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China Forward with One Spirit: A Strategy for the Transport Sector

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CONTENTS

Preface	v
Abbreviations and Acronyms.....	vi
Executive Summary	vii
Chapter 1: Prologue.....	1
A. Sector Objectives.....	2
B. Current Modal Strategies.....	2
Chapter 2: Competition: The Foundation of Sector Strategy	7
A. Conditions That Promote Competition	7
B. Multimodal Transport.....	12
C. Intramodal Competition.....	12
D. Strategies to Increase Competition.....	13
Chapter 3: Transport Demands of a Competitive Economy.....	15
A. Demand for Freight Transport.....	16
B. Demand for Passenger Transport	20
C. Modal Allocation.....	20
Chapter 4: Transport Investment: Standards and Compromises.....	23
A. Satisfying Demand	25
B. Asset and Investment Needs.....	26
C. Alternative Scenarios.....	28
Chapter 5: Financing Transport Investment.....	31
A. Present Sources of Investment Finance.....	31
B. Current User Charges	32
C. Proposed Changes to Existing User Charges	35
D. A New User Charge—Transport Fuel Surcharge.....	37
E. Private Investment Finance.....	38
F. Management of Sector Investment Funds	40
G. Making Private Investment More Attractive.....	42
Chapter 6: Social and Environmental Impacts	43
A. Regional Income Disparities	43
B. Rural Income Disparities.....	44
C. Motorization	45
D. Transport’s Social and Environmental Impacts	46

Chapter 7: Forward with One Spirit—A Transport Strategy and an Institutional Structure.....	53
A. Transport Strategy	53
B. Institutional Functions	54
C. Proposed Institutional Structure	58
D. Transport System Management.....	60
Annex A: A Transport Investment Fund.....	65
Bibliography	71

BOXES IN TEXT

Box 2.1: A Consequence of Badly Organized Multimodal Transport.....	12
Box 5.1: Conventional and Innovative Aviation Finance	39
Box 5.2: Asset-Based Highway Finance.....	39
Box 5.3: Railway Built with Private Funds	40
Box 7.1: Institutions and Incentives.....	54
Box 7.2: Forward with One Spirit.....	58
Box 7.3: Transport Ministries and Commissions.....	59

FIGURES IN TEXT

Figure 3.1: International Comparisons of Infrastructure Density.....	15
Figure 3.2: Modal Allocation of Freight Output (Percent).....	22
Figure 3.3: Modal Allocation of Passenger Output (Percent).....	22
Figure 4.1: Transport Infrastructure Investment	23
Figure 5.2: Application of User Charges	32
Figure 5.1: Financing Needs and Possible Sources	32
Figure 5.3: Potential Revenue from Road User Charges	34
Figure 5.4: Required Revenue From User Charges	38
Figure 6.1: East Asia Motorization, 1960-90.....	45
Figure 7.1: Institutional Structure of the Proposed Ministry of Transport and Communications	60

TABLES IN TEXT

Table 3.1: Freight Transport Intensity	16
Table 3.2: Structure of the Economy and Freight Transport Intensity	18
Table 3.3: Freight Transport Demand by Economic Sector	19
Table 3.4: Projection of Passenger Travel Demand.....	20
Table 4.1: Estimated Transport Investment Requirements.....	24
Table 4.2: Transport Assets Included in the Analysis	24
Table 4.3: Principal Infrastructure and Vehicle Utilization Standards	25
Table 4.4: Transport Sector Investment Needs.....	26
Table 4.5: Investment as a Percentage of GDP by FYP: 1996-2010	29

Table 6.1: China's GDP by Region, 1992.....	43
Table 6.2: International Comparison of Fuel Prices	47
Table 6.3: Projected Fuel Consumption.....	48
Table 6.4: International Comparison of Road Accident Rates	49
Table 7.1: Principal Sector Policy Proposals	62
Table 7.2: Principal Modal Policies.....	63

Preface

The transport strategy developed in this report deals with issues related to the sector as a whole. It does not deal with issues specific to particular modes, other than where these have a broader impact. Neither does not deal with urban transport. Each of the transport modes has been, or will soon be in the case of inland waterways, the subject of a separate report. Urban transport was dealt with in a comprehensive report published in December 1996.

This study was prepared by Robin Carruthers, Senior Transport Economist, EASTR, with Tilly Chang, Research Assistant (EASTR). Other staff of the Unit made significant contributions and provided comments on earlier drafts. K.L. Luthra (Consultant) provided a comparison of the institutional structure of the transport sector in China with those of other developing countries. The report draws on papers prepared under the direction of Hernan Levy (now OEDD3, then Task Manager) for a seminar on transport policy, held in December 1993, and on an initial draft prepared by Françoise Clottes (now IENTI). Richard Scurfield was the Division Chief during much of the report's preparation.

Wang Qingyun, Deputy General Director, Transport and Energy Department of the State Planning Commission, made valuable suggestions on the scope and orientation of the report. Other agencies of the Chinese government, including the Ministry of Finance, the Ministry of Communications, the Ministry of Railways, and the Civil Aviation Authority of China, made useful comments and suggestions following a presentation of the report's preliminary recommendations in November 1996. The content of the report, however, remains the responsibility of the World Bank and does not necessarily reflect the views of the Chinese Government. It is intended to form the basis of a policy dialogue between the Government and the Bank, and to play a part in the development of a sector strategy in the preparation of the Tenth Five-Year Plan.

David Brindley (Consultant) helped in editing the text, while Cynthia Warren provided valuable support throughout its preparation and Meredith Dearborn completed the desktop publishing preparation. Peer reviewers are Mirta Pokorny (ECSIN), Kenneth Gwilliam (TWUTD), and Graham Smith (ECSIN). Jeffrey Gutman is the Sector Unit Manager and Yukon Huang is the Country Director.

Abbreviations and Acronyms

BOT	Build-Operate-Transfer
CAAC	Civil Aviation Authority of China
COSCO	China Ocean Shipping Company
CR	China Railways
dwt	Deadweight Ton
FDI	Foreign Direct Investment
FYP	Five-Year Plan
GDP	Gross Domestic Product
GNP	Gross National Product
MOC	Ministry of Communications
MOF	Ministry of Finance
MOR	Ministry of Railways
MOTC	Ministry of Transport and Communications
mte	Medium Truck Equivalent
NEPA	National Environmental Protection Agency
NTHS	National Trunk Highway System
pkm	Passenger-kilometer
PSB	Public Safety Bureau
RCS	Railway Construction Surcharge
RMF	Road Maintenance Fee
SETC	State Economic and Trade Commission
SINOTRANS	China National Foreign Trade Transportation Group
SOE	State-Owned Enterprise
SPC	State Planning Council
TIF	Transportation Investment Fund
tkm	Ton-kilometer
TSB	Transportation Safety Board
VPF	Vehicle Purchase Fee
VUF	Vehicle Use Fee

Executive Summary

Transport provides an essential framework for our national economy. It gives the foundation and serves as a precondition for establishing and developing a socialist market economy. However, transport system capacity falls far behind demand, and that lack of capacity has led the sector to become a serious bottleneck that restricts the development of the national economy. The problems are mostly caused by three factors: inadequate investment, insufficient strength of reform, and problems of management and operation.

*Director, Transportation Department
State Planning Commission of China
December 1993*

Inadequate physical access to jobs, health, education, and other amenities frustrates China's efforts to improve the quality of life. Without the ability to reach resources and markets, growth stagnates and poverty reduction cannot be sustained. Inappropriately designed transport strategies and inadequately funded programs, such as China has experienced since the opening of the economy in 1979, result in transport systems that fail to provide the necessary conditions for economic growth, aggravate income inequalities, harm the environment, and ignore the increasing needs of users. So transport will play a vital role in China's reorientation of its economy to one that is increasingly dynamic, decentralized, and market-based.

Previous sector policies have made achieving these ends particularly difficult. Since investment has never been adequate, parts of the transport network are seriously congested, while some regions of the country remain inaccessible. Infrastructure bottlenecks and inadequate services are impediments to continued economic growth and increased social welfare. Under the system of planned targets, operational efficiency meant that use of assets was maximized, even when this resulted in poor service. Stimulating competition is only now becoming recognized as a policy priority to encourage efficiency in production and in the allocation of transport demand between modes. Finally, the sector's institutions and policies are uncoordinated and lack a critical, systemwide perspective.

As transport demand shifts from state-owned to private enterprises, new users are increasingly dissatisfied with the services available. Improving them presents many challenges, most importantly encouraging transport operators to be more responsive to users' needs, and investing in enough infrastructure and vehicles to satisfy them. Meeting these challenges will require flourishing competition, compatible pricing and regulation among modes, more widely available multimodal transport services, and more finance for investment.

Even as these challenges are recognized and are being met, it will still be difficult to keep pace with rapidly increasing demand. Massive investment in transport infrastructure and rapidly improving services will be essential to sustain the continued high economic growth needed to satisfy social and economic objectives. Unless the transport sector strategy can overcome its current deficiencies, coping with continued rapid economic growth will be unsustainable. In turn, this would retard the achievement of other national policy goals, such as poverty alleviation and improvement of environmental quality. Implementing a coherent transport strategy, in which all elements work together to achieve sector objectives, is fundamental to China's social progress and development.

This report analyzes these challenges and proposes a strategy that will help fulfill China's economic and social goals. If implemented, the strategy recommended will bring about greater competition and enhanced modal integration, more resources for investment, higher-quality services, and greater user satisfaction. At the same time, it will help reduce regional income differentials, improve the sector's safety record, and mitigate transport's negative environmental impacts. Given China's transitional state, the strategy focuses on establishing market and institutional structures that can stimulate competition—while constraining its excesses—and further integrate transport into the productive and social fabric of society. The strategy includes

- sector objectives,
- demand projections,
- a policy framework to help achieve the objectives,
- an assessment of resources needed and the means to generate them, and
- a supportive institutional framework.

A. SECTOR OBJECTIVES

The first objective is to enhance China's economic growth and increase its competitiveness in world markets. This will best be achieved by stimulating users to express their demands more clearly, giving operators incentives to satisfy those demands, and creating institutional structures to facilitate interaction between operators and users. Bringing this about will require

- removing constraints on competition,
- alleviation of capacity bottlenecks and providing for further growth,
- charging for the use of infrastructure to cover long-term social costs, and
- institutional reform that recognizes the transport sector as an integrated whole, rather than as an aggregation of independent modes.

The second objective is geared toward reducing income disparities between inland and coastal provinces and between rural and urban areas, one of the main targets of the Ninth Five-Year Plan (9FYP). Reducing regional income inequalities will not be possible until the inland provinces become more accessible. Reorienting road development strategies to put a higher priority on reducing the isolation of rural communities and to providing them with opportunities to move beyond subsistence economies is a more difficult task. Reducing the sector's negative effects on the environment and improving the sector's poor safety record complete the trio of sector objectives.

B. TRANSPORT DEMANDS

Five long-term trends are evident in the projections of transport demand:

- **Freight transport will grow more slowly than the economy.** The current high freight intensity of the economy [the amount of transport required to produce economic output, measured in ton-kilometers (tkm) per dollar of gross domestic product (GDP)] will decline as it becomes more market-oriented and less centrally planned, and as location decisions are based more on minimizing total production costs, including transport. In addition, as the economy grows and moves into the service sector and as more higher-value goods are produced, it will depend less on industries with the highest transport needs.

- **Passenger transport will grow more quickly than the economy.** Restrictions on personal travel have resulted in a very low intensity of passenger demand. As constraints are relaxed, personal incomes increase, and more capacity is added to the system, the propensity to travel [measured in passenger-kilometers (pkm) per person] will rapidly increase and demand for passenger travel will grow more quickly than the economy.
- **The road and waterway share of freight transport will increase,** the former because it can provide better door-to-door service, the latter because it can be much cheaper for many bulk products. The extent to which the rail share decreases will depend on how well the railway responds to the new pattern of demand and growing competition. **Rail and bus modal shares of passenger transport will fall,** unless private car use and air transport services are deliberately constrained. Until recently, most interurban passengers had to travel by rail but capacity constraints made this policy unsustainable. Interurban bus transport was first to capture the frustrated demand, followed now by air transport. The level of car travel is set to take off and air travel is expected to maintain its current phenomenal growth rate.
- **Demand for multimodal transport services will grow faster** than for single-mode services. If the economy is to remain internationally competitive, there will be a much greater use of containers and multimodal transport. Exporters and foreign investors who support them want services that are reliable and can deliver freight on time and in good condition, so as to minimize the impact of transport on production costs.
- **Users will increasingly require higher-quality services.** Current transport services are not good enough to satisfy demanding users. Shippers resort to high-cost and resource-inefficient measures, such as operating their own truck fleets, to ensure at least a minimum quality of service. Infrastructure and other assets will have to increase as users demand these better services.

C. RESOURCES NEEDED

China's stock of road, rail and air infrastructure is small when compared with other developing countries. Even excluding the large desert areas, the density in respect to area is low, while the density per capita is exceptionally low. The low network density occurred for several reasons, including an emphasis on rural production, the lack of a policy of national integration, but mostly because of the limited amount invested in the sector.

From 1966 to 1994, total sector investment was less than half the proportion of GDP invested by other large developing countries. Although funding increased dramatically during the 8FYP (1991-95), this rise was not enough to prevent conditions from worsening, since the economy was growing at an unprecedented rate and increasing competition in the manufacturing sector was creating demands for more and better transport. The infrastructure investments planned for the 9FYP will reach record amounts in absolute terms, but will contribute little to alleviating bottlenecks and improving services.

To make an impact in achieving the sector objectives, China will need to invest a minimum of 3.6 percent of GDP per year for at least the next 15 years. Since many of the needs are urgent, the rate will need to be higher, about 3.7 percent of GDP, during the 9FYP and 10FYP. This translates into an average \$46 billion per year and a total of nearly \$700 billion over 15 years. (These amounts exclude urban transport, for which a further 3 percent per year of GDP will be needed.) The projected investment would include an average of about

- \$9 billion on railway infrastructure, traction and rolling stock,
- \$34 billion on roads, and
- \$2 billion per year for inland waterways and ports and a further \$2 billion for air transport.

Traditional Sources of Finance. These will be inadequate to meet the above demands. While user charge revenues have financed most investment, the shortfall has been covered by infusions from central or provincial governments and loans from bilateral and multilateral sources (the amortization of these loans is also financed from user charge revenues). This procedure is unsustainable. Moreover, bilateral and multilateral funding for transport infrastructure is likely to decline and large-scale private finance is not yet feasible. So, more revenue must be raised from existing and new user charges, as well as from new sources of finance.

User charges in the different subsectors vary in their effectiveness: The least efficient is the current road maintenance fee, which is expensive to administer, easy to evade, and currently generates less than 40 percent of its potential revenues. Airport, port and waterway and railway infrastructure user charges are less problematic. To supplement the revenues of existing charges, an additional surcharge should be levied on the price of transport fuels. This would have low collection costs (less than 1 percent of revenue), be almost impossible to evade and could generate all the additional revenue needed. It would better balance the benefits gained from and costs imposed on the network with the charges for its use. Even with this new charge, investment financed directly from user charges is likely to fall from about 73 percent at present to about 54 percent by 2010.

New Sources of Finance. Where operations have been gradually separated from the State apparatus, as in large parts of road, maritime and air transport, new finance sources have already materialized: In 1994 and 1995, Chinese airlines purchased \$1.5 billion of new aircraft, of which almost 80 percent was financed by US and European export credit agencies, and most of the remainder was covered by long-term commercial loans and lease-back arrangements. Elsewhere in the economy, the China Ocean Shipping Company (COSCO) used Japanese trading-house finance to purchase more than \$400 million of new ships in 1996. China Railways has already issued almost \$700 million of three-year corporate bonds.

However, obtaining finance for most transport infrastructure will be difficult. Expected traffic levels on most sections of the National Trunk Highway System still to be built will not generate enough revenue to amortize this level of borrowing. The financial rate of return on the high-speed railway between Beijing and Shanghai, one of the potentially most profitable in China, is projected at less than 20 percent, too low to attract the high-risk private finance needed. To attract adequate private funding, projects have to be redesigned to be more cost effective, and the regulatory and fiscal environment will have to be more favorable to reduce the perceived risks. New sources of finance other than build-operate-transfer and simple concessions could include local bond market issues, stock market offerings by private infrastructure operators, and capitalization of future revenues from infrastructure networks to support debt issues. More advantage could be taken of the benefits of increased land values arising from infrastructure investment by including the right to their exploitation in concessions or taxing them when the right to use the land changes.

The political and legal framework for making use of foreign private finance will need to change. Since transport investments do not have an intermediate purchaser and instead rely on many individual users to pay fees, they are riskier than other forms of infrastructure investment. International lenders and

equity providers seek higher financial returns and seek strong guarantees to reduce their perceived commercial risk. To attract local debt finance, which is less even less costly than foreign debt but until now has been little utilized, the banking system will need to be reformed; at present, banks only provide short-term debt (up to three years), which is not enough to cover costs, even during the construction period, and restrictions on bond holding need to be loosened.

A **Transport Investment Fund**, with some characteristics similar to the Infrastructure Funds already established in Pakistan, India and Sri Lanka, would be one possible way of managing the sector's financial needs. However, given the increasing involvement of private sources for transport in China, the high returns to risk incurred in project finance, and the emergence of private funds for infrastructure finance in Asia, there would be even greater advantages in mixed public and private investment in the Fund. Brazil and Mexico are already working towards the creation of Funds of this type. The fund would be able to leverage the revenues from already completed revenue-generating projects and spread its risks over many more projects than could a private fund. It would also provide a mechanism to ensure that funding was available on a priority basis for projects with high social as well as acceptable financial benefits, as well as for transferring resources from coastal to inland provinces.

D. INSTITUTIONAL FRAMEWORK

The current institutions in the transport sector are relics of the planned economy and need to be restructured if the sector is to fulfill its economic and social function. In transport, as elsewhere, the role of the State will need to change to one where it participates less but sets the *rules of the game* under which others provide services. In this new role it will stimulate more competition within and between modes of transport and manage rapidly emerging multimodal transport services. It will need to provide far greater coordination between transport modes than occurs under the present framework, in which each mode is the responsibility of a different ministry or administration. Indicative planning for the sector is still necessary in a market economy (due to the long lead time for, and integrated nature of, new transport infrastructure) but now occurs by default, since only the State Planning Commission has any responsibility in this area. The present vertical structure of the institutions is unsuited to these new roles. There are three options for a new institutional structure:

- create a new **State Transport Commission**, by separating the transport functions of the State Planning Commission;
- create a broad-based **Ministry of Transport**, combining the Ministry of Communications and the Ministry of Railways and incorporating some functions from the State Planning Commission and the Civil Aviation Authority of China; or
- create a **Transport Council**, with representation from all present commissions and ministries involved in the sector.

While each of these has its own advantages, the first would be little different to the present system and leave most of its problems unresolved, while the third, being a new institutional concept in China, would have many startup problems and many overlapping responsibilities with existing ministries that would be hard to resolve. The second option is therefore recommended. However, it would be difficult to implement while the Ministry of Railways is still so closely involved in railway operations. Separation of this function from that of management of the subsector would be a precondition for any institutional restructuring. The main functions of the new Ministry would include

- managing competition policy,
- coordinating sector pricing and regulatory policy,
- planning and coordinating sector activities,
- managing the Transport Investment Fund,
- establishing and implementing infrastructure and vehicle design and use standards,
- facilitating multimodal transport,
- coordinating transport policy with those of other sectors of the economy,
- improving rural accessibility,
- minimizing the negative environmental impacts of transport, and
- increasing the safety of transport operations.

E. A POLICY FRAMEWORK

Satisfying users' needs is the cornerstone of a market-based economy. To achieve this in China's transport sector, more competition is essential. The conditions that foster competition are not yet well developed. With the exception of those in export industries, few users are themselves subject to competitive pressures. In most modes, there are too few independent operators to provide genuine competition; tariffs and regulations are not compatible between modes, and many tariffs are still controlled; finally, protection of existing operators restricts the entry of new competitors and delays the exit of those that are inefficient. Even if more competition were introduced, few users would respond since they have no way of becoming aware of the new opportunities and of how to react to them. Furthermore, many have only a limited understanding of their own cost structure and of the management methods needed to respond to these opportunities.

If the transport system is to be better integrated, operators in the various modes will need to cooperate as well as compete with each other since successful multimodal and container services require a high level of coordination. It is in the realm of freight forwarding that the pivotal balance between competition and cooperation can best be resolved. The role of forwarders is to coordinate and integrate the services offered by competing operators and they need to function in their own competitive environment to fulfill this role. At present, the forwarders market is dominated by two state-owned enterprises (SOEs) that are closely linked to SOE transport operators. This is not a context conducive to competition and coordination.

The basis of transport strategy over the next 15 years will be to address four policy areas so that the sector objectives can be met.

- Stimulate competition within the transport sector itself, so that operators will provide services that users want and are prepared to pay for.
- Adding to capacity so that it does not become a constraint on economic growth.
- Encourage development of inland provinces, and reorient urban development to avoid dependence on motorized transport, and minimize the environmental and social impacts of growth in transport infrastructure and operations.
- Revise the institutional structure to make it compatible with a competitive environment

Policies to achieve the first of these include

- reducing the competitive advantages of transport SOEs compared to private operators;
- removing the remaining controls on transport prices;
- removing barriers to the entry of new operators and the exit of existing inefficient ones;
- stimulating new freight forwarders and constraining the duopoly powers of COSCO and SINOTRANS; and
- simplifying documentation and inspection procedures that inhibit the wider use of containers within China.

Eliminating capacity constraints will be encouraged by

- investing at least 3.6 percent of GDP in transport infrastructure and operations;
- remodeling the system of user charges to better reflect benefits derived from investments; and
- implementing a Transport Investment Fund with private and public participation.

Social objectives will be furthered by policies to

- allocate an increasing share of investment to inland provinces and rural areas;
- complement rapid motorization with policies to encourage public transport use and manage the demand for private vehicle use; and
- strengthen and enforce vehicle emission standards and encourage users to switch to low-polluting vehicles.

The principal institutional policies should be to

- separate the responsibilities of the Ministry of Railways for railway operation from those of managing the subsector; and
- create a new Ministry of Transport and Communications, with specific responsibilities including management of the Transport Investment Fund and a new Transport Safety Board.

I Prologue

Transport provides an essential framework for our national economy. It gives the foundation and serves as a precondition for establishing and developing a socialist market economy. However, transport system capacity falls far behind demand, and that lack of capacity has led the sector to become a serious bottleneck which restricts the development of the national economy. The problems are mostly caused by three factors: inadequate investment, insufficient strength of reform, and problems of management and operation.

*Director, Transportation Department
State Planning Commission of China
December 1993*

Transport is playing a vital role in China's reorientation of its economy, from a planned and centralized system to one that is increasingly dynamic, decentralized, and market-based (World Bank, 1994a). Unless there is adequate physical access to jobs, health, education, and other amenities, the quality of life cannot improve. Without the ability to reach resources and markets, growth stagnates and poverty reduction cannot be sustained. Inappropriately designed transport strategies and inadequately funded programs, such as China has experienced since the opening of the economy in 1979, result in transport systems that fail to provide the necessary conditions for economic growth, which aggravate conditions among the poor, harm the environment, and ignore the changing needs of users (World Bank, 1996g).

Previous sector policies have made achieving these ends particularly difficult. Since investment in the sector has never been adequate, parts of the transport network are seriously congested, while some regions of the country remain inaccessible. Infrastructure bottlenecks and inadequate services are impediments to continued economic growth and increased social welfare. Under the system of planned targets, operational efficiency meant that use of assets was maximized, even when this resulted in poor service. Stimulating competition is only now becoming recognized as a policy priority to encourage efficiency in production and in the allocation of transport demand between modes. Finally, the sector's institutions and policies are uncoordinated and lack a critical, systemwide perspective.

As transport demand shifts from state-owned to private enterprises, new users are increasingly dissatisfied with the services available. Improving them presents many challenges: most importantly encouraging transport operators to be more responsive to users' needs, and investing in enough infrastructure and vehicles to satisfy them. Meeting these challenges will require flourishing competition, compatible pricing and regulation among modes, more widely available multimodal transport services, and more finance for investment.

Even when these challenges are recognized and are being met, it will still be difficult to keep pace with rapidly increasing demand. Massive investment in transport infrastructure and rapidly improving services will be essential to sustain the continued high economic growth needed to satisfy social and economic objectives. Unless the transport sector strategy can overcome its current deficiencies, coping with continued rapid economic growth will be unsustainable. In turn, this would frustrate the achievement of other national policy goals. Therefore, implementing a coherent transport strategy, in

which all elements work together to achieve sector objectives, is fundamental to China's social progress and development.

This report analyzes these challenges and proposes a strategy that will help fulfill China's economic and social goals. If implemented, the strategy presented here will bring about greater competition and enhanced modal integration, more resources for investment, higher-quality services, and greater user satisfaction. At the same time, it will help reduce regional income differentials, improve the sector's safety record, and mitigate transport's negative environmental impacts. The strategy focuses on establishing market and institutional structures that can stimulate competition—while constraining its excesses—and further integrate transport into the productive and social fabric of society. The strategy includes:

- Sector objectives;
- Transport projections and quality requirements;
- A policy framework to help achieve the objectives;
- An assessment of resources needed and the means to generate them; and
- A supportive institutional framework.

A. SECTOR OBJECTIVES

The primary sector objective is to enhance China's economic growth and increasing competitiveness in world markets. This will best be achieved by providing a context that stimulates users to express their demands more clearly, gives operators greater incentives to satisfy them, and creates institutional structures that will facilitate interaction between operators and users. Achieving this will require

- Stimulating competition;
- Promoting development of the transport network to alleviate capacity bottlenecks and provide capacity for economic growth and to open up isolated areas;
- Charging for the use of infrastructure so as to cover long-term social costs, and;
- Implementing institutional reform that recognizes the transport sector as an integrated whole, rather than as an aggregation of independent modes.

