

**REPORT AND RECOMMENDATION
OF THE
PRESIDENT
TO THE
BOARD OF DIRECTORS
ON A
PROPOSED LOAN
AND A
TECHNICAL ASSISTANCE GRANT
TO THE
PEOPLE'S REPUBLIC OF CHINA
FOR THE
JING-JIU RAILWAY TECHNICAL ENHANCEMENT PROJECT**

June 1994

CURRENCY EQUIVALENTS

(as of 31 May 1994)

Currency Unit	--	Yuan (Y) = 100 fen
Y 1.00	=	\$0.115
\$1.00	=	Y 8.661

On 1 January 1994, the PRC's dual exchange rate system was unified. The exchange rate of the Yuan is now determined under a managed floating exchange rate system.

ABBREVIATIONS

CTC	Centralized Train Control
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
8FYP	Eighth Five Year Plan
FCTIO	Foreign Capital and Technical Import Office
FIRR	Financial Internal Rate of Return
GMSRC	Guang-Mei-Shan Railway Company
GRC	Guangzhou Railway Corporation
GSRC	Guangdong Sanmao Railway Company
HJRC	Hefei-Jiujiang Railway Company
JRC	Jinan Railway Corporation
MOR	Ministry of Railways
MPT	Ministry of Posts and Telecommunications
NEPA	National Environmental Protection Agency
OECF	Overseas Economic Cooperation Fund of Japan
PMO	Project Management Office
PBC	People's Bank of China
PRC	People's Republic of China
RRA	Regional Railway Administration
RIS	Railway Investment Study
SEIA	Summary Environmental Impact Assessment

WEIGHTS AND MEASURES

kg/m	kilogram per meter
km	kilometer
passenger-km	passenger-kilometer
route-km	route-kilometer
ton-km	ton-kilometer

NOTES

- (i) The fiscal year (FY) of the Government ends on 31 December.
- (ii) In this Report, "\$" refers to US dollars.

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**PEOPLE'S REPUBLIC OF CHINA
JING-JIU RAILWAY TECHNICAL ENHANCEMENT PROJECT
LOAN AND PROJECT SUMMARY**

- Borrower** : People's Republic of China (PRC)
- Project Outline** : The Project involves the acquisition of modern technology and the provision of policy support to enhance the efficiency of the operation and management of the Jing-Jiu Railway (the Railway). If approved, the proposed loan will be the Bank's thirty-second loan to the PRC, the eleventh for the transport sector and the fifth for the railway subsector.
- Classification** : Economic growth
- Rationale** : To help alleviate infrastructure constraints in the PRC's railway subsector through technological modernization and adoption of appropriate policy and institutional reforms that will enhance the operational efficiency of the Railway
- Objectives and Scope** : The main objectives of the Project are to (i) enhance the operational efficiency of the Railway by acquiring modern railway technology, including the associated training requirements; and (ii) support the Ministry of Railways (MOR) in formulating and implementing effective policy reforms to improve efficiency and commercialize operations of the Railway. The Project is expected to serve as a model for the adoption of technological improvements and policy reforms on the national railway system. The Project consists of two parts:
- (i) Part A - Technology Modernization Component:
- (a) modern railway telecommunications and train operation systems involving the introduction of advanced technology in related fields;
 - (b) modern signalling systems in the two largest marshalling yards;
 - (c) the use of special quality rails for track;
 - (d) mechanized track maintenance with an advanced, fully mechanized maintenance technology; and

(iii)

- (e) human resource development for training of staff in the new advanced technologies.

(ii) Part B - Policy Initiatives Component:

- (a) developing appropriate organizational and institutional arrangements;
- (b) determining an appropriate tariff-setting policy and tariff structure; and
- (c) developing financial management, accounting and financial settlement systems among regional railway administrations.

Cost Estimates

Component	Foreign Exchange	Local Currency	Total
(in \$ million equivalent)			
1. Track	67.7	-	67.7
2. Signalling	50.0	144.7	194.7
3. Telecommunications	48.5	134.4	182.9
4. Train Operation Equipment	16.5	-	16.5
5. Contingencies	17.3	27.8	45.1
6. Interest During Construction	20.0	5.1	25.1
Total	<u>220.0</u>	<u>312.0</u>	<u>532.0</u>

Financing Plan

Source	Foreign Exchange	Local Currency	Total	Percentage
(in \$ million equivalent)				
Bank	200.0	-	200.0	37.6%
MOR ^a	20.0	312.0	332.0	62.4%
Total	<u>220.0</u>	<u>312.0</u>	<u>532.0</u>	<u>100.0%</u>

^a Including MOR's internal funds and those of provincial governments along the Railway.

(iv)

Loan Amount and Terms	:	\$200.0 million from the Bank's ordinary capital resources for 25 years, including a grace period of 3 years at an interest rate to be determined in accordance with the Bank's pool based variable lending rate system for US dollar loans, and a commitment charge of 0.75 per cent per annum in accordance with the current Bank policy
Period of Utilization	:	Until 30 June 1997
Executing Agency	:	MOR
Implementation Arrangements	:	MOR has established a Project Management Office (PMO) to coordinate the construction of the Railway, which is being implemented by eight agencies in the field. The PMO will also oversee the implementation of the Project. Procurement will be assisted by experienced domestic tendering companies, and engineering design and technical matters by the Third and the Fourth Railway Design Institutes.
Procurement	:	Procurement of all goods, materials and equipment to be financed by the Bank will be carried out in accordance with the Bank's <i>Guidelines for Procurement</i> . Advance procurement action up to bid evaluation was approved by the Bank in January 1994 to expedite Project implementation.
Consulting Services	:	The consulting services for policy support to MOR (14 person-months of international and 27 person-months of domestic consultants) from the technical assistance (TA) grant will be engaged in accordance with the Bank's <i>Guidelines on the Use of Consultants</i> . To allow sufficient time for policy discussions between the Bank and the Government before commissioning the Railway, advance recruitment action of consultants was approved by the Bank in March 1994. In addition, local consultants, to be financed by MOR, will assist in Project supervision and implementation.
Estimated Project Completion Date	:	31 December 1996

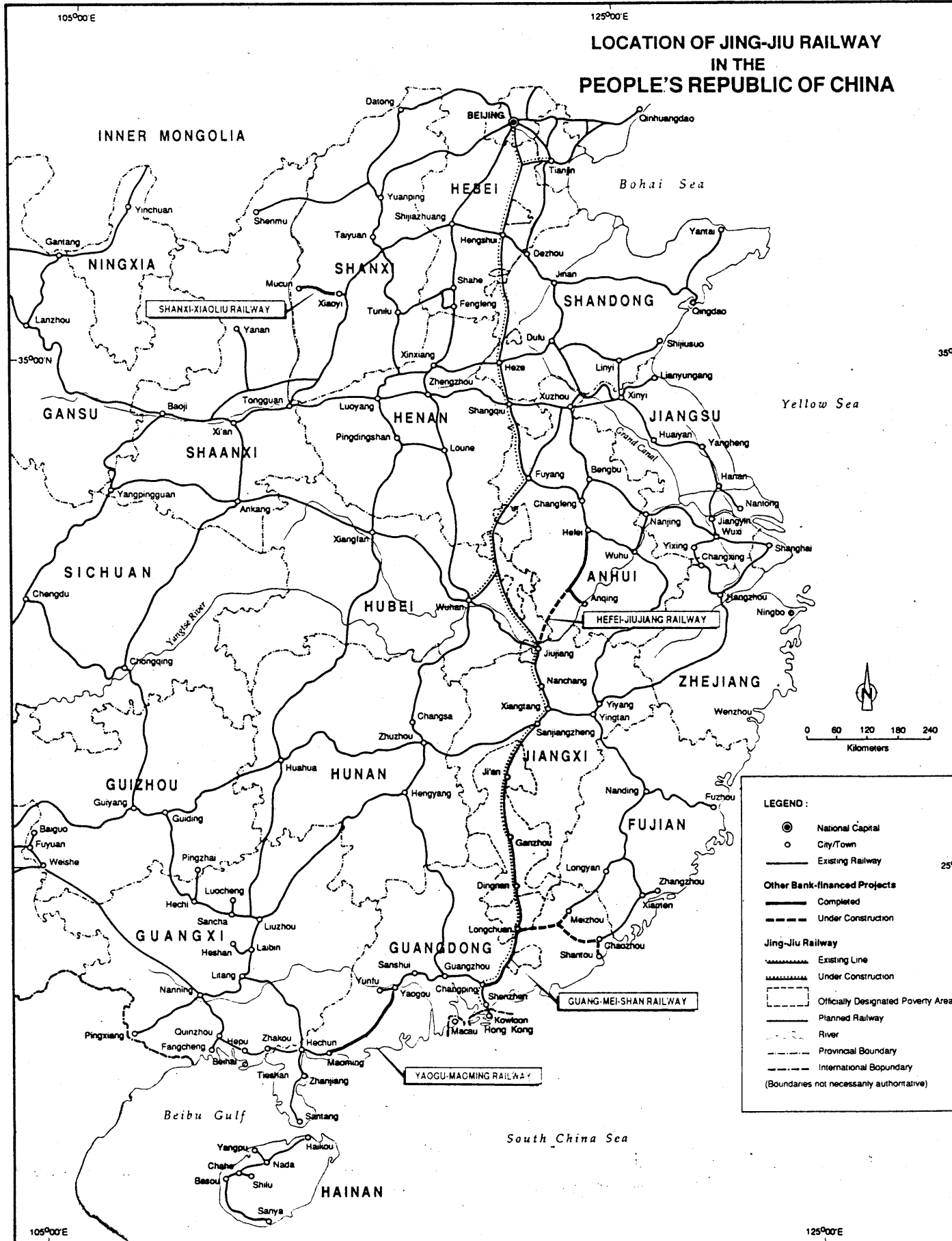
(v)

Project Benefits and Beneficiaries

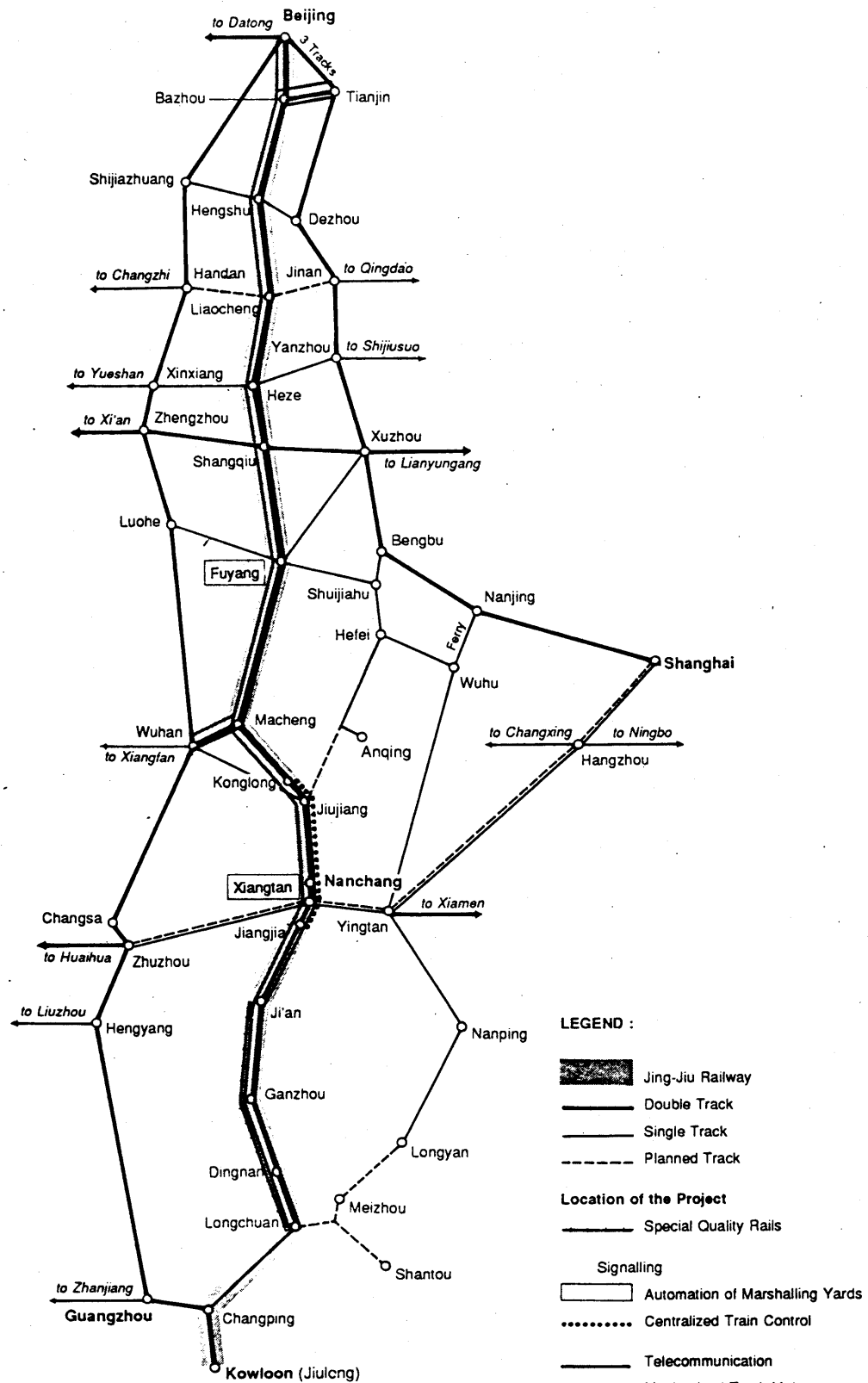
: The Railway, linking Beijing and Kowloon through Shenzhen, will expand railway capacity on the high traffic density north-south corridor and will help improve access to several less developed inland provinces, which serve as the hinterlands of the coastal region. The Project will facilitate (i) the ongoing reform process of commercialization of railway operation and management; and (ii) the application of advanced technology on a system basis to ensure efficient and cost-effective operation of the Railway, particularly in the areas of signalling, telecommunications and train operations, track materials and maintenance systems. The financial internal rate of return is estimated at 17.1 per cent, while the economic internal rate of return is estimated at 19.8 per cent.

Technical Assistance

: A TA grant in an amount of \$600,000 equivalent to study (i) appropriate organizational arrangements for the Railway's operation; (ii) tariff-setting policies and structures; and (iii) financial management, accounting and financial settlements



JING-JIU RAILWAY PROJECT (Schematic Map)



I. THE PROPOSAL

1. I submit for your approval the following Report and Recommendation on a proposed loan to the People's Republic of China (PRC) for the Jing-Jiu¹ Railway Technical Enhancement Project (the Project). The Report also describes proposed technical assistance (TA) for Policy Support for the Ministry of Railways (MOR), and if the proposed loan is approved by the Board, I, acting under the authority delegated to me by the Board, shall approve the technical assistance.

II. INTRODUCTION

2. During the 1993 Country Programming Mission, the Government requested Bank assistance for technical advancement and institutional reform components of the Jing-Jiu Railway (the Railway). The Bank, under a project preparatory TA, engaged consultants to review the Government's feasibility study for the Railway and to strengthen project preparatory work.² A Bank Fact-Finding Mission visited the country and the Project site from 22 November to 9 December 1993, followed by an Appraisal Mission³ from 21 February to 6 March 1994. The Appraisal Mission confirmed that the Project had been accorded high priority by the Government, that it was suitable for Bank financing and that MOR was an appropriate Executing Agency. Loan negotiations were held in Manila from 6 to 8 June 1994 with authorized representatives of the Government of the PRC. If approved, the proposed loan will be the Bank's thirty-second loan to the PRC, the eleventh for the transport sector and the fifth for the railway subsector. This Report is based on the findings of the Bank Missions and the Consultants, a review of relevant documents and discussions with representatives of the PRC Government.

III. BACKGROUND

A. The Transport Sector

3. During the 1980s, the implementation of economic reform policies and consequent rapid economic development in the PRC resulted in a significant increase in transport demand. Over the past decade, the growth in real gross domestic product has averaged 9.0 per cent per annum. Despite substantial increases, the capacities of all transport modes have failed to keep pace with growth in freight and passenger volumes, and capacity constraints are evident in all modes. The inability of transport infrastructure to cope with accelerated traffic demand has developed into a major constraint to the efficient growth of the PRC economy. In 1980-1992, freight transport grew from 849.4 billion ton-kilometers (ton-km) to 2,084.4 billion ton-km, equivalent to an annual growth rate of 7.5 per cent, while passenger traffic by all motorized modes grew at 9.7 per cent per annum, reaching 649.9 billion passenger-kilometers (passenger-km). Because the freight ton-km carried on the railway grew at a rate of 6.1 per cent per annum during the same period, the railway's share of the freight market declined from 67.3 per cent to 57.4 per cent. This reflects (i) the Government's policy of encouraging diversion of the less economic short-distance traffic to the more suitable road

¹ Jing-Jiu stands for Beijing and Kowloon.

² TA No. 1909-PRC: Jing-Jiu Railway Project, for \$400,000, approved on 22 July 1993.

³ Persons involved in the processing of the Project comprised T. Kondo, Sr. Project Engineer (Mission Chief); E.A. Cua, Sr. Programs Officer; R.S. Soin, Sr. Project Engineer; M.L. Faelnar, Counsel; H. Koide, Project Economist; P.N. King, Sr. Environment Specialist; H. Tokuda, Environment Specialist; N. Kawasaki, Financial Analyst; and M. Ojiro, Project Economist.

transport to reduce the pressure on the overburdened railway system; (ii) the rapid growth of secondary manufacturing, which is more reliant on road than rail transport; and (iii) capacity constraints that prevented the railways from carrying all of the traffic offered. The road and air transport subsectors grew most rapidly, and in 1990 the road subsector overtook the railway subsector as the dominant mode for passenger transport. Nevertheless, the railway subsector is expected to maintain its dominant role in freight transport, given the country's large geographic area and the need to transport coal and other bulk commodities across regional boundaries.

4. In the Eighth Five-Year Plan (8FYP, 1991-1995), the Government continues to accord high priority to transport development. Emphasis is being placed on providing critically needed infrastructure, improving management and efficiency, promoting structural reform and improving cost recovery. Although the Y 83.1 billion (about \$9.6 billion equivalent at the current exchange rate), or 17.6 per cent of total investment allocated to the transport sector under the 8FYP, represents a 46 per cent increase over the allocation under the Seventh Five-Year Plan, significant additional investments would be required to address the historical underinvestment in transport infrastructure and to overcome transport bottlenecks through new construction and efficiency improvements of the existing facilities.

B. The Railway Subsector

1. Network and Constraints

5. The PRC's railway system comprises about 53,600 route-kilometers (route-km) of the national railway network and 4,400 route-km of local railways.¹ In 1992, about 14,083 locomotives, 373,233 freight wagons and 28,464 passenger coaches were used for transport services on the national network. Although the railway system plays the dominant role in transport services, railway operations have been constrained by obsolete track, equipment and information technology, including signalling and railway telecommunications. This has increased operational and maintenance costs. In addition, the labor-intensive methods used for truck maintenance and for providing information for railway operations are becoming inadequate. Despite the limitations of the existing technology, rolling stock, track and equipment are utilized intensively to serve the heavy traffic density. In 1992, freight traffic density averaged about 21.6 million net ton-km per route-km per annum, which was the highest freight density in the world after the former Soviet Union and was 50 per cent higher than that of the United States railway system. The PRC's passenger traffic density of about 4.9 million passenger-km per route-km per annum is, after India, the second highest in the world. However, inadequate rail freight transport capacity has aggravated the shortage of key commodities such as coal, which needs to be shipped from the energy-rich provinces in the north to the coal-deficient provinces in the south. Recently, more than 40 per cent of the railway links reached bottleneck levels. Railway transport on most major railway routes is severely constrained, particularly the north-south trunk routes such as the Beijing-Guangzhou line and the Beijing-Shanghai-Hangzhou line, and east-west routes to the major cities and ports in the coastal regions. Apart from the construction of new rail capacity, further increases in productivity will be needed through installation of durable

¹ In comparison, the Indian Railway covers 76,200 route-km.

tracks, improvement of track maintenance and technology modernization, including progressive introduction of computerized railway management systems.

