimates	142	157	174	191	211	874	213	232	252	273	296	1,266		

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Table A1.5 continued

Comparison of Ordinary Road Maintenance Needs (CNY billion)														
	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030
Other Costs														
Phase 1 Unconstrained	44	47	50	53	56	251	60	63	67	71	75	336		
Phase 1 Baseline Growth	44	47	50	52	55	248	59	62	65	69	73	327		
New Estimates														
Total														
Phase 1 Unconstrained	173	187	203	220	238	1,021	258	278	300	324	349	1,510		
Phase 1 Baseline Growth	170	183	196	210	225	983	240	257	275	294	315	1,381		
New Estimates	255	283	313	345	379	1,574	380	413	449	487	527	2,256		
Difference in Ordinary Road Construction Needs: New Estimate - Phase 1 Estimate (CNY billion)														
National Roads														
Phase 1 Unconstrained	24	26	28	30	33	141	24	25	27	28	30	135		
Phase 1 Baseline Growth	25	29	33	37	42	165	35	39	43	47	52	217		
Provincial Roads														
Phase 1 Unconstrained	37	41	45	50	54	228	53	56	61	65	70	304		
Phase 1 Baseline Growth	37	40	43	47	51	218	48	51	54	57	60	271		

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Table A1.5 continued

Difference in Ordinary Road Construction Needs: New Estimate - Phase 1 Estimate (CNY billion)														
	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030
Local Roads														
Phase 1 Unconstrained	66	76	86	98	110	435	105	116	128	140	154	644		
Phase 1 Baseline Growth	67	78	90	103	118	456	115	128	142	157	173	715		
Total														
Phase 1 Unconstrained	82	95	109	125	141	553	123	135	148	163	178	747		
Phase 1 Baseline Growth	84	100	117	135	155	591	140	156	174	193	213	875		

Source: Authors' calculation.

Table A1.6: Cost Sharing

Cost Sharing Scenario (a)
Maintenance of Ordinary Roads

Central Government Funding Requirement (CNY billion)																		
	CG Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	100%	26	28	42	47	52	57	63	260	57	62	68	73	79	340	430	550	600
Provincial Roads	80%	31	37	57	63	70	77	85	352	88	95	103	112	122	520	712	960	872
Local Roads	80%	83	91	113	126	139	153	169	699	171	186	201	219	237	1,013	1,440	2,000	1,712
Total		**141**	**155**	**212**	**235**	**260**	**287**	**316**	**1,311**	**316**	**343**	**373**	**404**	**438**	**1,873**	**2,582**	**3,510**	**3,184**
Provincial and Local Government Funding Requirement (CNY billion)																		
	CG Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Provincial Roads	20%	8	9	14	16	17	19	21	88	22	24	26	28	30	130	178	240	218
Local Roads	20%	21	23	28	31	35	38	42	175	43	46	50	55	59	253	360	500	428
Total		**29**	**32**	**43**	**47**	**52**	**58**	**63**	**263**	**65**	**70**	**76**	**83**	**90**	**383**	**538**	**740**	**646**
Construction of Ordinary Roads																		
Central Government Funding Requirement (CNY billion)																		
	CG Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	100%	-	40	231	242	254	267	280	1,275	87	91	96	100	105	479	458	386	1,754
Provincial Roads	80%	-	139	206	216	227	238	250	1,136	185	195	205	215	225	1,025	1,106	1,275	2,161
Local Roads	80%	-	53	145	152	160	168	176	800	227	239	251	263	276	1,256	1,340	1,394	2,056
Total		**-**	**232**	**581**	**610**	**641**	**673**	**706**	**3,211**	**499**	**524**	**551**	**578**	**607**	**2,760**	**2,904**	**3,056**	**5,971**

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Table A1.6 - Cost Sharing Scenario (a) continued

Provincial and Local Government Funding Requirement (CNY billion)																		
	CG Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Provincial Roads	20%	-	35	51	54	57	59	62	284	46	49	51	54	56	256	276	319	540
Local Roads	20%	-	13	36	38	40	42	44	200	57	60	63	66	69	314	335	349	514
Total		**-**	**48**	**88**	**92**	**97**	**101**	**106**	**484**	**103**	**108**	**114**	**119**	**125**	**570**	**611**	**667**	**1,054**
Total Funding Requirement																		
Central Government Funding (CNY billion)																		
		2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads		26	68	273	289	306	324	343	1,535	144	153	163	174	185	819	888	936	2,354
Provincial Roads		31	176	263	279	297	315	335	1,488	273	290	308	327	347	1,545	1,818	2,235	3,033
Local Roads		83	143	258	278	298	321	344	1,499	398	424	452	482	513	2,269	2,780	3,394	3,768
Total		**141**	**387**	**793**	**846**	**901**	**960**	**1,022**	**4,522**	**815**	**867**	**923**	**982**	**1,045**	**4,633**	**5,486**	**6,566**	**9,155**
Provincial and Local Government Funding (CNY billion)																		
		2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Provincial Roads		8	44	66	70	74	79	84	372	68	73	77	82	87	386	454	559	758
Local Roads		21	36	64	69	75	80	86	375	99	106	113	120	128	567	695	849	942
Total		**29**	**80**	**130**	**139**	**149**	**159**	**170**	**747**	**168**	**179**	**190**	**202**	**215**	**953**	**1,149**	**1,407**	**1,700**

– = not applicable, CG = central government.

Source: Authors' calculation.

Cost Sharing Scenario (b)
Maintenance of Ordinary Roads

Central Government Funding Requirement (CNY billion)

	CG Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	100%	26	28	42	47	52	57	63	260	57	62	68	73	79	340	430	550	600
Provincial Roads	80%	31	37	57	63	70	77	85	352	88	95	103	112	122	520	712	960	872
Local Roads	60%	62	68	85	94	104	115	126	524	128	139	151	164	178	760	1,080	1,500	1,284
Total		**120**	**133**	**184**	**204**	**226**	**249**	**274**	**1,136**	**273**	**297**	**322**	**349**	**379**	**1,620**	**2,222**	**3,010**	**2,756**

Provincial and Local Government Funding Requirement (CNY billion)

	CG Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Provincial Roads	20%	8	9	14	16	17	19	21	88	22	24	26	28	30	130	178	240	218
Local Roads	40%	42	45	57	63	69	77	84	350	85	93	101	109	118	506	720	1,000	856
Total		**49**	**54**	**71**	**79**	**87**	**96**	**105**	**438**	**107**	**117**	**127**	**137**	**149**	**636**	**898**	**1,240**	**1,074**

Construction of Ordinary Roads

Central Government Funding Requirement (CNY billion)

	CG Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	100%	-	40	231	242	254	267	280	1,275	87	91	96	100	105	479	458	386	1,754
Provincial Roads	60%	-	104	154	162	170	178	187	852	139	146	153	161	169	769	829	956	1,621
Local Roads	40%	-	26	72	76	80	84	88	400	114	119	125	132	138	628	670	697	1,028
Total		**-**	**171**	**457**	**480**	**504**	**529**	**556**	**2,527**	**339**	**356**	**374**	**393**	**413**	**1,876**	**1,957**	**2,040**	**4,403**

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Table A1.6 - Cost Sharing Scenario (b) continued

Provincial and Local Government Funding Requirement (CNY billion)																		
	CG Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Provincial Roads	40%	-	70	103	108	113	119	125	568	93	97	102	107	113	512	553	638	1,080
Local Roads	60%	-	39	109	114	120	126	132	600	170	179	188	197	207	942	1,005	1,046	1,542
Total		-	**109**	**211**	**222**	**233**	**245**	**257**	**1,168**	**263**	**276**	**290**	**305**	**320**	**1,454**	**1,558**	**1,683**	**2,622**

Total Funding Requirement

Central Government Funding (CNY billion)																	
	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	26	68	273	289	306	324	343	1,535	144	153	163	174	185	819	888	936	2,354
Provincial Roads	31	141	211	225	240	256	272	1,204	227	241	257	273	291	1,289	1,541	1,916	2,493
Local Roads	62	94	157	170	184	199	214	924	242	258	276	295	316	1,388	1,750	2,197	2,312
Total	120	303	641	684	730	778	830	3,663	612	653	696	742	791	3,495	4,179	5,050	7,159

Provincial and Local Government Funding (CNY billion)																	
	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Provincial Roads	8	79	117	124	131	138	146	656	115	121	128	135	143	642	731	878	1,299
Local Roads	42	85	165	177	189	202	216	950	256	272	289	307	326	1,448	1,725	2,046	2,398
Total	**49**	**164**	**282**	**301**	**320**	**341**	**362**	**1,606**	**370**	**393**	**417**	**442**	**469**	**2,091**	**2,456**	**2,923**	**3,697**

– = not applicable, CG = central government.

Source: Authors' calculation.

Cost Sharing Scenario (c)
Maintenance of Ordinary Roads

Central Government Funding Requirement (CNY billion)

	CG Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	100%	26	28	42	47	52	57	63	260	57	62	68	73	79	340	430	550	600
Provincial Roads	60%	23	27	43	47	52	58	64	264	66	71	78	84	91	390	534	720	654
Local Roads	60%	62	68	85	94	104	115	126	524	128	139	151	164	178	760	1,080	1,500	1,284
Total		**112**	**123**	**170**	**188**	**208**	**230**	**253**	**1,048**	**251**	**273**	**296**	**321**	**348**	**1,490**	**2,044**	**2,770**	**2,538**

Provincial and Local Government Funding Requirement (CNY billion)

	PL Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Provincial Roads	40%	16	18	28	32	35	39	42	176	44	48	52	56	61	260	356	480	436
Local Roads	40%	42	45	57	63	69	77	84	350	85	93	101	109	118	506	720	1,000	856
Total		**57**	**64**	**85**	**94**	**104**	**115**	**127**	**526**	**129**	**140**	**152**	**165**	**179**	**767**	**1,076**	**1,480**	**1,292**

Construction of Ordinary Roads

Central Government Funding Requirement (CNY billion)

	CG Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	100%	-	40	231	242	254	267	280	1,275	87	91	96	100	105	479	458	386	1,754
Provincial Roads	40%	-	70	103	108	113	119	125	568	93	97	102	107	113	512	553	638	1,080
Local Roads	40%	-	26	72	76	80	84	88	400	114	119	125	132	138	628	670	697	1,028
Total		**-**	**136**	**406**	**426**	**448**	**470**	**493**	**2,243**	**293**	**308**	**323**	**339**	**356**	**1,619**	**1,681**	**1,721**	**3,862**

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Table A1.6 - Cost Sharing Scenario (c) continued

Provincial and Local Government Funding Requirement (CNY billion)																		
	CG Share	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Provincial Roads	60%	-	104	154	162	170	178	187	852	139	146	153	161	169	769	829	956	1,621
Local Roads	60%	-	39	109	114	120	126	132	600	170	179	188	197	207	942	1,005	1,046	1,542
Total		-	144	263	276	290	304	319	1,452	310	325	341	358	376	1,711	1,834	2,002	3,163
Total Funding Requirement																		
Central Government Funding (CNY billion)																		
		2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads		26	68	273	289	306	324	343	1,535	144	153	163	174	185	819	888	936	2,354
Provincial Roads		23	97	146	155	166	177	189	832	158	169	180	192	204	903	1,087	1,358	1,735
Local Roads		62	94	157	170	184	199	214	924	242	258	276	295	316	1,388	1,750	2,197	2,312
Total		112	259	576	614	656	700	746	3,291	544	581	619	661	704	3,109	3,725	4,491	6,401
Provincial and Local Government Funding (CNY billion)																		
		2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2021–2025	2026–2030	2011–2020
National Roads		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Provincial Roads		16	123	183	194	205	217	230	1,028	183	194	205	217	230	1,029	1,185	1,436	2,057
Local Roads		42	85	165	177	189	202	216	950	256	272	289	307	326	1,448	1,725	2,046	2,398
Total		57	207	348	370	394	419	446	1,978	439	465	494	524	556	2,477	2,910	3,482	4,455

– = not applicable, CG = Central Government, PL = Provincial and local.

Source: Authors' calculation.

Table A1.7: Central Government Revenues

Fuel Tax Revenues (CNY billion)															
	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2011–2020
Phase 1 Report															
Gross Receipts	165.3	177	189	203	217	232	248	1,088	262	277	292	309	326	1,465	2,553
Diversions		(53)	(57)	(61)	(65)	(70)	(74)	(327)	(79)	(83)	(88)	(93)	(98)	(440)	(766)
Net Fuel Tax for Ordinary Roads		**124**	**133**	**142**	**152**	**162**	**174**	**762**	**183**	**194**	**204**	**216**	**228**	**1,026**	**1,787**
New Estimate															
Gross Receipts	165.3	180	195	215	235	256	276	1,177	297	317	338	359	382	1,693	2,870
Debt Servicing		(26)	(26)	(26)	(26)	(26)	(26)	(130)	(26)	(26)	(26)	(26)	(26)	(130)	(260)
Mgmt & Other Diversions		(37)	(41)	(45)	(49)	(54)	(58)	(247)	(63)	(67)	(72)	(77)	(82)	(361)	(608)
Net Fuel Tax for Ordinary Roads		**117**	**128**	**144**	**160**	**176**	**192**	**800**	**208**	**224**	**240**	**256**	**274**	**1,202**	**2,002**

continued on next page

Table A1.7 continued

VPT Revenues (CNY billion)															
	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2011–2020
Phase 1 Report															
Gross Receipts		162	187	206	226	249	274	1,142	296	319	345	373	402	1,735	2,876
Diversions		74	86	95	104	114	126	525	136	147	159	171	185	798	1,323
VPT for Ordinary Roads		87	101	111	122	134	148	617	160	172	186	201	217	937	1,553
New Estimate															
Gross Receipts	116.4	179.2	227.3	249.6	280.1	315.4	355.1	1,428	399.8	450.1	506.8	570.6	642.4	2,569.7	
Diversion Rate			45%	33%	20%	10%	10%		0%	0%	0%	0%	0%		
Diversion to Expressways (Table 3.7)			102	82	56.03	31.54	35.51	307	-	-	-	-	-		
Net VPT for Ordinary Roads			**125**	**167**	**224**	**284**	**320**	**1,120**	**400**	**450**	**507**	**571**	**642**	**2,570**	**3,690**

General Budget Allocations (CNY billion)															
	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2011–2020
Phase 1 Report															
Total		40	42	44	46	49	51	232	54	56	59	62	65	296	528
Ordinary Roads		28	29	31	32	34	36	162	38	39	41	43	46	207	370

Total Net Central Government Funding for Ordinary Roads (CNY billion)															
	2009	2010	2011	2012	2013	2014	2015	2011–2015	2016	2017	2018	2019	2020	2016–2020	2011–2020
Net for Ordinary Roads: Phase 1			**263**	**284**	**306**	**331**	**357**	**1,540**	**381**	**405**	**432**	**461**	**491**	**2,170**	**3,709**
Net for Ordinary Roads: New			253	311	384	460	512	1,920	608	674	747	827	916	3,772	5,692

– = not available, ( ) = negative, VPT = vehicle purchase price.