Another objective is geared toward reducing income disparities between inland and coastal provinces, as well as between rural and urban areas, one of the main targets of the Ninth Five-Year Plan (9FYP). Although the State is committed to reducing regional income inequalities (Li Peng, 1996), doing so will not be possible until the inland provinces become more accessible. Reorienting road development strategies to put a higher priority on reducing the isolation of rural communities and to providing them with opportunities to move beyond subsistence economies is a more difficult task. Reducing the sector's negative effects on the environment and improving the sector's poor safety record completes the trio of sector objectives.

B. CURRENT MODAL STRATEGIES

Current modal strategies have more limited objectives, which have been reviewed and commented on in several Bank reports issued during the last three years. Although many of the recommendations

made in those reports are being implemented, they lack an overall conceptual framework. The strategy presented here builds upon a number of the reports' common themes and uses them to provide that framework. The short-term investment proposals made here for each mode are broadly similar to those of the 9FYP. However, significant changes in emphasis are made that should improve service quality, reduce inaccessibility, and increase capacity. Long-term investment proposals aim to further enhance service quality, reconstruction, and maintenance of infrastructure.

Highway Infrastructure

Highway infrastructure strategy was reviewed in *Highway Development and Management: Issues, Options and Strategies* (World Bank Report 11819-CHA, June 1993). As outlined in the 9FYP, the main focus of this policy is to extend China's highway network to 1.23 million kilometers (km); complete the most important sections of the four principal corridors of the National Trunk Highway System (NTHS); improve the most heavily trafficked sections of the provincial networks; and build new bridges over the Changjiang and Huanghe rivers. The Bank report recommended the following policies, all of which are being implemented to some extent:

- Restructure current user charges by replacing them with a fuel surcharge and an axle-load charge. This strategy is being implemented on a pilot basis on Hainan Island and is likely to be applied on a national scale;
- Diversify financial sources to include more private funding. A pilot project for a road bridge over the Changjiang River is being prepared for bidding on a Build-Operate-Transfer (BOT) basis, with several other roads packaged into regional networks and assigned to Expressway Companies with "H" shares being listed on the Hong Kong exchange;
- Strengthen transport planning capacity. The State Planning Council (SPC) is developing a national planning model and the Ministry of Communications (MOC) is piloting new feasibility study and investment prioritization methodologies; and
- Improve management and supervision of construction. Various innovative projects to do this are under way, including joint-venture supervision between national and foreign companies.

Highway Transport Operations

A coherent policy for road transport operations is lacking. Instead, individual operators largely are creating their own market environment, without corrections for the distortions resulting from the dominating participation by state-owned enterprises (SOEs). A recent report that addresses this issue (Wilbur Smith and Associates, 1996b) calls for a restructuring of transport SOEs to allow them to compete on a more equitable basis with private operators. The report also recommends establishment of opportunities for management training and a more favorable legal framework for private transport operations. The need to create incentives for multimodal freight transport is also highlighted. While interurban truck and bus tariffs are not strictly controlled, provinces are expected to monitor them to ensure that they do not diverge more than 20 percent from recommended levels.

Inland Waterways

The 9FYP identifies an increasingly important role for inland waterways transport and places priority on upgrading and deepening the Changjiang waterway, the Grand Canal, and the Xijiang River. Investments will be financed from an Inland Waterways Development Fund, sourced from the revenues of an Inland Waterways Construction Fee charged to waterway users, a Port Construction Fee, an additional Waterway and Highway Transportation fee, and the allocation of some of the revenues derived from the Road Vehicle Purchase Fee. So far, there is no policy to improve waterway services.

Railways

Transport investment in the 9FYP focuses on increasing China's railway network to 68,000 km, 34 percent of which would be double-tracked and 27 percent electrified. China Railways (CR) is undergoing a period of rapid technical improvement that will be supported by an institutional and structural reorganization. Studies have been launched to determine the specific changes that should be made. Responsibility for policy and regulatory issues will be increasingly separated from that for operations, and more attractive conditions will be made for the private finance of more railway investment.

Evidence of private financing support comes from the recent formation of two joint-stock railways as pilot projects: the Dalian Railway Company Ltd. and the Guang-Shen Railway Company Ltd. Shares of the latter were oversubscribed when issued, on the Hong Kong and New York stock exchanges. Other pilot projects with different structures (Railway Industrial Corporation and China Civil Engineering Construction Corporation) are being implemented. In addition, domestic railway bonds have already been issued, while issuance of foreign-currency bonds is planned.

Railway tariffs are controlled by the Ministry of Finance (MOF) as part of a national development policy. In aggregate, tariff revenues are planned to be sufficient to cover operating costs, while revenues from the Railway Construction Surcharge (RCS) are planned to cover investment needs. At present, some revenues from the RCS are being used to supplement tariff revenues in order to cover operating deficits.

Air Transport

Air transport services were deregulated between 1985 and 1989 as part of a policy of separating the State's operational and regulatory responsibilities. China Airlines and seven regional carriers were created and remain as public corporations, but private and provincially owned airlines were also permitted, and 19 are already in operation. The Civil Aviation Authority of China (CAAC) retains control over aircraft purchases and leases and uses this control to limit increases in capacity, to ensure that load factors and aircraft utilization do not fall too far below their present very high levels.

Although central responsibility for airport development remains with CAAC, the provinces are increasingly involved in detailed planning, construction, operation and financing (CAAC will support between 20 and 60 percent of the total cost, depending on the role of the airport in the national hierarchy). Air navigation is still the exclusive domain of CAAC and is likely to remain so for the foreseeable future. Although a plan for the development of air navigation facilities exists, there is no overall strategy for airport development. Instead, each proposal is considered on its own merits. The 9FYP's aviation policy emphasizes safety and regular, quality service. To achieve this, substantial additions to capacity are being built at international airports in Beijing, Shanghai, and Guangzhou, as

well as in provincial capital airports, and improvements in facilities for airport management, flight control, fuel supply, and maintenance are under way.

Sector Policy

In December 1993, a seminar was arranged by the Bank in collaboration with SPC to review transport sector policy. Many of the issues that arose during the meeting are covered in more detail in this report. Further seminars were held in October 1995 on Containerization and Transport Logistics; in November 1995 on Urban Transport (not covered here); in December 1995 on Inland Waterways Transport Development [sponsored jointly by MOC and the Asian Development Bank (ADB), with World Bank participation]; in February and December 1996 and October 1997 on the future development of the railways [sponsored jointly by the Ministry of Railways (MOR), SPC, and MOC]; in October 1996 on Highway Safety (organized by MOC and the Organization for Economic and Cultural Development) and the Private Finance of Infrastructure; and in May 1997 on Highway Sector Issues.

This report builds upon the conclusions of the 1993 seminar on transport strategy. It provides proposals for increasing competition and efficiency (Chapter 2), identifies the changing patterns of demand for transport (Chapter 3), and advances the analysis of investment needs of the sector (Chapter 4) and their financing (Chapter 5). Methods to deal with income inequalities and environmental problems related to the sector are also addressed (Chapter 6). An institutional structure more in tune with the future needs of the sector is proposed (Chapter 7). Although most of recommendations presented here are unlikely to be controversial, those relating to the raising and management of sector finance and to changes to the institutional arrangements for the sector, are more so.

2

Competition: The Foundation of Sector Strategy

An economy in transition must cope with two apparently contradictory objectives of the transport sector: maximizing the intensity of use of assets and satisfying the demands of users. The first of these is inherited from the era of China's planned economy. Since output was not subject to considerations of demand (and, therefore, of cost and quality of service), the negative impacts of high asset utilization were largely unimportant and more than compensated for through cost savings. In contrast, the primary objective of the emerging socialist market economy is to produce the quantity and quality of services that users are prepared to pay for. Competition is the means of determining which services are demanded, how and by whom they should be provided, and at what price. From the perspective of a planned economy, this results in a misuse of resources, since it requires more assets to transport a given volume of freight and passengers. From a market perspective, however, it results in a better allocation of resources and greater economic efficiency.

A. CONDITIONS THAT PROMOTE COMPETITION

Competition is the principal means by which a market economy maximizes net social benefits, but cannot do this unless minimum conditions are satisfied. Economies in transition face the dilemma of deciding how fast and how far to meet these conditions and seek the improved service quality of a market economy. Despite recent progress, China's transport sector is further from satisfying these minimum conditions than those of most other transition economies. The foundation of sector strategy should be to create the conditions for competition to flourish. This needs

- many competing operators to offer services they think will satisfy users' demands. This implies a freedom of entry of new participants with a minimum of conditions attached, but also the speedy exit of failed operators without support from the State to perpetuate their presence;
- informed and cost-conscious users (who are themselves subject to competitive pressures) with the freedom to choose the mode, service, and transport operator that best suits their needs;
- freedom of operators to determine their own prices, subject to controls on maximum prices when monopolies exist; and
- compatible regulatory policies between and within modes, applied equitably to different categories of operator.

Many Competing Operators

Although there are many operators in the sector, most of them are SOEs that conspire among themselves to limit competition. Through their dominance, they constitute a barrier to the entry of new operators. In air and road freight transport, where policies to stimulate competition were first applied, a remarkable improvement in service quality and reduction in costs has occurred, which have combined to stimulate high rates of growth. In inland waterways and the railways, the introduction of competitive conditions has been slower, and neither have significantly improved their services nor reduced their operating costs, and their growth has stagnated. Nonetheless, many operators does not necessarily equate with many *competing* operators. Policies to stimulate genuine competition within and between all modes are urgently needed in order to provide users with the full benefits of a market socialist economy.

Limits to competition in transport may take the form of natural monopolies (for example, in the transport of coal from a mine to a power station), geographical monopolies (such as for certain ports) or they may be created to protect companies (mostly state-owned) from competition. Many of these artificial monopolies are now reluctant or unable to adapt to the changing requirements of a socialist market economy. Policies that could accelerate the reform of industrial and commercial SOEs in China are well documented¹ and apply just as well to the transport sector. Implementation is however too slow. If SOEs in the transport sector only adapt at the slow pace of those in the rest of the economy, the lack of capacity and poor quality and high cost of services will be serious inhibitors to continued growth, so sector-specific measures to reform transport SOEs are needed.

Three types of SOEs are important to the transport sector: those that use transport services, making up an estimated 60 percent of the total demand for freight transport; those whose main business is the provision of transport services, such as CR; and those that operate primarily outside the sector but provide transport services as a secondary business (perhaps by utilizing excess capacity from their internal transport fleets). While SOEs of the first type continue to dominate demand and are not themselves subject to competitive pressures, the lack of pressure for better services will inhibit the development of competition among transport suppliers. The second type of SOE is quickly being subjected to competitive pressures, since an increasing proportion of demand comes from private users who are demanding better service. It is the third type of SOE that poses the greatest difficulty to the development of competition within the sector. They can offer services at tariffs below those of operators more committed to the sector (whether SOEs or private) without consideration for their impact on profitability, since they are not subject to market disciplines. They are significant participants in road and water transport, where their presence results in a misallocation of resources and inhibits the emergence of more user-oriented services.

One potential reform would be to require SOEs of the second and third type to enter into compulsory Transition Agreements. These would comprise clearly specified actions and incentives to move them, or at least their transport operations, to becoming market-oriented enterprises within three to five years. In exchange for specified and limited state financial support for reducing their labor force, they would be required to convert their transport operations into self-contained and financially independent units. These would then bid with other operators for the transport contracts of the parent companies as well as compete in the remainder of the transport market. SOEs whose main activity is the provision of transport services would have to bid for transport contracts from the State or from other SOEs in an open and transparent process, but would not be obliged to engage in unprofitable activities. Should any of these be required, they would be bid on the basis of negative prices and awarded to the company requiring the least State support to bring the value of the contract up to an acceptable level. These Transition Agreements would be very different to the generally unsuccessful Operating Agreements used in other countries in an attempt to introduce a semblance of market discipline to state-owned utilities.²

China Railways has further to go than other SOEs in meeting the conditions for competition. Attempts in other countries to introduce competition within the railway sector have not been very successful. The most frequently used model to make monopolistic state railways more competitive has

¹ *China's Management of Enterprise Assets: The State as Shareholder*, World Bank, Report No. 16265-CHA, March 1997 and *China: Reform of State-Owned Enterprises*, World Bank, Report 14924-CHA, June 1996.

² *Bureaucrats in Business*, World Bank, 1995.

been to break them into regional operations, which are then concessioned for periods from 10 up to 50 years. Despite its other virtues, this once-in-a-generation competition for a concession does not increase the number of operators within a region and so fails to satisfy this criterion for competition within the mode. In addition, this model would be difficult to implement in China, given the large size of the regional railways and the impracticality of allowing foreign operators to control railway infrastructure. More applicable to China, and potentially more successful in terms of introducing competition within the mode, are systems that open railway infrastructure to additional qualified operators. Although this model has drawbacks, principally with regard to the regulation of potentially large numbers of operators, there are technical solutions to these problems, whereas those of regional concessions are inherent in the model. MOR has launched a review of alternative restructuring options, scheduled for completion by the end of 1998. Implementation of its recommendations should begin by the end of 1999.

Transport operators are already largely free to offer the services they think will be profitable, with the notable exception of CR. Tariff restrictions on CR render many potential new services unprofitable or unfeasible. For example, the regulated rail tariff for containers results in charges about 30 percent higher than for the same products transported by conventional means. However, until users of the transport system, most of which are still SOEs not subject to the rigors of competition, face more competition within their own markets, they will not demand the regulatory changes that would permit such new and innovative services. In anticipation of such pressures, all remaining operating and tariff restrictions on new railway services should be removed.

It is not enough that there be an adequate number of operators in a particular mode or within the sector as a whole. The conditions must also exist for new operators to start up and for existing operators to fail. Although there are few formal barriers to the entry of new operators, informal barriers are formidable. Established operators, mostly SOEs, have long exercised monopoly powers and have a close relationship with the government, giving them special access to capital and favorable relationships with major customers, also SOEs. While the finances of such operators continue to be managed on a noncommercial basis, they can provide services below cost and manage to stay in business even with insufficient revenues. Many are industrial and service conglomerates that utilize both direct and cross-subsidies to support uneconomic transport activities. Because this privileged position makes it difficult for new operators to compete effectively, the State should take positive actions to modify it. These could include making new avenues of unsubsidized capital available to startup operators, encouraging new joint ventures with foreign operators, as well as implementing the proposed Transition Agreements for transport SOEs.

Informed and Cost-Conscious Users with the Freedom to Choose Services

As China's economy grows and diversifies, the number of users and their awareness of alternative transport methods will increase. The SOE share of gross domestic product (GDP) has fallen to less than 35 percent, while that of individually and "other" owned enterprises has increased to more than 25 percent. The nonstate share of industrial output has increased from less than 25 percent in the late 1970s to more than 65 percent by 1995.³ At the same time, foreign direct investment (FDI), an indicator of the international competitiveness of the economy, has increased from almost nothing to more than \$35

³ *China Statistical Yearbook, 1995*

billion per year.⁴ Meanwhile, transport decisions of large agricultural, mining, and industrial SOEs continue to be based on strategic rather than commercial considerations. This means that large segments of the transport industry do not yet demand low-cost, efficient services, but the situation is beginning to change.

Since few users operate in a competitive context, the limited amount of service information available to help them make well-informed choices is not yet a serious problem. It is however indicative of a lack of cost-conscious users. International joint-venture manufacturers, the recipients of much FDI, are subject to strong competitive pressures, and therefore demand more from their transport suppliers than national enterprises.⁵ As joint ventures begin to account for an increasing proportion of industrial output, their demands for better services and better information with which to make transport decisions will have a strong impact on providers of transport services.

Operators Who are Free to Determine Their Own Prices

The remaining state controls on transport tariffs continue to inhibit the emergence of genuine competition. As such, they should be eliminated, except for those that restrict monopoly pricing. Rail freight tariffs still require ratification by the State Council before they can be changed, which makes it difficult for railways to offer new services at rates that would allow better service, attract new traffic and improve the railways' worsening financial position. Road freight and inland waterway tariffs are subject to controls in the range of plus or minus 20 percent of locally established advisory tariffs. These limits are, however, no longer strictly enforced and serve no useful purpose. Controlled tariffs in one mode make it difficult for operators in other modes to compete effectively. Domestic air passenger tariffs until recently were regulated in order to restrict airlines' monopoly powers.⁶ On some routes, controlled air fares are lower than comparable rail fares, exacerbating the railways' financial problems (in 1996, rail passenger traffic fell by 9 percent).⁷ It would be more efficient to stimulate more competition between airlines, reducing the scope for monopoly pricing, than trying to control the monopolies.

One of the principal advantages of allowing operators to set their own prices is that ensuing price discrimination can result in levels of asset utilization as high as those to those found in a planned economy. Freight railways, interurban bus operators, and passenger and freight airlines operating in market economies have developed sophisticated techniques for maximizing the revenue yield of their assets based on price discrimination. Increased freedom to apply these techniques could bring about lower logistics costs, since companies that suffer from delays would be prepared to pay more for faster and more reliable services, while those that are unconcerned with time would benefit from lower tariffs. Since constraining capacity can also be used by operators to force up prices when other competitive conditions are not present, some regulatory protection of users is needed to balance the increased freedom of operators to set tariffs.

⁴ *China Statistical Yearbook, 1994*, quoted in *China: Reform of State-Owned Enterprises*, Report 14924-CHA, World Bank, June 1996.

⁵ *Far Eastern Economic Review*, February 1996.

⁶ Domestic air passenger tariffs were deregulated in November 1997.

⁷ *Economic Statistics Communiqué for 1996*, Statistical Bureau, April 1997.

Compatible Pricing and Regulatory Policies

Transport pricing and regulatory policies play important roles in the efficient allocation of demand and resources among modes and services. Through this, they can indicate where additional investment and operational resources are needed, but they must be consistent between modes for this to occur. As long as the economy is in transition and this consistency is absent, total demand and its distribution among modes is distorted, resources are misallocated, and investment decisions are based on misleading signals. Inconsistencies bringing about these distortions include continued regulatory allocation of demand for strategic products, different bases for infrastructure charges, tariffs controlled or unrelated to costs due to operators' lack of knowledge, cross-subsidies between services and clients, and a lack of competition in users' own markets. With high investment needs and a scarcity of financial resources, suboptimal investment decisions based on these misleading demand signals result in a costly yet avoidable waste of resources.

After the effects of controlled prices, the greatest distortions of market policies arise from the strategic allocation of demand to specific modes, irrespective of their relative costs. These allocations (for example, of coal to rail transport and all short-distance freight to road transport) are made in an attempt to simulate the effects of competition. As in the case of regulated air tariffs, important negative consequences are that revenue that could be used to increase capacity is lost; rail users are forced to suffer avoidable congestion and delay; road users are negatively impacted by underinvestment because too much demand is allocated to rail; and road investment is constrained through lack of revenue generated by user charges. Regulations that allocate demand among modes should therefore be replaced by market-based tariffs. These would achieve more economically efficient distributions, signaling where new infrastructure capacity can best be provided, and allowing the generation of user charge revenue sufficient to finance it.

Further distortions to market conditions arise from inconsistent infrastructure charging between modes. Although each mode now has a specific charge for the use of infrastructure, these are neither determined nor applied on a consistent basis. They are used almost exclusively as revenue-generating, and not demand-management, devices. In some modes, they generate surpluses that finance unjustifiable or marginally justifiable investments, while in others, their revenues are diverted to cover operating deficits. An institutional restructuring of the sector should result in the creation of an agency that would ensure the compatibility of infrastructure user charges and the application of their revenues.

The practice of charging for use of state-owned or controlled infrastructure must satisfy three, sometimes contradictory, objectives. First, economic theory indicates that the most efficient allocation of demand arises when users are charged the short-run marginal costs of infrastructure use. Second, revenues should cover total costs, but charging only at marginal costs would not generate sufficient revenue; and, third, all users should be subject to the same set of charges. The recommended solution to this conflict is to adopt a form of Ramsay pricing, in which charges are set at levels that generate sufficient revenue to cover investment, maintenance and operating costs, but are inversely proportional to price cross-elasticities, so as to minimize distortions from marginal cost pricing. This policy can conflict with poverty alleviation and income equalization objectives, when the resulting prices are beyond the reach of low-income users, or are excessively high on low-density routes that give access to remote areas. It should therefore be used as a principle of charging and not applied indiscriminately.

B. MULTIMODAL TRANSPORT

While increasing competition should become the foundation on which transport strategy is built, container and other multimodal services are a special case. They not only require intensive competition between freight forwarders, the final providers of services to users, but also strong coordination between operators in different modes. Rapid integration of the Chinese economy into the international trading manufacture network and of more export products in inland provinces will give increasing importance to efficient container transport. Although the physical conditions of genuine intermodal competition for container transport already exist in some corridors, institutional and informal institutional barriers are formidable. (See Box 2.1.) Simultaneous achievement of more intermodal coordination and freight forwarder competition would be the single most beneficial short-term measure to provide better freight services.

BOX 2.1: A CONSEQUENCE OF BADLY ORGANIZED MULTIMODAL TRANSPORT

When two white rhinos left Pittsburgh Zoo in 1996 for Chengdu, China, newspapers from Iowa to Florida covered the story. But the rhinos never made it to their new home. After being flown to Shanghai, the rhinos were handed over to the staff of Chengdu Zoo for what was supposed to be a 1,600 km rail trip to their new home. Instead they were loaded into trucks where they died, probably of exposure or dehydration during the long journey.

The market for freight forwarding is still a closely controlled state duopoly: two SOEs account for more than 80 percent of activities associated with this type of business (World Bank, 1996b) and control access to rail services as well as to inland container terminals. Through connections with other large transport sector SOEs, particularly CR, they have until recently effectively excluded competition for multimodal transport and hindered the growth of container services beyond the immediate environs of the deep-water ports.

Breaking up such a strongly institutionalized duopoly will be feasible only when pressure from users makes doing so politically desirable; there is some evidence that this point is being reached. The most promising way to do this is to permit and encourage joint ventures and other forms of association among national and foreign freight forwarders. These new ventures will have a level of access to multinational companies operating in China comparable to that of the present duopolists to SOEs. While some such joint ventures are already being formed with foreign shipping lines as the overseas partner, their effectiveness is being frustrated by their having to use the China National Foreign Trade Transportation Group (SINOTRANS) as an intermediary to gain access to CR.

C. INTRAMODAL COMPETITION

Competition already exists in road transport among small private operators and SOEs, collectively owned enterprises, and township and village enterprises. A recent study of the road transport industry (Wilbur Smith, 1996b) points to large differences in the cost structure of private and publicly owned road transport companies. While the latter enjoy considerable advantages in access to and charges for credit, and in making transport contracts with other state companies, they also suffer disadvantages, in particular, high staffing levels and inflexible unit labor rates, both of which are difficult to reduce. Reducing the formal advantages of publicly owned transport operators requires little more than political will, but the informal advantages will endure as long as most of them have SOEs as their principal clients. The proposed Transition Agreements would make a start in making competition between public and private transport operators more effective.

Companies with a high proportion of FDI are dissatisfied with services offered by trucking companies, and many have established their own inhouse transport capabilities. This appears to be an unavoidable step toward the creation of a truly competitive and efficient industry, as shown by the experiences of other countries that have restructured their road transport industry (World Bank, 1994f). If the use of inhouse services becomes widespread, there will be little demand for the services of commercial trucking companies, which will then be forced to become user-responsive or go out of business. At this point, a truly competitive road freight industry could emerge. Justification for inhouse services would weaken as commercial operators become more efficient and the market expands through the release of trucks previously owned by the relatively inefficient inhouse operators. The proposed Transition Agreements speed up this process by eliminating the protective advantages of publicly owned operators, making the inhouse road transport services of SOEs more independent, and encouraging them to become user-oriented more quickly through having to bid for contracts, even from their parent companies.

Following the restructuring of CAAC in 1987 and the creation of regionally based airlines, limited but productive competition in service quality has resulted despite the fact that fares are still regulated. While many domestic air routes have more than one operator, there appears to be an uncompetitive degree of cooperation among airlines, particularly in capacity sharing. Although this may have been justified when capacity was limited, this situation is being rectified through a massive program of investment in new aircraft and airports. Genuine competition among airlines should now emerge, with CAAC acting as stimulator of competition, opposing the perpetuation of agreements that constrain competition. Operating and revenue-sharing agreements between domestic airlines should be prohibited. Furthermore, in a competitive air transport market, CAAC's continued regulation over aircraft purchases is no longer necessary or justifiable.

While the volume of rail transport and its density in many corridors is sufficient to maintain more than one operator, political backing remains inadequate for policies that would introduce genuine competition between rail operators. Support for the further decentralization of railway administrations is increasing, which could result in greater competition in the future depending on how it is managed. In the meantime, removing the barriers to competition among freight forwarders and allowing them to contract with CR for the operation of private trains will indirectly help expand railway competition.