2. Organization and Management

6. MOR is responsible for administration of the national railway network and for financing its operating and capital expenditures. MOR is headed by a Minister, who is a member of the State Council, and who is assisted by four vice-ministers, a chief engineer and a chief economist. MOR employs 3.42 million people, of whom 2.05 million work on rail transport. The remaining 1.37 million work on nontransport activities like construction of railway infrastructure and facilities; manufacture of locomotives, rolling stock, signalling, communications equipment and other railway parts and components; and a variety of business ventures. Under the management of MOR's headquarters, railway transport services are provided by ten regional railway administrations (RRAs) and two railway corporations,¹ which operate as independent revenue-generating bodies with a considerable degree of autonomy. MOR is responsible for financing its operating and capital expenditures through both internally generated funds and borrowing on market terms. MOR has progressively introduced greater market orientation to its organization to cope more effectively and efficiently with increasing demands and the new economic environment. MOR has undergone several institutional reforms to improve its (i) regulatory and contractual relationship with the Central Government, and (ii) capacity for investment and financial planning and for financial resource mobilization. Simultaneously, MOR has introduced measures to modernize track, equipment and information technology.

7. During the last decade, MOR has taken several measures to improve railway management, including decentralizing railway management in 1986 and enacting the Railway Law in 1991. Before 1986, MOR had little financial responsibility or autonomy. MOR had to transfer all its net income to the Government, which then allocated budgets to MOR. Under this arrangement, MOR had little control of railway capital budgets. This arrangement did not provide MOR with adequate incentives to control railway construction and operation expenditures and to allocate railway investment in an efficient manner. In 1986, MOR entered into an "economic contract" with the Central Government, which expanded MOR's financial responsibility and autonomy. The economic contract has also provided MOR's staff with a set of incentives to improve their productivity by various means, including linking staff salary to productivity. The economic contract requires MOR to finance all of its operating and capital expenditures through either internally generated funds or borrowing from the market, and to pay the Government a business tax of 5.3 per cent on gross revenues and an annual lump-sum tax of Y 2 billion. In return, the contract allows MOR to keep its net income to finance railway capital investments.²

8. Prior to the enactment of the Railway Law in 1991, there was no formal legal framework for railway operations. This created ambiguity in the authority and accountability of railway organizations. The Law empowers MOR to (i) establish technical regulations such as design standards for track and equipment, (ii) plan and construct railway projects, and (iii) set

¹ The Guangzhou Railway Corporation and the Jinan Railway Corporation, which were the first two RRAs to have been restructured into corporate entities.

² In January 1994, a new tax law was promulgated, under which MOR has been required to pay 33 per cent of the income tax to the Government.

railway tariffs subject to the approval of the State Council. The Law also requires the ten RRAs and the two railway corporations to enforce safety standards, provide basic amenities and services to passengers, and safeguard against environmental pollution, in addition to providing railway transport services.

3. Tariffs

9. During the 1980s and the 1990s, MOR significantly increased railway tariffs, although railway tariff regulation and setting represent a complex aspect of the ongoing economic reforms. Although the Railway Law empowers MOR to set tariffs for freight and passenger transport, the tariff adjustments need State Council approval. The criteria for tariff review focus on macroeconomic concerns such as possible impacts of tariff increases on inflation and on the implementation of the objectives set forth in the Five-Year Plan. Since 1983, MOR has made significant efforts to increase its freight and passenger revenues so as to recover its operating costs and to finance part of its investment programs. In late 1983 (for the first time since 1967), the minimum chargeable distance was doubled to 100 km, and rates for bulk commodities were increased by 23 per cent on average. Tariffs for short-haul traffic were increased by a further 37 per cent in 1985 to reflect cost better and to encourage diversion to roads of short-haul traffic, which is uneconomic for railway transport. In 1989, passenger tariffs were increased by 121 per cent for short-distance trips of less than 200 km, and by 100 per cent for long-distance trips. In April 1990, freight rates were increased by 30 per cent on average, which was followed by an 18 per cent increase in March 1991. The 1991 tariff increase includes a levy of the Railway Construction Fund (initially Y 0.002 per ton-km, currently Y 0.027 per ton-km) approved by the State Council to support railway system expansion. These increases will allow MOR to cover all operating expenditures and to finance a large portion of its planned capital investment totalling Y 116 billion under the 8FYP.

10. MOR is planning to make further tariff adjustments in the next few years to reduce the existing financial gap and to achieve higher self-financing of increasing future investments as much as possible. In addition, MOR now looks into other tariff-related matters such as the efficiency of the tariff structure and possible tariff deregulation. In this respect, in 1993, MOR initiated a "new line, new tariff" policy, which aims at setting of new independent tariffs based on actual costs incurred for construction and operation of a railway line. MOR first adopted this policy on a railway section between Datong and Qinhuangdao, on which large volumes of high-quality coal for export are carried. MOR is presently reviewing possible implementation of the policy on other railway lines, including the Railway.

4. Physical Assets and Technology

11. Conventional technology is extensively used for railway transport services. Lack of modern technology, however, hinders improvements in MOR's operational efficiency. MOR's existing telecommunications system is inadequate in capacity and outdated in technology.¹ This results in inefficiency in railway transport operations and services. Data transmission is rudimentary and uses voice channels. Train dispatching and traffic management operations use

¹ Overhead lines still account for about 60 per cent of the transmission network, and the antiquated crossbar system still accounts for about 65 per cent of the switching equipment.

a dedicated telephone system linking more than 5,700 stations, of which more than 90 per cent have outdated manual telecommunications equipment. Similarly, MOR's railway management is constrained by the existing signalling system, which is not adequate for the current traffic volume. Conventional operations in manual and mechanical sorting yards are outdated, resulting in overly long detention of freight wagons in the marshalling yards; this reduces the optimum availability of freight wagons.

12. MOR's track maintenance and rehabilitation is still substantially carried out using slow, labor-intensive methods. Because the intervals between train passes have become increasingly shorter with higher traffic density, the time available for maintenance is being reduced. To serve increasing railway transport demands, MOR needs to increase train densities, speed and axle loads. This will require introducing heavier and more durable rails on high traffic density sections. Presently, the standard main line rail (60 kilograms per meter [kg/m] and 75 kg/m) is laid on about 20 per cent of main railway lines, while the balance is laid with ordinary rail (43 kg/m and 50 kg/m). The latter is no longer suitable for today's traffic volumes and axle loads. While the tensile strength, hardness and other characteristics of the rails used in the PRC are generally satisfactory, MOR's standard main line rail (60 kg/m) is well below the wear resistance of special quality rail¹ used elsewhere in the world on sharp curves or steep gradients on high traffic density sections. Because the rails do not have necessary wear resistance properties to serve present traffic, rails at some locations on the national network have to be replaced at shorter periods than their normal economic lives. Besides interrupting traffic and reducing line capacities, such replacements increase maintenance costs. Mechanizing most maintenance functions and using more durable rails would increase operational productivity and improve operational safety in a cost-effective manner.

13. Recognizing the need to improve operational efficiency, MOR began introducing modern technologies and started a series of studies in 1988 to identify cost-effective and efficient railway technology. MOR is focusing on system-wide technology modernization including railway telecommunications and signalling, track maintenance, locomotives and rolling stock, and computerized transport management information systems.

5. Local Railways and Enterprise Reform

14. Besides administering the national railway system, MOR also supports local governments in the development of local railways that link up with the national railway network.² Among the first of the independent companies established to construct and operate local railways were the executing agencies for three earlier Bank-financed projects.³ By acting in close co-operation or through shared ownership with local governments and local institutions, the new companies mobilize necessary funds from both foreign and domestic sources. Because of their greater degree of operational autonomy, which includes the right to set their own tariffs

¹ Rail in which the rail head is treated for superior wear resistance.

² Local railways are those built and operated by local governments and enterprises, often with financial assistance and managerial support from MOR.

³ (i) Guangdong Sanmao Railway Company (GSRC), the executing agency for the Yaogu-Maoming Railway Project (Loan No. 1087-PRC); (ii) Guang-Mei-Shan Railway Company (GMSRC), the executing agency for the Guang-Mei-Shan Railway Project (Loan No. 1167-PRC); and (iii) Hefei-Jiujiang Railway Company (HJRC), the executing agency for the Hefei-Jiujiang Railway Project (Loan No. 1221-PRC).

and to retain profits, the companies are more market-driven than MOR and provide services in a manner closer to commercial principles. Following the successful experience of local railway companies, particularly GSRC in Guangdong Province under Bank financing, MOR has replicated this experience and has established the autonomous Guangzhou Railway Corporation (GRC) and Jinan Railway Corporation (JRC), which have taken over the administrative responsibility of the respective RRAs. Through this means the reforms in the local railways development model are being adopted on a larger scale. The move to transforming RRAs into autonomous corporations in line with the ongoing enterprise reforms is expected to be followed by the diversification of ownership structure through the listing of shares in the stock exchanges in the medium term.

C. Government Policies and Strategies

1. Sectoral Policy Framework

15. The primary thrust of the Government strategic framework for the transport sector is directed at capacity expansion and efficiency improvement to support the PRC's rapidly growing economy. This objective is being pursued through institutional and policy reforms aimed at (i) encouraging the greater participation of local governments and transport enterprises in infrastructure development through decentralization and increased financial autonomy; (ii) restructuring tariffs to levels that reflect long-run marginal costs; (iii) promoting other sources of financing, including foreign direct investments; (iv) encouraging the adoption of modern technology and operational practices; and (v) strengthening intermodal coordination. The Bank has supported the Government's efforts to carry out such policy reforms in the railway, highway and port subsectors.

2. Railway Development Strategy and Policy Reforms

16. The Government's strategy for railway development aims to address capacity constraints on the system through construction of new lines and productivity enhancement of existing facilities. Apart from undertaking a program of double and multiple tracking and electrification on the network's busiest transport corridors, the Government is adopting systemwide technological improvements that will enable the use of faster and heavier trains and upgrade the signalling and telecommunications systems. In addition, the development of local railways, to be financed by provincial governments and operated by provincial railway companies, will continue to be an integral part of the Government's overall strategy for expanding the rail network.

17. The Government is committed to continuing the transformation of MOR into a market-oriented entity. The next phase of institutional and policy reforms will focus on strengthening internal management, developing a more effective regulatory framework, improving the system for railway investment and finance, and enhancing the efficiency and quality of railway services.

D. External Assistance to the Sector

18. The World Bank and the Overseas Economic Cooperation Fund (OECF) of Japan have provided significant financial assistance to develop PRC railways (Appendix 1). Since 1984,

the World Bank has provided seven loans totalling the equivalent of \$1.8 billion for six national railway projects and one local railway project. Initially, World Bank assistance has been used primarily to finance railway construction to expand traffic capacity in high-priority corridors. Starting with its Fifth Railway Project, the World Bank is now focusing its assistance to support policy initiatives and systemwide technological modernization (e.g., modern telecommunications and signalling, track materials and maintenance systems) to enhance operational efficiency and strengthen institutional capabilities. The World Bank is assisting MOR in improving its costing system, in permanent way maintenance and rehabilitation, in locomotive and rolling stock maintenance, and in railway investment planning. The World Bank has initiated railway management economics studies covering such policy matters as railway-government relationship, financial resource mobilization, labor productivity and human resource development.

19. OECF has provided a total of 431.1 billion yen (\$2.65 billion equivalent) for 12 railway projects. OECF-assisted railway projects have been directed mainly at expanding and improving the rail capacity for coal transport, specifically along major corridors linking the central production areas with the eastern coastal region, including the coal handling ports of Qinhuangdao and Shijiusuo. OECF has also assisted in developing new sections of the national railway network in the inland provinces such as Yunnan, Shaanxi and Ningxia. One of OECF's projects is the 409 km Hengshui-Shangqiu Railway, which is one of the strategic sections of the Jing-Jiu Railway.

20. The Bank coordinates its operations in the railway subsector with the World Bank and OECF. During processing of the proposed Project, the Mission held discussions with them on their operational experience in the railway subsector, which is in need of technology transfer and related foreign capital. The proposed Project is in line with the technology transfer and related foreign exchange policy support and technological enhancement approach of the World Bank, and will complement the assistance given by OECF for the Jing-Jiu Railway.

E. The Bank's Involvement in the Railway Subsector and Lessons Learned

21. The Bank has provided financial assistance totaling \$0.42 billion to four local railway companies to help finance the construction of important provincial railway lines, including those that will indirectly contribute to the reduction of poverty in the less-developed inland provinces (see Map 1).¹ In addition to financing railway construction, the Bank has assisted the local railway companies in introducing modern telecommunication systems and energy-efficient locomotives to ensure efficient train operations. Under these projects, policies have been adopted to introduce substantial managerial and financial autonomy and accountability in the executing agencies and to initiate tariff reform linked to the cost of service. To support such policy initiatives, institutional development, including introducing commercially oriented management practices, has been a key element of Bank-funded TA operations in the

¹

Loan No. 948-PRC: Shanxi-Xiaoliu Railway, for \$39.7 million, approved on 31 January 1989;
 Loan No. 1087-PRC: Yaogu-Maoming Railway, for \$67.5 million, approved on 20 June 1991;
 Loan No. 1167-PRC: Guang-Mei-Shan Railway, for \$200.0 million, approved on 25 June 1992; and
 Loan No. 1221-PRC: Hefei-Jiujiang Railway, for \$110.0 million, approved on 30 March 1993.

railway subsector.¹ All of the projects have been well planned and well implemented. No major problems have arisen during implementation. The first two projects, Shanxi-Xiaoliu Railway and Yaogu-Maoming Railway, have recently been completed, and Project Completion Reports have been circulated to the Board of Directors.² The lessons learned from those projects include the following: (i) an appropriate institutional arrangement for operation and management of the railway should be in place well before the start of commercial operation; (ii) through the implementation of cost-based and market-related tariffs, the new railway enterprises can recover costs, service debts and be financially viable; this is an important step in enterprise reform, which will enable the Government to use innovative ways for mobilizing resources for much needed railway capacity expansion; and (iii) the likely implication of market reforms and price liberalization on the project cost estimates should be duly considered. The Bank-financed Yaogu-Maoming Railway has been cited by the Government as a model for the development of commercially-oriented local railways, while its executing agency, GSRC, has been actively involved in the transfer of its experience to other local railway companies through Bank-financed TA. The commercially oriented management approach used under the Bank-financed railway projects will be replicated on a wider scale in the national railway system (see para. 24).

F. The Bank's Country and Sectoral Objectives and Strategy

22. The central theme of the Bank's operational strategy in the PRC is to assist the country in achieving economic growth in an efficient, equitable and sustainable manner. Accordingly, Bank operations are guided by three strategic objectives: (i) enhancement of economic efficiency, (ii) poverty reduction, and (iii) environmental protection and natural resource conservation. The Bank's operational strategy for the PRC has identified the removal of transport bottlenecks as a priority area for economy-wide efficiency improvement. Efficiency improvement will be pursued through relaxing policy and institutional constraints and introducing more modern technology and managerial practices. Another important consideration of Bank operational strategy is to channel increased assistance to the development of infrastructure in the poorer inland provinces so as to help create the conditions necessary to foster economic growth. Institutional strengthening activities are being pursued to support the Government's decentralization program and enterprise reform in the transport sector. Cost recovery, tariff reform and encouraging policies to promote direct foreign investment are part of Bank's strategy in the transport sector.

23. For the railway subsector, the Bank strategy focuses on increasing the capacity on key routes of the national railway system and expanding the railway system through the construction of important provincial railway lines, including those that will indirectly contribute

¹ TA No. 1117-PRC: Institutional Assistance to Provincial Railway Operations, for \$450,000, approved on 31 January 1989;

TA No. 1523-PRC: Institutional Strengthening of GSRC, for \$965,000, approved on 20 June 1991;

TA No. 1524-PRC: Regional Railway Sector Study, for \$275,000, approved on 20 June 1991;

TA No. 1720-PRC: Institutional Strengthening of GMSRC, for \$250,000, approved on 25 June 1992;

TA No. 1721-PRC: Institutional Strengthening of the Guangdong Planning Commission, for \$250,000, approved on 25 June 1992; and

TA No. 1861-PRC: Strengthening Business and Commercial Practices of the Hefei-Jiujiang Railway Company and Anhui Province, for \$600,000, approved 30 March 1993.

² PRC 21228: Yaogu-Maoming Railway; and PRC 22105: Shanxi-Xiaoliu Railway circulated in June 1994.

to the reduction of poverty in the less-developed inland provinces. The strategy also recognizes that the railway subsector will require (i) technological modernization in many aspects of its operations; (ii) an efficient intermodal system involving railways, roads and ports; (iii) institutional development; and (iv) improved operational and managerial efficiency. Measures to be adopted include the use of energy-efficient and faster locomotives; improved telecommunications and signalling; and improved information systems, including the introduction of computerized reporting and record-keeping systems. The Bank aims to strengthen the commercial orientation of railway companies and to make them more responsive to the needs of a market economy.

G. Policy Dialogue

24. Since 1988, the Bank has been actively promoting commercialization and institutional strengthening in local railway companies. As part of its ongoing policy dialogue, the Bank has stressed the need to broaden market-based reforms among local railways by promoting managerial and financial autonomy, improving operational and managerial efficiency, and facilitating technological modernization. The Bank's agenda for policy dialogue is intended to (i) pursue enterprise reforms in the railway subsector, (ii) diversify sources of investment financing, and (iii) improve financial and management information systems. These approaches were accepted by the Government, which has used a Bank-financed project¹ as a model for the development of local railway companies and also intends to transfer this successful experience to MOR as well in a phased manner. The Bank is broadening its impact in the railway subsector by continuing this process with MOR under the proposed Project.

25. The Bank's support in the areas of management, tariff policy and commercialization of local railways started with the provision of TA for the institutional strengthening of GSRC in the areas of financial and management information systems and market-based reforms, including diversification of its ownership. As a result, GSRC has (i) restructured its financial management team, (ii) introduced a policy of promotion based on ability and performance, (iii) strengthened its financial management team, and (iv) implemented profit center accounting. GSRC's computerized accounting and management information systems developed under the TA have strengthened its commercial operations. Furthermore, the successful implementation of higher tariffs indicates that the market can bear higher transport costs. This has helped to demonstrate that tariffs can be raised so that those who use the railways can pay for an increasing share of the capital and operating costs.

26. Following the successful implementation of Bank-financed TA for the institutional strengthening of GSRC, GMSRC and HJRC, the executing agencies for the Guang-Mei-Shan Railway and Hefei-Jiujiang Railway Projects, decided to take advantage of GSRC's experience to learn how to manage and operate a local railway efficiently. Recognizing their need for institutional strengthening, the Bank proposed that the knowledge and expertise gained by GSRC should be made available to GMSRC and HJRC through programs of cooperation that would ensure efficient and complete transfer of technologies and associated expertise without incurring start-up costs of the same magnitude as those for GSRC. These programs are being supported by the Bank.

¹ Loan No. 1087-PRC: Yaogu-Maoming Railway Project, for \$67.5 million, approved on 20 June 1991.

27. Experience gained under the two Bank-financed railway projects in Guangdong Province provided the basis for MOR to transform the Guangzhou Railway Administration into the autonomous GRC. GRC will serve as an experimental entity for the wider implementation of policy reform initiatives, including traffic costing, contract pricing and profit center business organization. Other institutional restructuring is being tested in JRC and the Fuzhou Railway Sub-Administration. Once these experiments prove successful, MOR is expected to carry out corporate reforms that will result in greater autonomy in operations, pricing and financial management in other regional administrations. The experience gained in testing these concepts on an experimental basis under a Bank-financed railway project is an essential prerequisite before the reforms can be implemented on a wider basis by MOR.

IV. THE PROJECT

A. Concept

28. The Jing-Jiu Railway was identified as one of the top priority projects under the Railway Investment Study (RIS), a computerized investment planning system developed by MOR. It is being financed by the Central Government and the local governments of the provinces along the Railway (see Map 1). The Railway, estimated to cost about \$3.5 billion equivalent, is considered the PRC's most significant railway undertaking since the implementation of economic reforms in 1978. MOR has provided a major part of the financing from its own resources, specifically the Railway Construction Fund. The balance of financing has been raised from domestic commercial borrowings and provincial government loans. Since 1991, OECF has provided financial assistance of \$200 million equivalent to finance construction of one of the segments, the Hengshui-Shangqiu section (409 km long).

29. To strengthen MOR's policy reform efforts, the Government requested Bank assistance to formulate effective policy measures, market-based reforms and institutional strengthening to improve the management and operational efficiency of the Jing-Jiu Railway. This will expand the ongoing reform process of commercialization of railway operations and management, which was successfully undertaken in the previously Bank-financed local railway projects. The Project also envisages the use of advanced technology to ensure efficient and cost effective operation of the railway, particularly in the areas of signalling, telecommunications and train operations, track materials and maintenance systems in which technological advancement is considered to be cost effective and significant.¹ As the Bank's first involvement with MOR, the Project represents an opportunity for the Bank to transfer the successful policy reform experience gained under the previous local railway projects for wider application in the national railway network.

