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PROJECT PERFORMANCE ASSESSMENT REPORT



CHINA

# NanGuang Railway Project

**Report No. 127580**

JUNE 26

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**Report No.: 127580**

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**PEOPLE'S REPUBLIC OF CHINA**

**NanGuang Railway Project**

**(IBRD-77220)**

**June 26, 2018**

## Currency Equivalents (annual averages)

*Currency Unit = Yuan (Y)*

2009	US\$1.00	Y6.83
2010	US\$1.00	Y6.77
2011	US\$1.00	Y6.46
2012	US\$1.00	Y6.31
2013	US\$1.00	Y6.20
2014	US\$1.00	Y6.14
2015	US\$1.00	Y6.23
2016	US\$1.00	Y6.64

## Abbreviations and Acronyms

CRC	China Railway Corporation
ERR	economic rate of return
FCTIC	Foreign Capital and Technical Import Center of the Ministry of Railways
GGRC	Guiyang-Guangzhou Railway Company Limited
HSR	high-speed railway
ICR	Implementation Completion and Results Report
ICRR	Implementation Completion and Results Review
IEG	Independent Evaluation Group
M&E	monitoring and evaluation
MLTRDP	Mid- and Long-term Railway Development Plan
NGRC	Nanning-Guangzhou Railway Company Limited
NPV	net present value
PDO	Project Development Objective
PGGGRC	Preparation Group of the GuiGuang Railway Company
PGNGRC	Preparation Group of the NanGuang Railway Company
PPAR	Project Performance Assessment Report

## Fiscal Year

Government: January 1—December 31

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This report was prepared by Fang Xu and Houqi Hong, who conducted a field mission in March 2018. The report was peer reviewed by Atul Agarwal and panel reviewed by Jack W. van Holst Pellekaan. Richard Kraus provided administrative support.

## Principal Ratings

	ICR*	ICR Review*	PPAR
Outcome	Satisfactory	Satisfactory	Satisfactory
Risk to Development Outcome	Negligible	Negligible	Negligible
Bank Performance	Satisfactory	Satisfactory	Satisfactory
Borrower Performance	Satisfactory	Satisfactory	Satisfactory

\* The Implementation Completion and Results (ICR) report is a self-evaluation by the responsible Bank global practice. The ICR Review is an intermediate IEG product that seeks to independently validate the findings of the ICR.

## Key Staff Responsible

Project	Task Manager/Leader	Division Chief/ Sector Director	Country Director
Appraisal	John Carter Scales	Ede Jorge Ijjasz-Vasquez	David Dollar
Completion	Gerald Ollivier / Martha B. Lawrence	Michel Kerf	Bert Hofman

**IEG Mission: Improving World Bank Group development results through excellence in independent evaluation.**

**About this Report**

The Independent Evaluation Group assesses the programs and activities of the World Bank for two purposes: first, to ensure the integrity of the Bank's self-evaluation process and to verify that the Bank's work is producing the expected results, and second, to help develop improved directions, policies, and procedures through the dissemination of lessons drawn from experience. As part of this work, IEG annually assesses 20-25 percent of the Bank's lending operations through field work. In selecting operations for assessment, preference is given to those that are innovative, large, or complex; those that are relevant to upcoming studies or country evaluations; those for which Executive Directors or Bank management have requested assessments; and those that are likely to generate important lessons.

To prepare a Project Performance Assessment Report (PPAR), IEG staff examine project files and other documents, visit the borrowing country to discuss the operation with the government, and other in-country stakeholders, interview Bank staff and other donor agency staff both at headquarters and in local offices as appropriate, and apply other evaluative methods as needed.

Each PPAR is subject to technical peer review, internal IEG Panel review, and management approval. Once cleared internally, the PPAR is commented on by the responsible Bank country management unit. The PPAR is also sent to the borrower for review. IEG incorporates both Bank and borrower comments as appropriate, and the borrowers' comments are attached to the document that is sent to the Bank's Board of Executive Directors. After an assessment report has been sent to the Board, it is disclosed to the public.

**About the IEG Rating System for Public Sector Evaluations**

IEG's use of multiple evaluation methods offers both rigor and a necessary level of flexibility to adapt to lending instrument, project design, or sectoral approach. IEG evaluators all apply the same basic method to arrive at their project ratings. Following is the definition and rating scale used for each evaluation criterion (additional information is available on the IEG website: <http://ieg.worldbankgroup.org>).

**Outcome:** The extent to which the operation's major relevant objectives were achieved, or are expected to be achieved, efficiently. The rating has three dimensions: relevance, efficacy, and efficiency. *Relevance* includes relevance of objectives and relevance of design. Relevance of objectives is the extent to which the project's objectives are consistent with the country's current development priorities and with current Bank country and sectoral assistance strategies and corporate goals (expressed in Poverty Reduction Strategy Papers, Country Assistance Strategies, Sector Strategy Papers, and Operational Policies). Relevance of design is the extent to which the project's design is consistent with the stated objectives. *Efficacy* is the extent to which the project's objectives were achieved, or are expected to be achieved, taking into account their relative importance. *Efficiency* is the extent to which the project achieved, or is expected to achieve, a return higher than the opportunity cost of capital and benefits at least cost compared to alternatives. The efficiency dimension is not applied to development policy operations, which provide general budget support. *Possible ratings for Outcome:* Highly Satisfactory, Satisfactory, Moderately Satisfactory, Moderately Unsatisfactory, Unsatisfactory, Highly Unsatisfactory.