D. STRATEGIES TO INCREASE COMPETITION

Taking advantage of the many opportunities to increase competition is the greatest challenge facing the transport sector. If these opportunities could be realized, the result would be lower operating costs and tariffs, improvements in service quality, and a transport system more attuned to the needs of its users. A necessary precondition for success is a new institutional structure, which recognizes both the need for more competition and the advantages of greater coordination, and has a strong policy rather than operations orientation. In Chapter 7, the creation of a new Ministry of Transport and Communications (MOTC) is recommended as the best way forward in this respect. The elements of strategy founded on stimulating competition would include:

- subjecting SOEs that undertake transport activities to enforceable Transition Agreements;
- requiring SOEs whose main activities are in other sectors to make their transport departments and operations independent and to contract for their transport requirements;

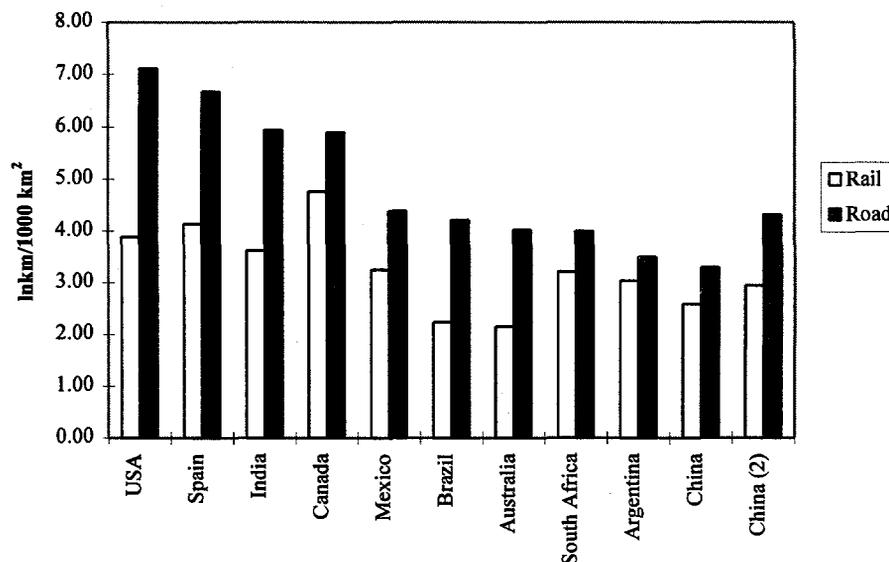
- completing the review of alternatives for introducing competition into railway operations and implementing its agreed recommendations by the end of 1999;
- removing remaining controls over transport tariffs, other than where monopoly conditions persist;
- replacing remaining regulations that allocate freight to specific modes with market-based pricing policies;
- creating an institution to rationalize user charges for infrastructure; and adopting Ramsay pricing as the principle behind charging for infrastructure;
- removing barriers to joint ventures and other forms of association between national and foreign freight forwarders;
- allowing freight forwarders to contract with CR for the operation of private trains; and
- ending capacity and revenue-sharing agreements between domestic airlines, as well as CAAC's regulatory control of new aircraft purchases.

3

Transport Demands of a Competitive Economy

Since the early 1980s, transport demand has grown much faster than capacity and the ability of the system to deal with it. This has led to increasing bottlenecks and delays, declining quality of service, and an enormous backlog of deferred investments. Compared to other countries, road and rail network density in China is still very low, particularly when measured on an area basis. For example, the density of China's road network is at present less than 3 percent of that of the United States. Implementation of the investments suggested in the next chapter would increase this to almost 7 percent by 2010 (Figure 3.1).

FIGURE 3.1: INTERNATIONAL COMPARISONS OF INFRASTRUCTURE DENSITY



- Notes: (a) China (2) is for 2010 after implementation of the recommendations made here.
 (b) Area is calculated on the basis of Total Area less "other use" area. It is similar to arable area.
 (c) Vertical scale is logarithmic.

Source: *World Development Report*, World Bank, 1994.

The transport sector's lack of capacity has been somewhat compensated for by the very high utilization of infrastructure and vehicles, with rates now so high that they mitigate against improving service quality. As users demand more and better transport services, this lack of capacity and declining quality of service will become even more restricting unless investment is significantly increased. Estimating how much capacity to provide, of what type, in what mode, and in what location, is an imprecise process because it depends on projections of macroeconomic parameters that are subject to large margins of error and others specific to the transport sector, such as modal preferences, that are themselves uncertain.

However, the shortage of finance for infrastructure, the long lead time for its implementation, combined with its long life and high costs, put a high premium on efficient investment prioritization and this in turn depends on having reliable demand projections available. Even in the best of circumstances,

these projections are difficult to make and unreliable other than as indicators of orders of magnitude. Quantifying the probability of a given projection becomes increasingly difficult the further into the future and the more detailed it is. For the aggregate demand projections relating to the year 2010 presented here, there is a range of certainty of about plus or minus 25 percent, with an 85 percent level of confidence. For projections of particular products or modes of transport, the certainty of plus or minus 35 percent for this same level of confidence [for example, for the estimated demand for 1,442 billion ton-kilometers (tkm) of transport of agricultural production in 2010, shown in Table 3.3, there is an 85 percent probability that the total will turn out to be between 937 billion and 1,947 billion tkm].

Five long-term trends are evident in the projections of demand:

- freight transport will grow more slowly than the economy;
- passenger transport will grow more quickly than the economy;
- the infrastructure and assets needed to satisfy a given level of transport demand will increase as users demand higher-quality service;
- the share of road transport will increase at the expense of rail, the extent depending on the rail sector's response to a more competitive environment; and
- demand for multimodal transport services will grow faster than for single-mode services.

A. DEMAND FOR FREIGHT TRANSPORT

Not only has China's economy been growing at record levels for the last 15 years, it is expected to continue at a high, if somewhat lower rate in the foreseeable future. The structure of the economy, while remarkably stable with high growth, is also changing rapidly and has exhibited an increasing emphasis on light industry and the service sector (World Bank, 1997c). Expected total demand for freight transport results from adding together that for each economic sector, taking account of their transport intensity, the quantity of transport needed to produce each unit of their final output. A particular feature of the Chinese economy has been its consistently high transport intensity (Table 3.1), which is likely to decline in the

TABLE 3.1: FREIGHT TRANSPORT INTENSITY

Transition Economies	Freight Transport Intensity	Market Economies	Freight Transport Intensity
Former Soviet Union	3.59	Canada	0.74
China (a)	4.58	United States	0.64
China (b)	3.57	India	0.51
Poland	0.86	Australia	0.40
Czechoslovakia	0.82	Spain	0.37
Bulgaria	0.72	Holland	0.34
Hungary	0.58	Sweden	0.32
Yugoslavia	0.48	France	0.22

Note: Data refer to 1989. The Freight Transport Intensity index is calculated as freight tkm per dollar of GDP, purchasing power adjusted. China (b) excludes international shipping.

Source: *What Determines Demand for Freight Transport?* Policy Research Working Paper 998, World Bank, October, 1992.

future but still remain higher than in competing economies. Although conclusions based on international comparisons should be made with great caution, the high freight transport intensity of China's economy requires explanation, particularly when it is used as a parameter to forecast future demand. Planned economies have three characteristics that result in their having higher freight transport intensities than market economies: the way that industrial location is determined; the structure of the economy; and the reliability of transport data. China exhibits two additional characteristics that impact on transport intensity: its high proportion of domestic transport and its dependence on coal as a source of primary energy.

Industrial Location Decisions

Industrial location decisions in planned economies are based more on social and political considerations than cost minimization. As a result, average transport distances for raw materials to production centers and of their output to areas of consumption are relatively long in comparison with those of market economies. As China's economy moves more toward a market structure, transport cost will become more important in industrial location decisions, so transport distances and therefore freight transport intensity will decline. A smaller but contrary influence will come from the policy to encourage new industry to locate in inland rather than coastal provinces.

Structure of the Economy

Planned economies have emphasized primary production that is highly transport-intensive, rather than manufacturing and services that are less so. China has exhibited remarkable stability over time in its economic structure, particularly the proportion of industrial output that comes from primary industry. It is projected that light industry will grow rapidly in the near future, but this will be outpaced by growth of the service sector by the end of the period. While agriculture is the slowest-growing economic sector, together with services, it is the only one with a projected increase in transport intensity. These changes will result in a continuation of the decline in transport intensity observed over the last 10 years or so, and this will be accentuated by a decline in the transport intensity of each of the sectors themselves.

Statistical Reliability

In planned economies, a high proportion of freight is transported by a small number of state enterprises, which tend to exaggerate their output but to keep complete statistical records. In market economies, transport services are provided by a larger number of private enterprises, which tend to underreport their activity and to keep incomplete records. So as a transition economy, such as that of China, comes to depend more on private transport and the role of SOEs in transport diminishes, reported freight transport intensity will decline more quickly than actual intensity. This is already apparent in the preliminary transport statistics reported for 1996 (State Statistical Bureau, April 1997), which show reductions of 14 percent in freight transported by road and 3.3 percent by waterway (both increasingly carried out by private operators). At the same time, rail transport (still overwhelmingly the responsibility of CR) increased by 1.4 percent, while the economy grew at just under 10 percent in real terms. It is possible that these figures indicate a large and rapid reduction in the freight intensity of the economy and a reversal of the long-term shift in modal choice toward road transport. However, a more plausible explanation is that an increasing proportion of road and waterway freight goes unreported, while rail freight continues to be accurately recorded or even exaggerated.

Additional Factors That Impact Transport Intensity

Because of China's large size, much transport activity is domestic and therefore included in statistics of transport output, which in smaller countries would be recorded as international movements. The impact of size will decrease over time as the economy becomes more oriented to foreign trade, which is projected to increase from an already high 42 percent of GDP in 1994 to almost 47 percent by 2010.

The high energy intensity of the economy, the use of coal as a principal energy source, and the location of coal deposits far from centers of industrial production and population are other specific factors that contribute to high transport intensity. In 1995, China required about 1.8 kilograms (kg) of coal equivalent for each US dollar of gross output, and coal provided about 78 percent of these needs (World Bank, 1997a). Coal accounted for about 10 percent of transport demand when measured in tons but for more than 21 percent of the total in ton-kilometers (tkm), because the average distance over which it is transported (576 km) is longer than the average (268 km) for all freight.⁸ As the structure of the economy moves more toward light industry and services, its energy intensity will fall to about 1.1 kg of coal equivalent by 2010. Also, as other energy sources are developed, coal's contribution to this total will fall to about 64 percent over the same period (World Bank, 1997a). The washing of coal before it is transported, and increased generation of electricity close to coal sources, will both contribute to a lowering of coal's share of transport demand. The net effect of these changes will be a substantial contribution to reducing the freight intensity of the economy (World Bank, 1995b).

Demand Projection

If ocean shipping is excluded, China currently requires 3.72 tkm of freight transport for each \$1 million of GDP, a reduction of 30 percent since 1984. The impact of projected changes in the intensity of particular economic sectors and the structure of the economy will be a further reduction of 15 percent to about 3.17 by 2010 (Table 3.2). The net impact of these changes, together with that of the growth of the economy, will be an increase in the demand for freight transport of about 6.4 percent per year during the period 1995-2010. The 2,506 billion tkm of freight transported in 1995 (excluding ocean shipping) is projected to increase to 6,251 billion tkm by 2010 (Table 3.3).

TABLE 3.2: STRUCTURE OF THE ECONOMY AND FREIGHT TRANSPORT INTENSITY

Economic Sector	1995		2000		2005		2010	
	Percentage of GDP	Freight Transport Intensity						
Agriculture	19.0	5.00	15.9	5.52	13.1	6.09	10.9	6.73
Mining	1.5	8.00	1.5	7.05	1.5	6.60	1.4	6.28
Heavy Industry	25.0	6.00	25.2	5.42	24.1	5.04	21.9	4.80
Light industry	18.0	4.00	19.7	3.71	21.1	3.51	22.1	3.39
Other industry	8.5	3.50	9.4	3.16	10.5	3.04	11.2	2.96
Services	28.0	0.48	28.3	0.50	29.7	0.57	32.5	0.66
Average freight intensity		3.72		3.52		3.34		3.17

Sources: *China Statistical Yearbook*, 1995.

China: Transport Investment Model, World Bank, 1998a (for projections)

⁸ *China Statistical Yearbook*, 1995.

International Trade

Projecting the transport needs of international trade involves projecting four categories of imports and exports—bulk solids, bulk liquids, general freight, and containerized freight—each of which requires different port facilities. The proportion of GDP represented by international trade is projected to increase, with the share of imports and exports expected to rise from 20.4 and 22.8 percent, respectively, in 1994, to 22.1 and 24.8 percent by 2010. Unit values per ton are also expected to increase, from \$1,100 for imports and \$900 for exports in 1994, to \$1,600 and \$1,300 by 2010. The combination of these two factors results in a projected increase in the volume of imports and exports from 116 and 158 million tons in 1994, to 281 million and 384 million tons by the end of the period, representing an average annual increase of 6 percent. The projected increase in domestic shipping, also needed to plan for port requirements, is from 393 million tons in 1994 to 1,039 million tons in 2010, an average annual increase of 6.7 percent.

TABLE 3.3: FREIGHT TRANSPORT DEMAND BY ECONOMIC SECTOR

Sector	1995	2000	2005	2010
Billion tkm				
Agriculture	639	859	1,126	1,442
Mining	81	104	137	175
Heavy industry	1,010	1,342	1,710	2,075
Light industry	485	716	1,042	1,479
Other industry	200	292	451	654
Services	91	140	239	427
Total	2,506	3,453	4,707	6,251
Percentage				
Agriculture	25.5	24.9	23.9	23.1
Mining	3.2	3.0	2.9	2.8
Heavy industry	40.3	38.9	36.3	33.2
Light industry	19.3	20.7	22.1	23.6
Other industry	8.0	8.4	9.6	10.5
Services	3.6	4.0	5.1	6.8
Total	100.0	100.0	100.0	100.0

Source: China: Transport Sector Investment Model, World Bank, 1998a.

Containers and Multimodal Transport

Demand for transport by containers will grow much faster than for freight transport as a whole. Because China's international competitors are more advanced in the containerization of export trade, adaptation by the transport sector to container requirements is crucial to increasing international competitiveness. The proportion of domestic freight tkm that is suitable for container transport will expand to more than 32 percent by the end of the analysis period, an almost threefold increase since the early 1990s.

Multimodal transport will become increasingly important for containerized industrial products, as well as for bulk minerals and agricultural products. The extent to which it realizes its potential will depend on the opportunities open to operators and freight forwarders to take advantage of the services it

can offer. They are more likely to do so if they can compete among themselves. Without a more favorable institutional and commercial context, many opportunities for increasing multimodal transport will be lost. The current structure of transport systems and the lack of effective freight forwarders impede the development of these services. A systems approach, which views transport as a single system rather than as a collection of independent modes, will be fundamental in realizing the potential of multimodal transport.

B. DEMAND FOR PASSENGER TRANSPORT

Demand for passenger transport was severely constrained by a lack of capacity and restrictions on personal mobility until the middle of the 1980s. Since then, scarce rail capacity has continued to be largely reserved for freight transport, and bus and air passenger services have expanded rapidly to fill the gap. In the last five years, rail passenger transport has increased by only 5 percent while bus passengers have increased by 12 percent and air passengers by more than 60 percent. However, the continuing low intensity of passenger transport output reflects an ongoing lack of capacity. By 1994, Chinese residents made an average of nine interurban trips per year, with a travel intensity of 1.39 km per dollar of GDP.

Passenger demand will increase as capacity constraints are reduced and individuals' propensity to travel increases more than in proportion to increases in personal incomes. Travel distance per person increases relatively slowly as income increases, until a threshold is passed, from which point the propensity to travel increases more rapidly. There is a double impact on total demand when average incomes approach this level, as the increased individual propensity to travel is compounded by a rapid increase in the number of people who have this level of income. The income intensity of domestic passenger travel is projected to increase to 1.64 km per dollar of GDP by 2010. When combined with the projected increase in GDP itself, this will result in an average increase of more than 9 percent per year in personal travel, to a total of 3,400 billion passenger-kilometers (pkm) per year.

TABLE 3.4: PROJECTION OF PASSENGER TRAVEL DEMAND

	Units	1995	2000	2005	2010
GDP	\$ billion	673.5	980.4	1,407.5	1,974.1
Population	Million	1,211	1,279	1,351	1,427
GDP per person	\$/person	556	766	1,056	1,456
Personal travel	km/person/year	1,650	1,734	1,823	1,916
Total travel	billion pkm/year	936	1,440	2,213	3,403
Travel intensity	pkm/\$ billion	1.39	1.47	1.55	1.64

Source: China: Transport Sector Investment Model, World Bank, 1998a.

C. MODAL ALLOCATION

Projections of modal choice are instrumental in planning for future infrastructure and service needs. Given the acute shortage of available funds, investments should be made where they will have the greatest impact on capacity and service quality. The efficient allocation of demand among modes provides an appropriate basis for determining where future investments would best be made, and this requires that tariffs reflect long-term social costs. A prerequisite for this allocation to be efficient is that modal choices are not influenced by government decisions or by regulations that circumvent tariff-based

decisions, since modal choices in a market economy are largely made on the basis of relative prices and service quality.

Freight

The most significant change in freight transport costs over the next 15 years will be in road transport. The development of an interurban network of four-lane divided highways will allow the widespread use of large, articulated trucks and/or truck-trailers, which have operating costs less than half those of today's widely used medium-size trucks. Rail operating costs are likely to increase as investments are made to improve service quality and to reduce the present excessive utilization of assets, although the combination of higher tariffs and better quality will be more attractive to users than current low tariffs and poor-quality services. A greater realization of the many advantages of inland waterways, which have been neglected as a low-cost transport mode for bulk products, will be reflected in competitive tariffs and more efficient intermodal transfers in river ports. Investment in shiplocks will reduce the incidence of long and unpredictable delays.

Road transport is expected to increase its share of total tkm from its current level of 20 percent to more than 37 percent by 2010, as the advantages of the new interurban highway network and the use of more efficient vehicles are reflected in lower road tariffs. Inland waterways will also increase their share from less than 5 percent to almost 8 percent over the same period, particularly for longer distances and in combination with other modes. Where available, waterways offer the lowest costs for most bulk freight movements and, in combination with rail, can provide the least overall cost option for about a quarter of all coal movements. Rail transport will continue to increase in absolute terms, doubling its output in tkm by 2010, but by that time its modal share is expected to have declined from its current 52 percent to less than 35 percent. Air and pipelines will continue to account for less than 3 percent of total demand, while coastal shipping will retain its 20 percent share.

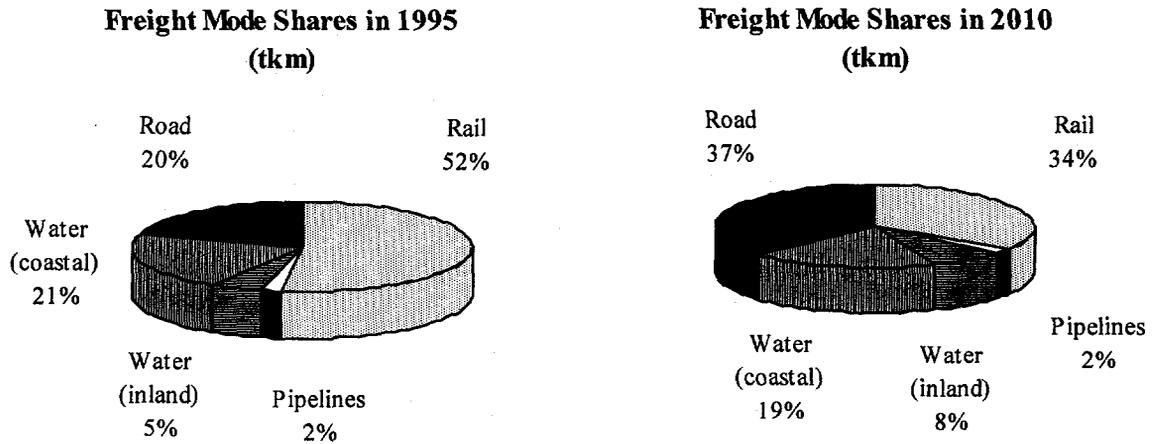
Whether or not rail will retain even its projected share of modal allocation depends on how far it responds to the competitive environment in which it will be operating. Evidence to date has not been encouraging with a long-term, continuous decline in its modal share from over 60 percent of tkm as recently as 10 years ago. Experience of railways in other countries that have faced a similar situation provide an even less positive prognosis, although where institutional reform has been effective, encouraging redress of previous losses has occurred. There is little time for CR to adapt to the new situation before it faces the full force of road competition upon completion of the NTHS within the next 5 to 10 years. The traffic that is potentially most profitable to CR is also that most susceptible to competition: high-value, long-distance, time-sensitive industrial and consumer products. If CR fails to retain a significant segment of rapidly growing demand in this area, its modal share could fall to less than 30 percent.

Passengers

Travel time and convenience figure highly in passengers' modal choice. Access to automobiles will be an increasingly important factor in their decisions, at least for trips of distances up to about 500 km. Within the next 15 years, many passengers will have four transport modes to choose from for trips over these distances—private car, bus, rail, and air, but bus and car (where available) will be the most competitive. Bus, rail, and air will compete for trips between 500 and 1,000 km, and rail and air will be

the main choices for longer trips. Waterway transport will continue to be the mode of choice in only about 2 percent of total pkm.

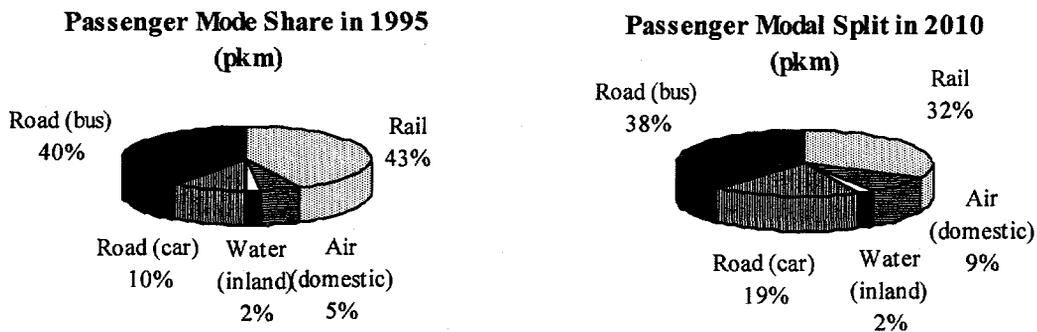
FIGURE 3.2: MODAL ALLOCATION OF FREIGHT OUTPUT (PERCENT)



Source: China: Transport Sector Investment Model, World Bank, 1998a.

Overall, the share of interurban passenger trips made by car is likely to double to almost 20 percent by 2010. Air transport will continue to increase its modal share to nearly 9 percent by that time, from 3 percent in 1990 and more than 5 percent in 1995. As with freight transport, total rail demand will increase even as its modal share decreases, from about 50 percent in 1989, to 42 percent by 1995, and just over 30 percent by 2010. These changes in modal allocation will be accompanied by an increase in average trip length to about 250 km by the end of the analysis period, from 157 km in 1995 and only 121 km in 1989.

FIGURE 3.3: MODAL ALLOCATION OF PASSENGER OUTPUT (PERCENT)

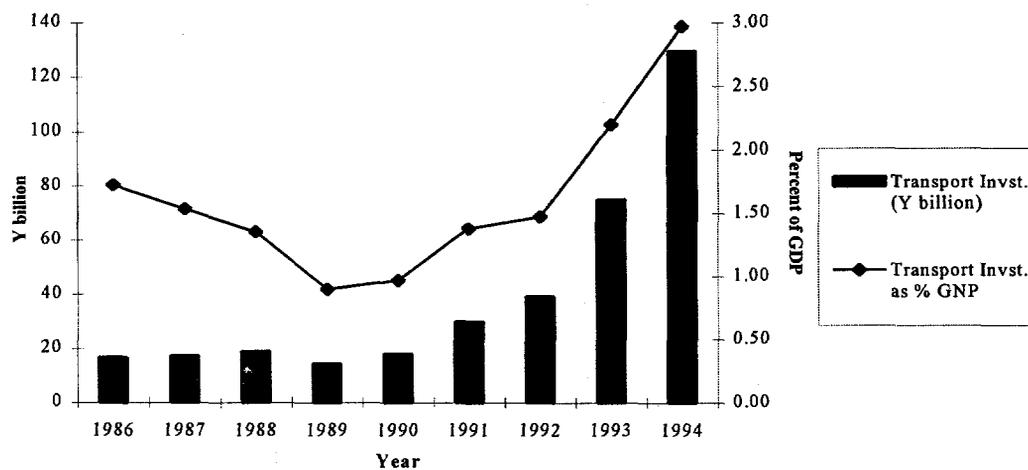


Source: China: Transport Sector Investment Model, World Bank, 1998a.

4

Transport Investment: Standards and Compromises

Future sector investment will require a compromise between the desirable and the affordable. Unless this balance is better managed over the next 15 years, continued growth of the economy will be hampered by a lack of transport capacity that will in turn limit operator's scope to improve service quality. During the 1980s, China invested record low proportions of its GDP in transport, averaging less than 1.3 percent and reaching a minimum of 0.9 percent in 1989 (World Bank, 1993a). A recovery started during the 8FYP and investment reached almost 3 percent of GDP in 1995. This was, however, inadequate to offset the early pattern of underinvestment, which has resulted in an unsustainably high level of asset utilization and an enormous investment backlog.

FIGURE 4.1: TRANSPORT INFRASTRUCTURE INVESTMENT

Source: *China: The Achievement and Challenge of Price Reform*, 1993 and "China: Country Economic Memorandum," 1994.

The strategy proposed here is to substantially increase investment in the short and medium terms to eliminate most of the capacity constraints, allowing a later return to investment levels more in line with those of other countries. A minimum annual average investment of 3.6 percent of GDP will be needed for the next 15 years to make a significant impact in meeting the investment objectives. This rate of investment is significantly higher than earlier World Bank estimates of 3 percent (World Bank, 1994d), and much more than some independent estimates (Peregrine, 1994; EIU, 1995). (See Table 4.1.) None of these other estimates explicitly indicate what investments are included, what levels of asset utilization are expected, whether making up for previous underinvestment is considered, or whether social and economic objectives are taken into account.