Source: Authors' calculation.

APPENDIX 2

Evaluation of Options

A2.1 Roles and Responsibilities

The policy options identified in Section 4.2.2 of the report include the following:

(i) Central government responsibilities
   a. Option 1a: Current arrangements but with expenditure control
   b. Option 1b: New bureau for funding roads
   c. Option 1c: New National Roads and Funding Administration (NRFA)

(ii) Provincial government responsibilities
   a. Option 2a: Changed responsibility for reporting
   b. Option 2b: Changed responsibility for requesting funds and reporting

(iii) Municipal and county government responsibilities
   a. Option 3a: Changed responsibility for reporting
   b. Option 3b: Changed responsibility for requesting funds and reporting

A2.1.1 Compatibility with the Specific Needs and the Policy-Making Environment in the PRC

The policy and contextual considerations associated with roles and responsibility changes are reflected in Section 4.2 of this report and the "Notice of Improving Financial Policy of Sustaining and Developing Ordinary Roads" issued by the General Office of the State Council in 2011, which provides some indication of the People's Republic of China (PRC) policy-making environment relevant to ordinary roads. This notice includes the following statements relevant to roles and responsibilities:

(i) Financial channels should be regulated to improve fund utilization and inspection.
(ii) Local people's congress should expand their financial budget for ordinary roads development.
(iii) Highway and ordinary roads need to be combined in the roads development system.
(iv) Each level of financial and transportation departments should strictly implement national treasury management system policies.
(v) All levels of government should eliminate debt remaining from ordinary road construction and take responsibility to return government principal and interest.

(vi) Financial inspection organizations should take action for the improvement of financial risk control.

Option 1a improves the transparency of fund collection and clarifies responsibilities but does not address the changed funding situation resulting from the Fuel Tax Reform. Options 1b and 1c address all of these considerations, as well as provide better accountability for ensuring technical standards are met. All three central government options are reasonably compatible with the State Council notice, although Option 1c combines expressways and ordinary roads under one system, and is therefore the most compatible. Each of the two options for provincial governments and for municipal and county governments described seems to be reasonably compatible with this criterion.

A2.1.2 Compatibility with Reform and Decentralization Policies of the Central Government

The central government decentralized the responsibilities for construction, maintenance, and management of national roads to provincial governments in 1958, while retaining the planning function and some part of the funding function. The Fuel Tax Reform has had the effect of giving almost all of the funding responsibility for all roads to the central government. It is not clear what the long-term reform and decentralization policies of the PRC are, but it would seem appropriate for provincial governments to manage national and provincial roads in their areas and implement works on these roads, rather than making a national agency responsible for implementing works on national roads. All the central government options are compatible with this approach, as are each of the two sets of options for provincial and municipal/county governments.

A2.1.3 Degree of Transparency and Accountability Provided

Option 1a makes the Ministry of Transport (MOT) accountable for ensuring central government funds are spent properly, thereby increasing accountability. Transparency would be increased if the MOT also publicly reported on these activities. However, Option 1a leaves three agencies involved with road planning and funding at the national level and would thus make it difficult to hold any agency accountable for the performance of the national road system. Option 1b provides good transparency and accountability for the use of central government road taxes. Option 1c improves transparency further by separating the authority from government ministries and also by bringing the responsibility for national roads under one organization, which allows for increased accountability.

Options 2a and 3a make provincial and local governments responsible for reporting achievement and performance information and would significantly improve accountability for both use of central government funds and provincial and local road network performance. Options 2b and 3b further improve accountability by making provincial and local governments justify requests for funds and commit to implementing particular works. For all options, transparency would be increased if the intent to do particular works and actual achievement and performance was publicly reported.

A2.1.4 Degree of Support from International Experience

There is little international experience supporting a central government ministry defining and controlling how central government road funds are spent. There are a number of

international examples of a central road-funding agency responsible for managing and disbursing central government road funds. Similarly, there are many examples of a central government agency responsible for national roads as well as for managing and disbursing central government road funds.

Most national/federal governments require their state/province governments to report achievements (physical works and financial expenditure) where central government funds are used and to report road performance; thus, Options 2a and 3a are well supported by international experience. National/federal government funding for major improvement works on state/provincial roads normally requires submission of project details and economic justifications to the national/federal government. However, this is not normally the case for maintenance works, which means Options 2b and 3b are only partly supported by international experience.

A2.1.5 Degree to Which the Option Facilitates Achievement of Central Government Policies and Goals

All of the central government options should generally facilitate achievement of central government policies and goals. Option 1c, however, is most likely to ensure uniform management and maintenance of the national road network. Options 2a and 3a would facilitate achievement of central government policies and goals to a small degree, especially if guidelines were provided on the use of central government funds. Options 2b and 3b would provide very close control on the use of the central government funds so that central government policies and goals could most easily be achieved.

A2.1.6 Degree to Which Provincial and Local Government Needs and Abilities Are Addressed

All of the central government options do a good job at accommodating provincial and local government needs by facilitating consultation in the planning process for national roads and providing central government funding to meet the needs of provincial and local roads. The remaining options do not change how provincial and local governments assess their road needs but require transparent and accountable reporting.

A2.1.7 Ease of Overcoming Barriers Identified from Stakeholder Interviews and Field Research

No specific barriers were identified with respect to any of the options, although the degree of change required and the potential for unseen hurdles is much higher for Options 1b and 1c.

A2.1.8 Degree of Change Necessary, Including Human and Other Resources, and Need for Enabling Legislation (Inverse Scoring)

Option 1a would require a few additional human and other resources to be employed in the MOT, but there would be no need for enabling legislation. Options 1b and 1c should only be implemented under enabling legislation and both options would require substantial human and other resources to establish the independent agencies (although much of the resourcing could be transferred from the MOT, the National Development and Reform Commission [NDRC], and the Ministry of Finance [MOF]). Option 1c would require more

resources than Option 1b. Options 2a and 3a would likely need to be implemented by an instruction or regulation and would require some additional resource at the provincial and local levels. The same would apply to Options 2b and 3b, except that the additional resources required would be greater.

A2.1.9 Savings Likely to Be Achieved Compared with Data Needs, Resources, and Costs for Administering the Option (Savings/Costs)

Option 1a is the least demanding of the central government options with regard to data and resources. Expenditure of central government road funds should be more effective in terms of national economics and priorities if properly controlled by the MOT and, therefore, the "savings" should far exceed the costs. Options 1b and 1c have the potential to achieve more "savings" than Option 1a but with increased data needs and costs. Options 2b and 3b require more data and resources than the alternative options (Options 2a and 3a), but the "savings" would likely be proportionately greater.

A2.1.10 Summary of Options: Evaluation of Central Government Options

The preferred central government option is to create an NRFA. Implementation of this option will require significant legislation, and therefore is likely a longer-term option. Option 1a, whereby the MOT controls the use of central government funds for road maintenance and for road development, could be implemented in the shorter term as a step toward the longer-term option. The analysis also indicates that the broader changes to provincial and local roles and responsibilities would better help to achieve reform goals; thus, Options 2b and 2c are favored.

A2.2 Program Approach

The policy options, as identified in Section 4.3.2, are as follows:

(i) Targeted spending share
(ii) Focus on core roads
(iii) Needs-based maintenance programs
(iv) Funding categories
(v) Varied program detail and oversight
(vi) Multiyear programs
(vii) Increased direction from central government
(viii) Special purpose programs

(Note: Option 3, funding categories, is part of any programmatic approach to funding roads and should not to be analyzed separately.)

A2.2.1 Compatibility with the Specific Needs and Policy-Making Environment in the PRC

The needs in the PRC are reflected in the summary findings in Section 4.3 and the "Notice of Improving Financial Policy of Sustaining and Developing Ordinary Roads" issued by the General Office of the State Council in 2011, which provides some indication of the PRC policy-making environment relevant to ordinary roads. This notice includes the following statements relevant to program approach:

(i) Financial channels should be regulated to improve fund utilization and inspection.

(ii) The part of replacing road maintenance costs in the new petroleum products consumption tax income baseline, and the part of additional funds equivalent with the ratio of maintenance cost and original baseline, should entirely be used in ordinary roads maintenance and management.

(iii) The special fund for reimbursing the part of displacing toll station revenue in new petroleum products consumption tax income, after reimbursement, should be entirely used in ordinary road management and construction.

(iv) Allocations from state budgets and revenue from vehicle purchase tax (VPT) shall mainly be used in ordinary roads construction.

(v) Local people's congress should expand their financial budget for ordinary roads development.

(vi) Expressways and ordinary roads need to be combined in roads development system.

(vii) New and upgraded expressways need to be categorized, planned and constructed with closely related ordinary roads.

(viii) The specific transportation fund formed for petroleum products price and tax reform should be used in specified areas without misappropriation.

A2.2.2 Compatibility with Reform and Decentralization Policies of the Central Government

It is not clear what the long-term reform and decentralization policies of the PRC are, but it would seem appropriate that each level of government should essentially be responsible for the planning, funding, and implementation of works on their roads (i.e., national government for national roads, provincial governments for provincial roads, and county governments for county and rural roads). However, it also needs to be recognized that some lower levels of government in rural areas do not have a good base for raising revenue.

(i) Option 1 advocates the sharing of the cost of roadworks between central and lower-level governments, could adjust the share to incentivize delivery of central government policies and priorities.

(ii) Option 2 would provide lesser support to weak lower levels of government and so would be less compatible with reform policies.

(iii) Option 3 would enable rational assessment of road maintenance needs and ensure that maintenance funding was used most effectively. This is highly compatible with the reform policies of the central government.

(iv) Option 5 takes into account the capability of provincial and local governments and so should be compatible with central government policies.

(v) Option 6 gives flexibility to provincial and local governments and so should be compatible with decentralization policies.

(vi) The compatibility suggested in Option 7 would depend on the details in the instructions or guidelines and whether compliance with these guidelines was audited.

(vii) Option 8, special purpose programs, could be compatible with the reform and decentralization policies of the central government. However, roadworks can often address a number of issues at the same time and so having separate programs can be unnecessarily confusing.

A2.2.3 Degree of Transparency and Accountability Provided

(i) Option 1 would greatly increase the transparency and accountability of both central government and provincial and local government expenditure for all roads.

(ii) Option 2 would increase the transparency and accountability of central government expenditure on those roads where central government funding was provided but would not address this on other roads.

(iii) Option 3 would ensure rational assessment of road maintenance needs and that maintenance funding was used most effectively, and so ranks high under this criterion.

(iv) Under Option 5, program details would be less where provincial and local governments were deemed capable. This would reduce administrative effort and give more flexibility to the provincial and local governments but would reduce transparency and accountability for the use of central government funding.

(v) Option 6 is neutral with regard to transparency and accountability for the use of central government funding.

(vi) Option 7 would increase transparency and accountability for the use of central government funding.

(vii) Option 8 would relate funding most directly to particular road network needs in a transparent manner.

A2.2.4 Degree of Support from International Experience

International experience on program approach is summarized in Section 3.

(i) Option 1, cost is common in other countries and so this option is well supported by international experience.

(ii) No country only spends central government funding on core roads and so Option 2 is not supported by international experience. Countries always provide some funding for purposes other than core roads, although this is usually limited.

(iii) Option 3 is clearly an international best practice.

(iv) Option 5 is used in a few countries where mainly large urban areas are given increased flexibility to decide how central government funding for roads is used.

(v) Option 6, multiyear programs, is generally incompatible with the annual government budget process. International experience shows that it is only compatible with a separate predictable source of funding. Without associated funding, multiyear programs become wishes rather than firm plans.

(vi) Option 7 is not well supported by experience in countries with three-tier governments. There is a tendency toward providing significant portions of central government funding to state, provincial, and local governments as untied grants.

(vii) A number of countries have special purpose programs and so Option 8 is supported by international experience. However, experience in some countries show that separate programs can be unnecessarily confusing because often roadworks can address a number of issues at the same time.

A2.2.5 Degree to Which the Option Facilitates Achievement of Central Government Policies and Goals

(i) Option 1 would greatly facilitate achievement of central government policies because the central government funding share could be adjusted to incentivize particular activities (e.g., maintenance compared with improvements or work in one region compared with another). This option also gives the provincial and local governments a share of the responsibility for ensuring that expenditure is efficient and effective because local as well as central government money is involved.

(ii) Option 2 is unlikely to satisfy all central government policies and goals, which includes having all roads in a satisfactory condition.

(iii) Option 3 would ensure rational assessment of road maintenance needs and that maintenance funding was used most effectively and so ranks high under this criterion.

(iv) Option 5 takes the capability of provincial and local governments into account, and could be targeted to ensure central government policies and priorities were achieved.

(v) Option 6, on its own, does not necessarily facilitate achievement of central government policies.

(vi) Option 7 could be targeted to ensure central government policies and priorities were achieved.

(vii) Option 8 would facilitate achievement of central government policies because programs could be tailored to specific needs.

A2.2.6 Degree to Which Provincial and Local Government Needs and Abilities Are Addressed

(i) Provincial and local governments can influence the works selected under Option 1 because they contribute to the funding of the works.

(ii) Under Option 2, there would be no central government funding for noncore roads. This would not assist provincial and local government ability to fund these roads.

(iii) Option 3 would ensure that provincial and local government road maintenance needs were assessed on a rational basis and that maintenance funding was used most effectively.

(iv) Option 5 takes the capability of provincial and local governments into account and so meets this criterion well.

(v) Option 6 gives flexibility to provincial and local governments and so meets this criterion well.

(vi) The degree to which Option 7 addresses provincial and local government needs and abilities would depend on how much flexibility was included in the instructions or guidelines for provincial and local governments.

(vii) Option 8 could be structured to take account of provincial and local government needs and abilities because programs could be tailored to specific needs.

A2.2.7 Ease of Overcoming Barriers Identified from Stakeholder Interviews and Field Research

(i) There are several potential barriers to the implementation of Options 1 and 2, including the need for additional funding to support the approaches, the need for new policies, and requirements for significant changes in business practices. At least some of the barriers will be difficult to overcome.

(ii) The PRC does not yet appear to have the systems and data to implement Option 3. Significant effort will be required to develop road asset management systems for at least paved/surfaced roads in all provinces.

(iii) No other barriers have been identified for the above options or for Options 5–8 from stakeholder interviews and field research.