**Risk to Development Outcome:** The risk, at the time of evaluation, that development outcomes (or expected outcomes) will not be maintained (or realized). *Possible ratings for Risk to Development Outcome:* High, Significant, Moderate, Negligible to Low, Not Evaluable.

**Bank Performance:** The extent to which services provided by the Bank ensured quality at entry of the operation and supported effective implementation through appropriate supervision (including ensuring adequate transition arrangements for regular operation of supported activities after loan/credit closing, toward the achievement of development outcomes. The rating has two dimensions: quality at entry and quality of supervision. *Possible ratings for Bank Performance:* Highly Satisfactory, Satisfactory, Moderately Satisfactory, Moderately Unsatisfactory, Unsatisfactory, Highly Unsatisfactory.

**Borrower Performance:** The extent to which the borrower (including the government and implementing agency or agencies) ensured quality of preparation and implementation, and complied with covenants and agreements, toward the achievement of development outcomes. The rating has two dimensions: government performance and implementing agency(ies) performance. *Possible ratings for Borrower Performance:* Highly Satisfactory, Satisfactory, Moderately Satisfactory, Moderately Unsatisfactory, Unsatisfactory, Highly Unsatisfactory.

## Preface

The purpose of this Project Performance Assessment Report (PPAR) for the World Bank's NanGuang Railway Project in China is to offer closer and deeper insights on the project's outcome, based on updated evidence, including an assessment of the project's contribution to sector reform and institutional improvement.

The PPAR is the first of three PPARs,<sup>i</sup> each for a World Bank-financed large railway investment project in China that was completed over the past five years. Although the World Bank's financing ranged from US\$200 million to US\$300 million and accounted for a small percentage of the total cost for each project, all three projects provided a platform for railway sector policy engagements between the World Bank and the Government.

The goal of the NanGuang Railway Project was to enhance transport services in a congested corridor connecting a large and populous less-developed western region in Southwest China and the more-developed Pearl River delta region, with the aim of contributing to regional economic development. The project was also intended to serve as a platform for the World Bank to continue its policy engagement with the Government of China in the railway sector.

This assessment was based on a mission by the World Bank's Independent Evaluation Group (IEG) to China in March 2018, using a mixed-methods approach that included field visits, interviews with stakeholders (such as government officials, implementing agency staff, experts from research institutes and universities, the World Bank operations team, and other knowledgeable persons), and desk research, including a review of project documents, research papers, and other materials.

IEG is grateful to the Government of China, the China Railway Corporation, the World Bank operations team, and other stakeholders for their strong support to the mission during its visit to China.

Following standard IEG procedures, a copy of the draft PPAR was sent to the relevant government officials and agencies for their review and feedback and no comments were received.

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<sup>i</sup> The two upcoming PPARs are for the ShiZheng Railway Project and the Third National Railway Project.

# Summary

## Context

Railways are vital to China's social and economic development. As a large economy with a vast geographical area and a huge population, China has massive volumes of passenger and freight traffic moving over medium to long distances. Railways are one of the most economic and effective means of transport for such an important medium- to long distance transport market in China

For the 10–15 years up to 2009, China railways had been pursuing capacity expansion and reform to meet a dramatically increasing demand for railway transport services. However, the expansion had not kept pace with the increase in demand. Consequently, the government developed an ambitious plan to invest more in railways. In late 2008, the government decided to implement an economic stimulus plan as a response to the global financial crisis, which further increased the planned annual investment in the railway sector.

The World Bank initiated a programmatic engagement with China railways in 2008, through a program of six projects (see Appendix B for details) to support construction of priority high-speed railway lines by financing a small percentage of the total cost. The program was also intended to serve as a platform for the World Bank to continue its policy dialogue with the government on railway sector reform. The NanGuang Railway Project was one of the six projects and one of the first projects implemented under the economic stimulus plan.

This is a Project Performance Assessment Report (PPAR) for the NanGuang Railway Project. The project was approved by the World Bank's Board in June 2009. Its development objectives were to increase transport capacity and reduce transport time between a less developed western region and a major more developed coastal region, through construction of a railway line linking the two existing railway networks in the two regions.

## Project Results

**The project's development objectives focused on developing a key transport link between the less developed western region in Southwest China and the more developed Pearl River delta region. Their relevance is rated High.** The project objectives were closely aligned with China's 2008 Mid- and Long-Term Railway Development Plan, China's 11<sup>th</sup> Five-Year Plan for 2006–10, and China's 12<sup>th</sup> Five-Year Plan for 2011–15, which placed a strong emphasis on constructing priority railways across regions to promote economic development in less developed western China. The project objectives were also highly consistent with the World Bank's Country Partnership Strategies for China for the period 2006–10 and for 2013–16. Both focused on reducing poverty, inequality, and social exclusion through affordable transport and improving transport connectivity to promote balanced regional economic development.

**The project design included all the key activities necessary to achieve the project's development objectives. The relevance of design is rated Substantial.** The project's main activity was to construct a new electrified railway line between the two regions, which was designed to be significantly shorter than the existing saturated line, and to allow trains to operate at a much higher speed than on the existing line. The successful completion of the construction of this rail line was key to the achievement of increased transport capacity and reduction of travel time. The project's results framework was simple but clear and logical. However, the project should have included support for improved accessibility for all at the stations on the rail line.