Three principal investment objectives are recommended:

- to provide sufficient capacity to meet demand (Chapter 3);
- to provide the quality of service demanded in a competitive economy (Chapter 2); and
- to help overcome the relative isolation of inland provinces and rural areas so that they can fully participate in and benefit from projected economic growth (Chapter 6).

TABLE 4.1: ESTIMATED TRANSPORT INVESTMENT REQUIREMENTS
(\$ billion)

	World Bank, 1994d (1995-2004)	EIU (1995-2000)	Peregrine (1994-2000)	World Bank, 1997 (1996-2010)
Roads	n.a.	36.7	52.1	505.0
Railways	n.a.	42.1	6.9	135.0
Ports and waterways	n.a.	7.7	9.2	29.0
Air	n.a.	3.4	2.9	29.0
Total	302.0	89.9	111.1	698.0
Annual average	30.2	15.0	15.9	46.9

Sources: World Bank (1994d); Economist Intelligence Unit (1993); Peregrine (194); World Bank (1997)

The analysis presented here aims to indicate the investment level necessary to achieve these objectives, and to what degree they could be met with a lower but more sustainable level of investment. It does not provide an investment plan, nor does it identify, recommend, evaluate, or otherwise justify any specific investment. Only public-sector investments for interurban transport are considered. Table 4.2 illustrates which investments have been analyzed and which have been considered the responsibility of the public sector. While financing for some of these public-sector items will come from private sources, they are included as "public goods" for which the State is responsible. A similar but separate analysis of urban transport needs was recently conducted and indicates that an additional 3 percent of

TABLE 4.2: TRANSPORT ASSETS INCLUDED IN THE ANALYSIS

Included in analysis	Excluded from the analysis	Included in Definition of Public Sector
Railway	Railway	Railway
Track	Signaling	Track
Electrification	Communications	Electrification
Locomotives	Workshops	Locomotives
Wagons		Wagons
Passenger coaches		Passenger coaches
Roads (National, Provincial, and County)	Roads (National, Provincial, and County)	Roads (National, Provincial, and County)
New construction	Urban roads	New construction
Reconstruction	Urban public transport	Reconstruction
Routine maintenance		Routine maintenance
Trucks		
Interurban buses		
Private and government cars		
Inland waterways	Inland waterways	Inland waterways
Deepening of canals	Locks	Deepening of canals
Maintenance of canals	River ports	Maintenance of canals
Barges		Barges
Ports	Ports	Ports
New berths (incl. Equipment)	Ships (coastal and deep-sea)	New berths (incl. equipment)
Air transport	Air transport	Air transport
Runways	Freight terminals	Runways
Passenger terminals	Aircraft for international routes	Passenger terminals
Aircraft for national routes	Maintenance buildings	En route navigation
En route navigation		

GDP is the minimum amount required to prevent further escalation of urban traffic congestion (World Bank, 1997a).

A. SATISFYING DEMAND

The projected increase in China's transport demand is unprecedented in a large, developing country over a long period of time, particularly because it follows more than a decade of sustained and exceptional sectoral growth. Prior underinvestment in transport has resulted in high levels of asset use, leaving few opportunities for further increases. With freight demand projected to grow at an average annual rate of more than 6 percent over the next 15 years, and passenger demand expected to grow at almost 9 percent per year during the same period, transport investments of up to 3 percent of GDP will be needed just to maintain the current quality of service

Assessing what is an appropriate level of investment and what stock of assets is needed to provide an acceptable quality of service, where best to make the tradeoffs between more or less investment, and between investment in more or better services, is highly subjective. A useful index of potential quality of service is asset utilization, with lower levels usually indicating better services but needing higher investment. The target asset utilization standards used in this analysis (shown in the last column of Table 4.3) are those appropriate for a middle-income developing country striving to be highly competitive in

TABLE 4.3: PRINCIPAL INFRASTRUCTURE AND VEHICLE UTILIZATION STANDARDS

Standard	Units	1995	2000	2005	2010	International standard
Rail						
Train density	trains/km/day	34.1	30.2	27.9	27.2	22.0
Network	km track/'000 km ²	7.36	8.83	9.86	10.14	12.00
Electrification	percent network km	14	18	27	42	60
Locomotives	million tkm/loco/year	88.0	99.2	119.1	145.9	200.0
Wagons	million tkm/wagon/year	2.79	2.02	1.75	1.84	1.75
Passenger coaches	km/coach/year	120,000	135,900	150,000	150,000	150,000
Road						
Road network	paved km/'000 km ²	17.4	21.4	29.0	40.1	50.0
Total network	percent paved as 4-lane	4.0	5.8	7.4	11.0	15.0
Trucks	tkm/truck/year	66,500	109,600	150,300	185,700	500,000
Interurban buses	km/bus/year	12,000	19,000	31,000	50,000	80,000
Private cars	per '000 pop	2.23	4.60	10.09	20.0	150.0
Ports						
Container berths	20-foot equivalent units/year	180,000	203,500	230,000	260,000	275,000
General berths	million tons/year	0.80	0.90	1.02	1.12	1.25
Bulk berths	million tons/year	4.0	4.5	5.0	5.5	7.5
Air transport						
Take-offs/landings	number/year/runway	9,800	19,100	30,800	39,300	50,000
Domestic aircraft	load factor percent	80.0	75.0	70.0	70.0	67.0
	hours/aircraft/year	2,000	2,250	2,500	2,545	2,545
Inland waterways						
Barge size	average tons/barge	67	114	195	295	350

Source: *China Statistical Yearbook* (for 1995 data), *World Development Report*, 1994 (for international standards of infrastructure), and China: Transport Sector Investment Model, World Bank, 1998a (for projections up to 2010).

international trade. These standards are derived from various sources, including the 1994 *World Development Report* and other World Bank reports.

However, it will not be feasible for China to achieve these standards within the next 15 years. In aggregate, they would need an unsustainable investment of more than 6 percent of GDP over the whole period. Lower and more feasible standards, but still high enough to maintain China's competitiveness in world markets, are shown in the penultimate column of Table 4.3. These standards represent a highly subjective compromise and other analyses might decide on different values. However, higher aggregate standards could only be achieved with an even higher proportion of GDP dedicated to transport, an unlikely outcome in light of other urgent investment needs.

B. ASSET AND INVESTMENT NEEDS

The difference between the numbers of assets currently available and those required to meet these standards is an indication of what is needed to meet the investment objectives. In addition, existing assets should be renewed when their net present value of maintenance and operating costs exceed those of replacements, including their capital costs. Because this study did not allow for such a detailed analysis, standard asset lives based on international experience were used instead to estimate the replacement rates. The cost of new and replacement assets, calculated by multiplying the numbers of each type by their unit cost, shows how much investment is needed.

The compromise standards would require an average annual investment of 3.6 percent of GDP, a high but sustainable level over a long period of time; this would translate into an average \$46 billion per year and a total of almost \$700 billion over 15 years (Table 4.4). The benefits of this high investment will be maximized the sooner it is made, but since building up the rate of investment takes time, only about 3.7 percent of GDP could be achieved at most during the 9FYP. This could be increased to 3.8 percent during the 10FYP, allowing a reduction to a more sustainable long-term level of 3.3 percent during the 11FYP.

TABLE 4.4: TRANSPORT SECTOR INVESTMENT NEEDS
(\$ billion)

Mode	1996-2000	2001-2005	2006-2010	1996-2010
Rail	45	45	45	135
Road	105	165	235	505
Inland Waterway	4	4	5	13
Ports	6	6	4	16
Air	7	10	12	29
Total	167	230	301	698
Annual average	33.4	46.0	60.2	46.9
Percent GDP	3.7	3.8	3.3	3.6

Source: China: Transport Sector Investment Model, World Bank, 1998a.

This projected investment would include:

- an average of about \$9 billion per year in the railway sector during the period of the 9FYP, and averaged over the analysis period (a total of about \$135 billion, 19 percent of the total investment);
- an average of about \$21 billion per year during the 9FYP for the road sector, increasing to \$33 billion per year during the 10FYP and \$46 billion during the 11FYP, an overall average of about \$34 billion (a total of about \$505 billion or 73 percent of the total); and
- about \$2 billion per year for inland waterways and ports (a total of almost \$30 billion), and a further \$2 billion annually (a total of just over \$30 billion) for air transport, about 8 percent of the total between the three modes.

Railways

Approximately one-third of investments in railways would go toward infrastructure, including 2,300 km of new tracks per year, about the same length of reconstruction, and more than 2,000 km per year in electrification. These investments would result in a network of more than 84,000 track-km (15,000 km electrified) by the end of the 9FYP and close to 100,000 km (40,000 km electrified) by the end of the analysis period. At least half of infrastructure investment would occur in four corridors that would directly benefit inland provinces (Chapter 6), while much of the remainder would be for relatively short sections to relieve bottlenecks in coastal provinces.

Other investments would be for traction and rolling stock. All remaining steam and outdated diesel locomotives would be replaced with new diesel or electric locomotives, a process that, together with expansion of the fleet, would require 1,400 new locomotives per year at an annual cost of about \$2.1 billion. This estimate assumes a significant increase in the productivity of locomotives, made possible in part by the reconstruction of tracks to allow the use of higher axle-load wagons. Improvement of service quality would require considerable expansion and renewal of the rolling stock fleet, which would have an annual requirement of 85,000 wagons (at an annual average cost of \$3.3 billion) and 23,000 passenger coaches (at an annual average cost of \$0.9 billion).

Proposed investment during the next five years is roughly the same as in the 9FYP, but the distribution between infrastructure and vehicles is reversed. The recommendations made here place greater emphasis on expanding capacity of existing lines rather than the construction of new lines, and the renewal and expansion of locomotive, wagon, and coach fleets. This approach focuses more on providing users with better-quality services, and less on expansion of the network to serve potential new demands.

Roads

Although China's new interurban expressway network is attracting a great deal of attention, it will account for only about 5 percent of total road investment. By far, the largest cost, an average of \$18 billion per year or 53 percent of the total, will be needed to reconstruct the existing road network so that it can cater for the larger trucks with high gross weights and axle loads that will take advantage of the higher-quality roads on the NTHS. Other new construction would require about \$10 billion per year, or 30 percent of total investment. Routine road maintenance, considered an investment for this analysis,

would claim a further 9 percent, or \$3 billion per year, while the upgrading of rural roads to all-weather standards would claim the remaining 3 percent, or \$1 billion per year.

The investment program would provide about 5,000 km of new interurban expressway by the year 2000 and 10,000 km by the end of the analysis period. While this is a slower rate of construction than included in current plans, it takes into account the need to defer construction of some parts of the network until traffic levels are higher. However, a more intensive program of upgrading the existing network than that implied in the 9FYP is also assumed. This would provide an additional 1,000 km of Class 1, 10,000 km of Class 2, and 20,000 km of Class 3 roads; reconstruction of 2,000 km of existing Class 1, 30,000 km of Class 2, and 85,000 km of Class 3 roads; and a total network of 150,000 km of paved roads adequate for a new generation of trucks and buses. About two-thirds of upgrading and reconstruction work would occur in inland provinces, which would also benefit most from a proposed upgrading of 30,000 km of unclassified rural roads to the all-weather Class 4 category.

Waterways and Ports

The proposed waterways investment would facilitate the operation of larger ships and barges throughout the system. An additional 500 km of waterways for ships of up to 5,000 deadweight tons (dwt), 600 km for ships of up to 3,000 dwt, 2,000 km for ships of up to 1,000 dwt, and 3,000 km for vessels of up to 500 dwt would be provided. Allowance has been made for the annual reconstruction of 125 km of waterways. Most of the improvements made for smaller vessels (500 dwt and 1,000 dwt) would be in the upper reaches of three principal waterway systems and would directly benefit inland provinces. The improvements to allow the use of larger vessels (3,000 dwt and 5,000 dwt) further downstream would also benefit inland provinces, since transshipment from smaller vessels at key transfer ports would be possible.

Between 20 and 30 new deep-water berths will be required each year to handle the expected increase in international and domestic maritime trade; 80 percent of these would be to serve container ships and the remainder would be for the transport of bulk solids and liquids. Additional berths for container handling will become available from the reconstruction and expansion of general freight berths, the need for which will decline substantially, as foreign trade is increasingly container-oriented.

Air Transport

The strong growth in air travel will create an infrastructure investment need of \$30 billion over the analysis period, an annual average of \$2 billion. During the time of the 9FYP, most of this amount will be for additional runways. However, as runway utilization and aircraft size increase, medium- and long-term investments will shift toward passenger terminals. Since the development of airports in most large cities in the coastal region is already under way, the projected investment in new runways will shift to the interior. Modernization of air traffic control in the coastal air corridors has begun, but as demand for internal flights increases, this system will have to be expanded to air routes throughout the country.

C. ALTERNATIVE SCENARIOS

The projection of investment needs relies on an assumption that economic growth will decline from an annual rate of 7.8 percent during the 9FYP, to 7.5 percent during the 10FYP, and 7.0 percent during the 11FYP. Although sustained higher growth is unlikely in the long run, there is a risk that substantially lower rates of growth will be realized. These would make it more difficult to improve transport quality

but easier to eliminate bottlenecks, as many of the investments aimed at the former would be unchanged since they are independent of the level of demand, while those to satisfy the latter would reduce as they are demand-dependent. The overall investment needs will increase as a percentage of GDP at these lower rates of growth (Table 4.5).

Lower growth rates will impact more on revenues to finance investment than on the investments themselves. Investment to improve standards and to compensate for previous underinvestment is largely independent of projected growth, whereas revenues to finance them are directly proportional to the level of demand. Revenues from existing user charges would cover more than 54 percent of total investment at the expected rate of economic growth, but only 48 percent if it turns out to be 2 percent per year lower.⁹ At this lower growth, investments to improve quality would have to be deferred by an average of five years if the percentage of GDP dedicated to transport investment were to remain unchanged. The impact of lower growth in GDP will be more apparent toward the end of the analysis period, as the cumulative effect on demand becomes more critical. The profile of transport sector investment as a percent of GDP is shown in Table 4.5 for each five-year plan period.

The modal share of freight traffic will also affect investment needs, with the rail share being both the most difficult to predict and having the greatest impact on investment needs and user fee revenues. The basic assumption is that cost changes will increasingly shift demand toward roads and waterways, with rail being the principal loser. While rail's share of freight traffic is estimated to decline to 35 percent by 2010, many uncertainties surround both the projections of long-term costs and users' response to them. Rail may be able to retain its competitive advantage for up to 45 percent of freight traffic if it can simultaneously increase quality of service and reduce unit costs. If it manages to retain this share, investment requirements for the transport sector will increase. Road investment will not fall in proportion to the decline in its modal share because a high proportion of proposed road investment is independent of the volume of road traffic; on the other hand, a high proportion of proposed rail investment is for additional traction and rolling stock to improve service quality, and so will increase in proportion to the growth in demand. With a rail modal share of 45 percent, total sector investment will be about 4 percent higher, and the rail share of investment will increase by about the same percentage (Table 4.5).

TABLE 4.5: INVESTMENT AS A PERCENTAGE OF GDP BY FYP: 1996-2010

Growth assumption	9th FYP	10th FYP	11th FYP	1996-2010
Baseline	3.7	3.8	3.3	3.6
Economic growth 1% lower per year	3.9	4.0	3.6	3.8
Economic growth 2% lower per year	4.0	4.2	3.8	4.0
High rail modal share	3.7	3.9	3.5	3.8

Source: China: Transport Sector Investment Model, World Bank, 1998a.

⁹ But see Chapter 5 for the impact of loan amortization charges on the adequacy of user charge revenues to finance investment.

5 *Financing Transport Investment*

A. PRESENT SOURCES OF INVESTMENT FINANCE

Initial financing of transport investments, which covers construction and other costs until projects generate their own revenues, still comes almost exclusively from public sources. These include modal investment funds supported by user charge revenues, central and provincial government equity, and loans from multinational agencies. This financing strategy is unsustainable. While investment needs are expected to more than double, peaking at \$56 billion in 2006, finance from existing sources will increase much more slowly, and some sources will even decline, resulting in a financing gap that will become increasingly difficult to close unless new sources are identified and exploited.

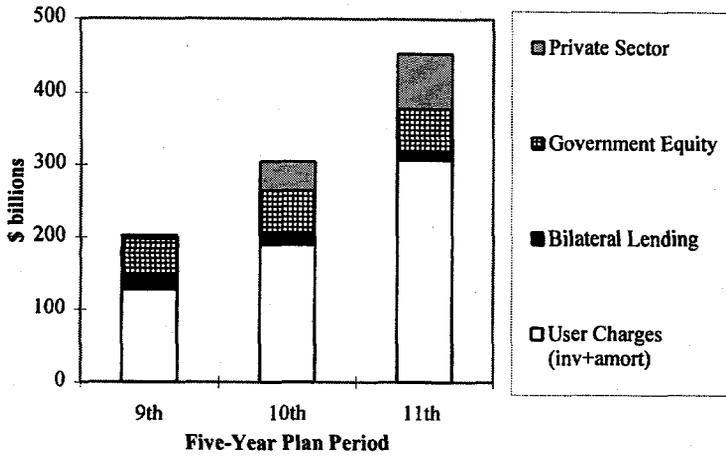
User charge revenues are increasing more slowly than traffic, as transport operations become more efficient. Central and provincial government revenues, the source of the operations' equity, are decreasing as a proportion of GDP (World Bank, 1996c) and a declining proportion of this revenue will be available to finance transport investments. At the same time, multilateral and bilateral funding for transport is being reduced because China is approaching its borrowing limits and is no longer viewed as a privileged low-income country. Such borrowing is therefore likely to focus on areas that are less able than transport infrastructure to secure private financing. Although supplier's credit for vehicle purchases will increase, this will have little impact on public-sector finance as most vehicles are the responsibility of private operators. A sustainable financing plan for public-sector investments will require a much greater use of private sources, supported by new user charges, and more efficient collection of revenues from existing charges.

User charge revenues serve two functions: they are a source of initial construction finance, financing some investments completely, and they provide the revenues to amortize the loans that supplement their direct investment. While public equity in new investments is not usually required to provide a financial return, private debt and equity that are contracted to supplement public funds are, and they will not materialize if they cannot be assured of a sufficient rate of return. As more private funds are used, their amortization will consume an increasing proportion of user charge revenue, leaving a smaller proportion for direct investment and thereby increasing the need for further debt financing. The skill in utilizing the revenues from user charges lies in balancing their allocation between construction finance and debt amortization.

Making projections of the likely sources of funds for investment over a period of 15 years is little more than speculative, but a necessary activity to have some idea of what level of investment is feasible (Figure 5.1). Multilateral and bilateral investment in the transport sector, currently about \$4 billion per year, is likely to decline by about half during the period. At the same time, government contributions, currently in the form of equity but more likely to be debt in the future, will fall from 30 percent to closer to 20 percent of total investment (although this represents an increase in absolute terms). The remainder of project financing will have to come from a combination of user charge revenues utilized as direct finance and private debt and equity.

User charge revenues presently generate about \$25 billion per year, sufficient to finance about 75 percent of recommended investment during the 9FYP, if some of it were not needed to amortize investment loans. When this is taken into account, they can directly finance less than 47 percent of investment. Without changes in their structure and efficiency of collection, over the full 15-year period

FIGURE 5.1: FINANCING NEEDS AND POSSIBLE SOURCES

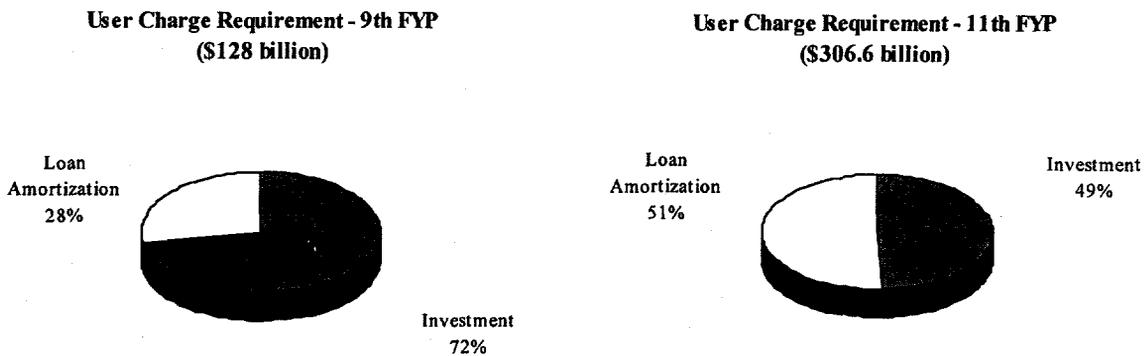


Note: Total needs in each period are the sum of direct investment and amortization of loans.

Source: China: Transport Sector Investment Model, World Bank, 1998a.

they could directly finance 54 percent of recommended investment, but less than 15 percent after allowing for the increasing amortization needed for the higher borrowing from the private sector. An optimistic assessment of the potential for user charge revenue is that, with greater efficiency and the imposition of a new fuel surcharge, it could reach \$60 billion by the end of the 11FYP. But this would not be enough to maintain the same level of direct investment for the proposed investment plan. After allowing for a massive increase in private investment in transport infrastructure with its associated debt repayment requirements, less than half of this would be available for direct investment (Figure 5.2).

FIGURE 5.2: APPLICATION OF USER CHARGES



B. CURRENT USER CHARGES

The principal economic objectives of a user charge system are to ensure that users face costs that approximate the marginal social costs of the facilities that they use (and so give appropriate price signals to producers) and to encourage an efficient distribution of demand between modes. The financial objective is: to generate enough revenue to attract finance for those facilities that are justified in economic terms. To accomplish these goals, a system of user chargers should satisfy three basic criteria.

First, the charges should be related to the benefits obtained from use of the infrastructure. Since these are often difficult to measure, charging according to the costs imposed on the network is often substituted. Second, the revenues from the system should be sufficient to finance necessary and predictable infrastructure costs, without large variations between years. When combined with the first

criterion, this usually results in a Ramsay pricing system. Finally, it should be difficult for users to avoid payment of the charges. None of the current charges adequately meets the first objective. While they are geared toward the second, none of them yet satisfies it. Some of them come close to covering actual investment costs, but this is inadequate given continuing underinvestment. While some charges are strictly applied to all users, others are subject to widespread evasion and avoidance. This results in some users cross-subsidizing others with the associated distortions of economic decisions, as well as misallocation of demand between modes with its attendant misleading investment signals.

Roads

The four most important road user charges currently generate more than half present total revenue and, if unchanged, they will generate \$37 billion annually by 2010. They are (a) a Road Maintenance Fee (RMF), charged either as a percentage of commercial transport enterprises' gross revenues or as a fixed rate assessed on the basis of noncommercial operators' truck or bus capacity. Although its title would indicate otherwise, its revenues are used to finance new construction and road improvements as well as maintenance; (b) a tax on new vehicles that is allocated to finance the government's equity contribution to new road construction; (c) an annual license fee, also based on vehicle capacity; and (d) for some roads, a toll charge averaging 4 cents per medium-truck-equivalent (mte)-kilometer, but with much variation between both provinces and roads within provinces. This is usually allocated to amortizing the debt incurred during the roads' construction. The first three charges provided the basis of the road user charge system. Toll revenues have only recently started to assume a significance beyond financing the debt of the roads to which they are applied, with some provinces now using them as a supplementary source of investment funds for road investment.

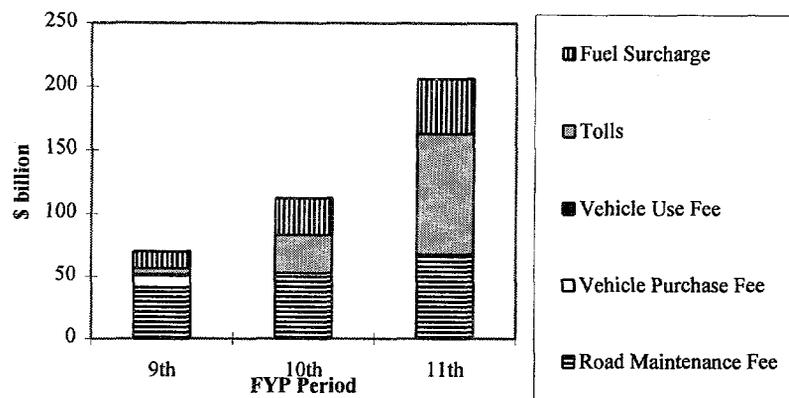
The RMF generates the most revenue, which in the absence of any leakage or evasion, would be currently about \$11 billion per year. However, a recent estimate (Kennedy, 1995) indicates that the actual (1993) amount collected is only about 40 percent of the potential, probably through extensive evasion and avoidance (circumstantial evidence shows that SOE trucking companies are often exempted from payment, and some nontrucking SOEs can masquerade as trucking companies, with no gross revenue and therefore no RMF obligation). Since 25 percent of the revenue collected is retained by MOF, that available for financing road maintenance and construction is only about 30 percent of potential. In addition, this charge is inefficient because its incidence bears little correlation with either benefits received from use of the road network or the costs imposed on it. As vehicle utilization improves and more freight can be carried in fewer trucks, the revenue potential of this charge will increase more slowly than use of the road network, so it will be even further from covering the justifiable costs of road investment and maintenance than it is now.

The second and third charges—the Vehicle Purchase Fee (VPF) and the Vehicle Use Fee (VUF) should together generate roughly \$5 billion annually, which is expected to increase to \$8 billion by 2010, but estimates of the actual revenues have proved very variable and highly unreliable. Revenue from these fees is more appropriate for funding municipal rather than national roads, and since urban roads are excluded from this analysis, the contribution of these charges has been discounted after the current 9FYP.