B. Rationale

30. The transport system in the PRC is characterized by high intensity of freight traffic. The major reasons for this are a relatively large heavy industry sector, reliance on coal as the major source of energy and a large volume of other bulk commodities. A substantial volume of

¹ The World Bank is providing assistance in other areas of technological modernization, e.g., locomotive and rolling stock production, in the national railway system.

freight traffic is currently carried on the railway from the energy rich provinces in the north to the industrialized but coal-deficient provinces in the southern and eastern coastal areas. Severe capacity constraints of the railway network, particularly in the north-south trunk lines, are constraining further development of energy and mineral resources and industries. Railway capacity expansion along the north-south corridor through a new railway construction such as the Jing-Jiu Railway will play an important role in the national railway system.

31. MOR is addressing critical railway infrastructure bottlenecks through a combination of policy and institutional reforms and technological modernization. Helping remove such constraints is one of the main elements of the Bank's PRC country operational strategy. Policy dialogue carried out during the previous railway projects focused on enhancing enterprise autonomy in railway companies (including more liberal and market-based tariff adjustment systems), diversifying sources of financing and introducing commercially-oriented accounting and management systems (see paras. 24-25). The success of these policy initiatives at the provincial level helped to convince the Central Government to implement such initiatives on a wider scale in MOR. By supporting the Project, the Bank can play a major role in assisting the formulation and implementation of effective policy measures for efficient railway operation and management. Enhancing the quality and efficiency of railway services by introducing modern technology will improve efficiency and expand the capacity of the national railway system. The Bank has successfully contributed to achieving such objectives under previously financed local railway projects through the use of more energy-efficient locomotives and modern telecommunications systems. The Bank involvement during the construction phase of the Jing-Jiu Railway is essential so that the technological upgrading components to be financed by the Bank may be appropriately interfaced with the other facilities before commencement of operations. Because of the Government's urgent needs to introduce new technologies to enhance the efficiency and safety of railway operations, the Bank's role in the Project is focused on areas in which modern technology and policy reforms will have a substantial impact. The Bank will support MOR's capacity expansion program by improving and modernizing signalling, telecommunications and train operations through appropriate technological inputs that are superior to the technology conventionally used in the PRC. This will improve the cost-effectiveness and efficiency of railway operations. MOR is making a huge investment for its top priority project, and through the proposed technological improvements the efficiency of such an investment will be enhanced. The equipment for these components is not readily available within the PRC and therefore has to be imported. The Project is expected to demonstrate, on a large scale in an integrated manner, the benefits of using more advanced technology in the national railway system.

C. Objectives

32. The main objectives of the Project are to (i) enhance the operational efficiency of the Railway by acquiring modern railway technology, including the associated training requirements; and (ii) support MOR in formulating and implementing effective policy reforms to improve the efficiency and commercialize the operations of the Railway. The Project will serve as the model for the further adoption of such technological improvements and policy reforms on the national railway system.

D. Scope

33. The Project comprises the following:

- (i) **Part A - Technology Modernization Component:** This includes the following subcomponents, which will enable the Railway to make systemic technological improvements to achieve a higher level of operational efficiency (see Appendix 2 for detailed description of Part A):
 - (a) modern railway telecommunications and railway operation systems involving the introduction of advanced technology in related fields to facilitate the larger volume of operations, improve staff productivity and increase asset utilization;
 - (b) modern signalling systems in the two largest marshalling yards on the Railway to improve productivity and efficiency; the busiest section on the Railway, from Konglong to Jiangjia, will be provided with centralized train control to improve operational efficiency and safety;
 - (c) the use of special quality rails for track, which are able to withstand more wear and tear than the conventional rails; the longer economic life of these special quality rails will delay the rail replacement cycle and reduce annual maintenance costs, while ensuring greater safety;
 - (d) mechanized track maintenance, under which MOR's maintenance teams will be equipped with mechanized maintenance technology so that maintenance operations can be undertaken more efficiently and cost effectively; better maintained track will improve safety and operational efficiency, and lower train operational costs; and
 - (e) human resource development for training of staff in the new advanced technologies so that the experience can be effectively replicated throughout the wider network of MOR.
- (ii) **Part B - Policy Initiatives Component:** On the basis of the successful reforms undertaken in the previously Bank-financed local railway projects, this component will focus on:
 - (a) developing appropriate organizational and institutional arrangements for the efficient operation and management of the Railway on a commercial basis;
 - (b) determining an appropriate tariff-setting policy and tariff structure with due consideration given to alternative railway lines (Beijing-Guangzhou and Beijing-Shanghai lines) and other transport modes; and

- (c) developing financial management, accounting and financial settlement systems among the Railway and regional railway administrations and companies concerned.

1. Location

34. The Project involves the technical enhancement of the Jing-Jiu Railway, which originates in Beijing, runs through seven provinces, including four inland provinces, and two municipalities¹ and terminates in Kowloon with a total length of 2,537 km (see Maps 1 and 2). Officially designated poverty areas by the Government along the Railway are shown in Map 1. The Railway will be connected to the existing major railway lines, namely the Beijing-Guangzhou (Jing-Guang) line on the west and the Beijing-Shanghai (Jing-Hu) line on the east. The Railway will also be linked to other Bank-financed local railways at Jiujiang in Jiangxi Province and at Longchuan in Guangdong Province.² Civil works for the Railway are being taken up simultaneously in different sections of the route, which are at various stages of progress, with substantial physical completion scheduled for the middle of 1996. A brief description of the Railway is presented in Appendix 3.

2. Traffic Forecasts

35. The introduction of direct rail transportation serving the Project area will reduce transport costs and alleviate transport capacity constraints for a broad range of traffic commodities. As a new main north-south corridor linking Beijing and Kowloon, the Railway will make an important contribution towards increasing the overall national trunk railway capacity for carrying coal and other traffic between northern and southern PRC.

36. The Railway will serve local traffic within the Project area, traffic between the Project area and both northern and southern PRC, and transit traffic. The forecast freight traffic is summarized in Table 1, and detailed forecasts freight by commodity and routing are given in Appendix 3. Relative to freight, passenger traffic will be modest. Traffic projections have been assessed based on the feasibility study prepared by the Fourth Railway Design Institute of MOR and analyzed within the context of the overall national railway system by using the RIS traffic analysis model.

¹ The seven provinces are Hebei, Shandong, Henan, Hubei, Anhui, Jiangxi and Guangdong. The two municipalities are Beijing and Tianjin.

² Loan No. 1221-PRC: Hefei-Jiujiang Railway; and Loan No. 1167-PRC: Guang-Mei-Shan Railway.

Table 1: Forecast Freight Traffic by Direction
(million tons)

Traffic		Y e a r				
		1997	2000	2005	2011	2016
<u>Southbound</u>						
(i)	To, from or within Project area	22.22	40.84	50.06	63.86	66.68
(ii)	Transit	<u>3.01</u>	<u>4.26</u>	<u>4.81</u>	<u>5.57</u>	<u>5.57</u>
	Subtotal	25.23	45.10	54.87	69.43	72.25
<u>Northbound</u>						
(i)	To, from or within Project area	12.22	22.73	27.96	35.80	37.44
(ii)	Transit	<u>2.42</u>	<u>3.42</u>	<u>3.86</u>	<u>4.47</u>	<u>4.47</u>
	Subtotal	14.64	26.15	31.82	40.27	41.91
TOTAL		39.87	71.25	86.69	109.70	114.16

37. The total freight traffic is expected to increase from 39.87 million tons when the Railway opens in 1997 to 114.16 million tons in the year 2016. The freight is expected to increase at a rate of 5.7 per cent per annum between 1997 and 2005. Traffic is forecast to grow more slowly, at 2.5 per cent annually, in 2005-2016. The major commodities carried on the Railway include coal, metal ore, nonmetal ore, grain and iron/steel. Because of the high level of southbound traffic from northern PRC to the Project area, capacity utilization in some sections of the southbound direction will be reached in 2006, while capacity utilization in the northbound direction will be reached in 2013.¹ Between 1997 and 2005 the forecast rate of growth of southbound transit traffic is conservative, since it is likely that the majority of southbound railway capacity can be absorbed by currently unsatisfied traffic requirements soon after commencement of the Railway operations.

E. Technical Justification

38. The technical enhancement component includes (i) telecommunications and train operations equipment, (ii) signalling, (iii) special quality rails, and (iv) mechanized track maintenance machines (see Appendix 2). Under each of the subcomponents, modern technology will be introduced and applied on the Jing-Jiu Railway. While some of these technologies have been applied on a test basis in scattered areas on the national railway network, the Project will apply the advanced technologies on such a large scale on a long route in an integrated manner for the first time.

39. The telecommunications component will facilitate train control and greater operational efficiency and safety of train operations. Under the signalling component, computer-controlled systems will be applied to the management and operation of two major marshalling yards on the Railway for improved and higher level of operations. For each of the sub-components, the Project supports human resource development and training related to the operation, maintenance and management of the new technology. The human resource

¹ The design capacities of the Railway are set at 70 million tons per annum for Beijing to Fuyang Section and 50 million tons per annum for south of Fuyang Section.

development will include the transfer of expertise and provision of training, simulation models and testing instruments. MOR will draw on the experience gained under the Project to replicate the learning process on other sections of the national railway network.

40. The special quality rails, to be provided mainly in the mountainous provinces in the southern sections of the Railway, will increase the service life of rails when compared with domestically manufactured rails. This will reduce operational costs and improve operational efficiency because of avoided (or delayed) line closures for maintenance and rail replacement. The Project will build on the experience gained so far in the application of heavy track maintenance machines and repair machines on the Railway as a system to mechanize track inspection, testing, routine maintenance and major repairs. Experience gained with the application of mechanized track maintenance on the Railway will provide important lessons in the use of this technology. Experience gained under the Project will provide the basis for replication of this approach on other sections of the national network.

F. Cost Estimates

41. The total cost of Part A of the Project, including provision for physical and price contingencies, interest and other charges during construction (IDC), is estimated at \$532.0 million equivalent, comprising \$220.0 million of foreign exchange costs and \$312.0 million equivalent of local currency costs. In addition, the Project includes a TA grant of \$600,000 under Part B. The cost estimates of Part A of the Project are summarized in Table 2 and detailed in Appendix 4.

Table 2. Summary of Project Costs
(\$ million)

Items	Foreign Exchange Cost	Local ^a Currency Cost	Total
I. <u>Base Costs</u>			
a. Track	67.7	-	67.7
b. Signalling	50.0	144.7	194.7
c. Telecommunications	48.5	134.4	182.9
d. Train Operations Equipment	16.5	-	16.5
Subtotal	182.7	279.1	461.8
II. <u>Contingencies</u>			
a. Physical Contingencies (5%)	9.8	15.3	25.1
b. Price Contingencies ^b	7.5	12.5	20.0
Subtotal	17.3	27.8	45.1
III. <u>IDC</u>	20.0	5.1	25.1
Total	220.0	312.0	532.0

^a Includes tax totalling about \$10 million.

^b Price contingencies have been calculated using 2.5 per cent for both foreign exchange and local currency for 1994 onward.

G. Financing Plan

42. It is proposed to provide a loan from the Bank's ordinary capital resources of \$200.0 million to finance the foreign exchange cost under Part A, excluding IDC. The Borrower will be the People's Republic of China. IDC on the proposed Bank loan will be financed by the Borrower from its own resources. The proposed Bank loan will have a repayment period of 25 years, including a grace period of three years, at an interest rate determined in accordance with the Bank's US dollar-based variable lending system. These terms are considered to be appropriate, taking into account the economic life of the Project facilities, its implementation period and the initial period of operation before full-scale commercial operations. The Borrower will make available the proceeds of the proposed Bank loan to MOR, the Executing Agency. All other Project costs, estimated at \$332.0 million equivalent, will be financed by MOR from its internal funds and from resources made available by the provincial governments along the Railway. A \$600,000 grant will be provided by the Bank to cover the foreign exchange cost and a portion of the local currency cost of the institutional initiatives component under Part B (see para. 56). MOR will finance local costs of \$100,000 equivalent for this component. A summary of financing plan for Part A of the Project is given in Table 3.

Table 3. Project Financing Plan
(\$ million)

Source	Foreign Exchange Cost	Local Currency Cost	Total	Percentage (%)
Bank	200.0	-	200.0	38
MOR	20.0 ^a	312.0 ^b	332.0	62
Total	220.0	312.0	532.0	100

^a IDC and other charges on Bank loan.

^b MOR's internal funds and provincial government sources.

H. Implementation Arrangements

1. Project Implementation

43. The Project Management Office (PMO) established by MOR for the Railway coordinates the construction activities, which have been assigned to eight implementing agencies in the field to facilitate closer supervision and efficiency of implementation. For the Bank-financed components, the PMO, with assistance from MOR through its Foreign Capital and Technical Import Office (FCTIO),¹ will oversee Project implementation including utilization of the Bank loan (see Appendix 5). The Mission is satisfied that both the PMO and the implementing agencies are staffed with well-qualified and experienced staff drawn from MOR. The Railway, including the Project, has been accorded the highest priority by the State Council, which has set up a leading group chaired by a Vice Premier to facilitate the progress of implementation.

¹ FCTIO has gained experience under World Bank loans.

The seven provinces and two municipalities have also established offices to facilitate the progress of construction (see Appendix 5). The Project is expected to be substantially complete by June 1996 to enable the Railway to become commercially operational by December 1996 (see Appendix 6). For the procurement of Bank-financed components the PMO will be assisted by experienced domestic tendering companies.

2. Procurement

44. Procurement of all goods and equipment to be financed by the Bank will be in accordance with the Bank's *Guidelines for Procurement*. A list of indicative contract packages is shown in Appendix 7. The Bank has approved advance procurement action under international competitive bidding procedures for goods and equipment financed by the Bank. Such advance action would include issuance of a general procurement notice and preparation and issuance of tender documents and evaluation of bids, in accordance with the Bank's *Guidelines for Procurement*. The Mission advised PRC authorities that approval of advance procurement action does not commit the Bank to financing the Project. For the procurement of Bank-financed components the PMO will be assisted by experienced domestic tendering companies. MOR has selected the domestic tendering companies in accordance with Government regulations.

3. Consulting Services

45. Consulting services for detailed design and implementation supervision of the Bank-financed components will be provided by MOR's Third and the Fourth Railway Design Institutes, which have gained experience in the modern technology to be provided under Bank financing (see paras. 38-40). Such domestic consulting services will be financed from MOR's own resources. A similar arrangement is being successfully employed with its ongoing construction works of the Railway. For arranging the procurement of Bank-financed components, MOR will be assisted by domestic tendering companies, the costs of which will be financed by MOR. The Mission is satisfied that the domestic consultants have the necessary expertise to undertake these assignments.

4. Operational Aspects

46. MOR will be responsible for overall management, supervision, day-to-day operation, and repair and maintenance of the Railway facilities. MOR assured that a sufficient quantity of rolling stock (locomotives, freight wagons and passenger cars) will be provided for the Railway operation by (i) expanding the production capacity of rolling stock, (ii) improving the quality of rolling stock having a longer economic life, and (iii) timely financing of rolling stock. MOR has also assured that sufficient staffing will be made available to meet the increase in traffic volume by shifting existing MOR staff to the Railway operation.

5. Project Monitoring

47. Quarterly progress reports during Project implementation will be prepared by MOR and submitted to the Bank. No major difficulties that may threaten the achievement of the Project objectives are anticipated during implementation, and the need for a mid-term review is not foreseen. Nonetheless, the need for a mid-term review will be assessed by MOR and the

Bank during Project implementation. To facilitate post-evaluation of the Project, MOR will also submit a Project Completion Report to the Bank within three months of physical completion of the Project, covering the execution and initial operation of the Project facilities. Details of achievements compared with performance indicators will be provided by MOR to the Bank within nine months of the end of each fiscal year to facilitate Project monitoring. These performance indicators, relating to traffic and financial information, are listed in Appendix 8.

I. Environmental Aspects

48. Since the Project is for technical enhancement of the Railway, it does not by itself directly involve environmental and social issues. The new construction of the Railway will, however, have significant environmental and social impacts. An Environmental Impact Assessment (EIA) was submitted to the Bank, and a Summary Environmental Impact Assessment (SEIA) was circulated to the Board on 7 March 1994. These reports cover the entire Railway and describe the potential environmental and social impacts, together with their mitigation measures, including relocation, community fragmentation, noise, soil erosion, water pollution and other indirect impacts. Generally, no significant adverse effects are expected to be caused by the Railway on the environmental or ecological systems. No virgin forests, animal reservations or areas with known archaeological value will be damaged. The Government assured that environmental degradation caused by industrial and commercial activities induced by the Railway will be properly managed through local authorities by (i) preparing EIAs for large-scale projects, (ii) strict implementation of environmental standards, (iii) appropriate forestry management, and (iv) preparing integrated regional development and environmental management plans. The Government assured that the National Environmental Protection Agency (NEPA) will undertake an environmental audit under which representative sections of the Railway will be inspected for compliance with mitigation measures as described in the EIAs. NEPA will ensure that all the environmental protection measures provided in the Environmental Protection Law of 1989 will be implemented by MOR before commissioning of the Railway.

49. The Railway will involve relocation of about 210,000 people. Compensation for the people affected and provision of housing relocation, being financed by MOR, have reached an advanced stage. At the time of appraisal 70 per cent of the people had already been satisfactorily relocated. Under similar ongoing Bank-financed projects in the PRC, it has been demonstrated that relocation of housing and compensation for affected people have been systematically undertaken, with sufficient financing allocated based on the policy that no one affected by a project should be made worse off. Similar procedures have been adopted for the Railway with the legal framework provided by the Land Administration Law of 1986. Each EIA/SEIA includes a compensation plan pertaining to land acquisition, relocation, livelihood, training program and benefit monitoring and evaluation. The aforementioned environmental audit will also cover a review of implementation of the resettlement program including land acquisition, relocation, compensation, livelihood aspects and the public consultation process. Consultations between the affected communities and the local governments have been carried out. The Mission also visited some of the newly built houses, interviewed a group of farmers and was satisfied with the arrangements and compensation made through the local government.

J. The Executing Agency

1. Organization

50. Within MOR, the Executing Agency for the Project, FCTIO, will be directly in charge of all the administrative work for the Bank-financed components and will act as the counterpart of the Bank (see Appendix 5). FCTIO will also coordinate with the PMO, the primary implementing agency established within MOR for the Railway. FCTIO has been responsible for the coordination of externally funded national railway projects for more than ten years, including World Bank and OECF projects. The Mission is fully satisfied with FCTIO's experience and accountability.

2. Audit

51. The Mission discussed with MOR the need to (i) monitor the financial performance of the Railway separately from the total revenues and expenses of MOR, and (ii) record the accounting information following an internationally accepted accounting practice. Accordingly, MOR has agreed to (i) set up separate Jing-Jiu Railway accounts (the accounts), and (ii) follow the new accounting standards introduced by the Government in July 1993 as the accounting principles for the accounts. MOR will submit audited financial statements and an auditor's report of the accounts, as well as those of MOR, to the Bank in English within nine months of the end of each fiscal year. The accounts will be audited by the State Audit Administration in accordance with the new accounting standards.¹ Such audited information will be accompanied by supplementary data, a format of which is shown in Appendix 8.

3. Tariffs

52. Tariff restructuring has played a critical role in MOR achieving a higher degree of financial autonomy, setting tariffs to recover costs and service debt, and raising needed funds to finance railway capacity expansion and efficiency improvement. Appropriate tariff setting is also important so that the price mechanism can play a greater role in closing the transport demand-supply gap. MOR's average national tariff rates are currently 5.35 fen per ton-km for freight and 4.50 fen per passenger-km for passengers.² MOR has submitted a proposal to the State Council to increase freight tariffs by an average of 1.5 fen per ton-km, or 28 per cent, and passenger tariffs by 2.0 fen per passenger-km, or 44 per cent. Furthermore, regarding tariffs, MOR intends to pursue a "new line (investment), new tariff" policy for the Railway through the policy discussion with the Bank. These policies are considered to be appropriate because (i) railway operators are able to recover costs and maintain financial self-sufficiency, and (ii) railway users are able to be provided better quality service from upgraded railway operations by new investments. An assessment of appropriate tariff setting policy and levels to be applied to the Railway will be carried out under the proposed TA.

¹ TA No. 1483-PRC: Audit Administration of PRC, for \$6000,000, approved on 21 February 1991, has assisted the State Audit Administration in developing an Audit Manual and Industry Audit Guides, including for the railway subsector.

² Since each country has a different tariff system and structure, a simple comparison of tariff levels is difficult. The freight tariff of the Indian National Railway is, on average, about 2.3 times higher than that of MOR.