A2.2.8 Degree of Change Necessary, Including Human and Other Resources, and Need for Enabling Legislation (Inverse Scoring)

(i) While cost sharing is already practiced informally for road improvements, it would need to be formalized under Option 1. The approach also would require the central government to standardize and adjust the arrangements under the Fuel Tax Reform situation. It would seem appropriate that cost-sharing arrangements be included in central government policy instructions rather than legislation. No additional human or other resources would be required for this option.

(ii) Option 2 requires that central government agencies become more responsible for the core road network, including making detailed arrangements with provincial governments to manage the core network and works on it. This would require some change to current management, including human and other resources. Under this option, it would be preferable for the core road network and the associated responsibilities to be defined in legislation.

(iii) As noted above, significant effort will be required to develop road asset management systems for at least paved/surfaced roads in all provinces so that Option 3 could be implemented. This will require significant human and other resources but legislation would not be necessary.

(iv) Option 5 infers increased program detail and oversight for some provincial and local governments, which would require additional human and other resources. Legislation would probably not be necessary.

(v) Multiyear programming under Option 6 infers a predictable source of funding separate from the government budget process. This would require significant changes including human and other resources and enabling legislation.

(vi) The degree of change required by Option 7 is similar to that for Option 6.

(vii) Special purpose programs under Option 8 would require more resource than at present to evaluate needs to ensure that program objectives were achieved and to administer the programs.

A2.2.9 Savings Likely to Be Achieved Compared with Data Needs, Resources, and Costs for Administering the Option (Savings/Costs)

"Savings" under this criterion need to be considered in terms of effectiveness of expenditure, particularly the use of central government road funds. International studies indicate that expenditure on road maintenance and rehabilitation projects produce national economic rates of return in excess of 35%. This is usually far in excess of the rates of return for many new roads and road improvements, so targeting of expenditure to maintenance and rehabilitation will give significant "savings."

(i) Cost sharing under Option 1 can incentivize expenditure on road maintenance while not requiring significant additional data, resources, or administration, and is thus rated high under these criteria.

(ii) Option 2 has the potential to achieve more "savings" than Option 2 for the core roads but does not address the effectiveness of expenditures on other roads. Overall, it rates lower than Option 1.

(iii) Option 3 will give by far the most "savings" but requires significant data, sources, and administration.

(iv) As noted above, Option 5 infers increased program detail and oversight for some provincial and local governments, which would require additional data and resources, so it rates lower than Option 1 under this criterion.

(v) As noted above, Option 6 infers a predictable source of funding separate from the government budget process but would require additional data and resources to administer. The predictable source of funding would allow the use of maintenance contracts based on longer-term performance that have been shown internationally to produce reduction in maintenance costs. Overall, this option rates high on this criterion.

(vi) The effect of Option 7 under this criterion is similar to Option 5.

(vii) As noted above, special purpose programs under Option 8 would require more resources than at present to evaluate needs and to administer the programs, and separate programs can be unnecessarily confusing. However, this approach can ensure that funding is targeted to meet priority needs and objectives. Overall, this option rates average on this criterion.

A2.2.10 Analysis of Cost-Sharing Options

(Note: As part of the research effort on this issue, the consultant team conducted a detailed analysis of different cost-sharing options. For documentation purposes, this analysis is included here.)

An important part of any new program approach for delivering the ordinary road program of the PRC will be to formalize how costs are shared between the central government and the

provincial and local governments for maintenance as well as construction. The proportion of cost funded by the central government will depend on the total central government revenue available for roads and the ability of the provincial and local governments to provide funding. It should provide sufficient incentive for provincial and local governments to undertake timely work on their roads and also encourage them not to waste central government funds. It may be necessary to provide a higher (incentive) cost share for maintenance compared with construction to overcome the tendency for provincial and local authorities to favor construction over maintenance.

To explore the implications of different options for cost sharing, three scenarios were developed that looked at different levels of central government cost responsibilities by network (national, provincial, and local) and by activity (construction and maintenance). All three scenarios assume that the central government should concentrate its funding on national roads and provide reduced proportions of the cost of roads as they become more local. Table A2.1 summarizes the cost-sharing scenarios in terms of the share of road costs that would be borne by the central government under what is effectively the current law (no cost sharing) and under three scenarios with increasing provincial and local responsibility for nonnational roads. Table A2.2 shows the average annual funding that would need to be provided by the central government and provincial and local governments for the 2011–2015 and 2016–2020 periods. Table A2.3 summarizes the funding required for the cost-sharing scenarios in addition to the estimated current revenues from fuel tax and VPT, using the average of the VPT estimates. It is important to note that under scenarios (b) and (c) the central government would have surplus funds during the 2016–2020 period.

Table A2.1: Share of Cost by Road Administrative Category for Cost-Sharing Scenarios

Cost-Sharing Scenario	National Roads		Provincial Roads		Local Roads	
	Construction (%)	Maintenance (%)	Construction (%)	Maintenance (%)	Construction (%)	Maintenance (%)
No cost sharing	100	100	100	100	100	100
Scenario (a)	100	100	80	80	80	80
Scenario (b)	100	100	60	80	40	60
Scenario (c)	100	100	40	60	40	60

Source: ADB.

Table A2.2: Total Funding Requirements for Cost-Sharing Scenarios (CNY billion)

Cost-Sharing Scenario	Average Annual Funding 2011–2015		Average Annual Funding 2016–2020	
	Central Govt.	Provincial and Local Govt.	Central Govt.	Provincial and Local Govt.
No cost sharing	1,053	...	1,118	...
Scenario (a)	904	149	927	191
Scenario (b)	733	321	699	418
Scenario (c)	658	396	622	495

... = not applicable, Govt. = government.

Source: ADB.

Table A2.3: Additional Funding Requirements for Cost-Sharing Scenarios[a]
(CNY billion)

Cost-Sharing Scenario	Average Annual Additional Funding 2011–2015		Average Annual Additional Funding 2016–2020	
	Central Govt.	Provincial and Local Govt.	Central Govt.	Provincial and Local Govt.
No cost sharing	670	...	363	...
Scenario (a)	520	149	172	191
Scenario (b)	349	321	(55)	418
Scenario (c)	274	396	(133)	495

... = not applicable, Govt. = government.

[a] Table A2.3 shows the estimated shortage in central government funding for the cost-sharing scenarios for ordinary roads using the average of the vehicle purchase tax estimates.

Source: ADB.

The options assessment is summarized as follows:

(i) Option 1, with central government providing a share of funding for all roads, is compatible with road user charging principles because fuel tax comes from travel on all roads. This option also allows the central government to influence activities on all roads.

(ii) If only national roads, or some other subset of roads, receive central government funding in the future, as would occur under Option 2, then this option would not be compatible with road user charging or the need for the central government to influence activities throughout the road network.

(iii) Option 3 would enable rational assessment of road maintenance needs and ensure that maintenance funding was used most effectively. This is highly compatible with better utilization of central government funding.

(iv) Option 4 would treat some provincial and local governments differently from others according to their capability. This would create efficiencies for central government inspection and audit efforts but may not be compatible with the PRC policy-making environment.

(v) Option 5 may not be compatible with central government budgeting but would be compatible with an independently administered road fund. Multiyear road programs would give assurance of funding for maintenance contracts based on longer-term performance and construction contracts that span more than one financial year.

(vi) Option 6 does not of itself mean that a programmatic approach would be used. The compatibility of this option would depend on the detail in the instructions or guidelines and whether compliance with these was audited.

(vii) Option 7 could be compatible with PRC needs; however, roadworks can often address a number of issues at the same time and so having separate programs can be unnecessarily confusing.

A2.3 Maintaining Purchasing Power

The options identified in Section 4.4 for better maintaining the purchasing power of current and future ordinary road revenues sources include

(i) indexing,
(ii) needs-based adjustment, and
(iii) occasional rate adjustments.

The methodology used to evaluate options for adjusting motor fuels tax rates reflects a slightly narrowed down and refined list of criteria. Specifically, the criterion assessing the ability of options to help maintain purchasing power has been revised to provide a broader assessment that considers the degree to which an option promotes financial sustainability. In addition, the criterion associated with the economic impacts and spending—while relevant to underlying considerations about whether to raise motor fuel taxes at all—is not likely influenced by the mechanism that is used to determine and impose fuel tax rate adjustments. The resulting list of evaluation criteria thus include the following:

(i) **Financial Stability.** The degree to which a rate adjustment supports a stable funding source for roads in the face of inflation and other considerations.
(ii) **Relationship to Needs.** The relation an approach creates among rate increases, overall funding needs, and the ability of government agencies to achieve the underlying road system goals.
(iii) **Cost Recovery Share.** Maintaining the appropriate balance of cost sharing between different categories of road users (e.g., cars vs. trucks).
(iv) **Legal, Institutional, and Political Acceptance.** The legality of potential approaches and acceptability from the perspective of affected institutions (e.g., central government agencies and provincial road and finance agencies) and political bodies.
(v) **Predictability.** The degree to which the rate increase mechanism is applied uniformly across years provides for consistent revenue increases and enables road officials to adequately plan.

The following discussion focuses on the application of each of these criteria to the three options.

A2.3.1 Financial Stability

Options 1 and 2 would both provide a reasonable level of sustainability as tax rates and associated revenue levels would increase on a regular basis and the concept of continual adjustments would become institutionalized; the degree of sustainability would be determined by the frequency of adjustments and the willingness of those who adjust the rates to make sufficient increases. Option 2 is the most sustainable due to its more holistic view of needed adjustments. Option 3 offers less stability since each decision to adjust rates would require a separate (likely highly political) debate and initiative.

A2.3.2 Relationship to Needs

By definition, Option 2 would establish a close relationship between road revenues and needs associated with both increased costs due to inflation and other drivers of maintenance and construction spending demand. For Option 1, the basis for indexing would determine the degree to which it would provide a relationship to needs (e.g., indexing to inflation would maintain purchasing power and indexing to travel growth could provide a good relationship to maintenance needs). Option 3 (occasional rate adjustment) could be driven by need but would provide little guarantee that the increases required would occur on a regular basis.

A2.3.3 Cost Recovery Share

The degree to which any of the options would help establish and maintain an appropriate balance of cost sharing between different road user categories would largely depend on how rate adjustments are determined. For all options, the process selected for adjusting tax rates could incorporate reconsideration of cost-sharing responsibilities, but it should also be noted that this activity could be highly contentious and political. Because Options 1 and 2 would provide for more regular adjustments to rates, both could tend to perpetuate the existing cost structure despite changes over time in system usage and the associate costs different users impose on the system. Also, attempts to incorporate a review of cost sharing into either option could negatively affect the "automatic" aspect of either approach. Conversely, Option 3 would likely provide more definitive points in time where cost share could be reconsidered.

A2.3.4 Legal, Institutional, and Political Acceptance

There appears to be little or no precedent in the PRC for tax rate indexing or other tax rate-setting mechanisms that allow for regular or automatic adjustments. On the contrary, there do not appear to be any laws or regulations that disallow it. From a legal and institutional perspective, the MOF and the State Administration of Taxation appear to already have the authority under current law to set fuel tax rates and could thus adjust rates based on needs or other considerations on either a regular or ad hoc basis. Politically, it appears that regular adjustments to tax rates would be poorly received; thus, Options 1 and 2 would likely result in significant political resistance. Option 3 would also face political challenges due to general resistance to raising tax rates but presumably would be more politically acceptable since increases would occur less often.

A2.3.5 Predictability

Options 1 and 2 would provide reasonably predictable rate increases across years and would allow for fairly accurate short to medium forecasts of future revenues. Option 3, however, would likely lead to more unpredictable rate increase cycles, both in terms of when increases would occur and the magnitude of the increases.

A2.3.6 Summary of Evaluation of Maintaining Purchasing Power Options

Based on the five criteria that appear most applicable to the issue of preserving purchasing power and sustainability of road-funding source, Option 2 is the preferred approach.

A2.4 New Revenue Sources

The policy options identified in Section 4.5 of this report include the following:

(i) Increase the motor vehicle fuel consumption tax
(ii) Sales tax on motor vehicle fuels
(iii) Heavy vehicle surcharge
(iv) Truck and/or automobile tire tax
(v) Vehicle taxes or fees
(vi) Diversion of excess toll revenues
(vii) General budget allocations

The decision to select one or more mechanisms to fund public spending is never an easy one. All tax and fee mechanisms have a range of consequences and decision makers should closely weigh the pros and cons of each option. These include considerations about the funding stream a source will provide; the realities associated with implementing and administering new funding sources at different levels of government; and assessment of the intentional and unintentional impacts new sources could have on system use, individual behavior, and various equity concerns.

A2.4.1 Revenue Potential

Due to poor data availability in the PRC, it was not possible to reliably estimate potential revenues from the seven potential new road-funding options and conduct a quantitative comparison. This assessment is therefore based on a subjective assessment of the options and experiences from other countries.

The potential new funding mechanisms with the highest potential revenue yields include Options 5 and 7. Options 1 and 2 could provide significant revenues, but this is somewhat muted by the level of the existing tax and the assumption that any initial increases would first go to address the anticipated shortfall in maintenance funding. The level of funding that could be raised from Options 3 and 4 is likely low. Finally, PRC officials noted that some toll roads are earning excessive revenues (i.e., facilities in the eastern provinces) and this could potentially serve as a source of funding for ordinary roads, but no official data were available to support this position. In fact, an unverified sample of toll road financial data showed that many of the toll roads throughout the PRC have insufficient revenues to meet even existing debt service and operating costs. Toll revenue diversion is, therefore, considered weak in terms of revenue potential.

A2.4.2 Sustainability

All of the options have high sustainability with the exception of Options 1 and 2, which will likely have declining revenues in the long term due to the development of high efficiency and alternative fuel vehicles, and Option 6, since the ability of toll road operations to generate surpluses is currently unknown.

A2.4.3 Political/Public Acceptance

Options 6 and 7 are likely to be the most acceptable from a public opinion and political perspective since there would be no perceived increase in the cost of travel to system users under either approach (unless tolls were increased to pay for the revenue diversion). Option 5 would be more politically acceptable to most since it would build from the new vehicle and vessel taxes and would not be a new tax, although it could be perceived as reactivation of the road maintenance fees that were replaced by the motor fuel tax. Option 4 would face less opposition than other options since it would also build from the new vehicle and vessel tax and the impacts of the tax would be focused on heavy vehicle operators and owners. All other options are likely to face significant political opposition due to the increases they would create for travel and vehicle ownership costs.