Tolls are the greatest potential revenue generator among current road user charges and are increasingly applied to existing as well as most new roads. Although they currently generate only \$2 billion annually, this figure could rise to almost \$20 billion by 2010 if tolls are imposed on all parts of

the national network where revenues exceed collection costs. However, in the short term there is limited scope for tolling new roads at rates sufficient to amortize debt and give an acceptable return on equity that finance the full investment cost. Given a traffic growth rate of 8 percent per year, a construction cost of \$2.5 million per km, a required return on equity of 25 percent and 15-year loans at 20 percent interest, tolls at the present average of 4 cents per mte-km would require an opening-year level of traffic of about 8,000 mte to generate enough revenue to attract 100 percent private finance, if tolls were the only source of project finance.¹⁰ Few new roads in China come anywhere near this level of traffic.

FIGURE 5.3: POTENTIAL REVENUE FROM ROAD USER CHARGES



Note: Vehicle Purchase Fee and Vehicle Use Fee are slated to become municipal charges.

Source: China: Transport Sector Investment Model, World Bank, 1998a.

Railways

A Railway Construction Surcharge (RCS), currently levied at a flat rate of Y 0.027 (3.3 cents) per tkm, already generates about half of total revenues from rail freight charges and one-third of railways' total revenue. However, only about \$4 billion (60 percent) is invested; the remainder goes toward taxes and the reduction of the railways' operating deficit. If no changes are made in the level or application of the surcharge, and if the full amount is used to finance investment, \$7 billion in revenues could be generated by 2010, sufficient to finance directly about 73 percent of railway investment.

Airports

The airport development charge is currently standardized at Y 50 (about \$6) for departing domestic passengers and Y 90 (about \$11) for departing international passengers. Revenue from this charge stands at approximately \$0.3 billion per year, but will increase rapidly to about \$2 billion by 2010 as a result of increased demand for air travel. Aircraft landing fees and associated charges in China are about \$540 for a DC9 or B737 and \$3,400 for a B747, comparable to charges in other Southeast Asian and developing countries (World Bank, 1995). They currently generate about \$0.2 billion per year, and this should increase to about \$1.5 billion by 2010. Although no information is available on what proportion of

¹⁰ A recent World Bank study, *Effective Participation in Toll Roads* (Indonesia Discussion Paper No. 7, December 1996) indicated that an opening-year traffic level of about 30,000 vehicles per day would be needed to generate a rate of return high enough to attract 100 percent private finance of a road.

airport operating costs are covered by these charges or whether a surplus is available for investment funding, it is understood that it is intended to cover only airport operating costs.

Inland Waterways

Each province has its own scheme of waterway charges. Jiangsu Province, which administers approximately one-third of China's inland waterway system when measured in terms of tonnage and one-half in terms of turnover, has the most comprehensive system, with three user charges: a Canal Maintenance fee, a Shiplock fee, and a Canal Construction fee. The revenue from these charges covers about 30 percent of waterway investment and operating costs, which while being less than for other modes, is more than for other large inland waterway systems such as the Mississippi (United States), Rhine (Europe) and Parana/Paraguay (South America). The shortfall in investment funding is now being partly made up by a transfer of some of the revenues from the road sector's Vehicle Purchase Fee.

Ports

Users of Chinese ports must pay harbor dues and fees for pilotage, shifting, mooring, loading, unloading, and berthing. While MOC issues standard regulations for port dues, as well as charges that apply to oceangoing vessels engaged in international trade and to imported and exported cargo, some competitive pricing does occur in accordance with local conditions at ports.

C. PROPOSED CHANGES TO EXISTING USER CHARGES

All transport modes in China now have a national system of charges for the use of their infrastructure.¹¹ Each current user charge has a specific objective and is based on different principles. Current charges vary widely in their effectiveness and relationship to user benefits and the incidence of costs imposed by each category of user.

The present system of user charges will need substantial revision if it is to satisfy these criteria. While some of the existing charges satisfy one or two of them, none of the charges satisfies them all. To achieve this, some charges will need to be completely restructured while others require only minor changes. At least one new charge should be introduced.

The RMF poses the greatest dilemma. It is a long-established charge and is widely accepted by users. But this is also its principal disadvantage, in that many users have found ways to evade and avoid its imposition. Closing the loopholes that allow them to do this will be a difficult and controversial but necessary process. Losses could be reduced to 10 percent of gross revenue by making vehicle capacity the sole basis of payment, since most opportunities for evasion and avoidance come from declarations of gross revenue by transport operating companies. While the VPF and VUF make a useful addition to road user charge revenues, since they are collected through local agencies, they provide a convenient revenue source for funding municipal and local roads. The net impact of the three charges on users cannot be made proportional to the benefits they receive from the road network or the costs they impose on it. Achievement of this objective will require further expansion of toll charges and the imposition of a new charge.

¹¹ A system of inland waterways charges is still under development.

Tolls have the potential to become a principal source of road user fee revenue. When combined with a fixed annual RMF, they could provide the variable component of a two-part tariff system, with rates structured so as to closely mirror the marginal costs that users impose on the tolled roads. In principle, at least they are difficult to avoid, particularly with electronic tolling or monitoring systems, although some recent comparisons of actual and potential toll revenues with manual collection systems in China indicate a level of evasion comparable to that of the RMF.

Different considerations apply to the tolling of new high-grade highways and existing roads. The practice of tolling new high-grade highways to generate revenue to amortize the debt portion of their finance is well established in China. An increasing number of provinces are finding ways to capitalize toll revenues and use this as security for new debt in the form of bonds or equity in the form of shares. The funds generated this way are then used to finance construction of further toll roads. This practice has been followed with varying degrees of success in other countries with large toll networks (Spain, Italy, France and Mexico among others).

Despite enthusiasm for the use of private funding for toll highways, a recent study (Kennedy, 1995) indicates that only 11 percent of the proposed NTHS would generate enough toll revenue to attract 100 percent foreign BOT financing. An additional 36 percent of the network might be funded exclusively by less costly domestic loans. This conclusion is supported by the analysis undertaken in this report. However, most of the network that is included in the "profitable" 47 percent is already built or has been committed. If private-sector finance is to be attracted for the remainder of the NTHS, mixed private/public funding must be used or additional sources of revenue for the private developer must be identified. It appears that the preferred Chinese route to financing of highways is through Expressway Companies, with provincial governments providing equity and the private participants providing a mixture of equity and debt finance. Using the potential increase in land values consequent on opening of a new high-grade road as an additional source of developers' revenue has already been used,¹² and based on experience in other countries, holds out possibilities of attracting finance that would not otherwise be available.

Tolling existing roads is increasingly being used as a convenient way of generating revenue to supplement that of other user charges. However, the practice raises a number of economic issues, particularly its contradicting the concept of a road network as a public good that should be provided at no direct charge to the user. Any level of toll will reduce the level of demand for travel and this will result in a reduction in the economic benefits of having the network. These losses are minimized when the toll road is an additional high-grade facility and an alternative untolled road is available, but when the alternative road is also tolled, the loss of economic benefits and considerations of equity for low-income users must be addressed. The toll level and structure must be designed so as to minimize these impacts if the practice of tolling existing roads becomes accepted throughout China.

Proposals to modify the system of inland waterways charges will have to take account of decentralization to the provinces of responsibility for investment and operational funding. The system of charges used by Jiangsu Province has the potential to satisfy the three user charge criteria and studies on how best to modify the system are currently under way.

¹² *Financial Times*, London, July 22, 1996.

The Railway Construction Charge, levied at a flat rate for all rail freight, is too crude to be proportional to the costs imposed by different users on the rail network and it fails to recover any infrastructure costs from passengers. In particular, the unit infrastructure cost on high-density routes is much less than on low-density routes. However, until CR implements a systemwide traffic costing system, it will not be possible to devise a modified charge that more closely matches costs. While a charge system that takes account of the different costs of every freight shipment is still a long way off, a charging system that varies with traffic density and wagon loading, and incorporates a charge that takes account of the special infrastructure needs of passenger services, could be implemented now.

The airport passenger surcharge and aircraft charges are similar to those levied in most other countries and require little if any modification. Their levels need to be more easily adjustable over time and unless there is a policy of charging the same at all airports on the basis of equity, there should be more scope for varying the charges between low- and high-cost airports.

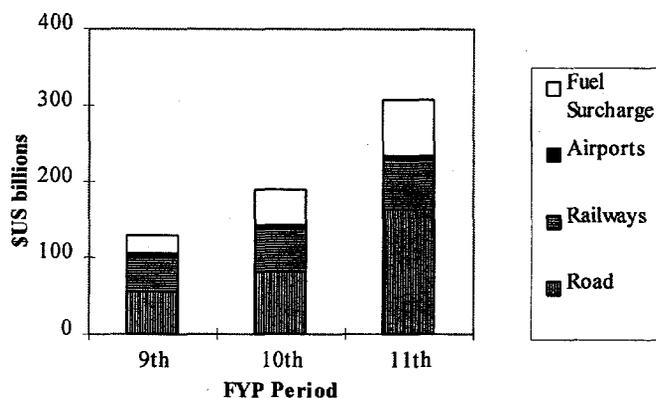
D. A NEW USER CHARGE—TRANSPORT FUEL SURCHARGE

Even if revenues from existing user charges were to be maximized, it would still be difficult for the first two criteria to be met. The allocation of road charges, in particular, would still bear little relation to benefits or costs, and the revenue generated by the sum of all the charges would still fall far short of what is needed for direct investment and loan amortization. Additional sources of user finance must be found if investment is to reach the recommended level. A surcharge on transportation fuel prices is one of the most efficient user charges and is widely implemented elsewhere, and is being considered in China as an alternative to the RMF. If instead it were included as an additional charge throughout the transport sector, the user charge system would come much closer to meeting all three criteria. A fuel price surcharge has many advantages, including

- a high correlation between costs imposed on , and benefits derived from, the transport system;
- little impact on the allocation of resources between economic sectors;
- minimum interference with current fiscal arrangements;
- easy administration and low collection costs;
- difficulty of evasion and avoidance;
- possible use in conjunction with a congestion charge and a pollution tax;
- ease of rate adjustment according to financing needs; and
- the possibility of sharing revenues with provinces and municipalities so as to finance their transport investment and maintenance needs.

China is unusual in that most road transport vehicles are still gasoline-powered. As the country's road network develops, the use of larger trucks will become increasingly advantageous, and most of them will be diesel-powered. The fuel surcharge should therefore be applied to gasoline and diesel, as well as to electricity used by the railway. A surcharge equivalent to 10 cents per liter would generate about \$5 billion per year during the 9FYP. This would rise to more than \$15 billion during the 11FYP, and \$145 billion throughout the entire analysis period. When combined with projected revenue from other user charges, the surcharge would support the direct funding and loan amortization of the entire investment program.

FIGURE 5.4: REQUIRED REVENUE FROM USER CHARGES



Source: China: Transport Investment Model, World Bank, 1998a.

E. PRIVATE INVESTMENT FINANCE

The lack of public finance for the construction of infrastructure, combined with relaxation in the regulations controlling SOEs from obtaining off-budget finance, has led infrastructure providers in all modes, with the exception so far of inland waterways, to seek alternative sources of finance. While some of the deals made have been of questionable social benefit, others have made possible the provision of new capacity and better services with little distortion to the economy. These alternative sources will have to be further exploited if adequate funding of construction is to be realized.

Deregulated quasi-state airlines have been the most aggressive in this respect, following the practices of airlines throughout the world in making use of lease and lease-purchase arrangements, export agency credits, and even attempting to make barter deals. They have been able to exploit the competition between aircraft manufacturers to obtain relatively favorable financing terms for the purchase of more than \$50 billion worth of aircraft in each of the last three years (Box 5.1). Airport infrastructure is financed similarly to highways, with a combination of national, provincial, and municipal sources, increasingly supplemented by private investment in aircraft maintenance facilities, though not yet in airports. Provincial funding makes use of the revenues from airport user charges.¹³

Provincial governments are increasingly turning to asset-based financing for new high-grade highway projects (Box 5.2). Several provincial Expressway Companies¹⁴ have been created, using either bond finance or H-share issues, with the rights to revenues from existing toll roads as security. Guangdong province has been the leader in creating its own operating concessions, with more than 12 specific road projects in operation, under construction or in preparation. While this method of funding

¹³ The Ambiji Group, 1993.

¹⁴ The Guangdong Provincial Expressway Development Company was the first, in 1993, followed by the Zhuhai Highway Company (which included revenues from car ownership fees together with toll revenues as part of the securitization process) and the Anhui Expressway Company, both in 1996. The Greater Beijing Region Expressway Company was also formed in 1996 and operates 10 toll expressways and is planning an imminent offering of H-shares on the Hong Kong Exchange. The Shenzhen Expressway Company issued 650 million H-shares in March 1997 and the Zhejiang Expressway Company plans a similar issue in May 1997. Other planned issues are by the Ninghu Expressway Company, the Cheng-Yu Expressway Company (in Sichuan province), and; the Hainan Expressway Company.

BOX 5.1: CONVENTIONAL AND INNOVATIVE AVIATION FINANCE**China Eastern Sorted**

China Eastern Airlines arranged last week to cover the \$375 million financing of three A340-300 aircraft, two scheduled to be delivered in May and one in July. The mandated structure will provide \$125 million of finance for each of the aircraft. The two May aircraft will be financed using German leverage leases with European Export Credit Agency (ECA) support. *Credit Lyonnais*, *ABN-Amro*, *BNP* and *Banque Paribas* will arrange the debt portion. *BBV Immobilien-Fonds* has been mandated to underwrite the equity portion of the GLL. The financing of these two deliveries will also include a commercial loan tranche.

The July delivery will be financed as a JLL, with the equity to be arranged by *Mitsubishi Bank* and *Sanwa*. Five leasing companies have underwritten the JLL equity portion: *Diamond Lease*, *Sanwa Business Credit*, *Japan Lease*, *Orix* and *Sumisho Lease*. As with the May deliveries, the debt will be supported by ECAs and arranged by the same four European banks. *Credit Lyonnais* will act as overall debt agent for the entire transaction.

Transport Finance, No. 58, February 8, 1996

Mango Juice for Jet

It may not be the biggest barter deal of the century, but it's certainly one of the oddest; Chinese mango juice for a Russian passenger jet. Under a deal in the works, a state-run company from the tropical Chinese island of Hainan plans to send 212 train cars filled with mango juice to Russia in return for an Il-28 passenger jet.

The Standard, January 13, 1993

involves less risk and should therefore be less costly than straightforward project finance, it is not necessarily the least-risk or least-cost way of securitizing revenues, neither is it compatible with the investment objectives of concentrating new investment in inland provinces or in four major corridors. It will make their finance more difficult by consuming a high proportion of debt finance that lenders are prepared to risk in a single country. Also, as offshore institutional investors approach their limits of the risk exposure, the cost of this type of financing is likely to increase as its availability diminishes.

BOX 5.2: ASSET-BASED HIGHWAY FINANCE

With the listing of the Shenzhen Expressway Co. Ltd. on the Hong Kong Stock Exchange, exploration of the securities market to pool foreign funds for highway construction is speeded up. The company will issue 650 million H-shares, hoping to raise between \$144 and \$148 million, to build the 44.3 km **Shenzhen Airport to He'ao Expressway**. More road building companies will be listed on the Hong Kong and domestic B-share markets. Besides the Shenzhen and Anhui Expressway Companies (the latter being the first listing at the end of 1996) at least three other companies will be included in the next batch to be listed, while two others will be authorized to float B-shares. Hainan Expressway Co. Ltd. is expected to raise \$48 million by issuing B-shares, to finance part of the \$361 million needed for construction of the left lane of the 260 km **northern Haikou to Sanya freeway**. The company is also planning to raise \$48 million through issues on the A-share market. The right lane of the road has been open since 1995.

China Daily, Business Week, March 2, 1997

CR's main instrument of attracting private finance until now has been short-term domestic revenue bonds, supplemented by joint ventures, principally for manufacturing activities, but also for some new lines (Box 5.3). The proposed Beijing -Shanghai high-speed passenger railway will almost certainly be financed as a form of joint-venture. While there is not yet an efficient secondary market for revenue bonds, and ownership restrictions still exist, during the next 15 years the local bond market will expand and develop (World Bank, 1997d). Long-term infrastructure bonds could become an important part of that market and a useful way of mobilizing China's high domestic savings for productive use. In the longer term, as China's attractiveness on the international bond market increases, CR will be well placed to take advantage of this additional funding source, provided it becomes more independent from the government and gains more freedom to set tariffs and control costs.

BOX 5.3: RAILWAY BUILT WITH PRIVATE FUNDS

China is courting increased foreign investment in its railroad industry, despite a slump in freight traffic and increased emphasis on air travel. Since opening railways to foreign funding in 1984, China has received \$1.8 billion in overseas loans for railway construction and renovation. Most came from the World Bank. Overseas companies continue to show little enthusiasm for what China believes to be a lucrative draw.

First fruits of the plan will mature in August when China's only joint-venture railway goes into operation. The 125-mile line will connect the seaport of Wenzhou and Jinhua in Zhejiang's industrial hinterland. China doesn't count the line's funding as foreign because it came from Taiwan, but the funds had to be channeled through a third point to keep within Taiwan's regulations on business with the mainland. "The Jin-Wen railway is a good example of what China is looking for in railway investment: low-cost, efficient and realistic."

Journal of Commerce, April 9, 1997

The development of property rights and commercial opportunities based on new and improved transport links and terminals located close to highway interchanges and rail and airport terminals offer excellent opportunities for gaining revenue from nonuser beneficiaries of transport investment. Precedents for this form of revenue generation exist in other countries, as well as in some of the highway concessions in Guangdong Province, where projected revenues from land development are a principal attraction for private developers (*Financial Times*, February 1996). Rail and airport terminals also offer attractive possibilities through the concessioning of commercial activities, such as restaurants, shops, car parking and hotels.

F. MANAGEMENT OF SECTOR INVESTMENT FUNDS

Transport sector investment poses many problems, from raising adequate finance, through decentralization, to the management of the source and application of resources. There is a demand for far more resources than the public sector can provide through taxes and borrowing. Given that public revenues are unlikely to rise as a proportion of GDP, the only way to reach the investment level needed is to attract private funds. Unless an adequate financial management system is implemented, these funds will not be found. Three approaches are possible: (a) a modification of the present system but with continued heavy dependence on budgetary allocations; (b) securitization of corporate or modal revenues to attract private finance; and (c) securitization of project revenues to attract private finance.

In the first of these, the State would retain full control of public revenues and borrowing, and the transport sector would rely on budgetary allocations to finance investments. Since public borrowing has a sovereign guarantee, the cost of funds would be low. This system would only be viable if taxation revenue and government borrowing for transport increase substantially, but government control over the source and application of funds for the sector would be maximized.

In the second approach, various forms of securitization of revenues from user charges would be used to raise supplementary private finance, usually through bonds but also possibly through equity. This system is presently operating to a limited extent on a national level, with CR and some airlines issuing bonds, at a provincial level with an increasing number of provinces creating Expressway Corporations to generate equity finance, and at a local level with the creation of some Highway Companies that use vehicle taxes in addition to tolls as their revenue source. Since the range of revenue sources for securitization is limited, bond and/or shareholders expect a high return to cover the perceived risks, so this is a more expensive way to attract private funds than relying on central government bonds. While it has the advantage of separating infrastructure borrowing from Treasury borrowing and avoiding a

sovereign obligation for the debt, it dilutes government control over the application of funds (sources continue to be controlled through MOF approval for changes in user charges). Supervision of the companies and agencies allowed to borrow would need to be increased to retain adequate control over the application of funds, to ensure that funds were used appropriately, taking account of economic as well as financial considerations.

The third approach would make maximum use of concessions to raise project finance. Project finance is the most expensive way to fund investment from private sources since dependence on a single revenue source is considered to be very risky. Management of investment would mostly be through the concession agreements, and it would be difficult to grant concessions of the BOT type in those parts of the country that most need more finance for infrastructure. Coastal provinces are in the strongest position to raise project finance and this approach has few possibilities of diverting revenues to inland or rural areas. While government control could be maintained by a system of approvals for concessions, decentralization of authority to provinces makes this increasingly difficult.

To maximize total sector investment revenue, all three methods of raising finance will need to be exploited to the fullest extent, and the management of sector investment needs to exploit the advantages of each approach while minimizing the disadvantages. One way to do this would be through a Transport Investment Fund (TIF). It would have access to the revenues of all genuine transport user charges, but not to taxation revenue raised from the transport sector such as that from current fuel taxes. With this base, it would be able to raise bond finance at a cost similar to that of the government. There would be reasonable prospects of raising sufficient private investment funding from a combination of domestic and international sources, without increasing competition with, and therefore the costs of, government borrowing. An acceptable management of the Fund would be possible if finance was allocated to provinces on the basis of approved investment plans. The provinces and other infrastructure operators could use a combination of financial and socioeconomic criteria in determining their priorities, and these would be assessed by the TIF managers on a national basis, so that sector objectives were met. In particular, they could give preference to development projects in inland and rural areas, so long as this did not detract from the fund's overall financial objective of breaking even once bond and other obligations had been met. The fund could allow project finance through concessions, but the benefits would be evaluated in respect of their impact on broad sector objectives rather than a single province.

Energy and water projects can raise project revenue with guaranteed revenue from purchase agreements between the infrastructure provider (a power station or water plant) and an intermediate institution (an electricity distribution or water supply agency). The commercial risk to the provider is minimized and the intermediate institution can reduce its risk by having multiple suppliers with different terms and phasing of their purchase agreements. Transport infrastructure does not have this advantage. Road, railway, airport, and waterway capacity is sold directly to final users, not to intermediate institutions. In the absence of an intermediate purchaser who can take commercial risks, potential private investors in transport infrastructure look for strong guarantees from the sponsoring agency in terms of levels of traffic, revenues, or a rate of return, as in the case of energy projects that lack an intermediate purchaser. A TIF would also act as a substitute for such an intermediary. It is recommended that consideration be given to the various ways in which sector investments could be managed, including the possible use of a TIF, and any desirable changes implemented at the same time as the more general institutional reorganization (Chapter 7). Annex A includes a summary of the advantages and disadvantages of a TIF.

G. MAKING PRIVATE INVESTMENT MORE ATTRACTIVE

Although China enjoys a high domestic savings rate and strong interest in mobilizing domestic equity finance for transport project infrastructure, this financing source remains substantially undeveloped. Several private international funds for infrastructure investment have been created, which will continue to provide project finance even after the creation of the TIF. Nonetheless, worldwide demand greatly exceeds supply, and fund managers can be very selective about what investments to support. Since this lender's market will likely prevail for the long term, China will need to make improvements in its borrowing environment to improve its attractiveness for private project finance. It should

- **Develop transparent policies and a regulatory framework for financial deal-making.** Unclear lines of authority between the provinces and the central government, a complex approval process, and ambiguous criteria and policies currently result in lengthy and costly project delays.
- **Improve the legal framework.** China's legal system has not developed enough to accommodate complex financial transactions, which has raised concerns among lenders on security-related financial and legal issues, including the enforceability of contracts and agreements.
- **Clarify tariff policies.** Automatic tariff adjustment provisions in concessions are not yet available. This leaves project sponsors and lenders without assurance that operating and financial costs can be recovered on a timely basis throughout the life of the concession.
- **Improve the creditworthiness of public entities.** Uncertain or insufficient creditworthiness of provincial/municipal contracting parties and concern over their ability to honor financial obligations under contracts discourage lending.
- **Increase transaction experience.** Few provincial/municipal authorities have any direct experience with project finance or BOT transactions. This causes foreign companies to commit expensive resources to time-consuming negotiations and on-the-job training of public-sector counterparts. Overseas Chinese have a wide range of experience in infrastructure finance arrangements and could be a rich source of technical assistance.
- **Implement better risk allocation.** An acceptable allocation of risk between the private financier and the sponsoring government agency is essential if a concession agreement is to be made and implemented successfully. In general, the commercial risk is borne by the concessionaire and the noncommercial risk by the government, but within this generality there is wide scope for negotiation and always a difference between the parties in perception of the risk. The greater risk the concessionaire has to face, the higher will be the financial return sought to cover that risk. The sponsoring agency therefore has to balance taking less risk itself, a higher financing cost and lower economic return with accepting a higher risk and increasing the possibility of a successful economic outcome.

6 Social and Environmental Impacts

One of the principal objectives of the 9FYP is to reduce income inequalities between inland and coastal and between urban and rural areas. The transport sector will play an important role in achieving this. Some of the economic impacts of concentrated growth in coastal cities, such as road congestion and high social infrastructure and labor costs, are already hindering their continued development. Continued migration of people attracted by the better work prospects and higher wages of the coastal provinces will exacerbate these impacts. Alternative sources of growth closer to the current locations of the potential migrant population are needed to avoid this outcome. But the poor accessibility of inland provinces and rural areas is a deterrent to their development and needs to be improved as a precondition to their further integration into the economy. At the same time, the negative externalities of transport growth that can significantly erode the benefits of transport—traffic congestion, deteriorating air quality, high accident rates, resettlement, and the loss of productive land—should be minimized as accessibility is improved.

A. REGIONAL INCOME DISPARITIES

China's impressive economic growth belies increasing regional disparities. Coastal provinces benefit from much greater shares of investment and higher growth rates than their inland counterparts (World Bank, 1995d). The poorest region, South Hinterland, has an average per capita income only 37 percent of that of the East Coast, the richest region; it also has only 26 percent of average income in manufacturing, a troubling observation given the importance of the industry in absorbing surplus labor in poor regions.