4. Financial Performance

53. Developing a framework that would lead to the Railway being operated in a commercial manner and achieving satisfactory levels of financial performance was an important element of the Mission's policy dialogue. Financial projections have been made for the Railway¹ and not for the Project investment only. The financial projections reflect the traffic forecasts and the assumptions given in Appendixes 3 and 8, respectively. The projections indicate that, once the Railway becomes fully operational in 1997, it will be able to achieve sound financial performance (see Table 4 and Appendix 9).

Table 4: Summary of Jing-Jiu Railway Projected Financial Performance
(Y million)

Year ending 31 December	1997	1998	1999	2000	2001
Operating Revenue	2,920.3	3,623.6	4,448.7	5,463.8	5,717.1
Operating Expense	2,301.2	2,793.7	3,112.8	3,652.4	3,829.0
Operating Income	619.1	829.9	1,335.9	1,811.4	1,888.1
Operating Ratio (%)	78.8	77.1	70.0	66.8	67.0
Debt-Service Ratio (times)	2.0	2.7	3.4	2.5	2.5
Freight Traffic (million ton-km)	47,127	58,066	71,549	88,170	92,323
Passenger Traffic (million passenger-km)	1,723	2,485	2,831	3,226	3,321

54. As a result of discussions with the Mission, MOR agreed that the Railway will maintain an operating ratio of not more than 70 per cent with effect from 1999, the third year of commercial operation. With this level of financial performance, the Railway will be able to cover non-operating costs and interest expenses, and to generate sufficient funds for additional capital investments. It was also agreed that the tariffs for the Railway will be set on the basis of cost recovery principles including adequate provision for depreciation to cover actual replacement costs. The tariff levels will be reviewed from time to time taking into consideration the traffic levels and costs, and adjustments will be made as necessary to achieve the target operating ratio.²

K. Technical Assistance

55. The Government agreed to introduce policy reforms so that (i) cost recovery principles will be applied to the Railway, (ii) a clear schedule on institutional reform will be formulated, and (iii) eventually its outcome will be applied throughout the national railway system. To achieve these objectives MOR requested TA to assist in (i) developing recommendations for appropriate organizational arrangements to operate and manage the Railway in a commercial manner; (ii) formulating an appropriate tariff policy and tariff structure,

¹ Although the Railway is part of the national railway system, a notional entity for operating and managing the Jing-Jiu Railway has been considered for the financial analysis.

² Because the proposed TA provides recommendations for tariff-setting policy and tariff levels for the Railway, the operating ratio to be maintained would be reviewed and modified, if necessary, in conjunction with the TA.

giving due consideration to alternative routes and other transport modes; and (iii) developing systems for financial management, accounting, and financial settlements based on an appropriate distribution of revenues and expenses for the Railway. Consultants engaged under the TA are expected to be fielded in the fourth quarter of 1994 and to complete their work over a period of one year. MOR will form a task force (the Task Force) to facilitate reform initiatives and provide guidance for the efficient implementation of the TA.

56. The total cost of the TA is estimated at \$700,000 equivalent, comprising a foreign exchange cost of \$468,000 and a local currency cost of \$232,000 equivalent. It is proposed that a grant of \$600,000 be charged to the JSF to finance the entire foreign exchange cost, including 14 person-months of international consulting services, and \$132,000 equivalent of local costs for 27 person-months of local consulting services, local travel of the consultants, report and communications, and supplies and equipment. All other costs will be financed by MOR. A detailed analysis of the cost estimates and outline terms of reference are given in Appendix 10.

L. Policy Issues

57. Since the Railway covers seven provinces, two municipalities and four RRAs, the organizational arrangements are relatively complex. Good coordination among these entities is essential to ensure smooth Project implementation and operation of the Railway. Apart from the option to manage and operate the Railway as part of the national railway system. MOR has been considering other organizational arrangements in line with enterprise reform. These alternatives include the creation of a single operating company or five companies assigned to four RRAs and GRC. Both the Government and the Mission recognized the need to study the various organizational alternatives to establish the most appropriate organizational framework for ensuring the efficient management and operation of the Railway in line with the needs of a growing market economy. During these discussions the Mission stressed the benefits of adopting an organization structure that will result in a commercially managed railway.

58. In the area of tariff reforms, recent adjustments, including the implementation of the Railway Construction Fund levy in 1991 amounting to 2.70 fen per ton-km, have raised average freight tariff to 5.35 fen per ton-km and passenger tariff to 4.50 fen per passenger-km. To ensure cost recovery on newly constructed lines, one measure recently adopted is the "new line, new tariff" policy, which will be pursued under the Project. The issue of proper tariff setting for the Railway needs to be examined in depth because (i) the Railway will be operated in a corridor where there are two alternative routes (Beijing-Guangzhou and Beijing-Shanghai lines); thus determining appropriate tariffs involves complex analysis; (ii) while the coal-dedicated new railway line from Datong to Qinhuangdao, where the "new line, new tariff" policy has been adopted for the first time by MOR has been opened, the Railway will transport a variety of bulk and general cargoes, which will require a more detailed tariff analysis than was the case for the alternative; (iii) the Railway will become one of the major trunk lines; hence the impact of the new tariff on the railway systems and other transport modes will be significant; and (iv) the 1994 World Bank-financed tariff reform study focuses on the overall framework of MOR's tariffs for the existing network and does not cover newly built railways.

59. The proposed TA will address these issues and provide the basis for further policy dialogue between the Bank and the Government. MOR agreed to form a Task Force that will work out organizational and institutional arrangements and an appropriate tariff-setting policy for operating the Railway on commercial and cost-recovery principles. As a result of the

Mission's discussions, a time-bound program was formulated that will be followed by MOR and the Task Force. The key elements of this program include the following: (i) the Task Force will formulate plans of action by 30 September 1994 for effective implementation of the TA and for implementation of the acceptable recommendations; (ii) based on the recommendations made by the TA, the Task Force will have a final meeting to determine organizational arrangements, tariff levels and schedule not later than 30 December 1996; (iii) the organizational arrangements and tariff levels adopted for the operation of the Railway will be monitored by MOR for about two years, and such arrangements will be revised, if necessary; and (iv) MOR will organize a seminar to disseminate the experience of and lessons learned from the operation and management of the Railway, and their replication throughout the national railway network.

V. PROJECT JUSTIFICATION

A. Financial Evaluation

60. The financial internal rate of return (FIRR) for the Project is computed by comparing the "with" and "without" the Project cases. The financial benefits of the Project are quantified in terms of savings from (i) delayed rail replacement, (ii) reduced railway operating costs, (iii) avoided accidents, (iv) saved labor and materials, and (v) reduced locomotive and rolling stock investment. The FIRR for the Project is estimated at about 17.1 per cent (see Appendix 11).

61. An FIRR for the Railway is also calculated to assess its financial viability. The FIRR for the Railway reflects the forecast traffic on the Railway line, the assumed tariff levels, and the estimated capital costs and operating costs incurred by the construction and operation of the Railway. The FIRR for the Railway is estimated at about 7.9 per cent, which exceeds the Railway's weighted average cost of capital. If the surcharge, which is to be transferred to the Railway Construction Fund, is included as part of revenue, the FIRR is at about 13.5 per cent.

B. Economic Evaluation

62. A two-step approach has been adopted for the economic evaluation. The Railway was first assessed to provide the economic justification for the Bank's involvement in the overall undertaking. In addition, the economic viability of each Project component was also evaluated. Economic benefits have been quantified by comparing the "with" and "without" the Project cases. The economic benefits of the Railway were quantified in terms of (i) transport cost savings for traffic that will be diverted to the Railway from the existing roads, inland waterways and other routes of the existing railway network; and (ii) net production value added in major committed expansion along the Railway of coal, iron ore, copper, zinc, lead and cement production, which will be made possible by the Railway. The economic benefits of the Project were quantified in terms of (i) savings from delayed rail replacement, (ii) reduced train operating costs, (iii) avoided accidents, (iv) saved labor and materials, and (v) reduced locomotive and rolling stock investment.

63. The economic internal rate of return (EIRR) of the Railway was estimated at about 15 per cent, while the EIRR of the Project was estimated at about 20 per cent (see Appendix 12). Among the Project components, the EIRR of the track maintenance mechanization component was estimated at about 24 per cent, followed by about 21 per cent for the signalling and telecommunications component and 16 per cent for the track component. Sensitivity

analysis was carried out to test the effects of possible unfavorable scenarios with respect to changes in the key parameters that determine Project costs and benefits. This analysis indicates that both the Railway and the Project will continue to be economically viable (11 per cent and 15 per cent, respectively) even under the most adverse scenario involving a 10 per cent cost increase, a 10 per cent decrease in benefits and a one-year delay in implementation (see Appendix 12).

C. Project Risks

64. The Project as formulated does not face unusual risks. One possible risk associated with it would be that the expected maintenance efficiency is not realized. This risk will be minimized through the use of railway maintenance equipment that, based on international experience, is technically efficient, relatively maintenance free and user friendly. The provision of comprehensive training on railway maintenance mechanization will help to assure that these benefits materialize. Potential risks associated with the Project are delays in implementation and increases in Project cost. The potential for such risks to affect the Project adversely in a serious manner is considered to be low. MOR is staffed by experienced personnel who are capable of managing and supervising the construction and operation of a railway. Further, advance procurement action has been approved for the Bank-financed components. An experienced domestic tendering company will assist MOR with international competitive bidding procurements. An appropriate level of contingencies has been provided to cover the risk of Project cost overrun. Another potential risk in the Project relates to the preparation and implementation of necessary policy reforms. The proposed TA was designed to reduce these risks.

D. Socioeconomic Impact and Poverty Reduction

65. The average per capita incomes of four of the seven provinces are lower than the national average of Y 1,694 in 1992.¹ There are 34 officially designated poverty counties along the Railway. Income levels are particularly low in the southern part of Jiangxi Province, where many of the Government-designated poverty counties are located (see Map 1). The contribution of the Railway to the socioeconomic development of the Project area, including the poverty-stricken areas, will be largely indirect through the provision of the infrastructure necessary to enable more rapid expansion of the industry, mining and agriculture sectors. To ensure that the local population can maximize the economic benefits resulting from the Railway, MOR and the local governments, with careful planning for the development and training of unskilled local people, have undertaken to build support facilities along the Railway such as access roads and storage facilities, especially for the local farmers so they can easily transport their produce to markets. This will also help promote the growth of township and village enterprises.

66. The Railway is expected to have a positive impact on the development of employment and private business opportunities for the local population, including low-income groups in relatively poor provinces. The Railway will generate an estimated total of 296,000 jobs during the construction phase. During operations, about 19,000 permanent positions related to the Railway will be made available. These impacts are expected to be significant in poor areas because MOR is committed to directing more work to local people. The Railway will also play

¹

Hubei, Y 1,514; Henan, Y 1,148; Anhui, Y 1,141; Jiangxi, Y 1,191 (in 1992).

a key role in stimulating new businesses along the Railway line. Local authorities are already planning to establish a network of service centers such as food, beverage and retail stores located near the railway stations to service the growing demand of the tertiary sector. These service centers, which will be operated by local entrepreneurs, are expected to provide significant employment opportunities for estimated 75,000 individuals. In addition to facilitating entrepreneurial development in the tertiary sector, the Railway will also support the creation of larger mining and industrial activities in relatively poor areas, which have significant employment potentials.

VI. ASSURANCES

A. Specific Assurances

67. The Government and the Executing Agency have given the following assurances, in addition to the standard assurances, which have been incorporated in the legal documents:

- (i) The Government will maintain for the Railway, for each fiscal year after its fiscal year ending on 31 December 1998, a ratio of total operating expenses to total operating revenues not higher than 70 per cent.
- (ii) The Government will ensure that tariffs for the Railway will be set on the basis of cost-recovery principles, including adequate provision for depreciation to cover actual replacement costs. The tariff level will be reviewed by the Government from time to time, taking into consideration tariff levels, the cost of inputs and adjustments made as may be necessary for achieving the stated principles.
- (iii) Based on the recommendation of the TA, MOR will, upon receipt of the final report of the consultants under Part B of the Project, formulate a proposal in consultation with the Bank on the tariff level and tariff schedule for the Railway. MOR will submit such proposal to the State Council within three months from the receipt of the Bank's concurrence.
- (iv) After the commencement of operation of the Railway, MOR will monitor the institutional arrangements and tariff levels for about two years and will revise such arrangements, if necessary. MOR will also organize a seminar to disseminate the experience of and lessons learned from the operation of the Railway.
- (v) The Government will ensure that all persons affected by the acquisition of land required for the Railway are appropriately compensated for their loss or damage in accordance with the Land Administration Law of 1986. The Government will ensure that the environmental protection measures provided in the Environmental Protection Law of 1989 (as amended from time to time) will be implemented by MOR before commissioning of the Railway.

- (vi) The Government will take appropriate measures satisfactory to the Bank to minimize any adverse environmental impacts of industrialization/development along the Railway route and will ensure that mitigatory measures are taken as necessary. The actions taken in this regard will be reported to the Bank on an annual basis.
- (vii) The Government, through MOR, will make appropriate organizational arrangements for the Railway acceptable to the Government and the Bank by the end of 1996, under which the management and operation of the Railway will conform to full cost-recovery principles.
- (viii) The MOR will maintain separate accounts (balance sheets, income statements, cash flow statements) for its overall operations, the Project, as well as the overall operations of Railway.

B. Condition of Loan Effectiveness

68. As a condition to the effectiveness of the Loan, MOR will form a Task Force to work out institutional arrangements and a tariff-setting policy for the Railway.

VII. RECOMMENDATION

69. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Bank and recommend that the Board approve the loan of \$200 million to the People's Republic of China for the Jing-Jiu Railway Technical Enhancement Project from the Bank's ordinary capital resources, with interest to be determined in accordance with the Bank's pool-based variable lending rate system for US dollar loans and with an amortization of 25 years, including a grace period of 3 years and such other terms and conditions as are substantially in accordance with those set forth in the draft Loan Agreement presented to the Board.

MITSUO SATO

President

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EXTERNAL ASSISTANCE TO THE PRC RAILWAY SECTOR

World Bank Group Assistance

Loan No.	Project Title	Length (km)	Province	Approval Date	World Bank (\$ million)	IDA (\$ million)	Total (\$ million)
1.	Railway I			27-Jun-84	220.0	-	220.0
	a. Construction of a single track between Xinxiang and Heze	165.0	Henan				
	b. Upgrading of the existing Heze-Yanzhou line	139.5	Shandong				
	c. Double-tracking of certain sections of the Datong-Taiyuan line	127.0	Shanxi				
	d. Electrification of the Datong-Taiyuan line	355.0	Shanxi				
	e. Zhuzhou Electric Locomotive Factory						
	f. Traffic Costing Study						
2.	Railway II			14-May-85	235.0	-	235.0
	a. Upgrading and Electrification of Zhengzhou - Wuhan line	547.0	Hunan and Hubei				
	b. Technical Assistance to the Changchun Passenger Coach Factory						
	c. Technical Assistance to the China Academy of Railway Sciences						
3.	Railway III			15-Apr-86	160.0	70.0	230.0
	a. Upgrading and Electrification of the Hongqing - Guiyang line	456.0	Sichuan and Guizhou				
	b. Upgrading and Electrification of the Yingtan - Xiamen line	704.0	Jiangxi and Fujian				
	c. Maintenance of Permanent Way Project						
4.	Railway IV			23-Jun-88	200.0	-	200.0
	a. Double-tracking of the Yueshan-Xiangfan section in the Beijing-Guangzhou rail corridor	492.0	Hunan and Hubei				
	b. Partial electrification of the Yueshan-Luoyang section in the Beijing-Guangzhou rail corridor	113.0	Henan				
	c. Expansion and modernization of three locomotive and rolling stock factories						
5.	Inner Mongolia Local Railway Project			12-May-89	70.0	80.0	150.0
	a. Single-track railway construction between Jining and Tongliao	948.0	Inner Mongolia				
	b. Acquisition and installation of operational equipment						
	c. Recruitment and training of staff to operate the railway						
6.	Railway V			24-Sep-91	330.0	-	330.0
	a. Double-tracking of the Zhegan (Zhuzhou-Hangzhou) line	594.0	Zhejiang, Jiangxi and Hunan				
	b. Capacity expansion at the Xuzhou marshalling yards		Jiangsu				
	c. Strengthening of MOR's long range track upgrading program						
	d. Improvement of locomotive and rolling stock maintenance						
	e. Planning Studies						
	- Permanent Way Maintenance and Rehabilitation						
7.	Railway VI			25-Mar-93	420.0	-	420.0
	a. Electrification and modernization of a double-track Beijing-Zhengzhou line	694.0	Hebei and Henan				
	b. Electrification and modernization of a single-track Chengdu-Kunming line	1,094.0	Sichuan and Yunnan				
	c. Systemwide technological modernization						
	- Mechanizing track maintenance						
	- Modernizing parts manufacture for locomotives and rolling stock						
	- Upgrading the telecommunications network and implementing a computerized Transport Management Information System (TMIS)						
	d. Pilot container transport						
Total		6,428.5			1,635.0	150.0	1,785.0

OECD Assistance

Loan No.	Project Title	Length (km)	Province	Agreement Date	Amount (¥ million)	Amount (\$ million)
First Round Yen Credit (1979-83)	Yangzhou-Shijiusuo Railway (I)	310.0	Shandong	30-Apr-80	10,100.0	40.0
	Yangzhou-Shijiusuo Railway (II)			09-Dec-80	3,110.0	15.0
	Yangzhou-Shijiusuo Railway (III)			26-Apr-82	3,200.0	13.0
	Yangzhou-Shijiusuo Railway (IV)			18-Oct-82	11,800.0	46.0
	Yangzhou-Shijiusuo Railway (V)			15-Aug-83	11,500.0	46.0
	Subtotal				39,710.0	160.0
	Beijing-Qinhuangdao Railway (I)	337.0	Beijing, Tianjin, Hebei, and Liaoning	30-Apr-80	2,500.0	10.0
	Beijing-Qinhuangdao Railway (II)			09-Dec-80	11,200.0	56.0
	Beijing-Qinhuangdao Railway (III)			26-Apr-82	9,200.0	36.0
	Beijing-Qinhuangdao Railway (IV)			18-Oct-82	30,900.0	121.0
	Beijing-Qinhuangdao Railway (V)			15-Aug-83	33,200.0	134.0
	Subtotal				87,000.0	357.0
	3. Hengyang-Guangzhou Railway (I)	-	Hunan and Guangdong	30-Apr-80	3,320.0	13.0
	Total (First Round)				130,030.0	530.0
Second Round Yen Credit (1984-89)	Hengyang-Guangzhou Railway (II)	541.0	Hunan and Guangdong	26-Oct-84	10,192.0	42.0
	Hengyang-Guangzhou Railway (III)			27-Aug-85	26,822.0	115.0
	Hengyang-Guangzhou Railway (IV)			04-Jun-86	24,491.0	147.0
	Hengyang-Guangzhou Railway (V)			06-Jul-87	8,789.0	59.0
	Subtotal				70,294.0	363.0
	Zhengzhou-Baoji Railway (I)	684.0	Shaanxi and Shanxi	26-Oct-84	7,575.0	31.0
	Zhengzhou-Baoji Railway (II)			27-Aug-85	13,258.0	57.0
	Zhengzhou-Baoji Railway (III)			04-Jun-86	9,462.0	57.0
	Zhengzhou-Baoji Railway (IV)			06-Jul-87	31,396.0	209.0
	Zhengzhou-Baoji Railway (V)			03-Aug-88	7,500.0	57.0
	Subtotal				69,191.0	411.0
	Datong-Qinhuangdao (Eastern Section) Railway (I)	337.0	Beijing, Tianjin, Hebei and Liaoning	03-Aug-88	12,131.0	91.0
	Datong-Qinhuangdao (Eastern Section) Railway (II)			23-May-89	6,279.0	44.0
	Subtotal				18,410.0	135.0
	Beijing Subway Construction Project (I)	1.4	Beijing	03-Aug-88	2,510.0	19.0
	Beijing Subway Construction Project (II)			23-May-89	1,490.0	10.0
	Subtotal				4,000.0	29.0
	Total (Second Round)				161,895.0	938.0
Third Round Yen Credit (1990-95)	Shenmu-Shouxian Railway Construction (I)	269.0	Shaanxi and Shanxi	22-Jan-91	4,200.0	29.0
	Shenmu-Shouxian Railway Construction (II)			04-Oct-91	9,940.0	72.0
	Shenmu-Shouxian Railway Construction (III)			15-Oct-92	1,231.0	10.0
	Shenmu-Shouxian Railway Construction (IV)			25-Aug-93	11,614.0	114.0
	Subtotal				26,985.0	225.0
	Baoji-Zhongwei Railway Construction (I)	502.0	Shaanxi, Gansu and Ningxia	04-Oct-91	5,572.0	40.0
	Baoji-Zhongwei Railway Construction (II)			04-Oct-91	9,300.0	67.0
	Baoji-Zhongwei Railway Construction (III)			15-Oct-92	12,901.0	107.0
	Baoji-Zhongwei Railway Construction (IV)			25-Aug-93	2,027.0	20.0
	Subtotal				29,800.0	234.0
	Hengshui-Shangqiu Railway (I)	384.0	Hebei and Henan	28-Mar-91	5,695.0	41.0
	Hengshui-Shangqiu Railway (II)			04-Oct-91	6,550.0	48.0
	Hengshui-Shangqiu Railway (III)			15-Oct-92	4,951.0	41.0
	Hengshui-Shangqiu Railway (IV)			25-Aug-93	6,407.0	63.0
	Subtotal				23,603.0	193.0
	Nanning-Kunming Railway (I)	800.0	Guangxi and Yunnan	04-Oct-91	5,461.0	40.0
	Nanning-Kunming Railway (II)			15-Oct-92	9,904.0	82.0
	Nanning-Kunming Railway (III)			25-Aug-93	23,342.0	229.0
	Subtotal				38,707.0	351.0
	11. Fujian Province Zhang Quian Railway	145.7	Fujian	25-Aug-93	6,720.0	66.0
	Beijing Subway Second Phase Construction (I)	10.6	Beijing	04-Oct-91	3,281.0	25.0
	Beijing Subway Second Phase Construction (II)			15-Oct-92	6,235.0	52.0
	Beijing Subway Second Phase Construction (III)			25-Aug-93	3,819.0	37.0
	Subtotal				13,335.0	114.0
	Total (Third Round)				139,150.0	1,183.0
	Total	4,321.7			431,075.0	2,651.0

Bank Assistance

Loan No.	Project Title	Length (km)	Province	Approval Date	Amount (\$ million)
1.	Shanxi-Xiaoli Railway	44.0	Shanxi	31-Jan-89	39.7
2.	Yaogu-Maoming Railway	232.0	Guangdong	20-Jun-91	67.5
3.	Guang-Mei-Shan Railway	480.0	Guangdong	25-Jun-92	200.0
4.	Hefei-Jiujiang Railway	335.0	Anhui & Hubei	30-Mar-93	110.0
Total		1,091.0			417.2

DESCRIPTION OF TECHNICAL ENHANCEMENT COMPONENT

A. Telecommunications

1. Dedicated telecommunications facilities constitute necessary infrastructure for ensuring the efficiency and safety of railway transportation operations. It is imperative that telecommunications facilities are provided together with the construction of railway lines. Such facilities should be of sufficient capacity to handle the anticipated traffic and to meet the requirements of data transmission, and should be easy to maintain with high reliability and expandability. The existing railway telecommunications of the Ministry of Railways (MOR) are plagued with old and inefficient equipment that can service only voice and low-speed services and are incapable of handling the workload imposed by modern and efficient railway networks. About 95 per cent of the transmission network is analog, and only 15 per cent of the exchange systems are digital.