A2.4.4 Ease/Cost of Implementation

Options 1, 5, and 7 would clearly be the easiest to implement as the tax/fee collection mechanisms are already in place. There would thus be little or no incremental cost for increasing motor fuel taxes, and diverting toll revenues would probably have small additional accounting requirements and costs. Option 5 would also have fairly small administration costs and hurdles since existing vehicle licensing mechanisms could likely be used to implement them. Option 6 would be easy to administer, but there would likely be significant legal and institutional hurdles associated with changing debt financing and other contractual covenants.

A2.4.5 Externalities

Most of the options are fairly neutral in terms of the mix of positive and negative externalities they could potentially foster. Options 1 and 2 are also given better-than-average scores due to the potential environmental benefits that could be achieved by creating incentives for improved vehicle fuel economy and reducing travel. Options 3 and 4 are given low scores because they could encourage evasion or have negative safety implications (e.g., people defer replacing worn-out tires).

A2.4.6 User Benefit–Pay Relationship

All options scored reasonably well with respect to maintaining some level of correlation between the benefits users receive and the amount they pay for their system use, with the exception of Options 6 and 7. Option 3 would have the highest correlation since fees would presumably be related to the added impact of trucks on pavement deterioration.

A2.4.7 Equity Considerations

Option 3 is presumably the least regressive of the options since it would be charged only to businesses, while all other options would also affect average citizens. Conversely, the options that impose fees on fuel or travel could have a magnified impact on people living in rural areas who may have to travel greater distances. (Given the low income in the rural regions of the PRC, this could be a significant issue.)

A2.4.8 Summary of Evaluation of New Revenue Options

Based on the seven criteria that were used to evaluate the short list of funding options developed during the Phase I study, Options 5 and 7 are the preferable options. These two mechanisms could be implemented together as a package.

A2.5 Debt Financing

The options for reintroducing and better managing debt financing, described in Section 4.6, are broken into three areas:

(i) **Debt control.** These options relate to the sources of funding that could be pledged to secure loans and/or how debt proceeds could be used:
- 1a. National funds
- 1b. New provincial and local funding

(ii) **Debt management mechanisms**
- 2a. Central issuance
- 2b. Borrowing caps
- 2c. Designated purpose

(iii) **Financing structures.** These are policies, programs, and approaches that could be established in conjunction with renewal of provincial and local debt issuance capabilities:
- 3a. Loan terms and prepayment requirements
- 3b. Credit assistance
- 3c. Shadow tolling

The following is a discussion of these options with respect to the applicable criteria. Given that these options are more likely to be used in combination and do not necessarily reflect a need to choose one option over the other, the discussion is organized by each of the three option categories but a comparative analysis is not provided.

A2.5.1 Eligible Funding

At this point, it is difficult to evaluate and compare Options 1a and 2a since the MOT has not yet identified if it wants to establish a new provincial local funding source or indicated which provincial and local funding sources it considers as the most promising candidates for adoption. Having said that, the national motor fuels tax and the vehicle purchase tax (VPT) are now well-established revenue sources and would presumably be viewed by banks or bond investors as low-risk sources and thus warrant low interest rates. Current law does not allow provincial or local governments to leverage motor fuel tax allocations, but that could presumably be changed without tremendous difficulty through amendments to the applicable laws and regulations. The leveraging of national fuel tax or VPT revenues would presumably allow the central government to better manage risk by exerting more influence over the management of provincial and local debt usage and would be universally applicable to governments across the PRC.

A2.5.2 Debt Management

As reflected in the low interest rates realized through the recent central government auction of local government bonds, Option 2a would likely provide the cheapest borrowing terms for provincial and local governments. The two other options in this category would also help to keep borrowing costs low by improving the transparency and viability of provincial and local road debt programs. Since laws and regulations were

recently established to enable central issuance of local debt, there would presumably be no institutional barrier to Option 2a, while the implementation of Options 2b and 2c would require the development of new laws and regulations, as well as require the central government to establish both new reporting requirements and oversight roles. All approaches would provide added levels of risk management. The impacts of the options on universal access to leveraging are difficult to gauge without getting more input about the sources of funding that would be leveraged or identifying the specific restrictions that might be applied to the use of debt.

A2.5.3 Financing Structures

Options 3a and 3b could improve the transparency and reduce the level of perceived risk associated with provincial and local road-related debt. This, in turn, would help to lower interest rates and associated borrowing costs. New laws and regulations would clearly be needed to establish national guidelines on provincial and local debt terms, but this seems a minor hurdle. It is not clear as to what barriers exist for the national governments to provide guarantees or other forms of credit assistance to provincial and local governments. Both options would provide a higher level of risk management and would be universally applicable.

Option 3c is somewhat of an outlier option as it relates to a specific mechanism for determining how private investors would be paid rather than how the central government would influence debt issuance and usage. The greatest benefit of shadow tolling is that it shifts some of the financing risk from a provincial or local government entity to the private investor. The degree to which this would provide cost-effective borrowing is thus a function of the perceived risk for a specific project or initiative. The approach would likely have broader applications in more densely populated areas with established travel demand than in rural area with emerging travel needs.

A2.5.4 Summary of Evaluation of Debt Financing Options

Based on the evaluations, expanding the current program for issuing debt for ordinary roads at the central government level offers the best opportunity to formally reintroducing road debt usage in the PRC. All other options are viable tools and approaches that the PRC could select from to establish a more viable and responsible approach to debt financing of ordinary roads.

A2.6 Funding Allocation

The policy options for managing funding allocation are described in Section 4.8 and include the following:

(i) Current formula
(ii) Prior-year consideration
(iii) Consistent baseline share
(iv) Improved formula emphasis
(v) Needs-based allocations

(vi) Multiyear allocations

A2.6.1 Compatibility with Specific Needs and Policy-Making Environment in the PRC

(i) Option 1, the current allocation formula, does not address the relative needs of the regions.

(ii) Option 2, tying funding to prior-year actual expenditure, would delay finalization of the allocation and make it more difficult to efficiently spend the allocation. Also, it does not solve how the allocation for the first year under such a system would be determined. Overall, this option does not effectively address the relative needs of the regions.

(iii) Option 3, maintaining a fixed split between "baseline" and "added" components of the allocation, would give increased predictability of funding for a jurisdiction. However, this adjustment does not effectively address the relative needs of the regions.

(iv) Option 4 could be compatible with PRC needs and policy making if a suitable formula could be devised.

(v) Option 5, needs-based allocations, would completely address the relative needs of the regions.

(vi) Option 6, multiyear allocations, would facilitate longer-term contracting, which can reduce contract management effort.

A2.6.2 Compatibility with Reform and Decentralization Policies of the Central Government

(i) Option 1 was developed by central government and presumably complies with this criterion.

(ii) Options 2, 3, and 4 could be compatible with central government policies.

(iii) It would be expected that central government reform and decentralization policies would recognize the relative needs of the regions; thus, Option 5 would satisfy this criterion very well.

(iv) Option 6 is only compatible with a funding source separate from the government budget process.

A2.6.3 Degree of Transparency and Accountability Provided

(i) Option 1 is transparent only in so far that the allocation formula has been published. The data required to predict the "national total added allocation" are currently not publicly available. Also, there seem to be no uniform statistics for the factors in the "added allocation" part of the formula. Accountability for use of the formula is split between the MOT and the MOF.

(ii) Option 2 would make the provincial and major city governments more accountable to spend all the allocation provided, because they would be penalized by the allocation of the future year if they failed to do so. However, this would not necessarily lead to more effective expenditure. Overall, transparency and

accountability would not be significantly improved compared with Option 1. The same is true for Options 3 and 4.

(iii) Tying allocations to defined projects or work categories under Option 5 would greatly improve transparency and accountability for use of central government funds. This would be reinforced if central government also audited the expenditure.

(iv) Option 6 would be neutral with regard to transparency and accountability.

A2.6.4 Degree of Support from International Experience

International experience on funding allocation is summarized in Section 3.

(i) There is some support from international experience for a formula-based approach to central government allocation of road funds to states and provinces, and it could be said that there is support for Options 1, 3, and 4. However, in most other countries, there is some restriction on how the road-related allocations are used, so the support for Options 1 and 3 on their own is weak. If a formula could be devised to better emphasize national goals and priorities, as proposed in Option 4, then it could be said that Option 4 is supported by international experience.

(ii) There is very little support from international experience for Option 2.

(iii) A needs-based road-funding allocation process, Option 5, is used in many countries. Determining funding on the basis of rational assessment of maintenance needs (using road asset management systems) is best practice internationally. Similarly, funding for road improvement projects should be based on rational evaluation of the costs and benefits involved. Therefore, this option is well supported by international experience.

(iv) Option 6 is also being used more extensively to give certainty of funding for longer-term maintenance contracts.

A2.6.5 Degree to Which the Option Facilitates Achievement of Central Government Policies and Goals

(i) It could be expected that central government policies would support development in weak regions, so Options 1 and 3 do not rate high with this criterion because they do not address the different regional needs.

(ii) Option 2, on its own, would not facilitate achievement of central government policies and goals.

(iii) Option 4 could facilitate achievement of central government policies and goals if an appropriate formula could be devised. The formula would need to be somewhat complicated.

(iv) Option 5 would satisfy this criterion very well.

(v) Option 6, on its own, would have little effect on achievement of central government policies and goals.

A2.6.6 Degree to Which Provincial and Local Government Needs and Abilities Are Addressed

(i) As noted earlier, Options 1 and 3 do not address the different regional needs, and so they do not rate high with this criterion.

(ii) Option 2, on its own, would not address local government and abilities.

(iii) Option 4 could address local government and abilities if these factors were included in the formula and if an appropriate formula could be devised. The formula would need to be very complicated.

(iv) Option 5 would satisfy this criterion very well.

(v) Option 6, on its own, could have a small effect on addressing local government and abilities by giving improved predictability to central government funding.

A2.6.7 Ease of Overcoming Barriers Identified from Stakeholder Interviews and Field Research

Most of the challenges and disadvantages with the options cannot be easily overcome.

(i) "Gaming" of the allocation process under Option 2 could be overcome by rules associated with the allocation method.

(ii) The Phase I study identified contentious and divisive debates as disadvantages of Option 4. International experience shows that this is true as the allocation formula becomes more complex. These disadvantages cannot easily be overcome.

(iii) No barriers have been identified from stakeholder interviews and field research for the funding allocation Options 1–4, or for Options 5 and 6.

A2.6.8 Degree of Change Necessary, Including Human and Other Resources, and Need for Enabling Legislation (Inverse Scoring)

(i) Option 1 does not require any change.

(ii) Option 2 would need information on actual prior-year expenditure. Additional resources would be needed if this information was audited.

(iii) Option 3 only requires a change to the formula, not human or other resources.

(iv) Option 4 involves a significant adjustment to the formula, which could be done by administrative order. The option probably would not require any additional human or other resources.

(v) Option 5 requires significant additional resources to maintain up-to-date road management information and use this to develop rational maintenance and improvement programs on which funding could be based.

(vi) Option 6 should not require any additional human or other resources.

A2.6.9 Savings Likely to Be Achieved Compared with Data Needs, Resources, and Costs for Administering the Option (Savings/Costs)

Data, resources, and costs for administering each of the allocation options are important considerations when evaluating the options. The consultants are required to recommend

the data required for key allocation factors, based on the needs of the funding allocation option and the availability and quality of information from provincial and local governments. As noted in earlier sections, "savings" need to be considered in national economic terms compared with the current system, that is, the effectiveness of expenditure.

(i) Option 1, the current formula approach, requires provincial-level data on oil products consumption, percent of national road length, road density index, local condition factor index, share of national water user taxes, and percent of national navigational channel length.

(ii) Compared with Option 1, Option 2 would require additional data on actual expenditure in the prior year. This would tend to delay finalization of allocation for a certain year until well after the prior financial year was complete, thereby making it more difficult to efficiently spend the annual allocation. Also, it would be important for the allocating authority to audit the prior-year expenditure data to ensure their accuracy. This would involve additional resources and costs compared with Option 1. All this effort would not guarantee and savings.

(iii) Option 3 would require no more data or resources than Option 1 but does nothing to achieve savings.

(iv) Option 4 would require additional data on road system performance and how proposed improvements relate to national goals and priorities. Additional resources and costs would be involved. However, "savings" from better targeted expenditure would be much more than the additional costs.

(v) Option 5, all allocations based on rationally justified needs, would require large amounts of data and resources and would be very costly to administer. "Savings" from better targeted expenditure would be larger than for other options and should be larger than the additional costs.

(vi) Option 6 would require data on the duration of projects and funding requirements across financial year boundaries, which should be available. There would be no significant additional resources or costs for this option and may result in "savings" from better contractual arrangements.

A2.6.10 Summary of Evaluation of Funding Allocation Options

Option 5, needs-based allocations, is preferred; Option 6, multiyear allocations, should also be considered.

A2.7 Fund Management

The policy options for fund management are described in Section 4.9 and include

(i) increased transparency,

(ii) establishing a trust fund, and

(iii) establishing a central road fund and board.

A2.7.1 Compatibility with Specific Needs and Policy-Making Environment in the PRC

The needs in the PRC are reflected in the summary findings in Section 3.9 and the "Notice of Improving Financial Policy of Sustaining and Developing Ordinary Roads" issued by the General Office of the State Council in 2011, which provides some indication of the PRC policy-making environment relevant to ordinary roads. This notice includes the following statements relevant to fund management:

(i) Financial channels should be regulated to improve fund utilization and inspection.

(ii) The part of the new petroleum products consumption tax income baseline replacing road maintenance costs, and the part of additional funds equivalent with the ratio of maintenance cost and original baseline, should entirely be used in ordinary roads maintenance and management.

(iii) The part of the new petroleum products consumption tax income for reimbursing displaced toll station revenue should, after reimbursement, be entirely used in ordinary road management and construction.

(iv) Allocations from state budgets and revenue from vehicle purchase tax (VPT) shall mainly be used in ordinary roads construction.

(v) Local people's congress should expand their financial budget for ordinary roads development.

(vi) The specific transportation fund formed for petroleum products price and tax reform should be used in specified areas without misappropriation.

Option 1 does not involve a designated fund. Although current arrangements could be made to have more transparent accounting and reporting, the need for predictability of funding is not addressed by this option.

Options 2 and 3, with legally dedicated revenues and rules for management and allocation, both meet the need for predictability of funding.

A2.7.2 Compatibility with the Reform and Decentralization Policies of the Central Government

It is not clear what the long-term reform and decentralization policies of the PRC are, but it would seem that the policies should include recognition that adequate funding needs to be associated with decentralized functions. This includes sustainability of funding. Option 1 does not provide assurance of this. Option 2, with dedicated revenue sources, could provide sustainable funding depending on the rules for operation of the trust fund. Option 3, with a statutory board, is the most likely option to deliver adequate funding for ordinary roads.