TABLE 6.1: CHINA'S GDP BY REGION, 1992

Region	Population (million)	GDP/Capita (1992 \$)	GDP/capita as percent of National Average	Industrial GDP/capita (1992 \$)	Industrial GDP/capita as percent of National Average
China, Total	1,166	470	100	226	100
Far West	51	392	83	159	70
North Hinterland	147	429	91	220	97
South Hinterland	226	292	62	115	51
Central Core	305	331	70	140	63
North Coast	209	608	129	317	140
East Coast	125	784	167	450	199
South Coast	103	699	149	307	138

Source: *China: Regional Disparities*, Report No. 14496-CHA, June 30, 1995.

Improved accessibility will make low-income regions more attractive for industrial investment, particularly to FDI and to suppliers of goods and services in national markets. A recent report (World Bank, 1996b) recognized that inadequate transport links are a barrier to the movement of containers to inland provinces; it currently takes about 10 days to move a container more than 500 km from a port, and costs much more than transporting the contents as loose freight. Since the use of containers is essential to any export-oriented industry, until the transport infrastructure improves for inland provinces, they will

not be able to attract FDI to develop enterprises that take advantage of abundant raw materials and relatively low labor costs.

The policy to build a NTHS (World Bank, 1994a) with its east-west corridors and two principal waterways leading to the interior is a good example of how better access to the interior can be achieved by encouraging the concentration of growth. Development of the 4,100 km China section of the Eurasian landbridge will stimulate development in a region that has suffered particularly from inaccessibility. Support for similar development of the Changjiang and Zhujiang river corridors would extend the benefits of increased accessibility and consequent economic growth to the Far West, South Hinterland, and Central Core regions, where average incomes are lowest. While the North Hinterland region has a personal income rate closer to the national average, it suffers from a high concentration of basic industries controlled by SOEs and is therefore susceptible to a downturn as the economy becomes more competitive, unless it also benefits from improved accessibility. It is therefore recommended that four transport corridors be given development priority to address the issues of regional income disparities—the Eurasian landbridge corridor from Lianyungang to the border with Kazakhstan, the Changjiang corridor from Shanghai to Chengdu, the Zhujiang corridor from Guangzhou to Kunming and a northern corridor from Tianjin to Harbin.

B. RURAL INCOME DISPARITIES

During the 8FYP, rural incomes increased by an average of only 4.5 percent, compared with 7.7 percent growth in urban incomes; this trend underscores the difficulty of alleviating poverty in isolated rural regions (World Bank, 1996c).¹⁵ It is estimated that 30 percent of rural settlements have no access to all-weather roads (Kumar, 1993). Without this minimum level of accessibility, it is impossible for these counties to become integrated into the market economy, their income levels will remain depressed, and their economic growth will be neither achievable nor sustainable.

Improved rural accessibility results in direct productivity gains, broader employment opportunities, and the more frequent use of educational and health facilities (Wilbur Smith and Associates, 1996b). These benefits nearly always justify the provision of, at the very least, a basic all-weather road. A strong confirmation of the economic rationale for higher investment in rural roads is demonstrated in the Government's poverty alleviation strategy for isolated populations. Although this program includes investment in rural road projects, levels are not enough to significantly increase average rural incomes.

Counties with the greatest accessibility problems usually have the fewest financial resources, and therefore need most support for rural road construction from national and provincial governments. Making a noticeable impact on rural accessibility will require a strong institutional focus and clear identification of responsibility for planning, financing, and implementation. Minimum accessibility standards would be expressed in terms of access times and be set locally, according to national guidelines. Providing a national standard of an all-weather road to all counties is included in the recommended roads investment program at a cost of about \$3 billion annually over the 15-year period, which represents approximately 10 percent of total proposed road expenditures.

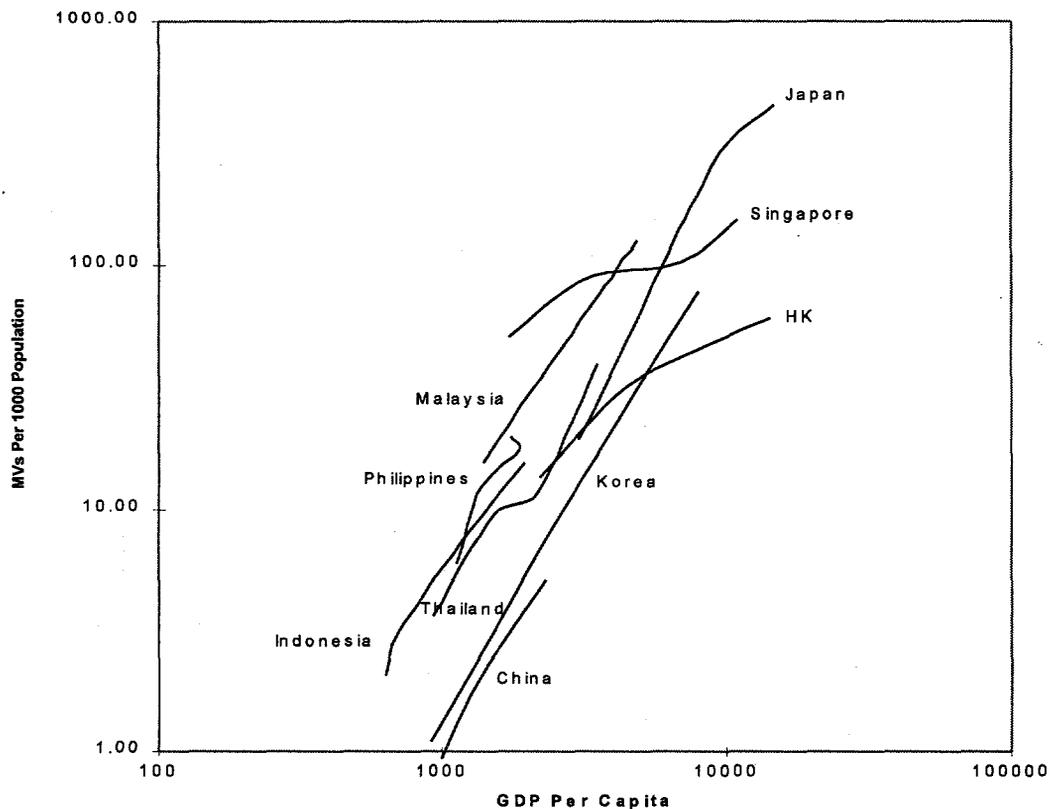
¹⁵ In 1995, rural/urban income differentials narrowed for the first time in 10 years.

C. MOTORIZATION

At the other end of the spectrum to the problems of rural inaccessibility are those associated with rapidly increasing urban motorization. Left unchecked, these will lead to widespread urban road congestion and severe air pollution. Current policies aim to resolve the issue through the massive construction of urban ring roads, an approach that will have only short-term benefits and, in the longer term, will create a pattern of land use that includes a dependence on private motorized travel.

Despite recent rapid growth, China's motor vehicle ownership rate is still among the lowest in the world at eight vehicles per 1,000 people, only two of which are passenger cars (Stares and Liu, 1995). Although a close correlation exists between income and motorized vehicle ownership levels, the latter is subject to many other influences, in particular the pricing of vehicle use, residential density and quality of public transportation services (Hau, 1994). At all income levels, China's vehicle ownership rates have been below those of other Asian countries (Figure 6.1). As its social and economic structure becomes more like those of its neighbors, however, China's vehicle ownership rate will likely catch up, but by moderating the factors that influence their use, the consequences can be made more acceptable.

FIGURE 6.1: EAST ASIA MOTORIZATION, 1960-90



Source: *China's Urban Transport Development Strategy*, World Bank, 1996.

Although it is difficult to accurately project growth in motor vehicles, a recent Bank report (World Bank, 1997a) estimates that national vehicle ownership could reach between 45 and 57 per 1,000 people by the year 2010; up to half of this number will be private cars. Urban car ownership levels are expected

to be up to three times higher and comparable with current levels in other advanced developing countries such as Korea and Brazil. The historical development of Chinese cities, which is based on a pattern of high population densities and an integration of industrial, commercial, and residential land uses, cannot sustain such a high levels of car ownership and use. Cities such as Shanghai and Guangzhou already have extreme levels of congestion and air pollution. As a result, they have restricted motorcycle ownership to levels that are very moderate by world standards.

Plans to relieve congestion through the construction of ring roads will do no more than release pent-up demand and create pressure to build even more roads. A revised pattern of urban growth that focuses more on corridors than ring roads will encourage continued use of nonmotorized vehicles and public transportation. Implementation of such a development strategy requires policies that support these transportation modes and make better use of existing infrastructure through demand and traffic management strategies (World Bank, 1996g).

Motorization trends have been reinforced by a controversial policy that has established car manufacturing as a pillar of economic growth. This policy needs to be complemented by others that charge for vehicle use in ways that reflect their full social and economic costs, and thereby encourage the use of nonmotorized and public transportation.

D. TRANSPORT'S SOCIAL AND ENVIRONMENTAL IMPACTS

Congestion

Congestion, already a serious problem in urban areas, is an increasing problem on interurban roads as traffic grows faster than capacity. In 1993, peak-period traffic levels on 62 percent of the National Highway network exceeded design capacity (ADB, 1995b). About 4 percent of GDP would have to be invested just in highways to accommodate the projected growth of interurban road transport without an increase in congestion. In the absence of any demand-constraint policies, an even greater amount would be needed to achieve the same result in urban areas.¹⁶

Since congestion cannot be avoided by increasing capacity alone, demand and traffic management measures will also be needed. These include a requirement that road users be charged: the full costs of providing capacity; the opportunity costs of the energy they consume; and, so far as is technically feasible, for externalities such as congestion and pollution. The current system of user charges is far from attaining these goals, so decisions by users of the transport system, particularly those related to car use, are not based on an appreciation of their full social costs. While there are few places in the world where users are subjected to all these charges, many cities, including some in China, are now considering the use of newly available technology to charge for congestion.

Policies in place now aim to keep the price of gasoline "at a reasonable level" (SPC, 1994), resulting in prices that are among the lowest in the world (Table 6.2). While these policies are maintained, it will be impossible to control urban transport congestion and traffic-induced air pollution. Pricing transport fuel at or above its opportunity cost, a widespread practice in other countries, would be a significant step in meeting the objectives, since fuel consumption increases significantly in congested traffic (World Bank, 1996g).

¹⁶ *China's Environment in the 21st Century*, World Bank, 1997a.

TABLE 6.2: INTERNATIONAL COMPARISON OF FUEL PRICES

Country	Gasoline price (cents/liter)	Diesel price (cents/liter)
Asia		
China	25	22
Taiwan (China)	60	41
Japan	104	71
Republic of Korea	93	41
Thailand	31	28
Vietnam	39	30
Europe		
France	118	74
Germany	94	69
Spain	78	61
Italy	112	83
Americas		
United States	37	31
Canada	49	38
Mexico	43	30
Brazil	75	39

Source: International Gas and Diesel Prices, World Bank, Second Quarter, 1997.

Several compelling arguments speak in favor of a two-part surcharge on the price of transport fuels. The first would be a proxy for an air pollution charge, with revenues going to finance projects that improve air quality, and applied to all petroleum that is refined for national use or imported. The second would be part of a broader transport infrastructure charge system and based on sales to gas stations and other major transport users such as airlines and CR. It would make the sum of user charges more closely parallel the costs of providing and maintaining the road network, with the revenue generated put into the TIF. Fuel surcharges would be collected at their source from the China Petroleum Company (CPC), which would be responsible for including them in retail prices, so the final charge would be on consumers. Such a system would be easy to enforce, difficult to evade, and have a low cost.

Fuel price increases and surcharges can be implemented over a period of several years to minimize their apparent inflationary impacts. The higher investment made possible by the second part of the surcharge would result in net savings in operating costs and not be inflationary. In addition, higher overall prices will bring about a more efficient use of fuel. This last benefit is important in light of the projected increase in transport fuel consumption, the lack of domestic hydrocarbon fuel resources, and the potential impact of imports on the trade balance. A total surcharge equivalent to 10 cents/liter would generate about \$175 billion over the analysis period, or about 26 percent of total transport investment (see Chapter 5).

Even if an increase in fuel efficiency results from these charges, hydrocarbon fuel consumption in the transport sector is projected to triple during the 15-year analysis period. The quantity of domestic fuel available for transport will hardly increase, and the additional cost of imported fuel will reach \$2 billion per year by the year 2010, or about 0.5 percent of GDP. Without the proposed surcharges, consumption would be 10 percent higher and the need for additional imports more than 15 percent higher. Already, China is making long-term contracts for the import of oil to ensure the availability of future supplies.¹⁷

TABLE 6.3: PROJECTED FUEL CONSUMPTION

Mode	Annual average fuel consumption (million barrels)			
	9FYP	10FYP	11FYP	Period
Road	33	50	77	59
Rail	12	14	18	16
Air	10	19	33	23
Inland waterway	0	1	1	1
Total	56	84	130	99

Source: China: Transport Sector Investment Model, World Bank, 1998a.

Air Quality

Urban air pollution is closely associated with transport activity. In Guangzhou, 87 percent of carbon monoxide and 67 percent of nitrous oxide emissions are attributable to mobile sources operating primarily in heavily congested traffic. While the number of automobiles in Beijing is only about 10 percent of that in Los Angeles or Tokyo, the city has the same level of vehicle emissions (Lin and Polenske, 1995). A recent survey of air pollution in major cities ranks Beijing second highest in the world, after New Delhi, in the level of particulates, and fourth highest in sulfur dioxide emissions.

Efforts to control emissions are unlikely to become effective until declining air quality is recognized as a serious problem. Responsibility for reducing pollution from vehicles is distributed among various agencies. National emission standards for new cars are similar to those found in Europe and the United States during the early 1980s. Those for gasoline engines are so low, however, that they can be met without the use of catalytic converters. Emissions from new Chinese vehicles are about 10 times higher than from vehicles manufactured in Japan (Hook and Replogle, 1996). Because the implementation of testing for vehicles already in use is weak, a single Chinese-made automobile emits the same amount of carbon monoxide as 40 to 60 US automobiles, and emits nitrous oxide equivalent to that from 8 to 15 US automobiles (Lin and Polenske, 1995).

¹⁷ CNPC is to invest \$4.3 billion over 20 years to secure a 60 percent stake in Kazakhstan's state-owned oil company. It also intends to spend an additional \$3.5 billion to construct a 3,000 km pipeline from Kazakhstan to Xinjiang. CNPC is reported to have made another deal with Iraq on the \$1.2 billion development of the Ahdad oil field, once UN restrictions are lifted (*Financial Times*, London, July 5, 1997).

The issue of vehicle emissions needs to be addressed in two ways: through more stringent construction standards for new vehicles and tougher maintenance standards for existing vehicles. Establishing emission standards for new vehicles would be a relatively simple first step toward reducing air pollution attributable to road transport. But regulating standards for all vehicles on a regular basis would have a greater impact. This process would be best achieved by establishing minimum national standards and by allowing municipalities and provinces to set even higher standards if their particular conditions demand it. Some municipalities have already implemented emission standards. Guangzhou, for example, requires annual tests for every motorized vehicle in order to verify compliance.

Safety

Transport is inherently dangerous, but becomes even more so when motorized and nonmotorized users must share the same road space, and when speeds increase and infrastructure is used intensively.

More than 100,000 people died in transport accidents in China in 1994, the latest year for which data are available,¹⁸ and the road accident death rate was one of the highest in the world when measured as fatalities per motorized vehicle (Table 6.4). One reason for the high accident rate per motorized vehicle is the large number of nonmotorized motor vehicles, though no reliable data on this pattern are available for China or other countries. Shared institutional responsibility between the Public Safety Bureau (PSB), MOC, and provincial and municipal authorities makes it difficult to address the question of road safety in a comprehensive manner. Overlapping and imprecise institutional responsibilities for highway safety also exist in other countries, but have been resolved because of the issue's urgency.

China should draw on these international experiences in achieving a more productive institutional integration. The proposed Transport Safety Board (Chapter 7) would, among other functions, establish an independent safety inspectorate and address the sectoral, rather than modal, aspects of transport safety.

Nonmotorized vehicles offer nonpolluting, low-cost mobility suitable for multiple short- to medium-distance trips. Bicycle riding and walking account for up to 90 percent of total trips in several major Chinese cities (World Bank, 1996i, Annex), and nonvehicular transport (tractors, bicycles, animal-drawn

TABLE 6.4: INTERNATIONAL COMPARISON OF ROAD ACCIDENT RATES

Country	Fatalities	Fatalities per 10,000 vehicles	Fatalities per 100,000 people
China	71,007	75.4	5.9
Brazil	5,500	4.1	3.6
Canada	3,485	1.7	12.7
France	9,052	2.8	15.8
Germany	10,643	2.4	13.2
India	54,058	32.8	6.1
Indonesia	10,887	12.2	5.9
Japan	10,942	9.6	8.8
Mexico	5,252	4.6	6.2
Pakistan	6,299	27.6	5.3
Republic of Korea	10,402	12.7	23.8
Thailand	9,496	9.3	16.4
United States	39,235	2.0	15.4
Zimbabwe	1,021	0.1	9.8

Source: *World Road Statistics*, International Road Federation, 1994 and *China Statistical Yearbook* (1995).

¹⁸ Although official road accident statistics recorded 71,000 deaths in 1994 (*China Statistical Yearbook*), these exclude 30,000 deaths at railway level crossings ("Road Safety in China," Alan Ross, High Level Highway Seminar, Beijing, 1997).

carts, and rickshaws) accounts for up to 30 percent of total traffic on many interurban highways. However, the mixture of nonmotorized and motorized traffic is a major contributor to both high accident rates and low highway capacity. Where implemented, their separation has greatly contributed to solving these problems at a relatively low cost. Use of the first high-grade highways in China has shown that where complete separation is not possible, grade-separated crossings or tunnels for nonmotorized users are cost-effective alternatives. MOC should emphasize the incorporation of design features for nonmotorized road users into new road projects, as well as ensure that all designs are subject to a safety audit (Ross, 1997).

Air safety became a serious problem in the early 1990s following the liberalization of air transport regulations and the separation, in 1988, of CAAC's air transport and regulatory activities. A number of crashes and near misses during 1992-94 prompted a ban on new aircraft purchases until serious airport capacity and pilot, crew and maintenance training issues could be addressed (*Flight International*, 1994). A joint United States-China task force, including CAAC representatives, has taken the lead in generating both short- and long-term solutions to airport/airspace capacity and safety problems (*Aviation Week and Space Technology*, 1994).

Increased investment in aviation infrastructure and training programs has significantly improved air transport safety in China. An 18-month period without a fatality came to an end in April 1997. The rapid growth of air transport continues to make safety precautions an urgent priority. The creation of a Transportation Safety Board (TSB) would provide a valuable source of safety guidance, independent of the agencies that are responsible for promoting air transport, such as CAAC and airlines.

Resettlement

A sustainable transport policy requires careful attention to voluntary resettlement of people whose homes, workplaces, or landholdings are displaced by transport infrastructure improvements. World Bank highway projects in China have had impacts ranging from under 10 to more than 300 people affected per kilometer of road construction. At an average of 50 affected residents per km of new Expressway, Class 1, and Class 2 roads, the investment plan outlined in Chapter 3 would require compensation of some form for more than 2 million people. Although China has excellent resettlement policies, the scale of the problem necessitates continuous vigilance to minimize the number of affected people and to ensure that injustices do not occur.¹⁹

Land Use

China's high population density makes the efficient use of land an imperative development policy objective. The interurban transport network is still sparse and utilizes a smaller proportion of potentially productive land than in other countries. However, concerns exist that the development of a new transport infrastructure could contribute to an increased shortage of land for food production.

¹⁹ In China, national, provincial, and municipal government principles guide the process of resettlement. These principles require that incomes and standard of living of affected individuals be restored or improved as soon as possible following the disruption caused by land acquisition. These principles seek to (a) relocate houses and enterprises as close as possible to their initial location; (b) maintain or improve housing quality and size; (c) replace farmland through readjustment in the same village; and (d) arrange jobs in nearby enterprises when farmland cannot be replaced. National regulations and resettlement issues are governed by the Land Administration Law of China for Land Acquisition and Resettlement and the Regulations for Implementation of Land Administration of China.

Debate over the total amount of land that might be lost to cultivation over the next 30 years is ongoing, with estimates ranging from 25 million to more than 40 million hectares. All of the land used for new transport infrastructure is not taken from productive uses, and new route locations take into account the need to minimize such losses. Although new transport infrastructure can have a negative impact on adjoining productive land, it may also make other areas more productive by increasing their accessibility to markets. The proposed construction of more than 34,000 km of new rail lines, 250,000 km of new Class 3 and higher roads, widening of more than 3,000 km of inland waterways, and construction of 40 new airport runways and associated facilities will consume more than 2 million hectares of land, compared with an estimated 139 million hectares currently under cultivation (Crook, 1994). Better integration of transport mode planning could reduce the need for new infrastructure, and closer coordination among transport and agricultural institutions would ensure that land is taken from nonproductive uses whenever possible.

In addition to consuming land, road building and other large-scale construction projects often give rise to environmental damage. While not a significant systemwide problem, runoff caused by inadequate drainage on China's roadways has been known to contaminate adjacent agricultural areas, and long sections of highway built on embankments can bring about large-scale drainage problems. Noise and dust are also commonly associated with increased road building and motorization. All of these trends exacerbate the impact of new transport infrastructure on agricultural production.

7

Forward with One Spirit—A Transport Strategy and an Institutional Structure

A. TRANSPORT STRATEGY

The three principal transport sector objectives for the medium to long term should be to (a) enhance the prospects for economic growth by facilitating transport network development and expansion; (b) help reduce income inequalities; and (c) reduce the negative environmental and safety impacts of transport. The recommended strategy to achieve these objectives is the aggregation of the actions and policies identified in the previous chapters. Taken together, they provide an integrated and consistent framework that will allow the sector to satisfy its objectives. They need to be considered as a package and not as a set of independent measures from which a selection can be made, since failure to make progress in any one of them will impede the effectiveness of the others. The unifying theme behind them, which translates them into a strategy, is that the transport sector can best function as a single entity, and that its best way forward is with one unified spirit.

The recommended actions and policies that comprise the sector policy are

- **Adopt a vigorous competition policy.** Without more competition, the sector will be unable provide the quality of service that is increasingly demanded by users. At the same time, without an adequate regulatory system, users may be exploited by monopolies and cartels, which have the potential to destroy nascent competition. Revised regulations should encourage more equitable competition between private operators and transport SOEs (Chapter 2).
- **Adopt compatible regulatory and tariff policies** in each mode, adopt infrastructure pricing principles that are compatible between modes, and relax remaining constraints on what operators charge their users for different types of service (Chapter 2).
- **Facilitate multimodal transport.** Transport operators need to respond quickly to new demands for multimodal and intermodal services in order to help China better integrate its transport system with that of the rest of the world, thereby increasing its international competitiveness. Divided institutional responsibilities for different transport modes are the greatest impediment to the expansion of multimodal transport. A more integrated structure would facilitate their operation and encourage their expansion (Chapter 2).
- **Undertake indicative sector infrastructure planning,** to assess the social and economic impacts of alternative investment strategies. The transport planning function of a planned economy was intended to ensure that infrastructure and services were available to meet a known demand, and to allocate that demand between modes and services. In a competitive economy, both the volume of demand and its modal distribution are uncertain. Infrastructure planning must account for these uncertainties, while service planning is replaced by the need to create the conditions under which any operator, private or public, can supply services (Chapter 5).
- **Increase investment in transport** to 3.8 percent of GDP in the short and medium term and 3.3 percent in the long term. A high proportion of this investment should be allocated to improving and maintaining existing infrastructure. New infrastructure investment would be aimed at compensating

for past underinvestment, and be concentrated in four corridors, so as to provide improved routes to vast areas of the interior that presently suffer from inadequate access to the main centers of population and ports (Chapter 4).

- **Stimulate new sources of finance** so that this high level of investment can be sustained, by modifying and unifying the structure of user charges and making joint public/private finance of infrastructure projects more attractive (Chapter 5).
- **Create a Transportation Investment Fund** to better manage the allocation of scarce financial resources and better prioritize investments. The Fund would be financed primarily through revenue from new and expanded user fees and, through securitizing these revenues, attract more private finance (Chapter 5).

B. INSTITUTIONAL FUNCTIONS

The current institutional structure of transport served the transport sector well in the past, although as long ago as 1987 there was an intention to create a Ministry of Transport. Implementing the new Strategy proposed here, appropriate for a developing market-oriented economy, will not be possible with an institutional structure designed for a planned economy. It is rigid and inflexible, stifles competition and initiatives for new services, and has been unable to provide the infrastructure the economy needs. It is now leading to incompatible and inconsistent policies between modes, investment decisions in one mode that fail to take account of those in others, unduly slow progress in separating the operational from the facilitatory role of the State, a failure to stimulate genuine competition, confusion on the part of remaining state operators as to their role, and a failure to integrate services between modes.

Instead, it should provide an enabling framework to stimulate competition by eliminating the formal and informal barriers to entry, equalize the operating environment for public and private providers of services, facilitate the provision of infrastructure by a dynamic partnership between public and private finance, and ensure that the negative environmental impacts of transport are minimized. After more than a decade of economic transition, the functions and structure of the transport sector's institutions have changed little and the time has come for a fundamental reassessment and restructuring in order to better serve the country's needs.

BOX 7.1: INSTITUTIONS AND INCENTIVES

Institutions are rules of the game in a society, or more formally, they are the limitations created by man to shape human action. As such, they structure incentives for human exchange, be it political, social or economic. History has shown that where institutions create positive incentives, people act on them productively and where institutions create disincentives, initiative is effectively deterred.