**The achievement of the first objective of increasing transport capacity between the two regions is rated High.** A railway line of about 462 kilometers connecting the two regions (the project line) was constructed as planned, meeting key international standards and permitting a train speed up to 250 km per hour. Data examined by IEG reveal that the average number of pairs of express passenger trains operating on the project line daily has increased from seven in the baseline year 2008 to 31 in the project closure year 2015, and to about 56 in 2018, exceeding by 180 percent the target of 20 pairs of passenger trains.

**The achievement of the second objective of reducing transport time is rated Substantial.** The average travel time of the express passenger trains operating on the project line has been reduced to around 182 minutes, from over 10 hours (620 minutes) for the passenger trains operating on the conventional line in the baseline year 2008. The trains are fast, operating at a maximum speed of 200 kilometers per hour. The project's average travel time target was substantially achieved.

**Policy impact and other achievements.** Using this project and the other five high-speed railway projects as a platform, the World Bank carried out policy engagements with the government on core railway system reform issues such as separation of policy and regulatory function from commercial management, railway price regulation, and railway investment mobilization. China's railway sector achieved significant progress in these reform areas during the project's implementation. IEG interviews with authorities and other stakeholders indicated that the World Bank's policy dialogue contributed significantly to this achievement. IEG also found that the services of the express trains on the project line were affordable for the local middle class, safe, punctual, and comfortable. They have accessible design, with passenger traffic about being equally divided between men and women. Small station cities along the project line have some gaps in their integration with other transport modes but there was evidence that these cities were catching up in addressing those gaps.

**The efficiency of project implementation is rated High.** The project's unit cost was among the lowest in the world. The main railway constructed under the project, the 400-km railway line from Litang West and New Zhaoqing (the NanGuang line), has achieved a traffic density level and a reduction of travel time necessary for the line to be economically viable. IEG estimated that the economic rate of return of this line was 15.0 percent, higher than the social discount rate of 12 percent. The net present value was Y27 billion at 2015 prices (US\$4.2 billion).

**The overall outcome of this project is rated Satisfactory**, on the basis of the high relevance of the project development objectives, the substantial relevance of the project design, the high efficacy of the first objective and substantial efficacy of the second objective, the project's contribution to sector reforms and institutional development, and the project's high efficiency.

**Bank performance is rated Satisfactory.** The project design was based on careful technical, economic, social, and financial analyses, and was substantially relevant. The formation of the project company proved helpful for improved implementation and operations. The World Bank's project team conducted implementation supervisions diligently with the required expertise, and carried out several studies to identify project benefits and impacts. The World Bank's policy engagements with the government were productive and contributed significantly to China's railway sector reforms. A shortcoming of the project's design, however, was that the planned monitoring and evaluation activities did not include a scheduled Mid-Term Review, and the outcome indicators and intermediate outcome indicator had some limitations.

**Borrower performance is rated Satisfactory.** The government was strongly committed to the project and ensured that it was well prepared and implemented in compliance with the World Bank's fiduciary and social safeguards policies.

### Lessons

- **Sound technical design, project preparation, and implementation management, combined with a strong financial capacity, are a recipe for success for a high-speed railway project.** The NanGuang Railway Project was completed on time, with high quality, and at a relatively low cost. Evidence from the project shows that the project's success was attributable to good preliminary design, meticulous planning, strict control over compliance with standards and specifications, and reliable and responsible contractors. China Railway Corporation (CRC) and Ministry of Railways (MOR) deserve major credit for these achievements. Their success was also attributable to MOR/CRC's smooth coordination with local governments on land acquisition and timely provision of counterpart financing. The World Bank contributed to the success by providing guidance and support to ensure the project's preparation and implementation met high standards, especially in its technical and environmental specifications and in achieving economic benefits in China's less developed regions.
- **Agglomeration effects are an important benefit of high-speed rail development and should be incorporated in the benefit-cost analysis of such projects.** In addition to conventional benefits, such as user time savings, operating cost savings for traffic diverted from the conventional lines, and reductions in environmental externalities, this project has confirmed that a high-speed rail project also has significant agglomeration benefits, coming from more closely connected economic activities and markets, better knowledge sharing, and greater productivity due to increased competition between spatially closer markets as a result of high speed rail connections. The magnitude of agglomeration benefits depends on local circumstances, such as industry structure, local

conditions, and governance. It is important to identify and quantify agglomeration benefits in feasibility studies to better inform the selection of rail routes and stations.

- **Successful reforms in large and complex infrastructure sectors such as railways in China require sustained policy dialogue and engagements.** By the time of the project approval, China had pursued reforms in the railway sector for about 10–15 years, and had achieved solid progress in core reform areas. The World Bank contributed to this process by providing support for capacity building and institutional development in multiple dimensions across the system. To promote further reforms, the government asked the World Bank’s advice on relevant international experience in railway development. Using this project and the other five high-speed rail projects as a platform, the World Bank continued its policy engagements with the government, including an introduction to the experience in railway sector governance in eight countries. These engagements played an important role in informing relevant reforms in China’s railway sector, especially the 2013 landmark reform separating the commercial management of railway services from the railway regulatory function, and established corporations for railway services delivery.
- **Good connections of high-speed railway lines with other transport modes and between the rail stations and urban centers are critical to achieving the full benefits of high speed trains.** This project’s experience shows that a high-speed railway line often entails a major investment, requiring high traffic density for it to be economically viable. Integration of the railways with other transport modes is important to achieving a high traffic density throughout the system. It is therefore necessary to take measures at the design stage to ensure that rail station cities have concrete plans for a timely buildup of complementary infrastructure and the provision of services necessary for good local transport connections to the railway stations, such as reliable and safe public transport and taxi services.