2. The Project will support MOR's Master Plan to improve and modernize the railway telecommunications network. Under the Project, the Railway will be provided with a dedicated telecommunication system to facilitate train control and to support other railway operational functions. The backbone communications will be provided using fiber optic cable installed along the full length of the Railway, financed by MOR from own resources. For the fiber optic-based communications, electronic equipment including optical terminal and relay station equipment and optical fiber instruments will be provided under the Project. Considering the possibility of developing multi-user utilization of the fiber optic communications, MOR has, in consultation with the Ministry of Posts and Telecommunications (MPT) reserved some capacity in the fiber optic cable for MPT. The fiber optic communications will be augmented by conventional multicircuit communications cable, which will be used primarily to support signal and safety devices and local intrablock communications.¹ A mobile train radio network will provide ground-to-train and train-to-train communications as well as local communications for yard operations and infrastructure maintenance crews. The mobile train radio system will consist of mobile transceivers and fixed repeater stations linked over the fiber optic network. In difficult geographical areas involving mountainous terrain and tunnels, particularly in the southern part of the Railway in Jiangxi Province, special installations will be made to improve performance and coverage. Communications will be possible between locomotive drivers and between locomotive drivers and the train dispatching center at Guangzhou. A computer-based network management system will be provided for on-line monitoring. Additional equipment will be provided for data transmission and automation of passenger bookings and freight services for improving the quality of service to the consumer.

¹ Safety devices include detectors for monitoring axle boxes, which run "hot" while on the run and are a potential source of accidents.

3. It will be a first on the MOR's network that the aforementioned modern telecommunications facilities will be installed, operated and managed as a system on that scale. The digitalized and fully automatic telecommunications network will enable high quality of service and reliability of the network, and will assist in institutional reforms on staffing, operation and maintenance. Training of staff in the operation, maintenance and management of the technologically enhanced facilities will be included under the subcomponent. The foreign exchange costs of such training will be financed under the Bank loan. The experience gained on the Railway will be replicated on other sections of the national railway network.

B. Track Machines

4. Since the mid-1980s heavy duty on-track machines have been increasingly used on the national railway network of MOR for routine maintenance and major repairs of tracks. These machines have been increasingly introduced in heavily trafficked sections of the railway to improve the quality of track maintenance, the efficiency of railway operations and the safety of train operations.

5. Under the Project it is proposed to build upon the experience gained so far in the application of heavy track maintenance and repair machines on the Railway as a system in which all aspects of track inspection, testing, routine maintenance and major repairs will be mechanized. The mechanization of track maintenance will have the following benefits: (i) rationalization of staff for track maintenance, (ii) higher productivity and better quality of track maintenance, (iii) improved efficiency of train operations, (iv) savings in cost of train operations because of reduced fuel consumption and lower rolling stock maintenance cost, (v) reduced occupation of track for maintenance, and (vi) savings due to longer service life of track materials and rolling stock.

6. An important social aspect of the proposed system of mechanized maintenance on the Railway will be the improvement and upgrading in the job content of staff employed for the existing largely manual maintenance of track. The existing maintenance of track and light-tools, still largely prevalent on the national railway network, involves a lot of repetitive work day after day at outdoor locations fully exposed to the normal elements. Besides hard manual labor, such work involves a lot of drudgery. The job content of such staff has remained largely insulated from the development of track maintenance technology. Under the Project the work practices of such staff will be rationalized and upgraded and greatly improved. A substantial number of staff employed on track maintenance will benefit from the envisaged change. In addition, labor, with the mechanized track maintenance teams will be regrouped and headquartered at relatively larger stations instead of being spread along the railway line as in the old system. Such transformation will benefit the families of staff by way of better living conditions and educational facilities. Training of staff for operation, maintenance and working in conjunction with the track machines will be packaged under this subcomponent. The foreign cost of such activities will be financed under the loan, and the local currency cost will be financed by MOR from own resources. Experience gained by MOR in the systemic application of mechanized track maintenance on whole sections will provide important lessons for MOR and will be replicated on other sections of the national network.

C. Rails

7. On MOR's main lines the standard rail section used is 60 kilograms per meter (kg/m). The domestic rails do not have satisfactory wear resistance properties necessary for railway tracks carrying heavy density traffic in sections of the railway with sharp curves and steep gradients. Because of the unsatisfactory quality of domestic rails, at some locations on the national network rails in track have needed replacement within periods as short as four months. Besides interruptions to traffic, such replacements greatly increase the cost of maintenance.

8. Under the Project, 60 kg/m head-hardened rails will be provided in the southern section of the Railway in Jiangxi Province, which passes through submountainous regions. The head-hardened rails will be able to resist wear more effectively and almost double the service life of such rails when compared with the rails available domestically. Major repairs of rails will thus be required at much longer intervals, with benefits by way of savings in maintenance costs and higher operational efficiency due to reduced line closures. Besides, better quality rails will improve the safety of train operations. Thus, proven rail technology will be applied for increasing the service life of materials and improving the efficiency and productivity of railway operations.

D. Signalling

9. Xiangtang and Fuyang are the most important marshalling yards on the Railway. In these yards freight wagons are received, sorted out by direction and destination, and despatched. The quality of service to the consumer will in substantial measure depend on the performance of the marshalling yards.

10. Under the Project the facilities at the Xiangtang and Fuyang marshalling yards will be fully automated, including the provision of a microcomputer interlocking system, computer-controlled system for sorting freight wagons, a centralized train supervision system and supporting management information system, thus expanding substantial capacity in order to handle the anticipated level of freight traffic. Through these technological improvements the detention of freight wagons in the marshalling yards will be reduced, thereby increasing the turnaround of freight wagons. Additional benefits will accrue because the computer-controlled facilities will ensure smoother sorting operations in the yards with less damage to rolling stock compared with the conventional operations in manual and mechanical sorting yards. Training of staff in the operation and management of the automated computer-controlled yards will be accomplished with the assistance of the supplier/s and will be included in the subcomponent. The experience gained in the operation and management of the fully automated marshalling yards is to be replicated elsewhere on MOR's railway network.

11. Under the Project, the Konglong-Jiujiang-Jiangjia section (about 203 km long) will be provided with a centralized train control (CTC) system for train operations. This section is one of the busiest on the Railway because of the major railway yards at Fuyang and Xiangtang

and the need to regulate multidirectional railway traffic including the Jiujiang to Hefei Railway.¹ At Xiangtang a number of complex movements are involved because of the major marshalling yard and the crossing of the existing east-west main line from Shanghai to Zhuzhou. The CTC will be necessary to control the movement of trains effectively and efficiently on this section. Provision of the CTC together with the necessary supervisory system and automatic signalling and interlocking at all stations will enable substantial savings in staff for operation and maintenance. Because of increased sectional capacity, benefits will accrue by way of avoided cost of additional infrastructure. Under this subcomponent staff will be adequately trained in the operation, maintenance and management of the technologically enhanced facilities. This will enable development of a nucleus of well trained staff, which will benefit other sections of the network.

E. Human Resource Development

12. Training of staff and human resource development will be an integral part of the component to meet the needs of operation, maintenance and management of the new technologically advanced facilities provided under the Project. The foreign exchange costs of such training, transfer of expertise, and provision of training and simulation models and testing instruments will be financed under the loan. The local currency costs of such activities will be financed from MOR's own resources. MOR will in due course take all possible measures to replicate the experiences gained and expertise developed on the Railway on other sections of the national railway network.

¹ Financed by the Bank under Loan No. 1221-PRC: Hefei-Jiujiang Railway Project, approved on 30 March 1993.

JING-JIU RAILWAY AND TRAFFIC FORECASTS

A. The Jing-Jiu Railway

1. The Ministry of Railways (MOR) identified the Jing-Jiu Railway (the Railway) as the first priority railway project during its prioritization process of railway investments by using a computerized railway investment analysis system, the Railway Investment System (RIS), which it developed under World Bank assistance. The Railway comprises 13 connected railway line segments between Beijing and Kowloon with a total length of 2,537 kilometers (km), as shown in Table 1.

Table 1 : Jing-Jiu Railway Segments

	Location	Description	Length (km)
1.	Beijing-Hengshui ^a	New line	322
2.	Hengshui-Shangqiu	New line	409
3.	Shangqiu-Fuyang	Upgrading	150
4.	Fuyang District	Upgrading	21
5.	Fuyang-Jiujiang ^b	New line	526
6.	Jiujiang Yangtze Bridge	New line	8
7.	Jiujiang-Xiangtang	Upgrading	163
8.	Xiangtang District	Upgrading	15
9.	Xiangtang-Ji'an	New line/upgrading	191
10.	Ji'an-Ganzhou	New line	202
11.	Ganzhou-Longchuan	New line	225
12.	Longchuan-Changping	No change	213
13.	Changping-Kowloon	No change	92
	Total		2,537

^a Including a new connecting line between Bazhou and Tianjin (77 km).

^b Including a new connecting line between Macheng and Wuhan (80 km).

2. The Railway commences at Huangcun on the Beijing-Tianjin line, a short distance from the major marshalling yard at Fengtai in Beijing. From Huangcun, the new line crosses the northern part of the Huabei Plain to Hengshui station, located on the existing east-west line between Dezhou and Shijiazhuang. This segment of the new line crosses several major rivers, including the Yongding, Baigou, Daqing, Hutuo and Fuyang. A double-track connecting branch runs from Bazhou to the Nanchang marshalling yard in Tianjin. The alignment runs almost due south from Hengshui across the central Huabei Plain. The route crosses the Yellow River with

south from Hengshui across the central Huabei Plain. The route crosses the Yellow River with a very long high-level bridge and also crosses the Wei River and several other important waterways. This segment of the line terminates at Shangqiu, located on an important east-west double-track line.

3. The segment from Shangqiu to Fuyang is an existing single-track line that is being double-tracked. The Railway runs due south from Shangqiu across the southern portion of the Huabei Plain, crossing several important rivers including the Buo and the Ying and terminating at Fuyang. Fuyang is an important junction point between the north-south corridor and three other railway lines connecting to Hefei, Luohe and Xuzhou, respectively. As part of the Railway, a medium-sized marshalling yard is being constructed. This segment of the Railway also includes 21 km linking the new yard to the five railway lines radiating from Fuyang. From Fuyang, the Railway alignment crosses the valley of the Huai River with a very long bridge. After the Huai River, the line crosses the western fringe of the Dabie Mountains before descending into the Yangtze Valley. The Railway line parallels the Yangtze River on the north side until reaching the Jiujiang Yangtze River bridge. A single-track branching line connects Macheng, at about the mid-point of the Fuyang-Jiujiang line, to Wuhan on the existing Jing-Guang line serving the north-south corridor. The Hefei-Jiujiang Railway, which is currently under construction with Bank assistance,¹ will also connect this segment of the Railway at Jiujiang, creating a loop parallel from Fuyang to Jiujiang. The Jiujiang Yangtze bridge is located in the north side of Jiujiang. The bridge is a combined railway-highway bridge crossing the Yangtze River and floodplain.

4. From the south end of the Jiujiang Yangtze bridge the line extends in a southward direction, crossing a low mountain range, the Lu Shan, and then passing between the Jiuling Mountains to the west and Poyang Lake to the east. The line passes through Nanchang, the capital city of Jiangxi Province, continuing about 25 km further south to Xiangtang, where it forms a junction with the important east-west line running from Shanghai to Zhuzhou. From Xiangtang to Ji'an, the segment branches southward from the Shanghai-Zhuzhou line at Jinagjia, just west of Xiangtang Xi, and initially follows the existing Linchuan line as far as Sanjiangzhen, a distance of 11 km. Starting at Sanjiangzhen, a new alignment is being built to Nanbiankeng, 38 km to the southwest. Nanbiankeng is at the end of the Feng Luo branch, which originates at Fengcheng on the Shanghai-Zhuzhou line. From Nanbiankeng, a new provincial railway line has been constructed to Ji'an. The provincial railway is being upgraded, and provision has been made for a future second main track. Between Ji'an and Ganzhou, the Railway line alignment follows a mountainous route going about 50 km to the east of the Gan Valley. The reasons for the selection of the mountainous route include avoiding encroachment on valuable farmland and densely populated zones in the Gan Valley, avoiding a future reservoir site and helping development in the poorer mountainous region. The Railway goes further south by following the Tao River Valley for about 100 km and then crosses the mountainous region along the border between the provinces of Jiangxi and Guangdong. This stretch presented the most difficult engineering problems of the entire Railway. After the mountainous region the Railway descends to Longchuan, where it joins with the Guang-Mei-Shan Railway,

¹ Loan No. 1221-PRC: Hefei-Jiujiang Railway Project, for \$110.0, approved on 30 March 1993.

which is currently under construction with the assistance of the Bank.¹ The segment from Longchuan to Changping is formed by a portion of the Guang-Mei-Shan Railway for a length of 213 km. The final segment between Beijing and Kowloon is shared with the existing double-track line from Changping and Kowloon.

5. There are two major north-south lines located east and west of the Jing-Jiu Railway: the Beijing-Guangzhou (Jing-Guang) line and the Beijing-Hangzhou via Shanghai (Jing-Hu) line. The Beijing-Guangzhou line is also highly congested and is identified as a bottleneck in the national railway network except for the Wuhan-Hengyang section. This railway line, with a total length of 2,313 km, starts in Beijing and extends southward to Shijiazhuang, Zhengzhou, Wuhan and Hengyang and ends in Guangzhou. The Beijing-Shanghai line, with a total length of 1,459 km, starts in Beijing and connects major cities including Tianjin, Jinan, Xuzhou, Nanjin and ends in Shanghai. All of these sections are highly congested and unable to meet the transport demand.

B. Traffic Forecasts for the Jing-Jiu Railway

6. The feasibility study prepared by the Fourth Railway Design Institute of MOR has been the basis for traffic projections for the Railway. The traffic projections have been analyzed within the context of the overall national railway system by using the RIS traffic analysis model (see Table 3).

7. During the first four years of full operations between 1997 and 2000, total freight traffic is forecast to increase from 39.9 million tons to 71.3 million tons. This growth will be accounted for largely by the buildup of presently suppressed traffic in the northern subcorridor. In subsequent years annual traffic growth rates used were relatively modest, partly because full capacity utilization in certain sections would be reached in the southbound direction. Total traffic was forecast to reach 86.7 million tons in 2005, rising to 109.7 million tons in 2011 and 114.2 million tons in 2016. Southbound traffic was forecast to rise from 25.2 million tons in 1997 to 45.1 million tons in 2000, while northbound traffic was projected to grow from 14.6 million tons in 1997 to 26.2 million tons in 2000. About 70 per cent of the total freight traffic is bulk or semibulk commodities, and the balance is general cargo. Approximately one half of southbound traffic was expected to comprise coal transported from Shanxi and Henan Provinces, to destinations in Fujian, Jiangxi and Guangdong Provinces.² Other important southbound traffic commodities will include coke, nonmetal ore, grain and manufactured goods. In the northbound direction the most important transit traffic commodities will comprise timber, nonmetal ore and manufactured goods. Passenger numbers, which would contribute a relatively modest portion of Railway traffic, were forecast to rise from 5.4 million in 1997 to 7.7 million in 2000, and to reach 10.0 million annually from 2011 onwards.

¹ Loan No. 1167-PRC: Guang-Mei-Shan Railway Project, for \$200.0, approved on 25 June 1992.

² Coal transport from mines in northern PRC to the industrial centers of southern PRC is among the country's highest economic priorities. According to MOR, coal represents approximately 43 per cent of existing overall national north-south transit traffic.

8. Traffic by commodity and direction for each section was aggregated to estimate the overall traffic level. The traffic forecast comprises four main routing categories: (i) between the Project area and northern PRC; (ii) between the Project area and southern PRC; (iii) within the Project area; and (iv) transit traffic between northern and southern PRC (see Table 4). Average shares of traffic in the four categories compared with total annual traffic are (i) 62 per cent for traffic between the Project area and north/beyond; (ii) 18 per cent for traffic between the Project area and south/beyond; and (iii) 10 per cent for traffic within the Project area and transit traffic.

9. Because of the high level of southbound traffic from northern PRC to the Project area, capacity utilization in some sections of the southbound direction will be reached in 2006, while capacity utilization in the northbound direction will be reached in 2013. Between 1997 and 2005 the forecast rate of growth of southbound transit traffic is conservative, since it is likely that the majority of southbound railway capacity can be absorbed by currently unsatisfied traffic requirements from soon after commencement of the Railway operations. The existing national north-south rail capacity, mainly consisting of the Jing-Guang and the Jing-Hu Railway lines, is understood to fall well below the level of potential transit traffic requirements; and therefore, represents a major transport bottleneck in the PRC.

10. For traffic arriving in the Project area from other parts of the PRC the main commodities will comprise coal, crude oil and nonmetal ores, along with smaller quantities of various other goods. These will be provided mainly from locations to the north of the Project area. Such commodities mainly represent necessary production inputs and consumption goods and will be required throughout the Project area. At present this traffic depends mainly on road transport within the Project area, although Yangtze River barges are also used for transporting some bulk commodities to Jiujiang and Wuhan. Forecast coal traffic to the Project area would originate mainly from Shanxi and Henan provinces to the Project area and would rise from 4.2 million tons in 1997 to 7.6 million tons in 2000.

11. Traffic within the Project area represents a smaller transport subcorridor. It is expected to commence at 4.7 million tons in 1997, rising to 6.8 million tons in 2000 and reaching 8.8 million tons in 2016. These relatively low levels of forecast traffic reflect the limited level of existing economic development within the Project area and are considered to be conservative.