Douglass C. North, "The New Institutional Economics and Development," a paper presented to the *Conference on Public Choice and Development*, London, September 1993

The differing pace of change of the role of the public sector in each mode creates the greatest challenge to institutional restructuring. While the State's role in road, waterway, ports and air transport has already been substantially reduced, with major private involvement in them all, there has been little change in the railways. SOEs are still the main source of demand for the railway, and the State, national and provincial, is the sole supplier of services. Until this role is reduced and made more compatible with that of other transport modes, with at least a clear separation of responsibility of operations from

management, implementing a Strategy based on a unified concept of the sector will be impossible. This separation of responsibilities is a prerequisite for initiating the recommended Strategy.

The State's function in relation to infrastructure design and safety standards for operation and vehicles, and the relationships between them, will be similar to what they were under a planned economy, and remain specific to each mode. Yet most of the new roles relate to the sector as a whole and not to each mode. The policy focus will shift as transport operations are increasingly transferred to the private sector, and the State takes a more prominent role in monitoring and regulating private operators. Given that stimulating competition and satisfying the increasing demands for multimodal transport are not always compatible roles, it is imperative that implementation of the Strategy should achieve a balance between them. Devising an institutional structure that will achieve this balance will require skill and imagination. The sector-related functions that could be attributed to the new ministry, in addition to those relating to specific modes and to nontransport communications, include

- **Managing Competition Policy.** Formal and informal barriers to entry to the sector would be minimized, including those for freight forwarding and container transport. It would be responsible for making the recommended Transition Agreements with SOE operators, and monitoring their implementation. Informal barriers to entry are the most difficult to reduce, and the temptation to introduce multiple regulations for this purpose must be resisted strongly. A better approach is to eliminate those regulations that are often the basis for an informal barrier. There is always a choice as to whether to leave the management of competition to a central agency responsible for the whole economy or whether to delegate this function to sector ministries. The former has the advantages of compatibility of practices throughout the economy and efficiencies in specialization of staff. The latter has the advantage of better knowledge of the sector issues and efficiencies of smaller size. The government in the United Kingdom has changed its regulation of competition in financial markets from different regulatory agencies for each subsector to a single agency for the whole market,²⁰ an indication that there is no uniquely correct resolution of this choice.
- **Coordinating Pricing and Regulation Policy.** The new institution would set the principles for charging for transport infrastructure on the principle of Ramsay pricing in each mode. It would also monitor final user prices as part of its competition policy, but would not establish or recommend any specific prices or tariffs. It would investigate complaints of monopoly practice from users of transport service and have the power to penalize operators found to have indulged in them, by revoking their operating license.
- **Sector Planning and Coordination.** While market forces can do a better job than state institutions in producing transport services, planning and provision of services is still needed. This function is particularly relevant in a transition economy where coordination of large infrastructure projects by the private sector is still in its infancy, where most infrastructure investment is still made by the State, and where the investment needs are so great that the costs of wrong decisions are too high to be tolerated. In addition, the present imperfect competition of the transition economy has not proved successful in introducing multimodal and container services. The documentation requirements of a plethora of subsectoral agencies currently stifles the provision of such services and is slowing the economic growth of inland provinces.

²⁰ *The Economist* (London), June 1997.

The tools for carrying out sector planning should include macroeconomic models that follow an input-output format, which would allow for the indicative projection of sector demands at the national level. These could be supplemented by regional or corridor models that estimate individual product flows. The relative advantages of each mode to satisfy various demands could then be assessed. The models could also be used to illustrate the advantages of the better resource allocation that would result from more compatible pricing and regulatory policies between modes, and to help formulate new pricing and investment policies.

Development of these models has already started, for example with a Bank-supported Railway Investment Study (RIS)²¹ and with a highway investment prioritization model supported by Australian technical assistance.²² However, the development of these approaches is progressing very slowly and, despite their great potential for making investment decisions more efficient, their current application is very limited. In contrast, development of an Infrastructure Inventory Model by the Institute for Comprehensive Transportation at SPC, with technical assistance from Canada, is making good progress. An integration of these three approaches to transport planning, with the addition of an operational costing model, could form the basis of a sector planning and investment tool. Only a sector institution can bring about this integration of different approaches to planning, and formulate policies based on analysis of their outputs.

- **Management of the Transport Investment Fund.** Management of the proposed Transport Investment Fund would be a principal function of the new ministry. This would promote compatibility among the investment and financing policies of each mode. It would recommend to MOF the structure and level of transport infrastructure user charges.
- **Facilitating Multimodal Transport.** Much of the investment needed for multimodal transport can be provided by the private sector, but it will not materialize without the better coordination between modes that would come from a single sector institution. As an example, the import and export of high-value industrial products is hampered by the incompatible and time-consuming documentation requirements of the different modes that the products must use. In addition, while the technology of consignment tracking and location is now well advanced, the lack of coordination between the systems being proposed by shipping lines, customs agents, ports and railways is preventing its benefits from being realized. Simplification and integration of these procedures and systems will be easier with internalization of different transport sector interests.

The strong vertical integration of each mode's institutions, few horizontal linkages to the institutions of other modes, and the multiplicity of nontransport agencies, make it difficult for operators to provide multimodal transport. In particular, door-to-door container transport fails to achieve its full potential. Containers are frequently loaded and unloaded at ports of entry or exit (World Bank, 1996b), rather than at points of final destination or trip origin, despite recent attempts at document and procedural simplification. A more integrated strategy would remove the bottlenecks where modes interface, improve coordination of documentation procedures with the rapid development of paperless methods, and implement a wider use of information technology.

²¹ Financed through the Seventh Railway Project.

²² "Study of Prioritization of Highway Investments and Improving Feasibility Study Methodologies," Rust PPK for MOC.

- **Coordinating Policy with Other Sectors of the Economy.** This role is very different in a market economy to that in a planned economy. In the former, the State is only a facilitator and regulator of activities undertaken by private companies with their own commercial objectives. These are assumed in aggregate to be compatible with social policy. The market itself is expected to provide signals for investment and new services, and to provide the necessary checks and balances between users and suppliers. State intervention is limited to mitigating the impacts of market imperfections, so there is little need for coordination between transport and other sectors of the economy. In a planned economy, transport is just one part of a national State strategy to produce and distribute goods and services according to a predetermined plan, the execution of which requires a formal system of coordination between different economic sectors, including transport. The outcome of the plan is assumed to satisfy social and economic objectives.

A transition economy has a constantly evolving mixture of the two, but so long as the market system is still undeveloped and State intervention in the economy continues, coordination is needed. SOEs still have a significant role in agriculture, mining and manufacturing, the principal sources of demand for freight transport, and the State still has a role in providing transport infrastructure. Coordination is still necessary between state agencies responsible for planning production and those responsible for transporting their inputs and outputs. The more integrated this coordination, the more closely it can simulate the results of a market system, and this can best be achieved by a single transport sector agency.

- **Improving Rural Accessibility.** Many rural communities in China have not yet advanced beyond local subsistence economies. They will not be able to take advantage of a market economy unless their accessibility improves. Simply investing in infrastructure will not be enough to guarantee the provision of services they need. When further incentives are needed, they should be provided in a way that minimizes costs without reducing service quality. The provision of minimum standards of accessibility requires a high level of coordination between agencies within transport and other sectors of the economy, as well as between different agencies of government.
- **Minimizing the Negative Environmental Impacts of Transport.** China still has a very low level of vehicle ownership, about 8 vehicles per 1,000 people, but it is expected to increase rapidly (Chapter 6). Initial increases will primarily be in commercial vehicles, which currently make up more than two-thirds of the total, but the expected growth in private cars means that, by 2010, these will be more than half the total. Increasing fuel consumption and traffic congestion will impact on air quality, while agricultural losses and resettlement of residents displaced by new infrastructure will also increase. Minimization of these negative impacts could best be managed by a single sector agency. It would have to closely coordinate with the National Environmental Protection Agency (NEPA), which has overall responsibility for establishing and implementing environmental standards, including those for air quality.
- **Increasing the Safety of Transport Operations.** The State has failed in its obligation to provide a context in which transport operations can be safely carried out, with more than 100,000 deaths per year in transport-related accidents.²³ While it is feasible to reduce accident rates to levels comparable to those found in other countries at a similar stage of development, doing so will require: improved

²³ "Road Safety in China: Need for Action," Alan Ross, High-level Highway Seminar, Beijing, May 1997.

infrastructure design; better integration between vehicle and infrastructure design; more and clearer road signing; higher driving standards; and greater awareness of the risks of road transport. The present division of institutional responsibilities between PSB and other sector agencies fails to provide these needs. Other countries have resolved the same institutional conflict by making highway agencies responsible for measures related to infrastructure and vehicles, and the police for those related to drivers and driver behavior. A similar and clearer definition of areas of responsibility will be a necessary condition for making China's roads safer.

A positive first step toward mitigating this situation would be the creation of a Transportation Safety Board (TSB), similar to those found in the United States and other countries, under the executive responsibility of the proposed new ministry. The TSB would be responsible for investigating accidents that result in the death of passengers on public transportation vehicles (taxis, buses, trains, aircraft, and ferries), providing evidence of the causes of accidents, and would make recommendations as to how similar accidents might be avoided. It would be staffed by experienced transport operators and engineers, preferably without the participation of lawyers (except when assistance in drafting new laws is needed) in order to avoid the appearance that it is usurping legal investigative functions. The TSB's recommendations should be made public and be binding on operators and modal agencies.

C. PROPOSED INSTITUTIONAL STRUCTURE

Since many of these functions overlap with those of existing institutions, the allocation of responsibilities would have to be clearly defined. This is particularly true with respect to monitoring complaints of anticompetitive behavior by transport operators. There is always a dilemma as to whether these issues are best addressed by a specialized government or legal body that deals with antitrust issues in all sectors, or by sectoral institutions that have a close relationship with users and operators, but less specialization and experience in antitrust issues. Regulatory authorities can be industry-specific, with separate agencies for each sector (as in the United Kingdom, which has separate agencies to regulate each type of infrastructure); sector-specific (as in Hungary and Colombia, which have one agency for groups of infrastructure types), or multisectoral (as in the United States).²⁴ If there are sufficient practitioners (administrators and lawyers) with expertise in antitrust issues, then it is usually better to utilize sectoral institutions. These also make "capture" of the agency by regulated operators more difficult. A similar dilemma would exist with regard to environmental policy and the relationship between the proposed new MOTC and NEPA.

BOX 7.2: FORWARD WITH ONE SPIRIT

Planning in China has historically been very centralized and compartmentalized. **The goal now should be to break down the barriers between facility designers, operators and users, and between different modes and political jurisdictions.** The future demand for transport services cannot be estimated with precision and is no longer determined by a set of centrally politically prescribed production targets to be met largely by state-owned industries.

Source: China: Southeast Coastal Region, Strategic Issues in Ports and Shipping Development, Report 11771-CHA, World Bank, December 1993.

²⁴ *Designing Regulatory Institutions for Infrastructure—Lessons from Argentina*, Viewpoint Number 114, World Bank, May 1997.

It is recommended that a new state institution be created. The three principal options are (a) to create a new first administrative tier State Transport Commission, by separating the transport functions from SPC, in a similar way to the formation of SETC; (b) to create a broad-based Ministry of Transport and Communications (MOTC); or (c) to create a Transport Council, responsible only for transport sector issues, leaving modal issues to existing ministries. The first option has an advantage in that the existing ministries will be left largely intact, losing only the few sector functions that they perform. Another advantage is that it will not create an additional level of bureaucracy, since the current relationships between SPC and MOC and MOR will simply be transferred to the new State Transport Commission. Its disadvantage is that it will do little to facilitate integration of many of the functions of MOC and MOR. The second option will not retain the existing ministries, but neither will it create a new level of bureaucracy. Current relationships between MOR and MOC with SPC will be replaced by those between MOTC and SPC. The risks of this option are that the two existing ministries will be difficult to merge and that the resulting agency will be too large to be manageable. The third option will leave existing institutional relationships intact, but create a new institution and add a new level of bureaucracy. Its creation would also set a precedent in China, since there is no role in the government structure for an agency that only coordinates the responsibilities of different ministries.

BOX 7.3: TRANSPORT MINISTRIES AND COMMISSIONS

A survey of the institutional structure of the transport sector in six large developing countries showed that none of them has so far successfully addressed the issues of multimodal transport or compatibility of pricing and regulatory policy between modes. However, with the exception of India, which still has a Ministry of Railways, they have all now integrated their transport responsibilities into a single ministry. Brazil had for a long time a centralized transport planning agency (GEIPOT—National Transport Planning Agency). It undertook, on a contractual basis, transportation planning and analyses for state transportation agencies and companies, state and municipal governments and even neighboring countries. However, as elsewhere, these plans were generally unsuccessful and had little direct influence on transport strategy, policy or investments. More success was achieved when the plan was produced as part of an ongoing planning process and included the participation of the agencies with operational as well as planning responsibilities. Perhaps the most successful example of a Transportation Commission is that of Canada, which has recently overseen the successful restructuring of railway and air transport.

The concept of a unified sector going Forward with One Spirit clearly points to the second option. The new Ministry would absorb the existing Ministries of Communication and Railways, take over responsibilities for internal air fares and airport development from CAAC, and for developing container and multimodal transport from SETC. It would be responsible for managing the proposed TIF and TSB, the latter requiring a new relationship with PSB, and for developing a new relationship with NEPA for issues related to transport-induced air pollution. CAAC would retain most of its functions relating to international air travel and air navigation facilities. The first of these has only limited interaction with other transport matters, while the latter is still too closely linked to national defense considerations to pass to a civilian agency.

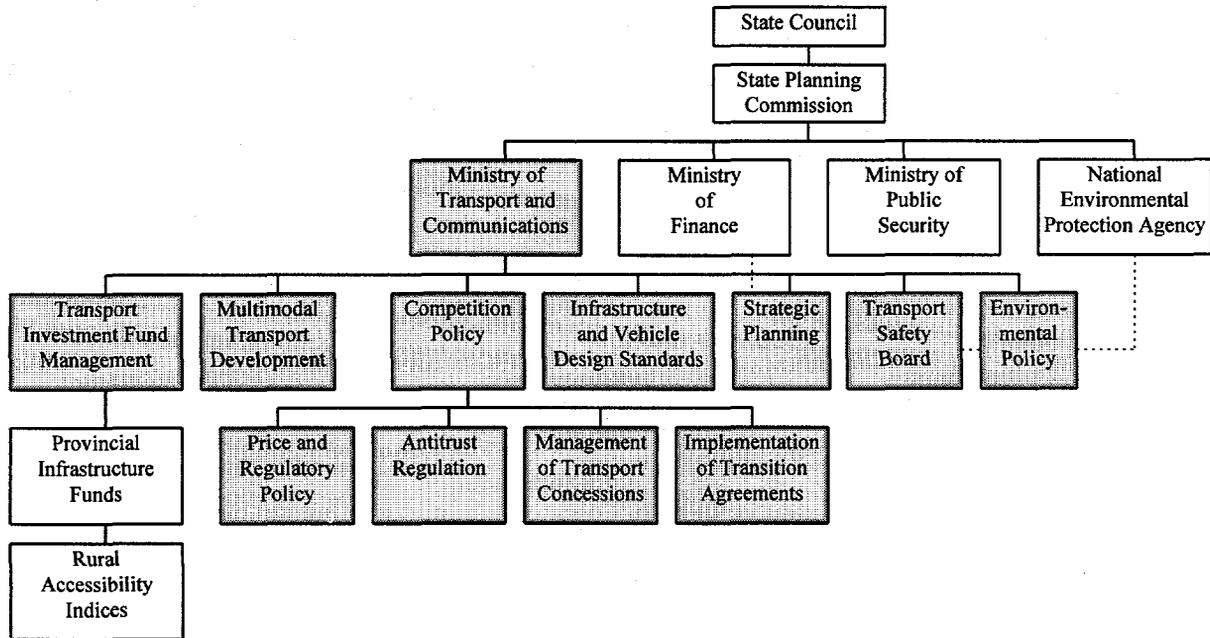
The most difficult jurisdictional issues would be in relation to planning and finance for transport. The new MOTC should prepare and submit five-year rolling transport sector investment plans to SPC. These would be supported by evidence that the proposals will provide capacity to satisfy expected demand, as well as demonstrating how they will be financed by the TIF.

In preparing these financial projections, MOTC would agree with MOF on the level of user charges over the plan period. In determining annual budgets, MOF would always have the right to veto any increase in charges or investments, but would not have the right to demand reductions in either charges

or investments beyond those already agreed as part of the sector investment plan. This would ensure that management of the TIF did not conflict with macroeconomic objectives, while retaining the funding assurances needed to support the TIF in its bond issues. It would also minimize the possibility that user charge revenues would be diverted to other uses.

The Ministry would be organized on national, provincial, and local levels in a similar manner as other national government agencies. The internal structure of the new MOTC will depend on which of its many potential functions are finally allocated to it. If it were to assume all of them, the simplest feasible structure would be as shown in Figure 7.1 (This only takes account of the technical functions, it does not include MOTC’s internal administrative functions). This figure also shows the relationship between the proposed MOTC and other sector agencies.

FIGURE 7.1: INSTITUTIONAL STRUCTURE OF THE PROPOSED MINISTRY OF TRANSPORT AND COMMUNICATIONS



Source: World Bank.

D. TRANSPORT SYSTEM MANAGEMENT

Implementing a new transport sector strategy with a new ministry will require a new approach to the varied and complex issues involved. Simply adapting the existing policies to a new context will achieve little. The basis of the strategy presented here is that the transport sector is much more than just the sum of its individual modes. One effective way to implement this approach is to use systems management, which would comprise market-based, regulatory, and technological measures to ensure complementarity and sustainability of policies to manage demand and facilitate supply.

Market-based policies would use principles of costing and pricing to better manage demand and stimulate supply. Infrastructure charges proportional to long-run social costs can also be used as an instrument of broader social policy by facilitating cross-subsidies among users (essentially income

transfers). There are sometimes compelling reasons, particularly in a transition economy with its many market imperfections, where market-based tariffs will not result in the politically or socially desirable outcome. In these cases, they need to be supplemented by regulatory measures. They should always be considered a second-best option and used only when prices will not produce the desired result. Demand regulations could entail demand management, including restrictions on the use of cars in urban areas and of heavily polluting vehicles. Supply management through regulation involves the application of investment criteria for new infrastructure in areas of resettlement, environmental concerns, and land use. Supply regulations can also directly address other key problems, such as regional inequities, or provide incentives to prioritize maintenance over new construction.

Recent technological advances make it possible for infrastructure pricing systems to distinguish between many different categories of user, reducing the need to resort to regulations in managing demand. Pricing rather than regulation can also be used to control vehicle operations, for example through charging for the use of trucks with different axle loads. Other technology-based policies focus on various aspects of supply management. These include infrastructure and vehicle maintenance systems, control of vehicle-induced pollution and technical standards for vehicle design and construction (to address environmental and safety concerns). Integration of vehicle and infrastructure design holds promise as a new way of reducing transport costs and reducing congestion. This could be of great benefit to China, given its present low levels of road development and vehicle ownership combined with the costs and difficulties of increasing road space in urban areas.²⁵

²⁵ A seminar on Simultaneous Vehicle and Infrastructure Design and Road Transport System Developments was held in Beijing in April 1996.

TABLE 7.1: PRINCIPAL SECTOR POLICY PROPOSALS

Policy Area	Policy proposal	Implementing Agency	Priority	Reference
Competition	Require transport SOEs to enter into enforceable Transition Agreements	MOTC	1	Ch. 2. Sec. A, p. 8
	Require nontransport SOEs to contract for transport services	SPC	1	Ch. 2. Sec. A, p. 10
	Complete review of MOR restructuring options, implement recommendations	MOR	1	Ch. 2. Sec. A, p. 9
	Remove all tariff restrictions on new railway services	MOTC	1	Ch. 2. Sec. A, p. 9
	Provide access to capital to startup operators	MOTC	2	Ch. 2. Sec. A, p. 9
	Allow existing operators to fail without financial support	MOTC	1	Ch. 2. Sec. A, p. 9
	Remove all remaining controls over transport tariffs, except in monopoly cases	MOTC	2	Ch. 2. Sec. A, p. 10
	Replace regulations with market-based pricing policies	SPC	2	Ch. 2. Sec. A, p. 10
	Rationalize user charges in the sector; adopt Ramsay pricing for infrastructure	MOTC	2	Ch. 2. Sec. A, p. 11
	Encourage joint ventures between national and foreign freight forwarders	SETC	2	Ch. 2. Sec. B, p. 12
	Allow freight forwarders to contract with CR for operation of private trains	MOTC	2	Ch. 2. Sec. C, p. 12
	Prohibit operating and revenue-sharing agreements between domestic airlines and CAAC's regulatory control of new aircraft purchases	CAAC	3	Ch. 2. Sec. C, p. 13
	Investment	Increase investment in transport sector	MOTC	2
For purposes of investment planning, adopt asset utilization standards consistent with middle-income developing countries		MOTC	3	Ch. 4. Sec. A, p. 25
Finance	Implement fuel price surcharge as user charge	MOF	2	Ch. 5. Sec. D, p. 37
	Create Transport Infrastructure Finance Fund	MOF	2	Ch. 5. Sec. F, p. 41
	Modify existing sector user charges	MOTC	2	Ch. 5. Sec. C, p. 45
	Create enabling environment for private sector finance	MOTC, MOF	3	Ch. 5. Sec. G, p. 42
Social and Environment	Target four transport corridors for development priority	MOTC, SPC, SETC etc.	3	Ch. 6. Sec. A, p. 44
	Introduce rural institutional focus and accessibility standards	MOTC and Provinces	3	Ch. 6. Sec. B, p. 44
	Rationalize fuel costs to be more in line with economic costs (congestion, air quality)	State Council	3	Ch. 6. Sec. D, p. 46
	Modify motorization policy to include consideration of externalities	State Council	3	Ch. 6. Sec. D, p. 46
	Tighten vehicle design and emission standards	MOTC	3	Ch. 6. Sec. D, p. 49
	Promote institutional integration on strategies to increase highway safety	MOTC	2	Ch. 6. Sec. D, p. 49
	Strengthen transportation and land use planning	SPC, MOTC	3	Ch. 6. Sec. D, p. 51
Institutional	Separate railway operations from railway management	State Council	1	Ch. 7. Sec. B, p. 54
	Create Ministry of Transport and Communications	State Council	1	Ch. 7. Sec. C, p. 59
	Develop integrated set of sector planning tools	MOTC	2	Ch. 7. Sec. B, p. 55
	Develop 5-year rolling transport sector investment plans	MOTC	2	Ch. 7. Sec. C, p. 59
	Review relationships of MOTC with MOF, SETC and NEPA	MOTC	1	Ch. 7. Sec. C, p. 59
	Create Transportation Safety Board	State Council	1	Ch. 7. Sec. B, p. 58
	Adopt principles of Transportation System Management	MOTC	1	Ch. 7. Sec. D, p. 60

Priorities:

- 1 Essential and urgent for the implementation of transport policy
- 2 Essential to better achieve sector objectives
- 3 Desirable for increased efficiency

TABLE 7.2: PRINCIPAL MODAL POLICIES

Mode	Policy	Implementing Agency	Priority	Source
Highways	Initiate Provincial Highway Development and Maintenance Plans	MOTC Provincial HD	3	Report 11819-CHA
	Focus investment upon upgrading existing network, ensuring proper road maintenance, and increasing rural accessibility	MOTC	2	Ch. 4. Sec. B, p. 28
	Close loopholes in collection of Road Maintenance Fee	MOTC	1	Ch. 5. Sec. C. p. 35
	Design of toll network should avoid maintenance and equity impacts	MOTC	2	Ch. 5. Sec. C. p. 36
	Develop rural accessibility standards	MOTC, MOA	3	Ch. 6. Sec. B., p. 44
Road transport	Make competition between SOEs and private operators more equitable	MOTC, MOF	1	Ch. 2. Sec. A, p. 8
Rail	Allow railways freedom to experiment with tariffs/ service	MOTC	2	Ch. 2. Sec. A, p. 9
	Focus investment on increasing capacity of existing lines and renewal and expansion of rolling stock	MOTC	3	Ch. 4. Sec. B, p. 27
	Implement network-wide costing system	CR	2	Ch. 5. Sec. C, p. 37
Inland waterway	Focus investment upon reconstruction, conversion of general freight to container berths, and upgrade of network and development of inland waterways.		3	Ch. 4. Sec. B, p. 28
	Develop Jiangsu Province system of charge for use in network	MOC	2	Ch. 5. Sec. C. p. 36
Air transport	Stimulate more competition and inhibit restricting agreements between airlines	CAAC	2	Ch. 2. Sec. C, p. 13
	Focus investment upon runway and terminal development, as well as shifting modernization of air traffic control to inland areas		3	Ch. 4. Sec. B, p. 28
	Consider alternative to uniform passenger use charges, based upon airport costs	CAAC	3	Ch. 5. Sec. C, p. 37
Multimodal transport	Increase competition between freight forwarders	SETC	1	Ch. 2. Sec. C, p. 12
	Strengthen transport system policy coordination, planning and management	MOTC	2	Ch. 7. Sec. B, D

Priorities:

- 1 Essential and urgent for the implementation of transport policy
- 2 Essential to better achieve sector objectives
- 3 Desirable for increased efficiency

Annex A***A Transport Investment Fund*****PURPOSE OF A TRANSPORT INVESTMENT FUND**

Subsector or sector investment funds are often proposed as a solution to lack of investment finance from budgetary sources. However, few have been implemented or managed successfully over a long period of time, although modal investment funds are widely used, with varying degrees of success. Although the latter are established to finance infrastructure in a particular mode, the revenues are often diverted to finance operating deficits or to invest in modes other than those from which the revenue is raised, and these diversions invariably lead to the ultimate collapse of the funds. Both these phenomena can be seen in the application of modal investment funds in China. Part of the revenue from the Railway Construction Fee is used to finance the railway's operating deficit, while many railway investment needs go unsatisfied, and part of that from the road sector's Vehicle Purchase Fee is now allocated to investment in inland waterways, while road investment is still underfinanced.