José Carbajo Martínez  
Director, Financial, Private Sector, and  
Sustainable Development  
Independent Evaluation Group

# 1. Background and Context<sup>2</sup>

## Country and Sector Background

1.1 Railways are vital to China's economy. As a large economy with a vast geographical area and a huge population, China has massive volumes of passenger and freight traffic moving over medium and long distances. Railways are one of the most economic and effective means of transport for such an important medium- to long-distance transport market. They are a more energy-efficient and environment-friendly means of transport and use less land space than highways of comparable capacity. Railways are also crucial to China's ability to extend the benefits of economic development widely within the society and to people living in the more remote western and central parts of the country.

1.2 Between 2000 and 2008, traffic on China's railways grew rapidly, with passenger traffic (in passenger-kilometers<sup>3</sup>) increasing by 70 percent (about 7 percent per year) and freight traffic (in ton-km) by 82 percent (about 7.5 percent per year). The railway network had not been able to keep pace with the increase in the demand. As a result, much of the network was operating at or near full capacity. Some traffic was diverted to other transport modes, resulting in higher economic and social costs. The network's infrastructure utilization was about three times that in the United States and over 10 times as high as in the European Union system. Hence, there was a strong demand for investment in the expansion of the capacity of China's railway network (World Bank 2009).

1.3 Since as early as the mid-1990's, China had pursued a policy of enhancing the capacity and service quality of a railway network that was already the busiest in the world, as well as for reforming the industry to be more responsive to the market economy and to ensure the efficient use of resources. The 2004 Mid- and Long-Term Railway Development Plan (MLTRDP), approved by the State Council, set an annual investment target at about US\$12–15 billion through 2020. This Plan was subsequently revised and increased in 2008, with the planned length of new construction approximately doubled. The 2008 MLTRDP also included a plan for the development of the National "Four Vertical and Four Horizontal" High-Speed Railway (HSR) Network (State Council 2008).

1.4 To meet the target, the Ministry of Railways explored ways to mobilize external funds including private sector funds. In 2008, the investment in the railway sector reached US\$45 billion. In addition to this vast investment, the Ministry of Railways had conducted many reforms, including the separation of its non-core activities, such as construction, manufacturing, hospitals, and railway law enforcement, from the railway system; granting concessions to branch lines; establishment of regulations permitting foreign investment; and various improvements of management practice and approach.

1.5 In late 2008, as a response to the global financial crisis, the government decided to implement an economic stimulus plan which included a huge increase in infrastructure investment, with a focus on accelerating the development of a high-speed rail network.

This further increased the planned investment in railways to \$90 billion per year over the next two years.

1.6 The Chinese government requested the World Bank's involvement. The NanGuang Railway Project was part of the World Bank's broad program comprising six projects and construction of a total of 2,660 kilometers of high-speed railway lines, aiming to support construction of priority railways through provision of financing for a small percentage of the total cost (See Annex B for details). It was expected that the programmatic support would achieve additional benefits beyond the relatively small direct investment, including improved sector management and strengthened policy dialogue. The NanGuang Railway Project was one of the first projects implemented under the economic stimulus plan. The two railways to be constructed under the project were part of the planned railway lines forming the railway network in western China to meet the demand for regional economic development, according to the 2008 MLTRDP.

1.7 In addition, the government was committed to reforming the railway sector, and had requested the World Bank's advice on relevant international experiences on reforms in the areas of separating administrative function from enterprise management, introducing competition, and strengthening industry regulations. Recognizing that progress on reforms would be largely driven by political imperatives independent of the capital investment program, the World Bank, Ministry of Railways, and the National Development and Reform Committee (NDRC, the ministry in charge of China's development planning) agreed that the World Bank would provide the advice in parallel to but separate from individual investment projects.

1.8 Another important reason for China to seek the World Bank's assistance was to have continued access to technical advice, especially on application of sound safeguard policies, and on international best practice in high speed railway project management.

## **Project Context**

1.9 The NanGuang Railway Project was approved by the World Bank Group's Board in June 2009. The total project cost was estimated to be US\$5.98 billion (Y41.00 billion) at appraisal. Actual cost was US\$6.50 billion (Y40.82 billion) at project closure, around 8.7 percent more than estimated in U.S. dollar terms, largely because of an appreciation of the Chinese Yuan against the U.S. dollar during the implementation period. In local currency terms, the actual cost at closure was about 0.4 percent less than the appraisal estimate. The World Bank provided an IBRD loan of US\$300.00 million, which accounted for a small percentage (about 5 percent) of the total project cost estimated at appraisal. The World Bank loan financed the international procurement and installation of electrification, communications, signaling, and maintenance equipment that was essential for the quality of rail lines to be constructed under the project and for their safe and effective operations.