A2.7.3 Degree of Transparency and Accountability Provided

(i) Option 1 increases the transparency and accounting of how funds for ordinary roads are obtained and used, but the funds are still within the central government financial management system.

(ii) Option 2 separates road revenues from other central government revenues, which would be more transparent and accountable than Option 1.

(iii) Option 3 is the most transparent and accountable option.

A2.7.4 Degree of Support from International Experience

International experience on fund management is summarized in Chapter 3.

(i) Option 1 does not explicitly dedicate revenues for road-related purposes. This approach is used by some well-developed countries and so is supported by international experience.

(ii) Options 2 and 3 do dedicate revenues, and this approach is supported by many developing as well as developed countries.

(iii) Option 3 is the approach used internationally by developing countries and some developed countries, and is supported by the World Bank and the Asian Development Bank.

A2.7.5 Degree to Which the Option Facilitates Achievement of Central Government Policies and Goals

All fund management options are essentially neutral with regard to achievement of central government policies and goals for ordinary roads. It is the fund allocation options that can facilitate achievement of central government policies and goals.

A2.7.6 Degree to Which Provincial and Local Government Needs and Abilities Are Addressed

All fund management options are essentially neutral with regard to addressing local government needs and abilities for ordinary roads. It is the fund allocation options that can facilitate achievement of local government needs and abilities.

A2.7.7 Ease of Overcoming Barriers Identified from Stakeholder Interviews and Field Research

No barriers have been identified for these options from stakeholder interviews and field research.

A2.7.8 Degree of Change Necessary, Including Human and Other Resources, and Need for Enabling Legislation (Inverse Scoring)

(i) Option 3 requires the most change, including human and other resources and legislation.

(ii) Option 2 also requires significant change but slightly less than for Option 3.

(iii) Option 1 requires the least change. It could be accomplished by government administrative order.

A2.7.9 Savings Likely to Be Achieved Compared with Data Needs, Resources, and Costs for Administering the Option (Savings/Costs)

The data needs, resources, and costs of administering Options 2 and 3 will be significantly greater than that for Option 1. However, economic "savings" would be greater for these options than for Option 1 because of better fund administration and control of expenditure.

A2.7.10 Summary of Evaluation of Fund Management Options

Option 3 is preferred over the other options. However, its implementation requires significant legislation and is therefore a longer-term option. Option 1, which involves more transparent accounting and reporting of road-funding revenue collection and allocation, should be implemented in the shorter term.

A2.8 Performance Management

The evaluation criteria for analyzing policy options and selecting the most appropriate policies for performance management are discussed.

A2.8.1 Compatibility with the Specific Needs and Policy-Making Environment in the PRC

The "Notice of Improving Financial Policy of Sustaining and Developing Ordinary Roads" issued by the General Office of the State Council in 2011 provides some indication of the PRC policy-making environment relevant to ordinary roads.

This notice includes the following intents relevant to performance management:

(i) Ordinary roads provide the foundation for economic and social development and the quality of life of people.

(ii) Fund utilization and inspection should be improved.

(iii) The part of the fuel tax that replaces the road maintenance fee and the part that allows for increased maintenance costs should be used for road maintenance and management, and the part that reimburses displaced toll station revenue should be used for road management and construction.

(iv) Allocations from state budgets and revenue from the VPT should mainly be used for road construction.

(v) Allocations from state budgets should be better used.

(vi) Society should be encouraged to better support the construction of ordinary roads.

(vii) Each level of financial department should show ordinary road funds in the budget.

(viii) Each level of financial and transport departments should ensure fund transfer entirely and on time.

(ix) The specific transport fund formed from fuel tax should be used in specified areas without misappropriation.

(x) Financial inspection organizations should take action for the improvement of financial risk control.

Since most of the above relate to program delivery, it can be said that Option 3 is compatible with the PRC policy-making environment. Option 4 also addresses program delivery and is therefore also compatible. Option 5 is also compatible since some reference is made to social development and living standards.

Options 1 and 2 address basic information about the road network and its use and are compatible with the needs of the PRC and the policy-making environment.

A2.8.2 Compatibility with the Reform and Decentralization Policies of the Central Government

All the options should be compatible with the reform and decentralization policies of the central government.

A2.8.3 Degree of Transparency and Accountability Provided

Transparency occurs when performance indicators are not only measured but also consistently published. Accountability occurs when an agency publishes both its intent with regard to improvement in performance indicators and the actual achievement.

Options 1 and 2 are the basic indicators of the quantity, condition, and the use of road assets. Annual publication of these indicators is the first step in transparency.

Options 3 and 4 relate more to the performance of an agency. Publishing intent and achievement for these indicators for the areas of responsibility of a particular agency would give a high degree of transparency and accountability.

Option 5 allows for wider indicators of road sector performance, including feedback from road users. This option would cause a road agency to strive to improve the social impacts of its activities, which would greatly improve transparency and accountability.

A2.8.4 Degree of Support from International Experience

International practice supports all performance management options. Most countries already have indicators for Options 1 and 2, and many countries have indicators relating to program delivery, Option 3. A lesser, but increasing, number of countries have indicators for Options 4 and 5.

A2.8.5 Degree to Which the Option Facilitates Achievement of Central Government Policies and Goals

Achievement of policies and goals depends on relevant indicators being established with targets and change in the indicators being measured over time. All of the options could serve this purpose.

A2.8.6 Degree to Which Provincial and Local Government Needs and Abilities Are Addressed

Provided consistent indicators are used by provincial and local governments, the central government would be able to compare jurisdictions on a rational basis and give increased attention to lagging jurisdictions. All options would contribute to this process.

A2.8.7 Ease of Overcoming Barriers Identified from Stakeholder Interviews and Field Research

Funding, equipment and systems, and technical ability are the main barriers to implementation of the performance indicators. These barriers could be overcome by the central government providing specific funding and technical assistance to lower levels of government.

The need for funding and assistance increases as more options are implemented.

A2.8.8 Degree of Change Necessary, Including Human and Other Resources, and Need for Enabling Legislation (Inverse Scoring)

Regular measurement of a set of indicators requires human resources, and equipment and systems, so significant change will be necessary to implement these options. At least an administrative order or State Council notice would be required to ensure uniform implementation of the options in all jurisdictions.

A2.8.9 Savings Likely to Be Achieved Compared with Data Needs, Resources, and Costs for Administering the Option (Savings/Costs)

As noted in the earlier sections, "savings" need to be considered in national economic terms compared with the current system, that is, the effectiveness of expenditure. There would be significant costs involved with implementing a performance management system using all the indicators in all the options considered, but the "savings" could far exceed these costs.

Most countries start with Option 1 then add the other options over time. This spreads the cost and allows the road agency time to purchase equipment, develop systems, and train personnel.

A2.9.10 Summary of Evaluation of Performance Management Options

All options rank highly on all evaluation criteria. The options could be implemented progressively.

APPENDIX 3

Road Network Data

Table A3.1: Length of Road by Administrative Category

Provinces and Cities	National Road	Provincial Road	County Road	Township Road	Special Road	Village Road	Total
Total PRC	164,048	269,834	554,047	1,054,826	67,736	1,897,738	4,008,229
Eastern PRC	46,343	81,643	140,140	328,801	8,026	491,593	1,096,546
Central PRC	44,542	79,246	175,771	348,585	21,406	673,753	1,343,303
Western PRC	73,163	108,944	238,136	377,440	38,303	732,391	1,568,377
Beijing City	1,314	2,148	3,708	7,991	509	5,443	21,113
Tianjin City	866	2,589	1,236	3,317	1,017	5,807	14,832
Hebei	7,684	13,347	13,133	44,068	1,432	74,682	154,346
Shaanxi	4,881	10,190	19,631	46,703	577	49,662	131,644
Inner Mongolia	8,583	11,628	25,892	35,658	5,005	71,227	157,993
Liaoning	6,450	8,914	12,626	30,881	929	41,745	101,545
Jilin	4,332	9,061	6,169	27,200	3,887	39,788	90,437
Heilongjiang	5,269	8,107	8,574	54,768	12,312	62,916	151,946
Shanghai City	613	974	2,456	6,829		1,102	11,974
Jiangsu	4,825	8,164	23,079	52,644	166	61,429	150,307
Zhejiang	4,171	6,031	27,234	18,435	715	53,592	110,178
Anhui	5,037	7,375	23,970	36,226	1,004	75,771	149,383
Fujian	4,206	6,150	13,485	35,676	486	31,012	91,015
Jiangxi	5,740	8,394	20,554	29,010	611	76,288	140,597
Shandong	7,503	16,614	22,711	31,906	2,373	148,752	229,859
Hennan	6,852	15,951	21,004	40,334	1,456	159,492	245,089
Hubei	6,358	11,303	20,026	58,603	810	109,112	206,212
Hunan	6,072	8,867	55,843	55,741	749	100,725	227,997
Guandong	7,091	15,017	17,682	91,839	375	58,139	190,143
Guangxi	6,814	6,818	24,311	28,068	569	35,202	101,782
Hainan	1,621	1,695	2,789	5,215	25	9,890	21,235
Chongqing City	3,109	8,155	12,047	15,119	546	77,973	116,949
Sichuan	7,618	11,734	40,384	49,980	4,933	151,433	266,082
Guizhou	3,924	7463	17,311	18,465	697	103,785	151,645
Yunnan	8,132	19,977	39,953	101,093	4,421	35,655	209,231
Xizang	5,618	6,294	12,150	15,605	2,391	18,751	60,809
Shanxi	7,085	5,596	17,241	23,961	1,806	91,773	147,462

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A3.1 continued

Provinces and Cities	National Road	Provincial Road	County Road	Township Road	Special Road	Village Road	Total
Gansu	6,663	6,197	15,695	12,309	3,132	74,883	118,879
Qinghai	4,477	8,842	9,267	12,256	875	26,468	62,185
Ningxia	2,075	2,341	1,615	7,740	716	8,030	22,517
Xinjiang	9,064	13,899	22,270	57,185	13,214	37,210	152,842
Army Road		3,957	5,476	11,225	3,750	7,650	32,058

PRC = People's Republic of China.

Note: This table includes expressways.

Local roads = county roads + township roads + special roads + village roads.

Source: Ministry of Transport, PRC.

Table A3.2: Length of Road by Technical Classification in 2010

Provinces and Cities	Total	Total Classified Road	Expressway								
			Subtotal	4 lanes	6 lanes	8 lanes+	Class I	Class II	Class III	Class IV	No Class
Total PRC	4,008,229	3,304,709	74,113	60,167	11,797	2,149	64,430	308,743	387,967	2,469,456	703,520
Eastern PRC	1,096,546	1,015,623	29,602	20,863	7,142	1,597	42,114	124,561	126,403	692,949	80,913
Central PRC	1,343,303	1,125,796	23,262	19,886	3,021	355	10,742	100,374	118,555	872,859	217,509
Western PRC	1,568,377	1,163,291	21,253	19,418	1,636	199	11,572	83,806	143,009	903,648	405,088
Beijing City	21,113	20,920	904	461	402	41	924	3,196	3,728	12,169	193
Tianjin City	14,832	14,832	982	499	388	95	1,040	3,165	1,275	8,371	
Hebei	154,346	146,053	4,307	2,996	1,278	33	4,037	15,872	16,318	105,520	8,291
Shaanxi	131,644	127,664	3,002	2,443	556	3	1,939	14,163	16,858	91,701	3,980
Inner Mongolia	157,993	144,395	2,365	2,358	7		3,387	12,443	26,842	99,357	13,598
Liaoning	101,545	84,757	3,057	2,302	341	414	2,876	17,135	31,382	30,308	16,789
Jilin	90,437	81,002	1,850	1,824	26		1,855	9,087	10,461	57,748	9,435
Heilongjiang	151,946	118,917	1,357	1,357			1,451	9,063	32,128	74,918	33,028
Shanghai City	11,974	11,974	775	305	267	203	335	3,065	2,602	5,197	
Jiangsu	150,307	141,706	4,059	2,384	1,419	256	9,514	21,328	15,258	91,547	8,601
Zhejiang	110,178	105,851	3,383	2,537	573	273	4,293	9,101	7,721	81,353	4,326
Anhui	149,383	142,341	2,925	2,717	165	43	499	10,504	15,306	113,106	7,042
Fujian	91,015	70,655	2,351	2,090	179	82	603	7,373	6,419	53,910	20,360
Jiangxi	140,597	101,455	3,051	2,936	111	4	1,386	9,340	6,670	81,008	39,142
Shandong	229,859	227,719	4,285	3,760	525		8,088	23,862	24,154	167,331	2,140
Hennan	245,089	182,560	5,016	2,757	1,954	305	564	24,040	18,049	134,890	62,529

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Table A3.2 continued

Provinces and Cities	Total	Total Classified Road	Expressway								
			Subtotal	4 lanes	6 lanes	8 lanes+	Class I	Class II	Class III	Class IV	No Class
Hubei	206,212	187,812	3,674	3,472	202		2,210	16,159	12,144	153,625	18,400
Hunan	227,997	184,045	2,387	2,380	7		838	8,018	6,939	165,863	43,953
Guandong	190,143	170,144	4,839	2,869	1,770	200	10,126	19,082	16,089	120,008	19,999
Guangxi	101,782	81,239	2,574	2,432	140	2	876	8,646	7,942	61,200	20,543
Hainan	21,235	21,012	660	660			278	1,382	1,457	17,235	214
Chongqing City	116,949	77,175	1,861	1,449	412		561	7,474	5,070	62,209	39,773
Sichuan	266,082	205,983	2,682	2,452	230		2,637	13,074	11,395	176,195	60,099
Guizhou	151,645	72,557	1,507	1,507			153	3,578	8,222	59,096	79,087
Yunnan	209,231	158,120	2,631	2,057	528	46	733	5,771	9,329	139,656	51,111
Xizang	60,809	36,229						956	7,101	28,172	24,581
Shanxi	147,462	134,498	3,403	2,961	291	151	787	7,235	14,791	108,282	12,964
Gansu	118,879	85,733	1,993	1,993			161	5,768	14,078	63,734	33,147
Qinghai	62,185	47,604	235	235			209	5,351	6,091	35,717	14,582
Ningxia	22,517	21,198	1,159	1,139	20		669	2,531	6,169	10,670	1,320
Xinjiang	152,842	98,560	843	835	8		1,399	10,979	25,979	59,360	54,283
Army Road	32,058	15,132					15	1,314	5,399	8,403	16,926

PRC = People's Republic of China.