12. The Railway passes over unexploited mineral and nonmineral reserves. It was estimated for the Railway that mining of unexploited but proven reserves would be feasible only when large bulk transport services are provided to the locations. To be conservative, among the unexploited but proven reserves, the traffic forecasts include only committed mining projects under the Eighth Five-Year Plan period (1991-1995) and the next five year plan period. Industrial development that would be directly induced by the Railway includes new coal, iron ore, copper, tungsten, zinc, lead and cement production, as the Railway would offer direct railway lines to the national railway network. It was assumed that traffic would be induced as shown in Table 2.

Table 2: Industrial Production

Commodity	Annual production at full exploitation (million ton)
Coal	10
Copper	2
Iron ore	2
Cement	2
Zinc	2
Lead	2

Table 3: SUMMARY OF FORECAST FREIGHT AND PASSENGER TRAFFIC

Direction	Commodity	Unit	1997	1998	1999	2000	2005	2011	2016
I. FREIGHT TRAFFIC									
A. Northbound									
	Coal		3,827	4,644	5,636	6,840	8,321	10,529	10,957
	Coke		1,752	2,126	2,580	3,131	3,809	4,820	5,016
	Oil		384	466	565	686	834	1,056	1,099
	Iron/Steel		513	622	755	916	1,115	1,411	1,468
	Metal Ore		1,100	1,334	1,620	1,965	2,391	3,026	3,149
	Nonmetal Ore		1,135	1,378	1,672	2,029	2,468	3,123	3,250
	Construction Materials		175	212	258	313	381	482	501
	Cement		48	58	70	85	104	131	136
	Timber		72	87	106	128	156	198	206
	Fertilizer		111	135	163	198	241	305	318
	Grain		1,127	1,368	1,660	2,015	2,452	3,102	3,228
	Cotton		11	13	16	19	24	30	31
	Salt		56	68	83	100	122	154	161
	Others		4,325	5,249	6,370	7,730	9,405	11,900	12,384
	Total		14,636	17,760	21,554	26,155	31,823	40,267	41,904
B. Southbound									
	Coal		6,636	8,054	9,774	11,861	14,431	18,260	19,002
	Coke		3,100	3,762	4,566	5,541	6,741	8,530	8,877
	Oil		635	771	936	1,136	1,382	1,749	1,820
	Iron/Steel		849	1,031	1,251	1,518	1,847	2,337	2,432
	Metal Ore		1,921	2,331	2,829	3,433	4,177	5,285	5,500
	Nonmetal Ore		1,979	2,402	2,915	3,538	4,305	5,447	5,668
	Construction Materials		290	352	427	518	630	798	830
	Cement		79	96	116	141	172	217	226
	Timber		119	144	175	213	259	327	341
	Fertilizer		184	223	271	328	399	505	526
	Grain		1,967	2,387	2,897	3,515	4,277	5,412	5,632
	Cotton		18	22	27	32	39	50	52
	Salt		93	113	137	166	202	256	266
	Others		7,362	8,935	10,843	13,159	16,010	20,258	21,081
	Total		25,232	30,623	37,164	45,099	54,871	69,431	72,253
II. PASSENGER TRAFFIC									
Total Freight Ton									
		('000)	39,868	48,383	58,718	71,254	86,694	109,698	114,157
Freight Ton—km on Jing—Jiu Railway									
		(million)	47,127	58,066	71,549	88,170	108,933	139,978	147,941
Total Passengers									
		('000)	5,428	6,092	6,837	7,673	8,672	10,043	10,043
Passenger—km on Jing—Jiu Railway									
		(million)	1,723	2,485	2,831	3,226	3,702	4,353	4,420
Overall Total CTKM ^a									
		(million)	48,850	60,551	74,380	91,396	112,635	144,331	152,361
Average Freight Distance									
		(km)	1,182	1,200	1,219	1,237	1,257	1,276	1,296
Average Passenger Distance									
		(km)	317	408	414	420	427	433	440

a Converted ton—km (CTKM) equals the sum of freight ton—km and passenger—km.

Table 4: SUMMARY OF FORECAST FREIGHT TRAFFIC BY SUBCORRIDOR
(000 tons)

Subcorridor/Direction	1997	1998	1999	2000	2005	2011	2016
A. Within Project Area							
Northbound: Using Main Line	1,683	2,128	2,304	2,432	2,419	3,120	3,159
Northbound: Using Bazhou–Tianjin Line	1	1	1	1	1	1	1
Northbound: Using Macheng–Wuhan Line	0	0	0	1	1	1	1
Subtotal	1,684	2,129	2,305	2,434	2,421	3,122	3,161
Southbound: Using Main Line	3,005	3,798	4,115	4,343	4,321	5,573	5,641
Southbound: Using Bazhou–Tianjin Line	1	1	1	1	1	1	1
Southbound: Using Macheng–Wuhan Line	1	1	1	1	1	1	1
Subtotal	3,007	3,800	4,117	4,345	4,323	5,575	5,643
Total	4,691	5,929	6,422	6,779	6,744	8,697	8,804
B. Between Project Area and North/Beyond							
Northbound: Using Main Line	7,543	9,643	12,289	15,767	20,358	26,276	27,412
Northbound: Using Bazhou–Tianjin Line	2	3	3	5	6	7	7
Northbound: Using Macheng–Wuhan Line	0	0	0	0	0	0	0
Subtotal	7,545	9,646	12,292	15,772	20,364	26,283	27,419
Southbound: Using Main Line	13,874	17,567	22,244	28,397	36,483	46,861	48,786
Southbound: Using Bazhou–Tianjin Line	3	4	5	6	8	10	11
Southbound: Using Macheng–Wuhan Line	2	3	3	5	6	7	7
Subtotal	13,879	17,574	22,252	28,408	36,497	46,878	48,804
Total	21,424	27,220	34,544	44,180	56,861	73,161	76,223
C. Between Project Area and South/Beyond							
Northbound: Using Main Line	2,986	3,280	3,916	4,529	5,173	6,386	6,849
Northbound: Using Bazhou–Tianjin Line	1	1	1	1	1	2	2
Northbound: Using Macheng–Wuhan Line	1	1	1	1	1	1	1
Subtotal	2,988	3,282	3,918	4,531	5,175	6,389	6,852
Southbound: Using Main Line	5,334	5,858	6,994	8,087	9,238	11,402	12,230
Southbound: Using Bazhou–Tianjin Line	1	1	2	2	2	3	3
Southbound: Using Macheng–Wuhan Line	1	1	1	1	1	2	2
Subtotal	5,336	5,860	6,997	8,090	9,241	11,407	12,235
Total	8,324	9,142	10,915	12,621	14,416	17,796	19,087
D. Transit Traffic							
Northbound: Using Main Line	2,402	2,695	3,023	3,391	3,830	4,432	4,431
Northbound: Using Bazhou–Tianjin Line	8	10	12	15	18	23	24
Northbound: Using Macheng–Wuhan Line	6	7	8	10	12	16	16
Subtotal	2,416	2,712	3,043	3,416	3,860	4,471	4,471
Southbound: Using Main Line	2,993	3,356	3,765	4,224	4,770	5,521	5,519
Southbound: Using Bazhou–Tianjin Line	12	14	18	21	26	33	34
Southbound: Using Macheng–Wuhan Line	7	9	11	13	16	20	21
Subtotal	3,012	3,379	3,794	4,258	4,812	5,574	5,574
Total	5,428	6,091	6,837	7,673	8,672	10,044	10,044
Overall Total	39,868	48,383	58,718	71,254	86,694	109,698	114,157

PROJECT COST ESTIMATES AND FINANCING PLAN ^a
(\$ million)

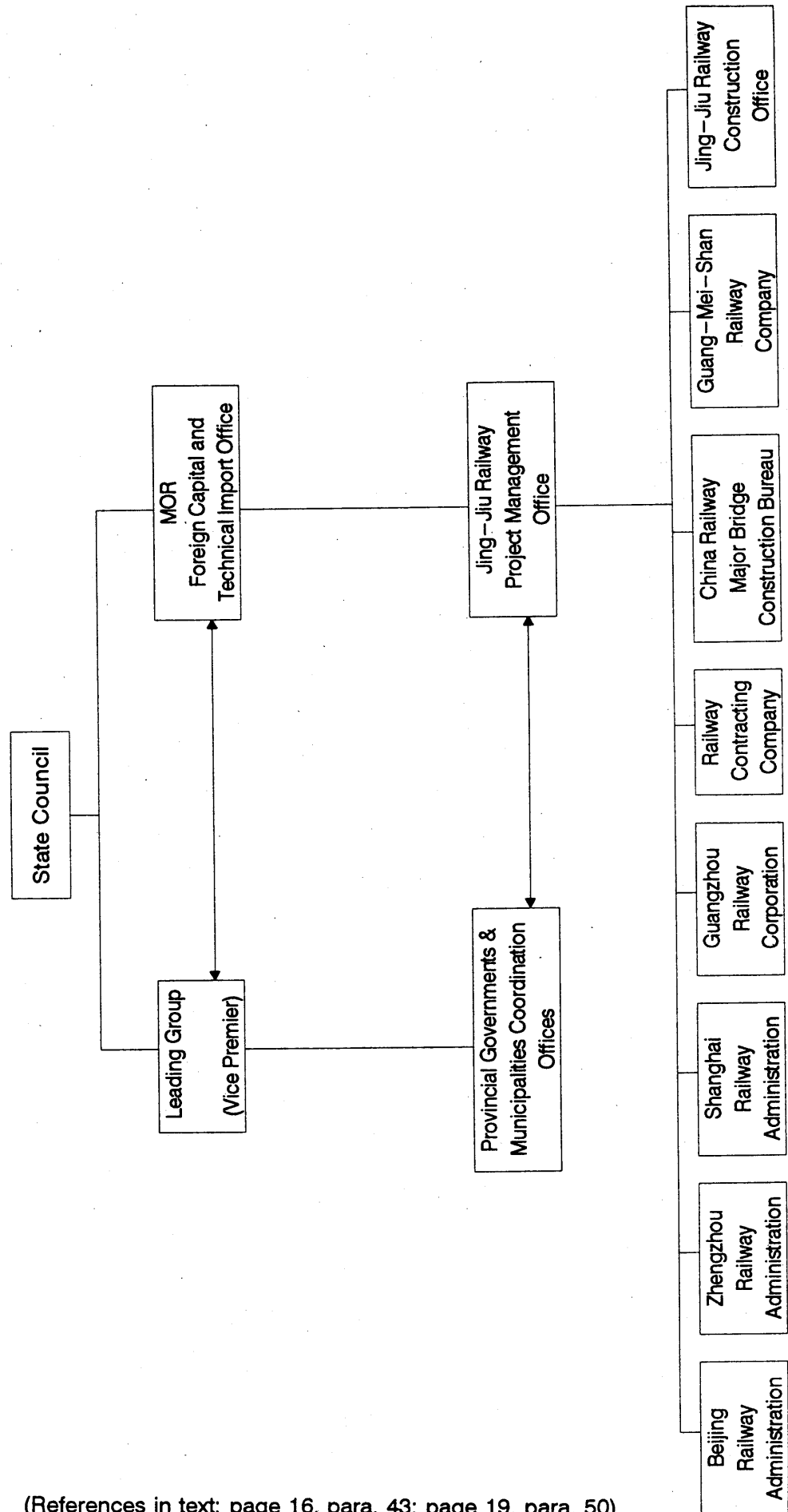
I T E M	COST ESTIMATE			FINANCING PLAN			
	FEX	LCC ^b	Total	B a n k FEX LCC	Government FEX LCC		
1. Track	67.7	—	67.7	67.7	—	—	—
2. Signalling	50.0	144.7	194.7	50.0	—	—	144.7
3. Telecommunicaitons	48.5	134.4	182.9	48.5	—	—	134.4
4. Train Operations Equipment	16.5	—	16.5	16.5	—	—	—
Subtotal (Base Cost)	182.7	279.1	461.8	182.7	—	—	279.1
5. — Physical Contingencies (5%)	9.8	15.3	25.1	9.8	—	—	15.3
— Price Contingencies ^c	7.5	12.5	20.0	7.5	—	—	12.5
Subtotal	17.3	27.8	45.1	17.3	—	—	27.8
6. IDC and Other Charges	20.0	5.1	25.1	—	—	20.0	5.1
Grand Total	220.0	312.0	532.0	200.0	—	20.0	312.0

^a Base costs reflect early 1994 prices. The administrative costs, including the domestic consulting services, are included in the overall cost of the Jing-Jiu Railway.

^b Includes tax totalling about \$10 million.

^c Price contingencies have been caluclated using 2.5 per cent for both foreign exchange and local currency for 1994 onward.

ORGANIZATION CHART FOR JING-JIU RAILWAY



[illegible]

1	:	Bidding Documents Preparation and Submission to the Bank	:	Review by the Bank
2	:	Bid Invitations		
3	:	Bid Opening		
4	:	Bid Evaluation followed by Contract Award		

INDICATIVE LIST OF CONTRACT PACKAGES ^a

Item		Approximately ^c Amount (\$ million)	No. of ^b Contract Packages	Mode of Procurement
1.	Rails	53.7	1/2	ICB
2.	Track Machines including Spares and Training	14.0	5	ICB
3.	Signalling Equipment			
	(i) Automation of Marshalling Yards	21.4	4	ICB
	(ii) Centralized Train Control System from Konglong and Jiangjia	25.1	2	ICB
	(iii) Automatic Blocking System Components	3.5	1	ICB
4.	Telecommunications and Train Operations Equipment	65.0	15	ICB

^a A detailed list of contract packages is kept in the Project files.

^b At the tendering stage, the indicative number of contract packages may change depending upon the physical progress.

^c Base cost excluding contingencies.

**PERFORMANCE INDICATORS FOR
JING-JIU RAILWAY
(Annual Targets)**

I t e m	Fiscal Year Ending 31 December				
	1997	1998	1999	2000	2001
A. TRAFFIC					
Freight Ton-Km (million)	47,127	58,066	71,549	88,170	92,323
Passenger-Km (million)	1,723	2,485	2,831	3,226	3,321
Freight Tons (thousand)	39,868	48,383	58,718	71,254	74,342
Passengers (thousand)	5,428	6,092	6,837	7,673	7,873
Average Freight Distance (km)	1,182	1,200	1,219	1,237	1,241
Average Passenger Journey (km)	317	408	414	420	422
TKM per Route-Km (million)	18.6	22.9	28.2	34.8	36.4
PKM per Route-Km (million)	0.7	1.0	1.1	1.3	1.3
B. STAFF (year end number)	39,083	42,204	45,416	48,880	49,637
C. FINANCIAL					
Working Ratio (%)	42.0%	41.2%	40.7%	40.4%	41.5%
Operating Ratio (%)	78.8%	77.1%	70.0%	66.8%	67.0%
Return on Net Fixed Assets (%)	1.9%	2.5%	4.1%	5.5%	5.9%
Debt-Service Ratio	2.0	2.7	3.4	2.5	2.5

D. PROFIT AND LOSS ACCOUNT (Y million)Revenue

Freight

Passengers

Other

Total

Operating Costs

Salaries and Wages

Materials

Fuel

Utilities

Other Expenses

Business Tax

Total Working Expenses

Depreciation

Total Operating Expenses

Operating Profit

Non-operating Expenses

Transfer to Railway Construction Fund

Net Profit

E. DEBT SERVICE STATEMENT

Principal

Interest^a

Total Debt-Service

Debt-Service Ratio (times)^b

Note: This page shows the format of supplementary data.

^a From profit and loss account.

^b Debt-Service Ratio is calculated as follows:

(i) Operating Profit plus Depreciation Total Operating Funds.

(ii) Total Operating Funds divided by Total Debt Service gives the Debt-Service Ratio.

**PROJECTED FINANCIAL STATEMENTS
FOR JING-JIU RAILWAY: INCOME STATEMENT
(Y million)**

Item	Fiscal Year ending 31 December (Forecast)				
	1997	1998	1999	2000	2001
Freight Tons Km (million)	47,127	58,066	71,549	88,170	92,323
Passenger Km (million)	1,723	2,485	2,831	3,226	3,321
Converted Tons Km (million)	48,850	60,551	74,380	91,396	95,644
Number of Staff	39,083	42,204	45,416	48,880	49,637
OPERATING REVENUE					
Freight	3,770.2	4,645.3	5,723.9	7,053.6	7,385.8
Passenger	112.0	161.5	184.0	209.7	215.9
Other	310.6	384.5	472.6	581.1	608.1
Gross Total Operating Revenue	4,192.7	5,191.3	6,380.6	7,844.4	8,209.8
Transfer of Surcharge to RCF	(1,272.4)	(1,567.8)	(1,931.8)	(2,380.6)	(2,492.7)
Net Total Operating Revenue	2,920.3	3,623.6	4,448.7	5,463.8	5,717.1
OPERATING EXPENSES					
Salaries & Wages	236.8	273.2	313.1	358.0	385.4
Materials	157.8	184.7	217.1	257.2	279.7
Fuel	207.4	274.7	359.4	469.2	520.4
Utilities	44.7	54.6	66.8	82.2	90.1
Others	133.7	154.1	178.4	208.1	225.5
Sub-total	780.4	941.4	1,134.7	1,374.7	1,501.1
Provision for Major Repairs	350.4	434.8	533.8	655.7	686.1
Business Tax	94.6	117.4	144.1	177.0	185.2
Total Working Expenses	1,225.5	1,493.6	1,812.7	2,207.4	2,372.4
Depreciation	1,075.8	1,300.1	1,300.1	1,445.0	1,456.7
Total Operating Expenses	2,301.2	2,793.7	3,112.8	3,652.4	3,829.0
OPERATING INCOME	619.1	829.9	1,335.9	1,811.4	1,888.1
Non-Transport Costs	67.6	79.6	96.3	118.1	123.1
Interest on Debt	573.8	573.8	554.8	533.9	492.6
Net Income before Income Tax	(22.3)	176.4	684.8	1,159.3	1,272.3
Income Tax	0.0	58.2	226.0	382.6	419.9
NET INCOME AFTER INCOME TAX	(22.3)	118.2	458.8	776.7	852.5

BALANCE SHEET
(Y million)

Item	Fiscal Year ending 31 December (Forecast)				
	1997	1998	1999	2000	2001
ASSETS					
Current Assets					
Cash	574.8	1,742.1	1,198.6	2,083.4	2,475.5
Account Receivable	243.4	302.0	370.7	455.3	476.4
Total Current Assets	818.1	2,044.1	1,569.3	2,538.7	2,951.9
Fixed Assets					
Gross Fixed Assets in Operation	34,908.4	34,908.4	36,933.0	37,446.4	38,487.3
Accumulated Depreciation	1,075.8	2,375.9	3,676.0	5,121.0	6,577.7
Net Fixed Assets in Service	33,832.6	32,532.5	33,257.0	32,325.4	31,909.6
TOTAL ASSETS	34,650.7	34,576.5	34,826.4	34,864.1	34,861.5
LIABILITIES					
Current Liabilities					
Account Payable	45.3	55.7	68.5	84.7	93.0
Long – Term Liabilities					
Foreign	3,476.0	3,438.9	3,399.3	3,357.1	3,245.5
Local	5,136.7	4,971.0	4,788.7	4,075.6	3,324.0
Total Term Loans	8,612.7	8,409.9	8,188.1	7,432.8	6,569.5
TOTAL LIABILITIES	8,658.0	8,465.6	8,256.5	7,517.5	6,662.5
CAPITAL					
Equity Capital from RCF	26,058.1	26,058.1	26,058.1	26,058.1	26,058.1
Retained Earnings	-65.3	52.8	511.7	1,288.4	2,140.9
TOTAL CAPITAL	25,992.8	26,111.0	26,569.8	27,346.6	28,199.0
TOTAL LIABILITIES & CAPITAL	34,650.7	34,576.5	34,826.4	34,864.1	34,861.5
Financial Indicators					
Working Ratio	42.0%	41.2%	40.7%	40.4%	41.5%
Operating Ratio	78.8%	77.1%	70.0%	66.8%	67.0%
Return on Fixed Assets	1.9%	2.5%	4.1%	5.5%	5.9%
Debt Service Ratio	2.0	2.7	3.4	2.5	2.5
Debt Equity Ratio	25 : 75	24 : 76	24 : 76	22 : 78	19 : 81

SOURCE AND APPLICATION OF FUNDS
(Y million)