1.10 At appraisal, domestic counterpart financing was expected to be US\$5.68 billion; the actual domestic financing was US\$6.20 billion at project closure, comprising mainly equity investment from the Nanning Railway Administration, Guangzhou Railway Administration, and local governments (in the form of land), domestic commercial loans,

and bonds issued in China. The domestic counterpart financing funded mainly civil works, for which China railways had developed strong capacity.

## **2. Objectives, Design, and their Relevance**

### **Objectives**

2.1 The project development objectives (PDO) as stated in the Loan Agreement and in the Project Appraisal Document were “To provide additional transport capacity and reduce transport time between the less developed western region in Southwest China and the relatively more developed Pearl River delta region.” Specifically, the PDO was to increase the transport capacity and reduce transport time between Litang West near Nanning, the capital city of Guangxi Zhuang Autonomous Region, and Sanyanqiao, close to Guangzhou, the capital city of Guangdong Province.

### **Relevance of Objectives**

2.2 At appraisal, the existing railway network in the project corridor was congested, and was expected to remain busy in the next 20 years based on traffic growth forecasts and existing plans for capacity expansion (World Bank 2009, paras 50 and 51). The project’s development objectives of increasing the transport capacity and reducing transport time in the corridor were highly relevant. The PDO was highly aligned with China’s 11<sup>th</sup> Five-Year Plan for 2006–10, which emphasized construction of railways across regions for promoting development in the less developed western part of China. It was also highly consistent with the pillars of the World Bank’s Country Partnership Strategy for 2006–10 on reducing poverty, inequality, and social exclusion through affordable transport. In addition, the PDO was very consistent with the Country Partnership Strategy’s pillar on managing resource scarcity and environmental challenges. Railways are more environmentally friendly and resource-efficient in comparison to other transport modes on a comparable capacity basis.

2.3 The PDO remained highly consistent with China’s national development strategy at project completion. China’s 12<sup>th</sup> Five Year Plan (2011–15) placed an emphasis on further developing China’s western regions and on expanding transport networks including railways, gave prominence to urbanization in smaller cities in inland areas, and assigned a high priority to development of a resource-efficient and environmentally friendly society.<sup>4</sup> The PDO continued to be closely aligned with the World Bank’s Country Partnership Strategy for China for the 2013–16 period, which had a strong focus on fostering greener growth through support for developing low-carbon transport and on improving transport connectivity to promote balanced regional economic development.

2.4 This report rates the relevance of objectives as High.

## **Design**

### **Components**

2.5 The project was designed to include the following components, as summarized from the Project Appraisal Document, which remained unchanged during implementation.<sup>5</sup>

2.6 Construction of a new two-track electrified railway line of about 400 km for passenger and freight services, connecting Litang West near Nanning in Guangxi Zhuang Autonomous Region and New Zhaoqing in the west of Guangzhou in Guangdong Province. Specific activities included construction of subgrades, tunnels, bridges, culverts, and buildings; acquisition and installation of equipment (communications, signaling and electrification equipment, and maintenance vehicles); and provision of related technical assistance, with scope to be identified during implementation.

2.7 Construction of two tracks for a new four-track electrified railway line of about 62 km to be shared with the GuiGuang Railway Project for passenger and freight services, connecting New Zhaoqing and Sanyanqiao in Guangdong Province. Specific activities included construction of subgrades, tunnels, bridges, culverts, and buildings; acquisition and installation of equipment (such as communications, signaling and electrification equipment, and maintenance vehicles); and provision of related technical assistance, with scope to be identified during implementation.

2.8 Construction of new and reconstruction of existing railway stations along the whole rail line from Litang West to Sanyanqiao (the project line).

### **Resettlement and rehabilitation of displaced persons**

2.9 The World Bank loan was to finance the procurement of goods for the project, including communications, signaling, electrification, and maintenance equipment. All other activities such as civil works and resettlement would be financed by counterpart financing, including investment from the Ministry of Railways and the China Railway Corporation (CRC), capital contributions in the form of land use rights from local governments along the project line, and loans from domestic commercial banks. The World Bank's social and environmental safeguards policies would apply to the whole project.

2.10 The rail tracks were to be laid to technical standards that would permit speeds of up to 250 km/h, with passenger trains operating at a maximum speed of 200 km/h and freight trains at a maximum speed of 120 km/h. To accommodate the designed speed, the tracks would have a relatively straight alignment. Bridges and tunnels were expected to be approximately 30 percent and 20 percent of the length of the project line, respectively.

### **Arrangements for Implementation**

2.11 As with previous railway projects that the World Bank financed in China, the Foreign Capital and Technical Import Center (FCTIC) of the Ministry of Railways was responsible for the financial management of the World Bank loan and for World Bank–

financed procurement, including provision of implementation progress reports every half year. FCTIC had long and extensive experience managing World Bank financed railway projects in China, and was the direct counterpart of the World Bank in the administration and management of the loan for this project (World Bank 2015, section III).

2.12 At appraisal, it was expected that a project company would be formed to implement the project and the Ministry of Railways would transfer the assets created by the project to the company. Nanning Railway Administration and Guangzhou Railway Administration would hold the majority of the shares of the company, and Guangxi Province and Guangdong Province hold the remaining shares through their respective investment arms. In September 2008, the Ministry of Railways formed the Preparation Group of the NanGuang Railway Company (PGNGRC), in anticipation of the establishment of the project company. The Group was charged with the general responsibility of implementing the construction of the 400 kilometers of railway line from Litang West to New Zhaoqing (NanGuang line) and its Resettlement Action Plan.