Source: Ministry of Transport, PRC

Table A3.3: Length of Road by Surface Type in 2010

Provinces and Cities	Total	High Level Road Surface			Simple Paved Road Surface	Unpaved Road Surface	All-Weather Length	Greenable Length		Maintenance Length
		Subtotal	Asphalt	Cement				Total	Already Green	
Total PRC	4,008,229	1,917,981	542,457	1,375,524	524,234	1,566,014	3,532,374	3,344,182	1,943,406	3,875,853
Eastern PRC	1,096,546	758,458	253,702	504,756	141,841	196,248	1,061,774	975,555	691,276	1,074,792
Central PRC	1,343,303	764,663	121,233	643,430	153,434	425,207	1,197,132	1,180,455	763,628	1,329,281
Western PRC	1,568,377	394,860	167,522	227,338	228,960	944,559	1,243,468	1,188,174	488,501	1,471,781
Beijing City	21,113	17,968	13,374	4,594	1,865	1,281	20,358	16,634	14,187	21,114
Tianjin City	14,832	14,538	11,589	2,949	61	234	14,832	14,182	13,935	14,832
Hebei	154,346	112,533	50,016	62,517	13,857	27,954	146,186	150,774	65,801	154,344
Shaanxi	131,644	81,900	22,468	59,432	27,488	22,256	128,844	120,450	52,558	131,588
Inner Mongolia	157,993	37,134	30,263	6,871	17,364	103,495	97,803	129,452	27,903	155,198
Liaoning	101,545	37,176	33,731	3,445	26,148	38,222	92,738	82,659	58,403	101,545
Jilin	90,437	62,192	18,541	43,651	77	28,168	78,855	89,720	82,255	89,790
Heilongjiang	151,946	88,259	10,102	78,157	1,499	62,187	120,261	148,072	117,794	151,883
Shanghai City	11,974	11,883	4,745	7,138	50	41	11,974	11,667	7,672	11,974
Jiangsu	150,307	129,014	39,234	89,780	3,149	18,144	144,076	139,606	129,442	141,285
Zhejiang	110,178	98,742	28,414	70,328	6,142	5,293	110,177	81,717	66,920	110,177
Anhui	149,383	74,349	8,410	65,939	31,949	43,084	145,514	66,163	60,448	148,622
Fujian	91,015	64,541	2,645	61,896	4,966	21,508	84,394	78,587	45,906	91,009
Jiangxi	140,597	82,345	7,975	74,370	8,170	50,082	131,111	137,776	38,135	133,099
Shandong	229,859	128,586	57,432	71,154	79,147	22,127	228,906	207,243	177,423	229,859
Hennan	245,089	112,588	34,794	77,794	53,355	79,145	184,590	244,023	173,507	244,217
Hubei	206,212	131,993	12,394	119,599	23,838	50,380	188,015	146,765	69,126	204,795

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Table A3.3 continued

Provinces and Cities	Total	High Level Road Surface			Simple Paved Road Surface	Unpaved Road Surface	All-Weather Length	Greenable Length		Maintenance Length
		Subtotal	Asphalt	Cement				Total	Already Green	
Hunan	227,997	131,036	6,548	124,488	7,057	89,905	219,942	227,486	169,805	225,287
Guandong	190,143	123,784	9,448	114,336	5,721	60,638	188,790	172,901	92,701	179,040
Guangxi	101,782	31,639	4,529	27,110	20,591	49,553	93,054	70,027	39,887	90,562
Hainan	21,235	19,694	3,075	16,619	735	807	19,343	19,585	18,886	19,613
Chongqing City	116,949	31,425	9,591	21,834	6,010	79,513	85,249	93,218	43,898	116,948
Sichuan	266,082	105,144	23,418	81,726	24,273	136,664	214,221	213,612	107,592	244,534
Guizhou	151,645	10,473	3,663	6,810	26,589	114,581	151,644	141,768	18,725	151,644
Yunnan	209,231	37,863	28,910	8,953	12,429	158,939	163,686	169,757	65,913	209,151
Xizang	60,809	6,438	6,212	226	1,998	52,373	13,774	17,631	4,013	55,856
Shanxi	147,462	76,296	19,974	56,322	22,619	48,547	143,587	121,340	35,291	147,151
Gansu	118,879	18,425	8,170	10,255	30,109	70,345	95,098	52,941	21,433	82,832
Qinghai	62,185	14,052	7,921	6,131	5,541	42,592	49,521	57,276	28,619	62,185
Ningxia	22,517	6,956	6,359	597	7,561	8,000	20,064	12,271	8,958	22,518
Xinjiang	152,842	19,012	18,511	501	53,875	79,956	115,767	108,881	86,269	133,202
Army Road	32,058	1,542	1,406	136	12,602	17,914	26,863	26,945	20,947	30,823

PRC = People's Republic of China.

Note: "Greenable" means the roadside can be planted with trees, shrubs, and flowers.

Source: Ministry of Transport, PRC.

Table A3.4: Technical Condition of Expressways in 2010

Provinces and Cities	Assessment Length (km)	Weighted Average based on Technical Condition					Length in each Classification (km)					Ratio of 'Very Good + Good' to All (%)
		MQI	PQI	SCI	BCI	TCI	Very Good	Good	Fair	Poor	Very Poor	
Total PRC	61,326	94.2	93.0	96.7	97.4	95.7	53,737	5,116	411	12	19	99.2
Eastern PRC	25,974	95.2	94.0	98.1	98.0	97.5	24,538	1,308	96	22	9	99.5
Central PRC	18,145	94.8	94.1	96.7	98.9	94.4	16,861	1,238	46	3		99.7
Western PRC	17,208	92.1	90.4	94.6	94.7	94.2	14,337	2,569	274	17	11	98.2
Beijing City	852	94.9	93.0	98.9	99.5	98.9	802	50				100.0
Tianjin City	945	94.6	92.7	98.3	99.6	99.2	933	11				99.9
Hebei	3,711	95.2	94.1	98.4	98.0	96.9	3,627	78	6			99.8
Shaanxi	2,039	96.1	95.1	97.3	99.2	97.7	1,916	123				100.0
Inner Mongolia	1,504	94.1	92.8	96.2	97.2	97.7	1,419	77	6	2		99.5
Liaoning	2,056	94.7	94.3	98.8	91.3	98.3	1,934	112	5	5		99.5
Jilin	802	93.2	91.7	95.3	99.9	95.1	688	112	3			99.6
Heilongjiang	48	94.2	91.9	99.5	100.0	99.3	47	1				100.0
Shanghai City	775	95.2	93.6	99.7	98.7	99.1	743	32				100.0
Jiangsu	3,855	96.3	95.2	98.5	99.9	98.8	3,847	7				100.0
Zhejiang	3,135	95.4	94.3	98.0	98.1	97.6	2,986	149	1			100.0
Anhui	2,925	95.4	94.8	96.3	99.2	94.2	2,925					100.0
Fujian	2,067	94.5	93.2	97.1	99.5	95.2	1,940	116	10	1		99.5
Jiangxi	2,293	95.5	94.2	98.0	99.9	96.8	2,190	102	1	1		99.9
Shandong	3,378	96.4	95.1	99.2	99.6	98.6	3,314	60	4			99.9
Hennan	4,655	94.5	94.0	97.1	98.7	93.7	4,268	361	25	1		99.5
Hubei	3,627	95.1	95.0	95.6	97.2	93.4	3,460	157	10			99.7

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Table A3.4 continued

Provinces and Cities	Assessment Length (km)	Weighted Average based on Technical Condition					Length in each Classification (km)					Ratio of 'Very Good + Good' to All (%)
		MQI	PQI	SCI	BCI	TCI	Very Good	Good	Fair	Poor	Very Poor	
Hunan	1,756	92.4	90.8	97.0	100.0	91.2	1,367	382	7	1		99.6
Guandong	4,551	94.6	93.5	97.0	97.7	96.7	4,015	492	32	9	3	99.0
Guangxi	2,396	93.2	91.4	96.0	99.5	96.2	2,026	343	26			98.9
Hainan	649	90.3	88.6	96.5	93.1	93.8	397	201	38	7	6	92.2
Chongqing City	933	91.1	90.7	90.1	86.3	86.4	198	711	24			97.5
Sichuan	2,227	95.9	94.8	97.7	99.1	97.9	2,142	77	8			99.7
Guizhou	1,199	92.8	90.4	98.4	98.1	93.9	858	327	12		1	99.9
Yunnan	2,496	92.5	90.4	95.8	94.4	93.8	2,081	273	133	8	2	94.3
Xizang												
Shanxi	3,076	86.8	85.2	88.9	83.1	88.8	3,064	12				100.0
Gansu	1,316	94.7	92.7	99.5	99.3	99.4	1,185	124	7			99.5
Qinghai	210	90.1	89.3	90.1	95.1	94.0	140	67	2		1	98.8
Ningxia	1,012	91.4	89.8	92.9	99.7	91.6	676	323	14			98.7
Xinjiang	839	90.6	88.0	91.4	99.4	96.5	548	235	42	7	7	93.3

km = kilometer, PRC = People's Republic of China.

Note: Maintenance quality indicator (MQI) incorporates several subindicators, including Pavement Quality Performance Index (PQI) (combining Pavement Surface Condition Index, Riding Quality Index, Rutting Depth Index, Skidding Resistance Index, and Pavement Structure Strength Index); Subgrade Condition Index (SCI); Bridge Tunnel and Culvert Condition Index (BCI); and Traffic-facility Condition Index (TCI).

Source: Ministry of Transport, PRC.

Table A3.5: Technical Condition of Ordinary National Roads in 2010

Provinces and Cities	Assessment Length (km)	Weighted Average based on Technical Condition					Length in each Classification (km)					Ratio of 'Very Good + Good' to All (%)
		MQI	PQI	SCI	BCI	TCI	Very Good	Good	Fair	Poor	Very Poor	
Total PRC	81,887	84.8	82.7	90.1	91.9	91.8	38,368	26,119	9,230	4,841	3,330	78.8
Eastern PRC	21,292	90.4	88.2	95.2	95.6	96.0	14,761	4,500	1,230	501	300	90.5
Central PRC	19,555	87.7	85.7	90.6	92.1	92.0	10,109	6,487	1,817	613	527	84.9
Western PRC	41,038	80.6	78.3	87.2	89.8	89.4	13,407	15,132	6,181	3,728	2,507	69.5
Beijing City	592	91.8	89.4	98.7	94.8	98.7	478	59	22	15	17	90.9
Tianjin City	453	91.4	88.3	99.1	98.6	98.7	333	81	2	4	34	91.3
Hebei	4,542	88.0	84.6	97.6	94.0	96.6	2,517	1,265	462	180	118	83.3
Shaanxi	2,891	88.3	85.7	91.6	91.6	95.6	1,325	1,184	320	47	15	86.8
Inner Mongolia	4,239	85.5	84.6	82.6	90.5	87.6	1,121	2,101	560	293	74	78.1
Liaoning	3,373	90.9	88.8	96.1	95.3	97.7	2,294	704	223	120	32	88.9
Jilin	880	91.1	89.0	94.3	98.3	95.0	669	160	43	5		94.3
Heilongjiang	1,544	85.3	82.7	90.9	94.4	96.9	693	506	208	72	65	77.7
Shanghai City	167	93.2	91.3	95.8	99.4	97.0	143	17	6			96.4
Jiangsu	1,469	94.8	93.3	98.0	99.6	98.0	1,398	59	11		1	99.2
Zhejiang	1,557	89.9	88.8	90.2	95.4	93.1	870	541	122	20	4	90.6
Anhui	1,985	92.9	90.9	95.2	98.6	97.0	1,347	542	45	43	8	95.2
Fujian	1,939	91.9	91.0	93.7	93.7	94.3	1,393	504	30	11		97.9
Jiangxi	2,971	92.0	91.1	92.9	95.6	93.6	2,040	737	165	28		93.5
Shandong	3,639	93.3	91.4	96.1	98.9	98.2	3,065	418	58	65	34	95.7
Hennan	3,294	85.5	83.4	90.9	90.9	89.5	1,402	1,256	462	126	48	80.7
Hubei	3,210	85.3	82.9	84.6	87.7	86.9	1,702	953	247	109	201	82.7

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Table A3.5 continued

Provinces and Cities	Assessment Length (km)	Weighted Average based on Technical Condition					Length in each Classification (km)					Ratio of 'Very Good + Good' to All (%)
		MQI	PQI	SCI	BCI	TCI	Very Good	Good	Fair	Poor	Very Poor	
Hunan	2,780	84.5	83.0	89.3	87.2	88.3	932	1,149	327	183	190	74.9
Guandong	2,873	85.9	83.7	89.4	92.3	90.4	1,739	730	271	74	59	85.9
Guangxi	3,811	83.6	80.7	90.3	92.2	87.6	895	1,926	609	324	57	74.0
Hainan	688	92.2	89.6	97.5	97.7	99.3	531	121	23	12	1	94.7
Chongqing	703	75.9	73.6	80.6	87.9	86.9	149	389	75	56	35	76.4
Sichuan	4,852	84.1	79.1	96.3	95.3	96.5	2,438	1,013	455	602	345	71.1
Guizhou	1,977	79.5	77.8	84.7	91.0	86.6	57	1,338	495	88		70.5
Yunnan	4,910	64.6	61.0	72.6	73.6	71.5	956	1,367	1,288	680	618	47.3
Xizang	3,911	75.4	84.5	86.6	75.8	84.2	1,427	1,106	513	563	302	64.8
Shanxi	3,870	90.9	89.1	93.9	94.6	95.0	2,690	954	140	82	4	94.2
Gansu	4,088	80.3	75.6	90.6	95.4	93.1	1,252	1,269	690	421	456	61.7
Qinghai												
Ningxia	946	80.4	74.9	90.5	93.5	97.0	243	457	69	97	81	73.9
Xinjiang	7,731	82.7	78.2	87.5	96.3	96.4	2,179	3,213	1,287	522	530	69.8

km = kilometer, PRC = People's Republic of China.

Note: Maintenance quality indicator (MQI) incorporates several subindicators, including Pavement Quality Performance Index (PQI) (combining Pavement Surface Condition Index, Riding Quality Index, Rutting Depth Index, Skidding Resistance Index, and Pavement Structure Strength Index); Subgrade Condition Index (SCI); Bridge Tunnel and Culvert Condition Index (BCI); and Traffic-facility Condition Index (TCI).

Source: Authors' calculation.