Management of sector revenues and investments needs to satisfy three objectives:

- the levels and application of user charges should be compatible between modes and based on the principle that users should pay for the benefits they receive from use of the infrastructure or for the cost they impose on it;
- the costs of borrowing should be as low as possible;
- investments should be made so as to maximize the economic return on the application of revenues.

Modal investment funds can go part way to achieving these objectives, but they usually fail to ensure that the economic returns on investment in the sector as a whole are maximized. If a comprehensive rather than modal view is taken of the transport sector, creation of a Transport Investment Fund, which would take over and expand the roles of the present modal funds, could provide one model for achieving the objectives. As multimodal transport becomes more widely used, and the boundaries between one mode and another become more diffuse, the justification for continuing single-sector funding becomes less sustainable.

TABLE A.1: POTENTIAL SOURCES AND APPLICATIONS OF FUNDS

Potential revenue sources	Potential applications
User charges	Provincial Transport Investment Plans, principally for infrastructure
Multilateral loans	Public Transport Companies Investment Plans, mostly for vehicles and equipment
Domestic and international bonds	Amortization of loans for infrastructure
Equity from private investment funds	Direct investment in infrastructure

ADVANTAGES AND DISADVANTAGES OF A TRANSPORT INVESTMENT FUND

Modal or sector investment funds are not usually permanent parts of the public finance system. They are used mostly in developing countries for the period when public finances cannot raise enough revenue to satisfy all the needs of a rapidly expanding economy, or when financial control is inadequate to ensure the best use of those funds which are available. The principal advantages of such a fund in China would include

- **Low cost of borrowing.** Since the TIF would have multiple revenue sources to use as security for bond or loan or finance, the cost of borrowing would be minimized. Debt incurred by the fund would not attract a sovereign guarantee, but financial markets might see an implied guarantee and charge accordingly.
- **Acting as intermediary between suppliers and users of transport infrastructure.** Energy and water projects can raise project revenue with guaranteed revenue from purchase agreements between the infrastructure provider (a power station or water plant) and an intermediate institution (an electricity distribution or water supply agency). The commercial risk to the provider is minimized and the intermediate institution can reduce its risk by having multiple suppliers with different terms and phasing of their purchase agreements. Transport infrastructure does not have this advantage. Road, railway, airport, and waterway capacity is sold directly to final users, not to intermediate institutions. In the absence of an intermediate purchaser who can take commercial risks, potential private investors in transport infrastructure look for strong guarantees from the sponsoring agency in terms of levels of traffic, revenues, or a rate of return, as in the case of energy projects that lack an intermediate purchaser. A TIF would also act as a substitute for such an intermediary, further contributing to a low cost of borrowing.
- **Greater consistency in the application of user charges.** Until now, user charges have been used to support separate funds for each mode, the objectives of which are different. Some are oriented toward new construction and others toward maintenance of existing assets, different proportions of the gross revenues of each fund are paid as taxes or to cover operating deficits, and regulations vary on the use of revenues to leverage finance from other sources.
- **Transparency in the selection of projects to be financed.** The TIF, the principal source of sector investment funds, would only support projects that form part of an agreed rolling investment program produced by the new sector agency (Chapter 2). All investments included in the Transport Plans submitted by the provinces and state-owned infrastructure operators would require a economic, financial and environmental evaluations and would be subject to a multicriteria appraisal. The Fund managers would use similar to criteria to determine which projects should be supported by the Fund.
- **Greater consistency in the terms offered to private transport infrastructure investors.** Even though investment in infrastructure for some modes is less risky than for others, the basis of lending terms offered to investors should be consistent. Although the existing use of modal funds creates strong competition among them—and, in the case of highways, among provinces that seek funding—it fails to control the risk of skewed incentives among particular modes or projects. If the proposed TIF were to supervise all transport investments, most of these differences could be managed.
- **Flexibility in the use of projected future revenues to guarantee private finance.** Securing future project revenues is one way to attract private debt and bond financing for packages of infrastructure

projects. Some projects would generate revenue; others would require initial support. The more projects that are in the portfolio of the TIF, the greater the confidence that reliable revenue streams will occur in the future, and the lower the risk premium sought from new projects.

- **Lower risk that investment funds will be unavailable for justifiable investments in one mode while a surplus of funds for another mode is used to finance unjustifiable projects.** While this is not yet a problem in China, it could become so if user charge revenues in a particular mode increase faster than investment needs.

While these are impressive advantages, there are also many risks and disadvantages, both conceptual and practical. Experience from the operation of investment funds in other countries gives some indication as to how these might be minimized. The principal disadvantages would include

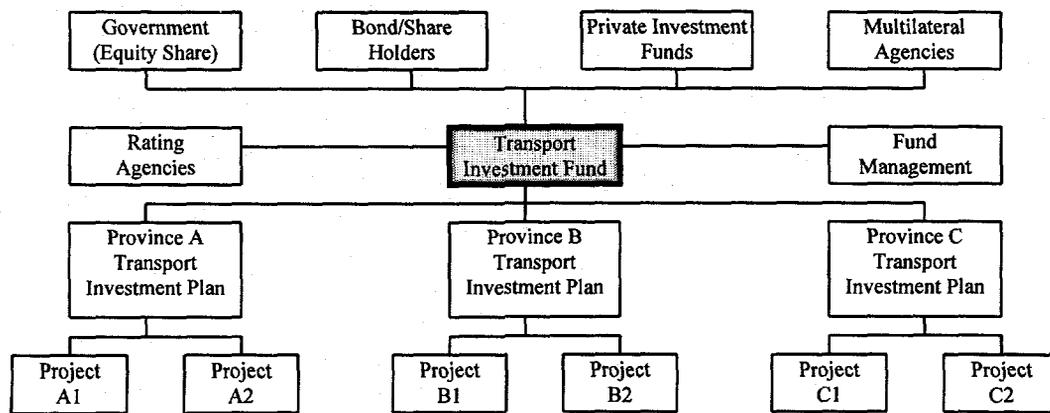
- **Dilution of government control over public revenues.** This raises the conceptual issue regarding the nature of user charge revenues. If they are treated as taxes, there is no justification for taking control away from government by earmarking. However, if they are considered genuine user charges, with their incidence being closely related to the benefits from and use made of transport infrastructure, then there is a strong justification for using their revenues to construct and maintain what is being paid for through the charges. In those funds that have had some success, user charge revenues have financed up to 80 percent of investment. The remainder continues to be financed through budget allocations, since some benefits of infrastructure apply more generally than to direct users who pay the charges. The budget contribution to the TIF would be a recognition of these social benefits and give a justification to MOF being included among its directors as a principal contributor to its revenues. This would give some government control and/or influence over the level of borrowing and investment. The levels of user charges, particularly proposed increases, would also be subject to MOF control, further reinforcing macroeconomic control. The MOF contribution to the TIF would be variable each year, as the investment and financing needs vary more than user charge revenues. The contribution could also be varied as a tool of macroeconomic policy, without prejudicing already committed and planned investments, for which user charge revenues would continue to be available.
- **Fund too large to be manageable.** The projected need for revenues to support transport investment, including amortization of loans and interest on bonds, will be of the order of \$100 billion annually by the end of the first decade of the next century. This could be too much to be well-managed by a single Fund and could give rise misallocation and susceptibility to political interference. The risk would be mitigated by the Fund approving provincial and agency investment plans and leaving implementation, including financial management of the funds allocated, to provincial governments. The fund would allocate agreed investment funds en bloc to the provinces each year, subject only to agreement on their Plan and a satisfactory accounting for previous expenditure.
- **Diversion of funds to other uses.** Many modal investment funds have failed through their revenues being used to finance operating deficits of transport operators in the public sector. This practice is such a temptation that few investment funds have avoided it. There is no way to avoid this risk, either in sector or modal funds, other than through good management and separation of that management from political influence.

- Lack of a market to allocate funds.** One of the principal advantages of project finance is that it uses the market to allocate private funds to those projects considered most profitable. Since each source has different objectives (high or low risk, short- or long-term perspective), this can satisfy a wide range of investment needs. Even long-term social investments can be attractive to some institutional investors with very long-term objectives. A TIF would not have this property, since it would attract debt (and possibly equity) finance based on its overall portfolio of projects and revenue sources. The only market influence would be on the management of the Fund itself. If the Fund managers were to apply too little attention to financial criteria and too much to social and developmental objectives, they would risk the financial stability of the Fund and make it less attractive to private investors. However, it is the ability to allocate some of the Fund to projects that are economically viable but would not be attractive to private investors that is one of the advantages of the TIF. The risk could be minimized by including a requirement that strictly defines its investment objectives in the statute that establishes the TIF.

MANAGEMENT OF THE FUND

The TIF would be managed as one of the principal functions of a new Ministry of Transport (Chapter 7). Its revenue would come from various all sector user fees, which would be modified to make them compatible and consistent, revenue bonds issued with future user fee income as security, and bilateral and multilateral loans. Direct investment from the many private infrastructure investment funds now being created would be another possibility. It would prepare and maintain a rolling five-year investment plan based on the Ministry's overall sector development strategy. The Investment Plan would include a financing strategy including conventional financial accounts of the Fund (a Revenue and Expenditure Account, a Source and Application of Funds Statement and a Balance Sheet). Private sources would be encouraged to invest in specific projects, if necessary as joint partners with the Fund on projects that have a strong economic justification but which lack sufficient financial returns to attract private finance. Fund managers would not become involved in the myriad of individual investment projects. Instead, they would allocate funds to modal or provincial fund managers, who would prepare their own Plans, which would be approved by the TIF management and included in the overall Fund Plan. Allocations to the subfunds for each year would be conditional on a satisfactory accounting of the use of the previous year's finance.

FIGURE A.1: AN OPERATING STRUCTURE FOR A TRANSPORT INVESTMENT FUND



Source: World Bank.

EXPERIENCES FROM OTHER COUNTRIES

Although risks are involved in the creation of a TIF and in its financing through user charges, experiences from other countries illustrate how such problems can be overcome. Infrastructure Funds based on similar principles have been implemented in Sri Lanka and India. Brazil used a similar funding mechanism for urban transport in the late 1970s and 1980s, after which it had outlived its usefulness, and Argentina financed a Transport Investment Fund through a surcharge on fuel during the 1960s and 1970s. Other countries, including Mexico, are planning similar funds. The best demonstrated security against the potential misuse of the TIF has been the inclusion of a "sunset clause" in its constitution, which would close or terminate its revenue sources after a predetermined time or under prespecified conditions. At that point, the success of the TIF could be reviewed and its mandate terminated if it was shown to no longer be necessary, modified if it had performed a useful function but with operating problems, or extended if it was doing well in all respects.

Bibliography

- Ambiji Group Pty., Ltd. 1993. *Civil Aviation Infrastructure Needs Analysis*, ACT, Australia.
- Asian Development Bank. 1995. *China: Transport Sector Strategy* (Draft), Manila.
- and Economic Development Institute (World Bank). 1989. *Transport Policy*. Manila. *Aviation Week and Space Technology*, August, 1994.
- Barr, Nicholas. 1994. *Labor Markets and Social Policy in Central and Eastern Europe: The Transition and Beyond*. World Bank. New York: Oxford University Press.
- Bayliss, Brian. 1992. *Transport Policy and Planning: An Integrated Analytical Approach*. Economic Development Institute, Washington, DC: World Bank.
- Brittan, Leon. 1996. *Economic Development along the Euro-Asia Continental Bridge*. Brussels: European Commission.
- Button, Kenneth. 1994. *Internalizing the Social Costs of Transport*, Brussels: OECD, European Council of Ministers of Transport.
- Carruthers, Robin. 1996. "Financing Urban Transport in China." *Proceedings of the Asia Urban Transport Conference*. Singapore.
- Carruthers, Robin. 1992. *Estudio de Financiamiento de la infraestructura de Carreteras (Study of the Financing of Highway Infrastructure)*, La Paz, Bolivia: CAEM Ltda.
- Center for International Affairs and the Pacific Basin Research Center. 1995. *Energy-Use and Air-Pollution Impacts of China's Transportation System*.
- China Business Review*. March/April 1994.
- China Statistical Yearbook*. various years through 1995.
- China Daily News*. July 1, 1996a. "Funding Hampers Railway Push."
- . July 6, 1996b. "Guizhou Expands Railway Network."
- . July 15, 1996c. "Major Plans Down the Line."
- Commission of the European Communities. 1995. "Towards Fair and Efficient Pricing in Transport: Policy Options for Internalising the External Costs of Transport in the European Union," Brussels.
- . 1996. "A Strategy for Revitalising the Community's Railways," Brussels.
- Comtois, Claude. 1993. *Transportation in China: Developments and Trends*, Montreal: University of Montreal.

- Crook, F. 1994. "Could China Starve the World?" *Asia and Pacific Rim Agricultural Trade Notes*, Washington, DC: US Department of Agriculture.
- Department of Foreign Affairs and Trade. 1994. *Tapping into China's Transport Infrastructure Market*, East Asia Analytical Unit, Working Paper No. 4. Canberra.
- Economist Intelligence Unit. September 1993. *Infrastructure in China*. London, England.
- Eskeland, Gunnar S. and Feyzioglu, Tarhan N. 1994. *Is Demand for Polluting Goods Manageable? An Econometric Study of Car Ownership and Use in Mexico*, Policy Research Working Paper 1309, Public Economics Division, Washington, DC: World Bank,
- European Commission of Ministers of Transport. 1994. *Internalizing the Social Costs of Transport*, Brussels, OECD.
- Fan, C. Cindy. 1995. *Of Belts and Ladders: State Policy and Uneven Regional Development in Post-Mao China*, Annals of the Association of American Geographers: Washington, DC.
- Far Eastern Economic Review*. January 18, 1996.
- Financial Times*. July 22, 1996.
- Flight International*. October 12-18, 1994.
- Ford Motor Company. 1996. *China Automotive Technology Workshop Recommendations*, Beijing, China.
- Giglio, Joseph. 1996. "The New Paradigm in Financing Transportation," *PW Financing*.
- Glaister, Stephen. 1984. *Fundamentals of Transport Economics*. New York: St. Martins Press.
- Guangdong Provincial Communications Department. 1994. *General Report in Highway Financing System*, Guangzhou.
- Halbrendt, C. and Gempesaw, C. "An Economic Analysis of an Improved Infrastructure on China's Rice Economy," *Journal of Transportation Research Forum*, Vol. 30, No. 2.
- Hau, Timothy. 1994. "Income and Car Ownership: A Cross Section and Time Series Exploratory Analysis," Hong Kong.
- Heggie, Ian. G. 1995. *Management and Financing of Road: An Agenda for Reform*, Technical Paper Number 275, Africa Technical Series, Washington, DC: World Bank,
- Highway Research Institute. 1991. *China: Road Funding Issues*, Beijing.
- Ho, Thomas. 1996. "Selective Property Investment as a Legitimate Means of Funding for Public Transport Projects," *Urban Transport Asia '96*.

-
- Hook, Walter and Replogle Michael. 1996. "Motorization and Nonmotorized Transport in Asia", *Land Use Policy*, (Vol. 13, No. 1,): 69-84.
- Infrastructure Finance*. February, 1996.
- International Monetary Fund and World Bank. "Enterprise Contracts: A Route to Reform." *Finance and Development*, Vol. 33, No. 3, Washington, DC.
- International Road Federation. 1995. *International Road Statistics*. Washington, DC.
- Juan, Ellis. 1995. *Airport Infrastructure: The Emerging Role of the Private Sector*, Washington, DC: World Bank.
- Kennedy, Thomas. 1995. "A Realistic Evaluation of Nontraditional Strategies for Highway Funding in China." *Seminar on Highway Financing and Commercialization*, Beijing: Wilbur Smith and Associates, Inc.
- Kumar, Ashok. 1993. *Development of Rural Roads in China*. Report for the World Bank. Washington, DC.
- Li Peng, Premier of the State Council. 1996. *Report on the Outline of the Ninth Five-Year Plan for National Economic and Social Development and the Long-Range Objectives to the Year 2010*. Beijing: National People's Congress.
- Lin and Polenske. 1995. *Energy-Use and Air-Pollution Impacts of China's Transportation Growth*, Report No. 82., Cambridge, Massachusetts.
- McCleary, William. 1991. "The Earmarking of Government Revenue: A Review of Some World Bank Experience." *The World Bank Research Observer*, Vol. 6., No. 1. Washington, DC: World Bank.
- Ministry of Communications. 1994a. *China: Reform, Institutional Support and Pre-investment Project: Work Plan for Strengthening the Ministry of Communications*, Beijing: MOC.
- . 1994a. *Regulation of Port Dues and Charges for International Trade*. Beijing: MOC.
- Ministry of Railways. 1993. *Cost Effective Technology Evaluation for Increasing Line Capacity*. Research Report prepared by CETEILC Project Team. Beijing: MOR.
- Peregrine. 1994. *China Infrastructure—Making Connections*, Hong Kong: Peregrine.
- RCG/Hagler Bailly, Inc. and Mitchel Stanfield & Associates. 1995. *Barriers to Private Sector Participation in Key Infrastructure Sectors in East Asia*, Washington, DC.
- Ross, Alan. 1997. "Road Safety in China: Need for Action," paper presented at High-Level Highway Policy Seminar, Beijing.
- Roth, Gabriel. 1995. *Roads in A Market Economy*, Aldershot, England, Avebury Technical.

- Skarstad, Odd et al. 1992. *Pricing of Railway Infrastructure*. TOI Report 140, Nordic Road and Transport Research. No. 3: Oslo.
- Scurfield, Richard. 1994. "The Private Provision of Transport Infrastructure," in *Financing Transport Infrastructure* (edited by. Sheila Farrell), London: PTRC.
- State Planning Commission. 1994. "The Development Strategy for Car to be Used by Households in China," *China Economic Daily*.
- Shirley, Mary. M. 1996. "Enterprise Contracts: A Route to Reform?" *Finance and Development*, Vol. 33, No. 3, Washington, DC: International Monetary Fund and World Bank.
- Smith, Warrick and Klein, Michael. 1994. *Infrastructure Regulation—Issues and Options*. Private Sector Development Department, Washington, DC: World Bank.
- Stares, Stephen and Liu, Zhi. 1995. "Motorization in Chinese Cities: Issues and Actions. World Bank." *Proceedings of an Urban Transport Seminar, Beijing*. Washington, DC: World Bank.
- (China) State Statistical Bureau. April 1997. "Economic Statistics Communiqué for 1996." *China Daily News*.
- Taplin, John. 1993. "Economic Reform and Transport Policy in China," *Journal of Transport Economics and Policy*.
- Transport Finance*, No. 56, January 11, 1996.
- Van der Ven, Joris. 1996. *Effective Private Participation in Toll Roads*, Indonesia Discussion Paper Series. Washington, DC: World Bank.
- Wider Study Group. 1992. "Private Investment in Infrastructure; The Mobilization of Equity Capital," Report No. 6 for the World Institute Research, New York: The United Nations University.
- Wilbur Smith and Associates. 1996a. *Policy and Institutional Support in the Road Sector*, Beijing: Asian Development Bank and the Ministry of Communications.
- . 1996b. *Highway Facilitation Study*, Beijing: Henan and Hubei Communications Departments.
- World Bank. 1985. *China: Transport Sector Study*. Report 5207-CHA, Washington, DC.
- . 1992a. *China: Railway Investment Study* (Two Volumes and technical Annexes), Report 10375-CHA, Washington, DC.
- . 1992b. *Transport Developments in Southern China*" Discussion Papers, No. 151, Washington, DC.
- . 1992c. *What Determines Demand for Freight Transport*. Policy Research Working Paper No. 998, Washington, DC.

-
- . 1993a. *China: The Achievement and Challenge of Price Reform*, Washington, DC.
- . 1993b. *China: Industrial Organization and Efficiency Case Study, Automotive Sector*, Washington, DC.
- . 1993c. *China's Railway Strategy*, Report 10592-CHA. Washington, DC.
- . 1993d. *China Transport Policy Seminar, Background Papers*, Washington, DC.
- . 1993e. *Southeast Coastal Region: Strategic Issues in Ports and Shipping Development*, Report 11771-CHA, Washington, DC.
- i. Regulation and Liberalization Policies for Intercity Transportation in Taiwan
 - ii. Development Plans and investment strategies for transportation systems in Taiwan
 - iii. The Role of Government in Transportation in Canada
 - iv. Role of Government in Transport in Japan
 - v. Long-term Stable Financing Strategy for Transportation Infrastructure in Korea
 - vi. The Government role in transport during the transition to a market economy
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 - x. The Strategies and countermeasures for development of China's transportation
 - xi. Development of China's air transportation and its countermeasures
 - xii. Development of Rural Roads in China
 - xiii. Transport Planning: Guangdong, Guizhou, Shandong, Xinjiang, Shenzhen
- . 1993f. *Transport Air Quality Management Project for the Mexico City Metropolitan Area: Staff Appraisal Report*. Report 10673-ME, Washington, DC.
- . 1994a. *China: Macroeconomic Stability in a Decentralizing Economy*, Report 13399-CHA, Washington DC.
- . 1994b. *China: Seventh Railway Project: Staff Appraisal Report*. Report 13795-CHA, Washington, DC.
- . 1994c. *China: Urban Transport Issues*, White Cover Report, Washington, DC.
- . 1994d. *East Asia and the Pacific: Investment in Infrastructure: Past Trends and Future Requirements*, Office of the Vice-President, East Asia and Pacific Region, Washington, DC.
- . 1994e. *Highway Development and Management Issues, Options and Strategies*, Report 13555-CHA, Washington, DC.
- . 1994f. *Mexico: The End of Transition. A Review of the Transport Sector*. Report 12654-ME, Washington, DC.

-
- . 1994g. "Valuing Infrastructure Stocks and Gains from Improved Performance," Background paper for *World Development Report 1994*, Washington DC.
- . 1994h. *Viet Nam Transport Sector—Serving an Economy in Transition*, Annex 7, Report 12778-VN. Washington, DC.
- . 1995. *Airport Infrastructure: The Emerging Role of the Private Sector*, Washington, DC.
- . 1995a. *China: Inland Waterways Project: Staff Appraisal Report*, Report 13934-CHA, Washington, DC.
- . 1995b. *China: Investment Strategies for China's Coal and Electricity Delivery System*, Report 12687-CHA, Washington, DC.
- . 1995c. *China: Public Investment and Finance*, Report 14540-CHA, Washington, DC.
- . 1995d. *China: Regional Disparities*, Report 14996-CHA, World Bank, Washington, DC.
- . 1995e. *China: Transport Sector Strategy, Task Reports*, Washington, DC.
Task 1: China Multimodal Study (P. Cook)
Task 2: Rail-Water Competition for Coal Transport on the Shanxi-Shanghai Corridor (M. Kuby)
Task 3: Rail-Road Competition for Containers (P. Cook)
Task 4: Case Study of Rail vs. Road for Passengers in the Beijing-Shanghai Corridor (P. Cook)
Task 5: Economic Structural Change (M. Kuby)
- . 1995f. *Bureaucrats in Business: The Economics and Politics of Government Ownership*. New York: Oxford University Press.
- . 1995g. *China: Strategies for Road Freight Service Development*, Report 12600-CHA, Washington, DC.
- . 1995h. *Management and Financing of Roads; An Agenda for Reform*, World Bank Technical Paper No. 275, Africa Technical Series, Washington, DC.
- . 1996a. *Reform of State-Owned Enterprises*, Report 17411-CHA, Washington, DC.
- . 1996b. *China: Container Transport Services and Trade: Framework for an Efficient Container Transport System*, Report 15303-CHA, Washington, DC.
- . 1996c. *The Chinese Economy. Fighting Inflation, Deepening Reforms*, Washington, DC.
- . 1996d. *International Gas and Diesel Prices*. Washington, DC.
- . 1996e. *Morocco Fourth Highway Project: Impact Evaluation Report, Socioeconomic Influence of Rural Roads*. Report 15808-MOR, Washington, DC.
- . 1996f. *Road Funds, User Charges and Taxes*. TWU-24, Washington, DC.

- . 1996g. *Sustainable Transport: A Sector Policy Review, Priorities for Policy Reform*. Washington, DC.
- . 1996h. *Air Pollution from Motor Vehicles*. Washington, DC.
- . 1996i. *China's Urban Transport Development Strategy*. Washington, DC.
- . 1997a. *China's Environment in the 21st Century*. Report No. 16481-CHA. Washington, DC.
- . 1997b. *China's Management of Enterprise Assets: The State as Shareholder*, Report No. 16265-CHA. Washington, DC.
- . 1997c. *China: Mobilizing Domestic Capital Markets for Infrastructure Financing*, Report No. 16637-CHA, Washington, DC.
- . 1997d. *China Rising*, Report No. 16643-CHA, Washington, DC.
- . 1997e. *Income Inequality in China*, Report No. 16685-CHA, Washington, DC.
- . 1998a. *China: Transport Sector Investment Model* (to be published). Washington, DC.
- Xiannuan, Lin and Polenske, Karen R. 1995. *Energy-Use and Air-Pollution Impacts of China's Transportation Growth*, Center for International Affairs and The Pacific Basin Research Center, Report No. 82, Cambridge, Massachusetts.
- Yang, Shi. 1996. "Simultaneous Vehicle/Infrastructure Design and Road Transport System Developments in China," SVID-China Seminar, Beijing.
- Yates, Charles. 1994. "The Mexican Approach to Toll Roads" in *Financing Transport Infrastructure* (edited by Sheila Farrell), London: PTRC.