2.13 In July 2009, the project company was established with the name Nanning-Guangzhou Railway Company Limited (NGRC). In August 2011, the implementation responsibility of PGNGRC was transferred to NGRC (World Bank 2015, para 13).

2.14 The 62-km railway line from New Zhaoqing to Sanyanqiao, with financing from both this project and the World Bank's GuiGuang Railway Project, was initially implemented by the Preparation Group of GuiGuang Railway Company (PGGGRC), established by the Ministry of Railways in November 2007 in anticipation of the formation of the Guiyang-Guangzhou Railway Company Limited (GGRC) under the World Bank's GuiGuang Railway Project. GGRC was incorporated in June 2009. In August 2011, the implementation responsibility of PGGGRC was transferred to GGRC.

## **Relevance of Design**

2.15 The causal link between the project activities and the PDO was logical. The construction of the new double-track electrified railway line would add additional transport capacity between the less developed western region in Southwest China and the more advanced Pearl River delta in Guangdong Province. It would also reduce travel time because the technical standards of the project would allow trains to operate much faster than conventional trains, with passenger trains operating at a maximum speed of 200 km per hour and freight train at 120 km per hour. In addition, the project would reduce the length of the rail line by about 250 km, according to the design at appraisal. This would further contribute to a reduction of travel time.

2.16 The outcomes of the project could be expected to contribute to the achievement of the higher-level objectives of integrating China into the world economy through improving transport services between a less developed western region and the more developed Pearl River delta region, reducing poverty and inequality through a positive impact on employment generation and economic development, and managing resource scarcity and environmental challenges because railway transport is more environmentally friendly than comparable other transport modes (World Bank 2016).

2.17 The design, however, should have included a subcomponent that supported improved station accessibility for all, especially in the cases of smaller stations on the project line, by providing facilities such as ramps, elevators, and conveniently accessible parking lots.

2.18 This report rates the relevance of design as Substantial.

### 3. Implementation

3.1 The project implementation process was smooth, in line with expectations, and completed on time, with actual cost only slightly higher than planned. According to this project's Implementation Completion and Results Report (World Bank 2015), the quality of work was good, and appropriate measures were taken to ensure compliance with environmental, social, safety, and specified quality standards.

#### Restructuring

3.2 On August 25, 2011, the project conducted a level-2 restructuring, assigning the responsibility for implementing the Litang West to New Zhaoqing section (400 km) to the project company, the Nanning-Guangzhou Railway Company Limited (NGRC), and the responsibility for implementing the New Zhaoqing to Sanyanqiao section (62 km) to the Guiyang- Guangzhou Railway Company (GGRC). These implementation responsibilities were originally assigned to the Preparation Groups of the NanGuang Railway Company (PGNGRC) and to the Preparation Groups of the GuiGuang Railway Company (PGGGRC), respectively.

3.3 On October 14, 2014, the loan closing date was extended for half a year, from December 31, 2014 to June 30, 2015, to allow completion of some remaining payment and accounting processes.

3.4 The World Bank decided not to amend the PDO indicator on average pairs of freight trains operating on the project line, because it was not confirmed by CRC until November 2014 that freight trains would not operate on the project line. This confirmation was provided one month after the project's second restructuring and only six months before loan closure. An amendment of the PDO at that time would not have affected the assessment of the project's implementation or outcome.

#### Safeguards Compliance

3.5 **Social safeguards.** The project involved resettlement of affected households in the right of way for the project rail line and triggered the World Bank's OP/BP 4.12 on Involuntary Resettlement, which was complied with during the project preparation and implementation (World Bank 2015, para 30). The project prepared and disclosed a Resettlement Action Plan in accordance with OP/BO 4.12, based on public consultations with affected villages and households on the selection of project alignment and location of railway stations, as well as on relocation arrangements, compensation rates, and livelihood restoration measures. A total of 2,463 households were relocated.

3.6 An interview by the Project Performance Assessment Report (PPAR) mission with the resettlement specialist for the project indicated that the project's purchase of the right of way for the project line affected farmers to a varying extent. The overall impact in a typical village was small, and for those who were affected compensation was in the form of a combination of cash payments and the re-allocation of land among farmers in a village. Affected households were relocated within their villages with compensation. Each affected household signed a formal agreement with the local government for its relocation. An external monitoring team was recruited by the Foreign Capital and Technical Import Center of the Ministry of Railways from a list of candidates recommended by the World Bank. It concluded that the Resettlement Action Plan was implemented satisfactorily. The World Bank's safeguard team conducted supervision on the implementation of the Resettlement Action Plan once or twice a year. Overall, the World Bank's supervision concluded that the implementing entities and local governments demonstrated strong implementation capacity with respect to social safeguards.

3.7 **Environmental safeguards.** The project's environmental classification was "Category A" and triggered the World Bank's OP/BP 4.01 on Environmental Assessment, OP/BP 4.04 on Natural Habitats, and OP/BP 4.11 on Physical Cultural Resources (World Bank 2015, para 29). These environmental safeguard policies were complied with during project preparation and implementation. The Environmental Impact Assessment Report prepared for the project identified a number of environmentally sensitive areas at project sites that needed to be protected, including nature reserve, forest, tourism and cultural relics areas, as well as community and construction impact issues (including waste and spoils disposal, water pollution and soil erosion, noise, and safety during construction) that needed to be addressed. The Environmental Management Plan for the project, which was prepared based on public consultations, included specific actions to protect the environmentally sensitive areas and address the environmental impact issues mentioned above.