Table A3.6: Technical Condition of Ordinary Provincial Roads in 2010

Provinces and Cities	Assessment Length (km)	Weighted Average based on Technical Condition					Length in each Classification (km)					Ratio of 'Very Good + Good' to All (%)
		MQI	PQI	SCI	BCI	TCI	Very Good	Good	Fair	Poor	Very Poor	
Total PRC	198,234	82.9	79.8	88.3	91.2	90.9	79,094	70,063	27,065	13,775	8,237	75.2
Eastern PRC	63,895	88.6	85.8	94.4	95.7	95.4	38,528	16,711	5,132	2,433	1,088	86.5
Central PRC	57,455	85.0	82.4	88.9	91.2	90.9	21,771	23,337	7,602	3,038	1,708	78.5
Western PRC	76,886	76.6	72.9	82.8	87.5	87.0	18,794	30,014	14,332	8,304	13,727	63.5
Beijing City	1,758	93.7	91.8	99.0	97.2	98.7	1,482	234	30	11	2	97.6
Tianjin City	2,034	91.5	88.6	99.4	97.6	98.5	1,551	322	63	69	29	92.1
Hebei	10,626	87.0	83.2	96.5	95.4	96.7	5,249	3,123	1,318	557	379	78.8
Shaanxi	8,619	86.5	83.0	91.1	93.0	94.6	2,885	4,337	998	315	83	83.8
Inner Mongolia	7,416	79.7	76.0	81.0	92.7	86.1	525	3,816	1,650	966	459	58.5
Liaoning	8,118	87.8	84.8	94.4	94.3	96.0	4,922	1,956	735	302	203	84.7
Jilin	656	91.1	88.5	96.2	98.2	97.0	441	177	33	4	1	94.2
Heilongjiang	7,451	88.8	87.7	91.0	94.5	95.6	4,285	2,156	682	207	121	86.5
Shanghai City	623	92.9	90.4	97.9	99.6	98.6	524	59	36	3		93.7
Jiangsu	5,633	93.7	91.8	97.2	99.5	97.7	4,747	702	142	26	16	96.7
Zhejiang	4,604	89.7	88.6	90.2	95.3	91.6	2,744	1,394	402	58	6	89.9
Anhui	6,101	86.1	83.1	94.4	95.0	95.8	2,706	1,939	862	468	126	76.1
Fujian	3,497	89.5	88.2	92.1	93.2	93.7	1,872	1,348	146	118	12	92.1
Jiangxi	7,788	87.2	86.6	87.1	87.8	91.1	3,074	3,583	900	231		85.5
Shandong	13,764	89.4	86.0	95.6	99.0	97.0	8,561	3,312	1,150	569	171	86.3
Hennan	11,971	82.8	78.9	90.5	94.4	89.7	3,439	5,343	1,825	876	489	73.4

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Table A3.6 continued

Provinces and Cities	Assessment Length (km)	Weighted Average based on Technical Condition					Length in each Classification (km)					Ratio of 'Very Good + Good' to All (%)
		MQI	PQI	SCI	BCI	TCI	Very Good	Good	Fair	Poor	Very Poor	
Hubei	9,204	81.0	78.4	81.1	82.7	82.5	2,862	3,845	1,627	502	370	72.9
Hunan	5,665	83.5	81.0	87.4	90.7	89.2	2,080	1,957	675	435	518	71.3
Guandong	11,830	84.8	82.1	90.2	91.5	91.4	6,063	3,835	1,034	639	259	83.7
Guangxi	6,031	79.8	75.3	89.2	93.0	88.2	971	2,885	971	954	249	63.9
Hainan	1,408	89.6	86.5	97.0	95.2	98.3	813	426	76	81	11	88.1
Chongqing	4,512	75.1	71.6	81.7	86.8	86.8	956	2,385	606	404	160	74.1
Sichuan	10,056	82.7	76.7	95.9	95.6	98.4	4,657	1,986	1,238	1,250	9,211	66.1
Guizhou	5,547	78.6	74.8	82.2	88.6	84.0	734	2,729	1,394	679	11	62.4
Yunnan	16,000	63.1	61.7	67.6	67.9	70.2	2,404	5,339	4,285	1,910	2,061	48.4
Xizang	5,488	71.4	67.5	71.0	89.5	92.3	1,435	1,843	1,076	588	546	59.7
Shanxi	5,351	88.2	86.0	91.9	93.6	92.9	2,810	1,942	368	205	27	88.8
Gansu	4,332	79.4	74.2	89.1	94.6	91.2	1,285	1,144	852	563	488	56.1
Qinghai	29	92.6	91.6	89.7	98.6	95.3	26	4				100.0
Ningxia	1,491	81.4	75.7	89.2	95.0	96.9	245	797	280	125	44	69.9
Xinjiang	10,633	82.0	77.7	89.3	94.2	94.3	2,746	5,144	1,612	660	471	74.2
Army Road	2,133	80.0	77.9	86.4	86.4	81.3	780	1,133	136	46	38	89.7

km = kilometer, PRC = People's Republic of China.

Note: Maintenance quality indicator (MQI) incorporates several subindicators, including Pavement Quality Performance Index (PQI) (combining Pavement Surface Condition Index, Riding Quality Index, Rutting Depth Index, Skidding Resistance Index, and Pavement Structure Strength Index); Subgrade Condition Index (SCI); Bridge Tunnel and Culvert Condition Index (BCI); and Traffic-facility Condition Index (TCI).

Source: Authors' calculation.

Table A3.7: Technical Condition of County, Village, and Special Roads in 2010

Provinces and Cities	MQI									PQI							
	Total Length (km)	Length in each Classification (km)						Ratio of 'Very Good + Good' to All (%)	Weighted Average Technical Condition	Length in each Classification (km)						Ratio of 'Very Good + Good' to All (%)	Weighted Average Technical Condition
		Subtotal	Very Good	Good	Fair	Poor	Very Poor			Subtotal	Very Good	Good	Fair	Poor	Very Poor		
Total PRC	3,574,098	1,534,872	376,691	570,887	244,324	213,476	129,494	61.7	61.4	1,392,913	310,065	494,734	246,424	200,710	140,980	62.8	62.6
Eastern PRC	968,518	464,644	167,421	171,901	48,893	52,812	23,617	73.0	54.1	335,442	113,369	111,992	49,689	33,274	27,118	67.1	66.6
Central PRC	1,219,376	807,328	171,057	312,090	140,485	108,350	75,346	59.8	64.4	798,956	163,147	301,369	146,285	112,992	75,163	67.5	61.4
Western PRC	1,386,204	262,900	38,213	86,896	54,946	52,314	30,531	47.6	65.2	258,515	33,549	81,373	50,450	54,444	38,699	44.5	60.7
Beijing City	17,652	3,237	2,547	555	109	22	4	95.8	92.5	3,237	2,085	831	221	71	29	90.1	89.9
Tianjin City	11,377	11,367	5,975	2,800	1,382	782	428	77.2	85.9	11,068	6,225	2,536	1,538	169	600	77.1	82.9
Hebei	133,314	24,522	8,435	7,030	2,256	3,759	3,042	63.1	65.1	917	373	289	10	65	180	72.2	71.2
Shaanxi	116,573	110,980	29,142	58,205	2,850	19,654	1,129	78.7	63.2	109,851	28,931	57,339	2,814	19,589	1,178	78.5	69.1
Inner Mongolia	137,764	15,406	1,865	7,517	3,253	2,366	405	60.9	60.6	15,353	1,945	6,878	3,713	2,297	520	57.5	58.4
Liaoning	86,181	54,955	24,285	14,342	8,930	4,731	2,667	70.3	80.3	54,953	22,108	13,150	6,586	6,679	6,430	64.2	75.3
Jilin	77,044	76,396	23,972	23,507	17,438	9,132	2,347	62.2	70.8	76,350	23,928	19,698	17,391	9,088	6,245	57.1	70.2
Heilongjiang	138,545	126,925	32,045	27,289	17,116	13,770	36,705	46.8	60.5	126,925	32,151	27,792	17,227	13,674	36,081	47.2	59.0
Shanghai City	10,388	5,080	2,491	1,809	460	109	211	84.7	87.2	4,997	2,007	1,927	717	235	111	78.7	85.9
Jiangsu	137,311	107,982	30,083	51,262	2,265	20,835	3,537	75.3	14.6	19,919	8,055	6,501	2,832	1,412	1,119	73.1	74.1
Zhejiang	99,975	23,926	2,967	10,780	4,902	4,238	1,039	57.5	55.4	23,225	3,161	10,110	4,968	3,988	998	57.1	47.0
Anhui	136,971	121,413	38,930	37,858	23,068	14,334	7,223	63.3	69.7	111,821	36,045	36,357	20,884	13,663	4,872	64.8	73.7
Fujian	80,623	6,014	1,915	3,109	503	335	152	83.5	86.0	6,014	2,025	2,655	746	276	312	77.8	84.2

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Table A3.7 continued

Provinces and Cities	Total Length (km)	MQI								PQI							
		Length in each Classification (km)						Ratio of 'Very Good + Good' to All (%)	Weighted Average Technical Condition	Length in each Classification (km)						Ratio of 'Very Good + Good' to All (%)	Weighted Average Technical Condition
		Subtotal	Very Good	Good	Fair	Poor	Very Poor			Subtotal	Very Good	Good	Fair	Poor	Very Poor		
Jiangxi	126,455	49,802	10,836	15,427	9,837	6,417	7,285	52.7	74.6	49,802	10,900	13,291	10,874	7,612	7,125	48.6	72.2
Shandong	205,742	194,057	74,229	67,334	24,517	15,766	12,211	73.0	57.8	177,805	53,284	61,282	28,400	18,249	16,590	64.4	60.0
Hennan	222,286																
Hubei	188,443	138,640	24,702	51,231	29,775	20,849	12,083	54.8	62.6	141,136	23,430	52,742	31,984	22,473	10,507	54.0	56.5
Hunan	213,059	183,172	11,430	98,573	40,401	24,194	8,574	60.1	60.1	183,071	7,762	94,150	45,111	26,893	9,155	55.6	55.6
Guandong	168,036	31,762	13,868	12,242	3,388	1,974	290	82.2	83.2	31,566	13,467	12,148	3,479	1,984	488	81.2	82.4
Guangxi	88,150	53,126	1,264	27,809	2,768	17,004	4,281	54.7	64.9	49,584	2,022	25,661	3,443	14,996	3,462	55.8	63.4
Hainan	17,919	1,742	626	638	181	261	36	72.6	81.0	1,741	579	563	192	146	261	65.6	77.3
Chongqing	105,676	32,524	6,641	13,563	5,863	4,208	2,249	62.1	63.5	32,523	6,626	13,336	6,123	3,897	2,541	61.4	61.6
Sichuan	246,693	61,361	18,056	9,409	12,251	13,368	8,277	44.8	64.3	61,361	12,596	12,711	8,374	14,742	12,938	41.2	57.4
Guizhou	140,255	1,165	14	616	375	156	4	54.1	78.7	1,166	29	603	372	156	6	54.2	76.1
Yunnan	181,122	33,877	4,298	10,147	10,276	5,878	3,278	42.6	64.6	33,093	4,058	9,720	10,089	5,227	3,999	41.6	58.1
Xizang	48,898																
Shanxi	134,780	9	7	2				98.8	89.6	8	7	1				98.8	89.0
Gansu	106,019	2,999	239	549	684	786	741	26.3	62.4	2,999	204	391	452	529	1,423	19.8	54.1
Qinghai	48,866	36,043	2,676	8,873	12,147	4,390	7,957	32.0	69.8	36,043	3,041	5,280	10,157	7,601	9,964	23.1	64.6
Ningxia	18,101	15,896	1,129	4,383	3,971	3,591	2,822	34.7	63.9	15,895	1,183	4,128	3,842	3,623	3,119	33.4	59.8
Xinjiang	129,880	10,494	2,024	4,028	3,358	567	517	57.7	70.3	10,490	1,838	2,664	3,885	1,376	727	42.9	65.3
Army Road	28,101	8,862	1,849	3,256	3,037	371	350	57.6	68.7	8,858	1,731	2,055	3,537	1,164	372	42.7	64.1

km = kilometer, PRC = People's Republic of China.

Note: Maintenance quality indicator (MQI) incorporates several subindicators, including Pavement Quality Performance Index (PQI) (combining Pavement Surface Condition Index, Riding Quality Index, Rutting Depth Index, Skidding Resistance Index, and Pavement Structure Strength Index); Subgrade Condition Index (SCI); Bridge Tunnel and Culvert Condition Index (BCI); and Traffic-facility Condition Index (TCI).

Source: Authors' calculation.

Table A3.8: Annual Average Daily Traffic on Expressway National Roads in 2010

Road name	Assessment Length (km)	Traffic Volume									
		Small Trucks	Medium Trucks	Large Trucks	Super Large Trucks	Trailer Trucks	Container Trucks	Cars & Vans	Large Buses	Total	PCU Equivalent Total
Beijing–Haerbin G1	717.19	1,129	2,206	1,049	3,325	1,058	23	8,047	818	17,654	29,027
Beijing–Shanghai G2	785.89	1,770	2,873	2,871	1,210	3,592	1,564	15,413	1,777	31,069	48,995
Beijing–Taibei G3	922.86	1,198	1,759	1,665	616	1,307	854	6,879	1,070	15,347	23,980
Beijing–HK&MC G4	1,629.30	1,973	2,099	1,293	789	3,082	665	14,969	1,666	26,535	38,782
Guangzhou–Macao G4W	17.33	465	362	382	43	62	103	1,701	305	3,423	4,555
Beijing–Kunming G5	1,079.03	592	1,241	868	1,337	770	149	4,784	535	10,277	16,546
Beijing–Lhasa G6	1,574.85	739	496	1,607	674	2,241	131	5,760	654	12,301	20,574
Beijing–Urumchi G6	43.35	427	486	1,566	6,707	2,623	2,626	523	13	14,970	40,696
Hegang–Dalian G11	227.79	478	176	160	285	25	11	3,626	274	5,033	6,057
Dandong–Fuxin G1113	219.67	710	522	218	988	0	0	6,181	266	8,885	11,472
Shenyang–Haikou G15	2,525.53	1,807	1,476	1,104	885	761	469	8,959	1,191	16,654	23,324
Changshou–Taizhou G15W	198.57	2,810	3,131	2,299	576	1,010	841	14,290	1,719	26,675	36,250
Rizhao–Lankao G1511	352.70	398	686	505	144	1,685	455	3,460	754	8,088	13,882
Ningbo–Jinhua G1512	54.10	2,155	478	1,220	306	521	535	4,805	1,121	11,141	15,884
Ningde–Shangrao G1514	19.15	1,044	470	390	126	213	215	5,280	699	8,437	10,520
Changchun–Shenzhen G25	1,645.81	671	857	756	323	901	446	4,548	799	9,301	14,225
Xinmin–Lubei G2511	25.30	205	137	59	367	0	0	2,659	130	3,557	4,484
Fuxin–Jinzhou G2512	23.69	327	514	586	3,794	0	0	2,409	229	7,860	16,405
Huaian–Xuzhou G2513	223.00	311	775	1,032	446	691	249	5,369	935	9,808	14,466
Jinan–Guangzhou G35	233.20	533	545	1,987	1,010	1,598	753	6,806	1,686	14,918	24,742
Daqing–Guangzhou G45	1,469.35	475	606	459	644	1,004	139	3,947	383	7,656	12,183
Erenhot–Guangzhou G55	703.29	318	328	182	449	487	24	2,137	265	4,191	6,590
Jincheng–Xinxiang G5512	113.64	434	836	281	133	1,575	99	3,418	273	7,050	11,501
Changsha–Zhangjiajie G5513	302.67	504	1,069	214	9	258	59	4,975	1,663	8,753	10,987
Baotou–Maoming G65	868.05	459	645	736	946	771	43	3,338	345	7,282	12,032