Item	Fiscal Year ending 31 December (Forecast)									
	1993	1994	1995	1996	1997	1998	1999	2000	2001	
SOURCE OF FUNDS										
Operating Income	0.0	0.0	0.0	0.0	619.1	829.9	1,335.9	1,811.4	1,888.1	
Depreciation	0.0	0.0	0.0	0.0	1,075.8	1,300.1	1,300.1	1,445.0	1,456.7	
Change in Working Capital	0.0	0.0	0.0	0.0	-198.1	-48.2	-56.0	-68.3	-12.9	
Funds from Operations	0.0	0.0	0.0	0.0	1,496.8	2,081.7	2,580.1	3,188.1	3,331.9	
Term-Loan	2,339.7	2,168.7	3,197.4	1,144.4	0.0	0.0	0.0	0.0	0.0	
Capital from RCF	4,359.6	7,584.9	9,401.4	2,619.1	2,093.1	0.0	0.0	0.0	0.0	
Overdraft	0.0	40.0	65.0	180.0	-285.0	0.0	0.0	0.0	0.0	
TOTAL SOURCE	6,699.4	9,793.6	12,663.7	3,943.6	3,304.9	2,081.7	2,580.1	3,188.1	3,331.9	
APPLICATION OF FUNDS										
Capital Expenditures	6,699.4	9,753.6	9,956.4	3,763.6	0.0	0.0	0.0	513.4	232.4	
Purchase of Rolling Stocks	0.0	0.0	2,642.3	0.0	2,093.1	0.0	2,024.7	0.0	808.5	
Total Capital Expenditures	6,699.4	9,753.6	12,598.7	3,763.6	2,093.1	0.0	2,024.7	513.4	1,040.9	
Interest on Foreign Loan	0.0	34.3	52.7	150.6	162.2	162.2	159.7	157.1	154.3	
Repayment of Foreign Loan	0.0	0.0	0.0	0.0	0.0	37.1	39.6	42.2	111.7	
Interest on Domestic Loan	0.0	0.0	0.0	0.0	411.7	411.7	395.1	376.9	338.4	
Repayment of Domestic Loan	0.0	0.0	0.0	0.0	0.0	165.7	182.2	713.1	751.6	
Interest on Short-Term Borrowings	0.0	4.0	10.5	28.5	0.0	0.0	0.0	0.0	0.0	
Total Debt Service	0.0	38.3	63.2	179.1	573.8	776.6	776.6	1,289.2	1,355.9	
Non-Transport Cost	0.0	0.0	0.0	0.0	67.6	79.6	96.3	118.1	123.1	
Income Tax	0.0	0.0	0.0	0.0	0.0	58.2	226.0	382.6	419.9	
TOTAL APPLICATION OF FUNDS	6,699.4	9,791.8	12,661.9	3,942.7	2,734.5	914.4	3,123.6	2,303.3	2,939.8	
Net Cash Position	0.0	1.7	1.8	0.9	570.4	1,167.3	-543.5	884.8	392.1	
Cash at the Beginning	0.0	0.0	1.7	3.6	4.4	574.8	1,742.1	1,198.6	2,083.4	
Cash at the End	0.0	1.7	3.6	4.4	574.8	1,742.1	1,198.6	2,083.4	2,475.5	

ASSUMPTIONS

1. **Funding:** The construction of the Railway will be funded by loan funds provided by the Bank, Overseas Economic Cooperation Fund of Japan, China Construction Bank, Industrial and Commercial Bank of China and the provincial governments and by capital from the Railway Construction Fund (RCF) of the Government. The procurements of rolling stock in 1995 and 1997 will be fully financed by RCF, and those from 1999 onwards will be financed by internal sources. Additional capital investments for capacity expansion starting from 2000 will be fully financed by internal sources.
2. **Construction and Operation:** The construction of the Railway will be undertaken between 1993 and 1996, and full operation will start in 1997.
3. **Revenue:** Projected revenues are based on forecast traffic and tariff levels likely to be set by the Ministry of Railways, which are assumed not to change over the period of the projections. The tariff rates are (a) 8.00 fen/ton-km for freight and (b) 6.50 fen/passenger-km for passenger traffic, which reflect the "new line, new tariff" policy and the proposed general tariff increase.
4. **Transfer to Railway Construction Fund:** The amount of 2.70 fen/ton-km out of the freight tariff of 8.00 fen/ton-km will be transferred to the Government's RCF to be used for other railway construction projects.
5. **Inflation:** Cost escalation caused by inflation is assumed as follows: 12.0 per cent (1994), 9.0 per cent (1995), 8.0 per cent (1996), 7.2 per cent (1997), 6.5 per cent (1998/1999), and 6.0 per cent (2000 onward).
6. **Working Expenses:** Fuel is treated as 100 per cent variable in line with forecast traffic. Materials, utilities and other expenses are treated as 40.0 per cent, 60.0 per cent, and 33.3 per cent variable, respectively. Salaries and wages are based on forecast staff numbers, which correspondingly reflect that staff numbers are variable in line with traffic growth until the target staff number of 21 staff/km is reached in 2006.
7. **Provision for Major Repairs:** Provision for major repairs is 12.0 per cent of the total revenue.
8. **Business Tax:** Business tax is based on 3.24 per cent of revenues.
9. **Depreciation:** Depreciation is based on historic costs and adjusted in consideration of inflationary factors. Salvage value is 4 per cent of the historical costs. Average economic life is 40 years for subgrade, bridges and culverts, tunnels and cuts, and housing; 15 years for track; 20 years for signal and communication equipment, and rolling stock; 10 years for electric power; and 25 years for other equipment. The cost of relocation is amortized over 40 years.

10. **Income Tax:** Income tax is based on 33 per cent of net income before income tax.
11. **Accounts Receivable:** Accounts receivable are based on one month's revenue.
12. **Accounts Payable:** Accounts payable are based on one month's operating expense excluding salaries and wages.

OUTLINE TERMS OF REFERENCE FOR TECHNICAL ASSISTANCE FOR POLICY SUPPORT TO THE MINISTRY OF RAILWAYS

I. BACKGROUND

1. Within the context of the PRC's overall reform program, the Ministry of Railways (MOR) is going through various policy and institutional changes. The restructuring of tariff systems has played a critical role in MOR achieving a higher degree of financial autonomy to set tariffs to recover costs and service debt and to raise needed funds to finance railway capacity expansion and efficiency improvement. A major step taken was setting up the Railway Construction Fund by adding a surcharge on selected freight tariff in 1991 to finance MOR's capital expenditure. Revising tariff levels, however, still needs approval by the State Council. MOR's average national tariff rates are currently 5.35 fen/ton-km for freight and 4.70 fen/passenger-km for passengers. Setting up economic tariffs by applying the "new line, new tariff" policy will be pursued for the Jing-Jiu Railway (the Railway).

2. One recent example of organizational reform in MOR has been the establishment of the Guangzhou Railway Corporation (GRC), which took over the functions of Guangzhou Regional Railway Administration. GRC will serve as an experimental entity for the implementation of policy reform initiatives including traffic costing, contract pricing and profit center line of business organization. Once the experiment proves successful, other regional railway administrations are expected to be corporatized, which will result in greater autonomy in operations, pricing and financial management. To achieve further commercial orientation and operational efficiency, GRC is expected to facilitate the further restructuring of the railway subsector. Aside from GRC, corporate reforms are also being carried out in the Jinan Railway Corporation in Shandong and in the Fuzhou Railway Sub-administration in Fujian.

II. OBJECTIVES

3. The objectives of the technical assistance (TA) are (i) recommendation of an appropriate organizational structure for management of the Railway as a commercial operation, (ii) formulation of an appropriate tariff structure for the Railway with due consideration given to alternative routes and other transport modes, and (iii) assistance to the Railway in financial and accounting management and financial settlements based on appropriate distribution of revenue and expenses.

III. SCOPE OF SERVICES

4. Since the Railway covers seven provinces, two municipalities and four railway administrations, the institutional arrangements are relatively more complex, and coordination is therefore essential to ensure smooth Project implementation and operation. For designing an appropriate organizational structure for the management of the Railway, apart from the option to manage and operate the Railway on its own, MOR has been considering other institutional arrangements for operation and management of the Railway in line with enterprise reform. The

relative merits of the alternatives will be assessed, and the most appropriate structure will be proposed. The proposed arrangements should ensure that the Railway is operated as a separate commercial enterprise whose financial performance may be monitored to ensure full cost recovery with a reasonable rate of return. Diversification of sources of financing including the possibility of stock holding by the provincial and municipal governments in the Railway will also be examined for future mobilization of MOR's financial resources.

5. Tariff setting of the Railway needs comprehensive analysis because (i) the Railway will be operated in a unique situation where there are two alternative routes, i.e., the Beijing-Guangzhou and Beijing-Shanghai lines; thus tariff setting would involve a more complex analysis; (ii) unlike the coal-dedicated new railway line from Datong to Qinhuangdao, where the "new line, new tariff" policy has been adopted for the first time by MOR, the Railway will transport a variety of bulk and general cargoes, which will also require a more complex analysis for the new tariff; and (iii) the Railway will become one of the major trunk lines; hence the impact of the new tariff on other railway systems as well as on other transport modes will be significant.

6. Since the Railway could be a pilot project to the test the efficiency of operation and management of the national railway line in light of the ongoing economic reforms, the Bank proposes that MOR adopt commercially oriented and profit center-based arrangements for the Railway. Ideally this will involve separation of the government functions of MOR such as enforcement of the Railway Law from the public utility, common carrier functions such as the commercial operation of the Railway. Enhancement of financial and accounting management capability on the basis of the new accounting standards promulgated by the Government in July 1993 is also stressed in the TA. Details of items to be covered by the TA are as follows:

- (i) Part A: Setting an appropriate organizational structure. Under this component, the consultants will:
 - (a) research MOR's economic reform process including the central Government-MOR relationship and the Railway Law enacted in 1991;
 - (b) assess existing arrangements for contributions among various stakeholders including MOR and provincial governments;
 - (c) review the process of corporatization of the Guangzhou and Jinan Railway Corporations and other regional railway administrations such as Fuzhou, and identify key issues in corporatization;
 - (d) identify financial and operational requirements and constraints for the commercial operation of the Railway;
 - (e) examine possible organizational structures and compare the merits and demerits of alternatives;

- (f) propose the most appropriate organizational structure for the Railway to be set up; and
 - (g) assess the feasibility of diversification of ownership: stock holding by local governments, the public sector and the private sector in a corporatized Railway.
- (ii) Part B: Tariff setting policy and tariff structure. Under this component, the consultants will:
 - (a) review the history of MOR's tariff reform as well as tariff studies conducted by MOR and the World Bank, and examine the "new line, new tariff" policy in line with these developments;
 - (b) formulate a tariff-setting policy for financial self-sufficiency of the Railway with due consideration for:
 - (1) cost recovery, debt service, provision for adequate depreciation and reasonable rate of return;
 - (2) price and service competitiveness of the Railway against alternative routes;
 - (3) price and service competitiveness of the Railway against other available transport modes;
 - (4) benefits for users of freight and passenger services of the Railway; and
 - (5) commodities being transferred by the Railway;
 - (c) propose desirable freight and passenger tariff levels and a tariff schedule; and
 - (d) forecast the traffic distribution to the Railway and the alternative routes, given the proposed tariffs.
- (iii) Part C: Financial and accounting management and financial settlements. Under this component, the consultants will:
 - (a) for financial management:
 - (1) assess MOR's capability of implementing the new accounting standards promulgated by the Government in July 1993 (the Standards) and hold a seminar and training if necessary;

- (2) assist MOR in setting up the separate operational accounts for the Railway on the basis of the Standards; and
 - (3) assist MOR in designing and establishing a financial management system for the operation of the Railway that will enable MOR to monitor selected performance indicators periodically and take necessary improvement measures, if necessary; and
- (b) for arrangements for financial settlements:
- (1) formulate a method of fairly allocating revenues and expenses among participants in the operation of the Railway; and
 - (2) devise an appropriate scheme for financial settlements among the participants, i.e., MOR, Regional Railway Administrations, GRC, Guang-Mei-Shan Railway Company, etc.

IV. REQUIRED EXPERTISE

7. The international consultants need to have extensive expertise in the following areas: (i) institutional/corporate structure, and (ii) financial accounting and financial management with experience in tariff setting. Skills in speaking and reading the Chinese language by at least one of the team members will be an advantage. The local consultants need to have extensive expertise in (i) legal aspects of registration of public companies, (ii) organizational development of the public sector, (iii) financial accounting and financial management, and (iv) transport (railway) economics.

V. IMPLEMENTATION SCHEDULE AND ARRANGEMENTS

8. MOR will be the Executing Agency for the TA, and the Foreign Capital and Technical Import Office will be in charge of all necessary coordination. MOR will set up a Task Force for the institutional arrangements and tariff setting for the Railway, and the Task Force will make preparatory work for the TA. The consulting service are expected to commence in October 1994 and should be completed over a period of one year. After six months from the commencement, a tripartite meeting (MOR, TA consultants and the Bank) will be held to review the progress of the TA.

VI. REPORTING REQUIREMENTS

9. The reporting requirements of the Government of the PRC and the Bank for the TA are as follows:

- (i) Inception Report: One month after the commencement of the assignment, an inception report should be submitted to the People's Bank of China (PBC), MOR and the Bank.

- (ii) Interim Report: After the tripartite meeting is held six months from the commencement of the TA, an interim report should be submitted to PBC, MOR and the Bank.
- (iii) Draft Final Report: At the completion of the TA, a draft final report summarizing all consulting activities under the TA should be submitted by the consultants to PBC, MOR and the Bank.
- (iv) Final Report: Within one month of receiving comments on the draft final report from PBC, MOR and the Bank, a final report should be submitted by the consultants to PBC, MOR and the Bank.

COST ESTIMATES FOR TECHNICAL ASSISTANCE FOR POLICY SUPPORT TO THE MINISTRY OF RAILWAYS

	<u>Amount</u> (\$)
A. Foreign Exchange Costs Financed by the Bank	
1. Professional Fees	290,000
2. Per Diem	70,000
3. International Travel	24,000 ^a
4. Reports and Communications	10,000
5. Supplies and Equipment	13,000
6. Contingencies	61,000
Subtotal	<u>468,000</u>
B. Local Currency Costs Financed by the Bank	
1. Local Consulting Professional Fees and Per Diem	105,000
2. Local Travel	10,000
3. Contingencies	17,000
Subtotal	<u>132,000</u>
TOTAL FINANCED BY TECHNICAL ASSISTANCE	<u>600,000</u>
C. Local Currency Costs Financed by the Government	
Administrative Costs (office space, support staff, translator facilities, communications, salaries of counterpart staff, local transport and office supplies)	<u>100,000</u>
GRAND TOTAL	<u>700,000</u>

^a Including provision for two Government officials to attend contract negotiations.

FINANCIAL INTERNAL RATE OF RETURN (FIRR)

A. Part A: FIRR for the Project

1. Financial benefits have been quantified by comparing the "with" and "without" the Project cases. The financial benefits of the Project have been quantified in terms of (i) rail replacement cost savings, (ii) railway transport cost savings, (iii) accident cost savings, (iv) labor and materials cost savings, and (v) savings in locomotive and rolling stock investment.

2. Major assumptions made in estimating the FIRR for the Project include:

- (i) All components of the FIRR calculations are based on constant early-1994 prices.
- (ii) Rail Component: The Project will introduce special track rails whose wear and tear are less than the standard track rails. The longer economic life of these special track rails will lead to less and delayed replacement of rails and annual maintenance costs.
- (iii) Railway Maintenance Mechanization Component: Under the Project, MOR's maintenance teams will be equipped with an advanced, fully mechanized maintenance technology that can undertake maintenance or replacement of a greater length of track than the current manual or semi-automated maintenance teams. Train operation costs will be reduced, mainly because of the fuel savings arising from improved track conditions. Reduced accident rates will lead to both lower accident costs and less blockage of the Railway line because of accidents.
- (iv) Signalling and Railway Telecommunication Improvement Component: Advanced technology to be introduced under the Project will reduce labor costs and rolling stock investments. Labor cost savings will be materialized because of more automation in telecommunications and less fleet management through manual data. The savings in rolling stock investment for the Railway will result from better fleet management.

3. The FIRR for the Project is estimated at 17.1 per cent (see Table 1).

Jing-Jiu Railway Technical Enhancement Project
(Y Million)

Year	Costs							Benefits					Total Net Benefit
	Equipment		Equipment Maintenance		Permanent way Rehabilitation		Net Cost	Net Labor and Material Cost Savings	Reduced Accident Cost	Reduced Train Operation Cost	Wagon Purchase Cost Savings		
	With Project	Without Project	With Project	Without Project	With Project	Without Project							
1994	481.7	394.2					87.5					(87.5)	
1995	829.7	623.6					206.1					(206.1)	
1996	640.8	475.6					165.2					(165.2)	
1997			12.8	9.3			3.5	45.2	2.6	13.0	0.1	57.4	
1998			24.5	17.4			7.1	61.7	5.2	26.0	1.5	87.2	
1999			24.5	17.4			7.1	61.9	5.2	26.0	1.5	87.4	
2000			24.5	17.4			7.1	62.2	5.2	26.0	1.5	87.7	
2001			24.5	17.4			7.1	62.4	5.2	26.0	1.5	87.9	
2002			24.5	17.4			7.1	62.6	5.2	26.0	1.5	88.1	
2003			24.5	17.4			7.1	62.9	5.2	26.0	1.5	88.4	
2004		262.0	24.5	17.4			(254.9)	0.0	5.2	26.0	1.5	287.5	
2005			24.5	17.4		650.0	(642.9)	63.4	5.2	26.0	1.5	738.9	
2006	267.4	240.7	24.5	17.4	650.0		683.9	63.6	5.2	26.0	1.5	(587.6)	
2007			24.5	17.4			7.1	63.9	5.2	26.0	1.5	89.4	
2008			24.5	17.4			7.1	64.2	5.2	26.0	1.5	89.7	
2009			24.5	17.4			7.1	64.5	5.2	26.0	1.5	90.0	
2010			24.5	17.4			7.1	64.9	5.2	26.0	1.5	90.4	
2011			24.5	17.4			7.1	65.2	5.2	26.0	1.5	90.7	
2012			24.5	17.4			7.1	65.6	5.2	26.0	1.5	91.1	
2013	524.0	262.0	24.5	17.4			269.1	18.0	5.2	26.0	1.5	(218.4)	
2014			24.5	17.4			7.1	66.3	5.2	26.0	1.5	91.8	
2015			24.5	17.4		722.2	(715.1)	66.7	5.2	26.0	1.5	814.4	
2016			24.5	17.4	722.2		729.4	67.1	5.2	26.0	1.5	(629.6)	

FIRR = 17.1%

B. Part B: FIRR for the Railway

4. The FIRR is estimated from the cost and revenue streams generated by the Railway. The major assumption underlying the FIRR analysis are set out below.

- (i) All components of the FIRR calculations reflect constant early-1994 prices.
- (ii) Capital investments are based on the cost estimates for the Railway construction but exclude price contingencies and interest during construction.
- (iii) Additional minor investments will be made from 2000 to meet increased traffic volume.
- (iv) The replacement cost and the salvage value reflect average economic life and depreciation of each asset.
- (v) Working costs are based on estimates of fixed costs, and estimates of variable costs consistent with forecast traffic.
- (vi) Tariff rates are constant over the period of analysis.
- (vii) The revenue is net of the surcharge to be transferred to the Railway Construction Fund.
- (viii) The FIRR for the Railway is estimated at 7.92 per cent (see Table 2), which exceeds the estimated cost of capital of 6.04 per cent (see Table 3).
- (ix) If the surcharge, which is transferred to the Railway Construction Fund, is included as part of revenue, the FIRR will be about 13.5 per cent (see Table 4).