3.8 The Environmental Management Plan was implemented satisfactorily, according to project documentation. Most of the sensitive areas were conserved through proper project design, such as selection of alignment and the use of tunnel or tunnel-bridge systems to minimize negative impacts. Noise barriers were adequately installed. Passages under and over the tracks were provided according to standards and based on additional demand from local residents. Construction and camp sites were restored with tree/grass replanting and farmland reclamation, and returned to local governments and local communities as agreed. Slope protection and greening works were properly carried out. Necessary environmental facilities such as wastewater and sanitation facilities were installed in accordance with the project design. A preliminary acceptance inspection of the project's environmental performance, conducted by the government before the project's trial operation in 2014, reached the same conclusions. The IEG PPAR mission travelled the project line and interviewed the environmental specialist assigned to the project, and found no evidence of negative environmental impacts from the project's implementation.

## Financial Management and Procurement

**3.9 Financial Management:** The project appraisal conducted a financial management assessment and concluded that the Foreign Capital and Technical Import Center (FCTIC) in the Ministry of Railways had the required ability to manage the project's financial management. During implementation, the project's financial management complied with World Bank policies, although there were several minor delays. The information provided by the project's financial management system was accurate and timely and showed with reasonable assurance that the World Bank loan was used for its intended purposes. Counterpart funding was provided as planned. The audits were unqualified, with minor issues identified and addressed by FCTIC and the project company, including a delay in providing interim financial report, a few deviations in the use of funds in activities financed entirely by counterpart funds, and some shortcomings in internal control (World Bank 2015, paragraph 28). The IEG PPAR mission found that five of the six World Bank Implementation Status and Results Reports (ISRs), issued after 2011 and available in the World Bank's project portal,<sup>6</sup> rated the project's performance in financial management as satisfactory, while one of them rated the performance as moderately satisfactory. There were two ISRs issued in 2010 and 2011 and available in the project portal, but they did not rate the financial management performance.

**3.10 Procurement Management:** The loan appraisal concluded that FCTIC had the required ability to manage the World Bank–financed procurement under the project. The actual procurement process went well, and there were no procurement issues or delays during implementation, according to project documentation. The rate of disbursements slowed in early 2015 due to finalizing contract amendments for 24 contracts financed by the project. In some of these cases World Bank approval was required, but the World Bank processed these contract amendments promptly without delaying the project timeline. The procurement process fully complied with World Bank guidelines, according to project documentation and as confirmed during IEG's PPAR mission's interview with CRC. IEG found that all six of the World Bank's Implementation Status and Results Reports, issued after 2011, rated the project's performance in procurement as satisfactory. The two ISRs issued before 2012 did not rate the performance on procurement.

## 4. Achievement of the Objectives

Objective 1: To provide additional transport capacity

4.1 The project's first development objective was to “provide additional transport capacity between the less developed western region in Southwest China and the relatively more developed Pearl River delta region,” according to the project's Loan Agreement and the Project Appraisal Document.

### Outputs

4.2 The project's main outputs were: (a) About 400 kilometers of new, double-track, and electrified railway line was constructed, connecting Litang West, about 95 km northeast to Nanning, and New Zhaoqing, about 70 km northwest of Guangzhou. The

new railway line was opened to traffic in December 2014, ahead of the original loan closing date of December 31, 2014; and (b) About 62 kilometers of a four-track railway was built, linking New Zhaoqing to Sanyanqiao, a station about 10 km west of Guangzhou. Both railways were planned in the Project Appraisal Document for the transport of passengers and freight.

4.3 Numerous tunnels, bridges, culverts, subgrades, and buildings were built. Considerable communications, signaling, electrification and maintenance equipment was acquired and installed. Thirty-nine percent of the 400-kilometer railway was on bridges and viaducts and 26.5 percent in tunnels. Both railways constructed under the project met international standards for power supply, electrical systems, signaling, communications, control and dispatching systems, and energy conservation. Technical assistance focusing on training and capacity building was planned in the Project Appraisal Document, to be financed by US\$300,000 out of the World Bank loan to the project, with specific scope to be identified during project implementation. Eventually no technical assistance was delivered because of lack of demand (World Bank 2015, Annex 1).

4.4 The project line connected the railway network of southwest China near Nanning to that of the Pearl River delta near Guangzhou, and reduced the rail distance between Nanning and Guangzhou by about 180 km. Based on interviews by the IEG PPAR mission with relevant agencies and experts, and as confirmed by publicly available information,<sup>7</sup> the technical standards of the project line permit a speed up to 250 km per hour, with passenger trains operating at a maximum speed of 200 km per hour, as designed during the project appraisal.