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Table A3.8 continued

Road name	Assessment Length (km)	Traffic Volume									
		Small Trucks	Medium Trucks	Large Trucks	Super Large Trucks	Trailer Trucks	Container Trucks	Cars & Vans	Large Buses	Total	PCU Equivalent Total
Lanzhou–Haikou G75	1,088.53	864	780	879	447	426	176	4,091	891	8,553	12,366
Chongqing–Kunming G85	393.65	681	1,120	488	679	142	172	5,328	899	9,508	12,993
Kunming–Mohan G8511	363.94	1,549	554	545	104	90	31	5,739	339	8,951	10,394
Suifenhe–Manzhouli G10	128.87	93	127	159	138	258	15	1,626	120	2,536	3,641
Haerbin–Tongli G1011	327.10	190	363	319	642	1,429	41	3,722	566	7,272	12,279
Hunchun–Ulanhot G12	453.10	374	423	146	105	469	0	6,781	681	8,979	10,824
Shenyang–Jilin G1212	16.49	653	508	185	1,082	0	0	3,770	190	6,387	9,085
Dandong–Xilinhot G16	365.65	545	533	424	2,246	219	1	3,484	349	7,801	13,598
Rongcheng–Wuhai G18	575.21	581	856	544	268	1,537	392	3,410	437	8,025	13,608
Huanghua–Shijiazhuang G1811	30.06	113	55	53	58	51	11	1,012	26	1,379	1,713
Qingdao–Yinchuan G20	578.11	1,604	1,117	2,038	725	2,663	380	8,538	1,324	18,389	29,186
Qingdao–Xinhe G2011	53.00	791	611	341	331	776	130	4,367	871	8,218	11,774
Qingdao–Lanzhou G22	333.52	520	615	274	79	984	258	4,007	428	7,164	10,600
Lianyungang–Horgos G30	2,505.74	434	584	716	315	1,662	149	3,442	440	7,740	13,220
Turpan–Hetian G3012	198.14	200	285	437	126	954	113	2,096	285	4,497	7,607
Nanjing–Luoyang G36	369.43	357	920	247	137	2,191	57	3,624	478	8,011	13,726
Shanghai–Xian G40	933.68	509	964	823	184	1,145	266	4,859	642	9,392	14,207
Yangzhou–Liyang G4011	100.00	318	739	911	434	672	2,039	5,024	281	10,419	18,130
Shanghai–Chengdu G42	695.14	1,231	3,118	1,570	1,182	590	857	16,520	1,523	26,592	35,741
Nanjing–Qianghu G4211	39.33	1,973	388	682	198	234	72	8,262	654	12,463	14,674
Shanghai–Chongqing G50	553.48	1,141	1,072	792	1,137	571	396	8,363	1,238	14,710	20,864
Hangzhou–Ruili G58	1,075.00	657	721	480	201	228	52	3,874	556	6,770	8,850
Shanghai–Kunming G60	1,668.22	1,224	1,366	996	307	1,170	314	6,422	1,112	12,911	18,728

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Table A3.8 continued

Road name	Assessment Length (km)	Traffic Volume									
		Small Trucks	Medium Trucks	Large Trucks	Super Large Trucks	Trailer Trucks	Container Trucks	Cars & Vans	Large Buses	Total	PCU Equivalent Total
Fuzhou–Yinchuan G70	844.82	845	501	604	247	352	116	3,396	667	6,728	9,346
Quanzhou–Nanning G72	784.74	755	896	787	434	684	463	5,017	864	9,899	14,727
Xiamen–Chengdu G76	597.46	850	1,337	571	837	102	114	7,175	1,085	12,071	15,959
Shantou–Kunming G78	238.72	297	686	471	288	314	202	2,576	1,005	5,839	8,763
Guangzhou–Kunming G80	396.51	938	565	750	728	265	434	5,613	1,588	10,881	15,562
Liaozhong Ringroad G91	114.60	316	216	111	935	0	0	2,129	81	3,788	5,918
Hangzhouwan Ringroad G92	65.78	5,861	731	2,391	588	672	134	12,725	2,072	25,176	31,758
Chengyu Ringroad G93	35.00	1,041	1,383	1,238	819	412	126	7,773	611	13,402	18,351
The Pearl River Delta Ringroad G94	36.42	2,069	2,242	796	308	392	791	35,189	3,770	45,558	52,342
Hainan Ringroad G98	557.24	1,307	1,264	1,401	636	146	142	5,447	1,940	12,283	17,133

km = kilometer, HK & MC = Hong Kong and Macau should be Beijing-Hong Kong-Macau, PCU = passenger car unit, small truck = 0–2 tons, medium truck = 2–7 tons, large truck: 7–20 tons, super large truck = 20 tons and above, large bus = 20 passenger seats and above.

Source: Ministry of Transport, PRC.

Table A3.9: Annual Average Daily Traffic on Ordinary National Roads in 2010

Road name	Assessment Length (km)	Traffic Volume									
		Small Trucks	Medium Trucks	Large Trucks	Super Large Trucks	Trailer Trucks	Container Trucks	Cars & Vans	Large Buses	Total	PCU Equivalent Total
Beijing–Shenyang G101	733.21	898	690	473	175	393	149	3,011	318	6,106	8,515
Beijing–Haerbin G102	930.47	1,451	922	866	212	515	116	3,811	474	8,366	11,616
Beijing–Tanggu G103	81.16	3,467	1,940	1,505	16	2,651	129	22,102	1,451	33,262	42,055
Beijing–Fuzhou G104	2,003.78	2,114	961	653	273	401	151	6,318	714	11,586	14,727
Beijing–Zhuhai G105	2,167.06	1,794	1,110	674	241	368	140	3,720	601	8,647	11,674
Beijing–Guangzhou G106	1,928.84	1,236	805	547	219	182	112	3,144	536	6,779	9,020
Beijing–Shenzhen G107	1,830.58	2,791	1,220	1,034	539	455	224	7,734	1,384	15,381	20,152
Beijing–Kunming G108	2,481.40	653	583	541	371	217	53	2,510	312	5,240	7,510
Beijing–Lhasa G109	2,282.10	370	299	348	138	396	26	1,110	187	2,874	4,586
Beijing–Yinchuan G110	954.19	540	642	650	261	1,523	72	1,895	275	5,859	10,681
Beijing–Jiagedaqi G111	2,095.72	296	208	157	86	128	23	1,008	97	2,004	2,788
Beijing Ringroad G112	814.18	1,116	774	716	744	426	147	2,558	281	6,762	10,639
Hegang–Dalian G201	1,228.44	684	346	268	137	116	46	1,621	248	3,465	4,627
Aihui–Dalian G202	1,219.95	1,035	673	495	170	297	109	2,932	436	6,147	8,348
Mingshui–Shenyang G203	529.27	682	429	361	133	209	96	1,962	259	4,132	5,714
Yantai–Shanghai G204	787.06	1,420	751	439	194	383	267	5,800	804	10,059	12,964
Shanhaiguan–Shenzhen G205	2,301.73	1,474	862	716	295	527	113	4,789	608	9,384	12,706
Yantai–Shantou G206	2,011.07	1,183	783	621	210	287	225	4,129	533	7,971	10,699
Xilinhot–Haian G207	2,728.37	652	501	536	236	273	76	1,989	385	4,650	6,801
Erenhot–Changzhi G208	792.85	477	433	561	609	660	119	1,280	257	4,396	8,080
Hohhot–Beihai G209	2,708.92	621	436	375	204	174	60	1,485	296	3,651	5268
Baotou–Nanning G210	1,934.13	563	440	403	133	421	23	1,645	222	3,850	5,738

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Table A3.9 continued

Road name	Assessment Length (km)	Traffic Volume									
		Small Trucks	Medium Trucks	Large Trucks	Super Large Trucks	Trailer Trucks	Container Trucks	Cars & Vans	Large Buses	Total	PCU Equivalent Total
Yinchuan–Xian G211	390.94	503	524	487	83	53	11	543	259	2,462	3,634
Lanzhou–Chongqing G212	779.48	571	491	400	74	85	51	854	369	2,895	4,145
Lanzhou–Mohan G213	2,251.40	494	388	311	100	42	19	1,547	268	3,168	4,129
Xining–Jinghong G214	2,261.34	348	293	232	118	26	13	769	118	1,918	2,670
Hongliuyuan–Golmud G215	538.01	457	174	138	102	108	107	6,536	281	7,904	8,905
Altay–Baluntai G216	644.00	165	89	116	220	68	6	740	96	1,499	2,293
Altay–Kuqa G217	279.00	625	277	458	323	182	23	1,449	217	3,553	5,313
Yining–Charkhlik G218	827.00	284	199	217	106	95	3	1,088	118	2,110	2,893
Yecheng–Lhaze G219	1,862.50	243	200	48	11	5	1	771	24	1,302	1,496
Beizhen–Zhengzhou G220	497.05	1,913	689	406	242	326	123	4,792	625	9,116	11,562
Haerbin–Tongjiang G221	203.06	454	222	202	67	24	30	1,281	122	2,401	3,016
Yichun–Haerbin G222	149.40	104	81	268	167	159	20	1,362	227	23,898	3,504
Haikou–Yulin(East) G223	318.69	1,004	849	711	142	27	43	2,225	687	5,689	7,593
Haikou–Yulin (Central) G224	296.00	877	552	452	118	24	21	1,411	520	3,974	5,285
Haikou–Yulin(West) G225	354.74	841	697	492	292	121	43	1,440	457	4,381	6,361
Xining–Zhangye G227	322.04	296	176	242	151	32	4	755	170	1,826	2,617
Suifenhe–Manzhouli G301	679.37	263	221	221	87	86	25	915	83	1,902	2,672
Hunchun–Ulanhot G302	590.28	371	268	243	119	49	22	1,741	213	3,027	3,891
Jian–Xilinhot G303	1,114.15	397	236	211	74	143	23	1,351	197	2,632	3,538
Dandong–Huolinhe G304	657.59	536	346	370	98	236	99	1,399	324	3,408	4,978
Zhuanghe–Linxi G305	672.52	547	362	199	93	161	42	2,033	198	3,635	4,705

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Table A3.9 continued

Road name	Assessment Length (km)	Traffic Volume									
		Small Trucks	Medium Trucks	Large Trucks	Super Large Trucks	Trailer Trucks	Container Trucks	Cars & Vans	Large Buses	Total	PCU Equivalent Total
Suizhong–Hexigten G306	406.99	571	382	340	115	131	48	1,159	235	2,980	4,216
Qikou–Yinchuan G307	869.27	631	607	696	518	848	182	1,819	253	5,554	9,775
Qingdao–Shijiazhuang G308	276.80	2,024	918	957	482	473	88	4,972	599	10,513	14,315
Rongcheng–Lanzhou G309	1,992.48	882	457	452	260	433	115	2,344	325	5,268	7,726
Lianyungang–Tianshui G310	981.65	767	508	588	244	367	48	2,362	356	5,241	7,580
Xuzhou–Xixia G311	366.45	893	525	164	103	92	9	2,024	222	4,031	4,974
Shanghai–Horgos G312	2,501.33	701	580	559	259	322	108	2,152	384	5,064	7,483
Urumchi–khunjerab G314	1,530.00	327	163	285	325	231	73	1,290	187	2,881	4,599
Xining–Shache G315	1,883.17	191	98	93	71	148	17	873	83	1,573	2,228
Fuzhou–Lanzhou G316	2,066.08	578	638	483	167	154	103	1,798	347	4,269	6,092
Chengdu–Nagqu G317	496.38	206	131	72	38	10	7	636	139	1,240	1,558
Shanghai–Nyalam G318	3,752.92	554	422	358	104	77	55	1,702	249	3,521	4,687
Xiamen–Chengdu G319	1,782.64	794	651	516	128	64	72	1,963	419	4,608	6,188
Shanghai–Ruili G320	3,252.44	835	666	590	216	96	51	2,861	404	5,718	7,568
Guangzhou–Chengdu G321	1,283.22	940	710	791	189	99	54	2,295	734	5,811	8,007
Hengyang–Youyiguan G322	596.79	903	812	652	411	212	213	3,167	588	6,958	9,981
Ruijin–Lincang G323	1,740.98	576	419	294	136	76	50	1,298	282	3,131	4,299
Fuzhou–Kunming G324	1,709.91	1,726	1,048	999	485	292	405	4,779	949	10,683	15,043
Guangzhou–Nanning G325	477.71	1,487	1,030	1,019	383	173	175	3,658	735	8,659	12,021
Xiushan–Hekou G326	1,321.06	605	444	403	139	25	12	2,000	270	3,898	5,010
Lianyungang–Heze G327	281.80	2,468	810	408	226	529	152	6,351	869	11,813	14,874
Nanjing–Haian G328	168.49	2,155	780	777	214	262	43	9,594	1,171	14,996	17,787
Hangzhou–Shenjiamen G329	194.66	3,656	1,238	1,058	272	687	563	8,767	1,138	17,380	22,670
Wenzhou–Shouchang G330	349.50	2,850	825	765	237	324	74	5,451	552	11,079	13,803

km = kilometer, PCU = passenger car unit, small truck = 0–2 tons, medium truck = 2–7 tons, large truck: 7–20 tons, super large truck = 20 tons and above, large bus = 20 passenger seats and above.

Source: Ministry of Transport, PRC.

Reforming the Financing System for the Road Sector in the People's Republic of China

The People's Republic of China (PRC) implemented the Fuel Tax Reform in 2009. It abolished a range of provincial and local government fees and increased the central government tax on motor vehicle fuel. This reform centralized the government revenues for the sector, but various issues remain.

This publication analyzes the implications of the reform on the operation and maintenance of ordinary roads. It recommends the formation of a National Road and Funding Administration, responsible for the national road programs and policy, and the creation of a central road trust fund to finance the operation and maintenance of ordinary roads.

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