TABLE 2
FINANCIAL INTERNAL RATE OF RETURN
(Y million)

Year	Capital Investment	Rolling Stock	Replace- ment	Salvage Value	Increase in Working Capital	Operating Cost Less Depreciat'n	Non-Transport Costs	Revenue	Net Cashflow
1993	-6,699.4								-6,699.4
1994	-9,345.4								-9,345.4
1995	-9,120.2	-2,523.7							-11,643.8
1996	-2,983.8								-2,983.8
1997		-1,880.8			-210.2	-1,016.4	-63.1	2,920.3	-250.1
1998					-53.6	-1,197.3	-74.8	3,623.6	2,297.9
1999		-1,711.5			-62.9	-1,408.1	-90.4	4,448.7	1,175.9
2000	-310.9				-77.3	-1,665.2	-111.4	5,463.8	3,298.9
2001	-132.8	-643.0			-19.3	-1,728.9	-116.1	5,717.1	3,077.0
2002					-19.3	-1,792.5	-121.1	5,970.5	4,037.5
2003	-166.2	-715.0			-19.3	-1,856.0	-126.4	6,223.8	3,340.8
2004	-112.2				-19.3	-1,919.5	-132.1	6,477.2	4,294.1
2005	-407.9				-19.3	-1,982.8	-138.0	6,730.5	4,182.4
2006	-382.7		-837.9	33.5	-24.0	-2,061.5	-138.0	7,045.5	3,634.8
2007	-97.5				-24.0	-2,136.5	-138.0	7,360.4	4,964.4
2008	-236.7				-24.0	-2,211.6	-138.0	7,675.4	5,065.1
2009	-124.1				-24.0	-2,286.6	-138.0	7,990.3	5,417.6
2010	-195.5				-24.0	-2,361.6	-138.0	8,305.3	5,586.1
2011	-71.9		-4,148.0	165.9	-24.0	-2,436.7	-138.0	8,620.3	1,967.6
2012					-7.3	-2,459.5	-138.0	8,715.8	6,111.0
2013					-7.3	-2,482.2	-138.0	8,811.4	6,183.8
2014					-7.3	-2,505.0	-138.0	8,906.9	6,256.6
2015					-7.3	-2,527.8	-138.0	9,002.4	6,329.3
2016			-7,619.4	8,277.6	673.1	-2,550.6	-138.0	9,098.0	7,740.6
								FIRR	7.92%

Table 3: CALCULATION OF THE WEIGHTED AVERAGE COST OF CAPITAL

Financed by	Million Yuan	Weighting	Cost	Weighted Average Cost
Local Currency Loans				
Construction Bank of China	1,771.4	5.9%	10.00%	0.59%
Industrial Commercial Bank of China	1,771.4	5.9%	10.00%	0.59%
Provincial Governments	1,594.0	5.3%	3.60%	0.19%
Foreign Currency Loans				
Bank	1,738.0	5.8%	10.57%	0.61%
OECD	1,738.0	5.8%	6.60%	0.38%
Capital from Railway Construction Fund	21,322.7	71.2%	15.0%	10.68%
Total Funds Provided (million yuan)	29,935.4	100.0%		13.04%
Less Inflation				7.00%
Real Cost of Capital				6.04%

Notes:

1. To derive an approximate yuan equivalent rate for the Bank's and Overseas Economic Cooperation Fund's (OECD's) portion of the Project, the Bank's current ordinary capital resources rate of 6.67 per cent and OECD's lending rate of 2.70 per cent are adjusted by 3.9 per cent for a total of 10.57 per cent and 6.60 per cent in nominal terms, respectively. The 3.9 per cent adjustment, which is the difference between the domestic inflation rate and the assumed international inflation rate, has been deemed to be a suitable proxy for the exchange rate risk premium on foreign currency loans.

2. The funds provided by the Railway Construction Fund of the Government are perpetual and bear no interest rate. They may, therefore, be regarded as equity capital. The cost of equity capital is estimated at 15.0 per cent in nominal terms, reflecting 10 per cent for a commercial lending interest rate and 5 per cent for a risk premium on the project.

3. The overall cost of capital for the Railway, in inflation-adjusted terms, is estimated at 6.04 per cent.

TABLE 4

[illegible]

ECONOMIC INTERNAL RATE OF RETURN (EIRR)

1. Economic benefits have been quantified by comparing the "with" and "without" the Project cases. The economic benefits of the Railway as a whole have been quantified in terms of (i) transport cost savings for traffic that will divert to the Railway from existing roads, inland waterways and other railway lines; and (ii) net production value added through major committed expansions along the Railway of coal, iron ore, copper, zinc, lead and cement production, which will become operational as the Railway will offer direct railway lines to the national railway network. The economic benefits of the Project have been quantified in terms of (i) rail replacement cost savings, (ii) railway transport cost savings, (iii) accident cost savings, (iv) labor and materials cost savings, and (v) savings in locomotive and rolling stock investment.
2. Major assumptions made in estimating the EIRR include:
 - (i) Cost: Economic costs were expressed in early-1994 constant prices. Operating costs were estimated on the basis of actual cost data for each mode of transport and other associated elements of journey costs. Local cost components were adjusted to border prices by application of the standard conversion factor (0.9).¹ The residual value of capital investment in 2016 has been based on the average asset life that was used for financial projections (see Appendix 9),
 - (ii) Rail Component: The Project will introduce special track rails whose wear and tear are less than the standard track rails. The longer economic life of these special track rails will lead to less and delayed replacement of rails and annual maintenance costs.
 - (iii) Railway Maintenance Mechanization Component: Under the Project, MOR's maintenance teams will be equipped with an advanced, fully mechanized maintenance technology that can undertake maintenance or replacement of a greater length of track than the current manual or semi-automated maintenance teams. Train operation costs will be reduced, mainly because of the fuel savings arising from improved track condition. Reduced accident rates will lead to both lower accident costs and less blockage of the Railway line because of accidents.
 - (iv) Signalling and Railway Telecommunication Improvement Component: Advanced technology to be introduced under the Project will reduce labor costs and rolling stock investments. Labor cost savings will be materialized because of more automation in telecommunications and less fleet management through manual data. The saving in rolling stock investment will result from better fleet management.

¹ Memo, Manager, PE1, "PRC: Price Contingencies, the Standard Conversion Factor and the January 1994 Devaluation of the Yuan", 19 January 1994.

- (v) Transport Cost Savings: A major part of existing freight traffic on the existing railways, roads and inland waterways will be diverted to the Railway. This will substantially reduce transport and handling costs. To estimate transport cost savings, annual unit economic railway operating costs ranging from Y 0.03 to Y 0.04 per ton-km were estimated on the basis of an analysis of the fixed and variable components of each main cost category in relation to annual traffic volume. The unit economic transport costs per ton-km were estimated at Y 0.36 for 5-ton trucks, Y 0.25 for 8-ton trucks and Y 0.08 for 100-ton river barges. The "without" case includes the costs of upgrading the existing roads along the Railway to Class II standard, as would be necessary to handle the forecast levels of traffic to, from and within the Project area. Costs for upgrading the existing road were based on an economic cost of Y 2.0 million per km, with works taking place over a four-year period from 2000 to 2003.
- (vi) Net Production Value Added: Since the Railway will offer direct rail connection to the national railway system and there are several large, proven mineral deposits located close to the railway alignment, it is highly expected that several new mining and cement production activities will be induced by the Railway. To be conservative, only committed expansion projects were selected for the evaluation. Estimation of the economic benefits for southbound transit traffic was based on the economic value per additional ton of coal produced at several locations along the Railway. Coal represents nearly half of existing transit traffic from northern to southern PRC, and coal production is constrained by lack of transport capacity. A gradual buildup was assumed for generated production within the overall Project area. Calculation of production value added was based on border prices of about Y 330 per ton of coal, Y 244 per ton of iron ore, Y 10,353 per ton of copper, Y 8,526 per ton of zinc, Y 3,654 per ton of lead and Y 618 per ton of cement—less production and transport costs, after appropriate quality adjustments. To be conservative, economic assessment assumes that the estimated production value added accounts for about 10 per cent of the total benefits.

3. The EIRR of the Railway was estimated at 15.4 per cent (see Table 1), while the EIRR of the Project was estimated at 19.8 per cent (see Table 2). Among the Project components, the EIRR of the track maintenance mechanization component was estimated at 24.3 per cent, followed by 20.6 per cent for the signalling and telecommunication improvement component and 16.3 per cent for the track component (see Tables 3-5). A sensitivity analysis has tested the effects of possible unfavorable scenarios with respect to changes in the key parameters that determine Project costs and benefits. This analysis indicates that both the Railway and the Project would maintain their economic viability (11.0 per cent and 14.7 per cent, respectively) even under the most adverse scenario (10 per cent cost increase, 10 per cent benefit decrease and one year delay in implementation). The sensitivity analysis for each Project component was also undertaken, and the results show that all the components maintain an acceptable EIRR under the most adverse scenario (see Table 6).

ECONOMIC INTERNAL RATE OF RETURN

Table 1: Jing-Jiu Railway
(Y million)

Year	Costs						Net Labor and Material Cost Savings	Reduced Accident Cost	Reduced Train Operation Cost	Wagon Purchase Cost Savings	Avoided Road Constructio Cost	Avoided Rail & Road Transport Cost	Avoided River Transport Cost	Net Production Value Added	Total Net Benefit	
	Capital Investment	Operation and Maintenance	Equipment Maintenance		Permanent way Rehabilitation											
	With Project	With Project	With Project	Without Project	With Project	Without Project										
1993	5,498.4						5,498.4									-5,498.4
1994	9,065.0						9,065.0									-9,065.0
1995	11,294.6						11,294.6									-11,294.6
1996	2,894.3						2,897.5									-2,897.5
1997	1,824.6	1,007.4		10.7	7.5		2,838.5	42.5	2.1	11.7	1.8		2,772.9	277.9	401.5	671.9
1998		1,187.5		21.5	15.0		1,193.9	52.6	4.2	23.4	35.1		5,545.7	555.9	803.0	5,825.9
1999	1,660.2	1,308.2		21.5	15.0		3,064.8	52.9	4.2	26.4	35.1		5,883.0	589.7	945.9	4,373.4
2000	279.8	1,657.8		21.5	15.0		1,944.0	53.2	4.2	26.4	35.1	348.0	6,240.8	625.6	803.3	6,282.6
2001	743.2	1,721.9		21.5	15.0		2,471.6	53.5	4.2	26.4	35.1	348.0	6,620.4	663.6	942.2	6,221.9
2002		1,785.9		21.5	15.0		1,792.4	53.9	4.2	26.4	35.1	348.0	7,023.1	704.0	993.8	7,385.1
2003	943.1	1,849.9		21.5	15.0		2,899.4	54.3	4.2	26.4	35.1	348.0	7,450.2	746.8	1,048.3	7,013.8
2004	101.0	1,914.7		21.5	15.0		2,022.1	-	4.2	26.4	35.1		7,903.4	792.2	1,105.7	7,844.8
2005	367.1	1,979.4		21.5	15.0		1,768.0	55.1	4.2	26.4	35.1		8,384.1	840.4	1,166.2	8,743.6
2006	1,124.7	2,052.9		21.5	15.0	585.0	3,768.0	55.6	4.2	26.4	35.1		8,635.6	885.6	1,230.1	7,083.6
2007	87.8	2,122.9		21.5	15.0		2,217.1	56.1	4.2	26.4	35.1		8,894.7	891.6	1,297.5	8,988.5
2008	213.0	2,193.0		21.5	15.0		2,412.4	56.7	4.2	26.4	35.1		9,161.5	918.3	1,368.5	9,158.3
2009	111.7	2,263.0		21.5	15.0		2,361.1	57.3	4.2	26.4	35.1		9,436.4	945.9	1,443.5	9,567.6
2010	175.9	2,333.0		21.5	15.0		2,515.3	57.9	4.2	26.4	35.1		9,719.5	974.2	1,522.5	9,824.5
2011	3,927.3	2,403.1		21.5	15.0		6,336.8	58.6	4.2	26.4	35.1		10,011.1	1,003.5	1,522.5	8,324.5
2012		2,424.3		21.5	15.0		2,430.8	59.4	4.2	26.4	35.1		10,311.4	1,033.6	1,522.5	10,561.8
2013		2,445.5		21.5	15.0		2,452.0	19.9	4.2	26.4	35.1		10,620.7	1,064.6	1,522.5	10,641.4
2014		2,466.8		21.5	15.0		2,473.2	61.0	4.2	26.4	35.1		10,938.4	1,095.5	1,522.5	11,211.9
2015		2,488.1		21.5	15.0		1,908.5	61.9	4.2	26.4	35.1		11,267.5	1,129.4	1,522.5	12,137.6
2016	-638.5	2,509.4		21.5	15.0	585.0	2,462.3	62.9	4.2	26.4	35.1		11,605.6	1,163.3	1,522.5	11,957.6
EIRR = 15.4% ^a																

^a NPV 12% = Y8.3 billionTable 2: Project
(Y million)

Year	Costs						Benefits						Total Net Benefit
	Equipment		Equipment Maintenance		Permanent way Rehabilitation		Net Cost	Net Labor and Material Cost Savings	Reduced Accident Cost	Reduced Train Operation Cost	Wagon Purchase Cost Savings		
	With Project	Without Project	With Project	Without Project	With Project	Without Project							
1994	472.8	383.9					88.9					-88.9	
1995	817.7	603.0					214.7					-214.7	
1996	631.6	459.7					172.2					-172.2	
1997				10.7	7.5		3.2	42.5	2.1	11.7	1.8	54.9	
1998				21.5	15.0		6.4	52.6	4.2	23.4	35.1	108.8	
1999				21.5	15.0		6.4	52.9	4.2	26.4	35.1	112.1	
2000				21.5	15.0		6.4	53.2	4.2	26.4	35.1	112.4	
2001				21.5	15.0		6.4	53.5	4.2	26.4	35.1	112.7	
2002				21.5	15.0		6.4	53.9	4.2	26.4	35.1	113.1	
2003				21.5	15.0		6.4	54.3	4.2	26.4	35.1	113.5	
2004		243.9		21.5	15.0		-237.5	-	4.2	26.4	35.1	303.1	
2005				21.5	15.0		-578.6	55.1	4.2	26.4	35.1	699.4	
2006	261.5	235.3		21.5	15.0	585.0	617.6	55.6	4.2	26.4	35.1	-486.3	
2007				21.5	15.0		6.4	56.1	4.2	26.4	35.1	115.4	
2008				21.5	15.0		6.4	56.7	4.2	26.4	35.1	115.9	
2009				21.5	15.0		6.4	57.3	4.2	26.4	35.1	116.5	
2010				21.5	15.0		6.4	57.9	4.2	26.4	35.1	117.2	
2011				21.5	15.0		6.4	58.6	4.2	26.4	35.1	117.8	
2012				21.5	15.0		6.4	59.4	4.2	26.4	35.1	118.6	
2013	487.9	243.9		21.5	15.0		250.4	19.9	4.2	26.4	35.1	-164.8	
2014				21.5	15.0		6.4	61.0	4.2	26.4	35.1	120.2	
2015				21.5	15.0	585.0	-578.6	61.9	4.2	26.4	35.1	706.2	
2016				21.5	15.0	585.0	591.4	62.9	4.2	26.4	35.1	-462.9	
EIRR = 19.8% ^a													

^a NPV 12% = Y210 million

Table 3: Track Component
(Y million)

Year	Costs				Benefits		Total Net Benefit
	Rail		Routine Maintenance Materials		Net Cost	Net Labor and Cost Savings	
	With Project	Without Project	With Project	Without Project			
1994	46.8	24.4			24.4		-24.4
1995	243.9	122.0			122.0		-122.0
1996	195.1	97.6			97.6		-97.6
1997			17.6	57.1	-39.5	0.7	40.8
1998			17.6	57.1	-39.5	1.3	40.8
1999			17.6	57.1	-39.5	1.3	40.8
2000			17.6	57.1	-39.5	1.3	40.8
2001			17.6	57.1	-39.5	1.3	40.8
2002			17.6	57.1	-39.5	1.3	40.8
2003			17.6	57.1	-39.5	1.3	40.8
2004		243.9	17.6	-	-226.4	3.2	229.6
2005			17.6	57.1	-39.5	1.3	40.8
2006			17.6	57.1	-39.5	1.3	40.8
2007			17.6	57.1	-39.5	1.3	40.8
2008			17.6	57.1	-39.5	1.3	40.8
2009			17.6	57.1	-39.5	1.3	40.8
2010			17.6	57.1	-39.5	1.3	40.8
2011			17.6	57.1	-39.5	1.3	40.8
2012			17.6	57.1	-39.5	1.3	40.8
2013	467.9	243.9	-	-	243.9	0.5	-243.4
2014			17.6	57.1	-39.5	1.3	40.8
2015			17.6	57.1	-39.5	1.3	40.8
2016			17.6	57.1	-39.5	1.3	40.8

EIRR = 16.3%^a

^a NPV @12% = Y 53 million.**Table 4: Track Maintenance Mechanization Component**
(Y million)

Year	Costs						Benefits				Total Net Benefit
	Equipment		Equipment Maintenance		Permanent way Rehabilitation		Net Cost	Net Labor and Material Cost Savings	Reduced Accident Cost	Reduced Train Operation Cost	
	With Project	Without Project	With Project	Without Project	With Project	Without Project					
1994	31.8	6.5					25.3				-25.3
1995	50.9	10.4					40.4				-40.4
1996	44.5	9.1					38.0				-38.0
1997			4.2	1.6			2.6	2.0	2.1	11.7	13.2
1998			8.4	3.3			5.1	3.9	4.2	23.4	26.4
1999			8.4	3.3			5.1	4.2	4.2	26.4	29.7
2000			8.4	3.3			5.1	4.5	4.2	26.4	30.0
2001			8.4	3.3			5.1	4.9	4.2	26.4	30.3
2002			8.4	3.3			5.1	5.2	4.2	26.4	30.7
2003			8.4	3.3			5.1	5.6	4.2	26.4	31.1
2004			8.4	3.3			5.1	6.0	4.2	26.4	31.5
2005			8.4	3.3		595.0	-579.9	6.5	4.2	26.4	616.9
2006			8.4	3.3	595.0		590.1	7.0	4.2	26.4	-552.6
2007			8.4	3.3			5.1	7.5	4.2	26.4	32.9
2008			8.4	3.3			5.1	8.0	4.2	26.4	33.5
2009			8.4	3.3			5.1	8.6	4.2	26.4	34.1
2010			8.4	3.3			5.1	9.3	4.2	26.4	34.7
2011			8.4	3.3			5.1	10.0	4.2	26.4	35.4
2012			8.4	3.3			5.1	10.7	4.2	26.4	36.2
2013			8.4	3.3			5.1	11.5	4.2	26.4	37.0
2014			8.4	3.3			5.1	12.4	4.2	26.4	37.6
2015			8.4	3.3		595.0	-579.9	13.3	4.2	26.4	623.7
2016			8.4	3.3	595.0		590.1	14.3	4.2	26.4	-545.3
EIRR = 24.3% ^a											

^a NPV @12% = Y 65 million.

Table 5: Signalling and Telecommunication Improvement Component
(Y million)

Year	Costs				Benefits			Total Net Benefit
	Equipment		Equipment Maintenance		Net Cost	Net Labor Cost	Wagon Purchase Cost	
	With Project	Without Project	With Project	Without Project		Savings	Savings	
1994	392.2	353.0			39.2			-39.2
1995	522.9	470.6			52.3			-52.3
1996	392.2	353.0			39.2			-39.2
1997			6.5	5.9	1.3	0.4	1.8	0.9
1998			13.1	11.8	1.3	7.8	35.1	41.6
1999			13.1	11.8	1.3	7.8	35.1	41.6
2000			13.1	11.8	1.3	7.8	35.1	41.6
2001			13.1	11.8	1.3	7.8	35.1	41.6
2002			13.1	11.8	1.3	7.8	35.1	41.6
2003			13.1	11.8	1.3	7.8	35.1	41.6
2004			13.1	11.8	1.3	7.8	35.1	41.6
2005			13.1	11.8	1.3	7.8	35.1	41.6
2006	261.5	235.3	13.1	11.8	27.5	7.8	35.1	15.5
2007			13.1	11.8	1.3	7.8	35.1	41.6
2008			13.1	11.8	1.3	7.8	35.1	41.6
2009			13.1	11.8	1.3	7.8	35.1	41.6
2010			13.1	11.8	1.3	7.8	35.1	41.6
2011			13.1	11.8	1.3	7.8	35.1	41.6
2012			13.1	11.8	1.3	7.8	35.1	41.6
2013			13.1	11.8	1.3	7.8	35.1	41.6
2014			13.1	11.8	1.3	7.8	35.1	41.6
2015			13.1	11.8	1.3	7.8	35.1	41.6
2016			13.1	11.8	1.3	7.8	35.1	41.6
EIRR = 20.6%								

Table 6: RESULTS OF SENSITIVITY ANALYSIS

Scenario	Project		Project Component						Jing-Ju Railway	
			Track		Track Maintenance Mechanization		Signalling and Telecommunication Improvement			
	EIRR	SI a	EIRR	SI a	EIRR	SI a	EIRR	SI a	EIRR	SI a
1. Base Case	19.8%	-	16.3%	-	24.3%	-	20.6%	-	15.4%	-
2. Increase in Costs (10%)	18.1%	0.83	14.9%	0.83	22.5%	0.72	19.0%	0.60	14.2%	0.6
3. Decrease in Benefits (10%)	18.0%	0.91	14.6%	0.92	22.4%	0.80	18.6%	0.68	13.9%	0.9
4. Implementation delay by 1 year	17.5%	-	14.6%	-	21.1%	-	17.0%	-	13.2%	-
5. Combination of 2, 3, and 4	14.7%	-	12.1%	-	18.1%	-	15.0%	-	11.0%	-

a Sensitivity indicator = Percentage Change in EIRR / Percentage Change in Variable Tested.