## **Outcomes**

4.5 The project has substantially achieved its first objective of providing additional transport capacity between the western region in Southwest China, near Nanning, and the Pearl River delta region, near Guangzhou. In interviews with CRC and relevant experts, IEG was advised that the traffic volume of the project line had increased rapidly since project closure. IEG was not able, however, to obtain data on train and passenger traffic from CRC to confirm this conclusion. It was therefore necessary for IEG to make estimates of traffic volumes using data from the railway timetables in CRC's online ticket booking website.<sup>8</sup>

4.6 IEG found that the average number of pairs of the passenger trains between Sanyanqiao and Litang West had increased from seven in the baseline year 2008 to 31 at project closure in 2015 to about 56 at the time of IEG's field visit in 2018, exceeding by 180 percent the target in the Project Appraisal Document of 20 pairs of passenger trains. One of the underlying reasons for this rapid passenger traffic increase was that the railway network linking the project line at Nanning with other major economic centers in Southwest China, such as Kunming in Yunnan Province, has been expanded significantly, bringing a lot of additional traffic to the project line.

4.7 The project set a target of eight pairs of freight trains using this line, but CRC decided not to operate freight trains on the project line in the short term as part of its network-wide strategy to operate dedicated passenger high-speed railways to meet the

increasing demand for passenger services (World Bank 2016). Overall, however, the project line was built and additional railway freight transport capacity was added. The number of pairs of passenger trains operating on the railway has well exceeded the sum of the targeted numbers of trains, although the mix of passenger and freight trains is different from appraisal.

4.8 While detailed train occupancy data were not available and were not included as part of the results framework, the IEG PPAR mission travelled on the project line in late March of 2018. Although this was not a busy travel season, IEG found that the second-class car the mission took was fully occupied throughout the whole railway line from Nanning to Guangzhou. In some sections, some passengers had to stand in the aisle. The first-class cars were also fully occupied. Using the railway timetable on the CRC's ticket booking website, the mission checked ticket availability at three other times, and consistently found the same pattern: there were only a few tickets available for most trains and only tickets for standing passengers were available for many trains about five hours ahead of the train departure time. By comparison, a supervision mission by the World Bank project team in May 2014 found that 50 percent of the seats were occupied at the first station, although it increased to 75 percent by the second station; and the ICR reported that figures for March 2015 indicated an average occupancy rate of 91 percent.

4.9 Assuming conservatively an average occupancy rate of 90 percent in 2018, and based on publicly available information on the types of trains operating on the project line and their capacities, IEG estimates that the traffic density<sup>9</sup> of the project line is likely to be about 20 million passengers in 2018, even though passengers travelling part of the line's full length were not included. This represents a 53.8 percent growth over the 2015 traffic density of 13 million passengers reported in the ICR (p. 23), almost fully in line with the ICR's forecast (21 million passengers), and much faster than the Project Appraisal Document's forecast of the total growth trend, which was a maximum 12.5 percent between 2015 and 2018 (or 4 percent per annum during this period). It is also almost 7 times the 3 million passengers who travelled between Guangzhou and Southwest China in 2007 that were expected to be diverted to this project line, according to the Project Appraisal Document. This is consistent with what the PPAR mission learned from officials in the CRC, who mentioned during an interview that traffic volume on this line had grown rapidly since project completion.

4.10 **Attribution of benefits to NanGuang.** Even as the NanGuang project made major contributions to the additional transport capacity, it nevertheless benefitted from becoming part of a broader railway system to which it was connected. In other words, NanGuang needed the rail system to which it was connected. The benefits of this intersystem connection are impossible to disentangle from the benefits of the NanGuang project on its own. Nevertheless, it is clear that the increased passenger traffic in the Southwest China/ Pearl River Delta corridor would not have occurred without this project.

4.11 Overall, on the basis of IEG's analysis of secondary data, the achievement of the first objective of providing additional transport capacity between the western region in Southwest China and the Pearl River delta region is rated High.

Objective 2: To reduce transport time

4.12 The project's second objective was to reduce transport time between the less developed western region in southwest China and the relatively more developed Pearl River delta region. The output that contributed to this second objective is the same as for the first objective.

### **Outcomes**

4.13 The project has substantially achieved its target of reducing the transport time for passengers between Litang West near Nanning and Sanyanqiao near Guangzhou. Although exact official figures are not available, IEG estimates that the 2018 average travel time of the express passenger trains on the project line to be approximately 182 minutes, very close to the project target of an average travel time of 170 minutes, and remarkably less than the over 10 hours (620 minutes) average travel time of the conventional passenger trains at the baseline year 2008. The estimation was based on data from the train timetable on CRC's ticket booking website.

4.14 In interviews with local experts as well as with randomly selected passengers travelling on the project line, the IEG PPAR mission was able to confirm that the express trains were in general very fast. During the mission's travel on the project line, for example, the train travelled at between 200 to 209 km per hour most of the time, except when it was near Guangzhou, based on the reading on the LED display board in the train. A quick internet search of a top travel website<sup>10</sup> led to the same conclusion: it takes about four hours and costs about Y170 (US\$26<sup>11</sup>) to travel on a second-class seat from Nanning to Guangzhou. In comparison, it takes about 8.5–14.5 hours and costs Y160-210 (US\$24–32) to travel the same distance by bus. Also, an on-board survey of passengers conducted by the World Bank project team between March 25 and April 14, 2015 found that 42 percent of passengers stated they took the train because of the short travel time (World Bank 2015).

4.15 Overall, the project's contribution to this second objective of reducing transport time between the less developed western region in southwest China and the relatively more developed Pearl River delta region is rated Substantial.

### **Policy impact**

4.16 Using the NanGuang project and the other five high-speed railway projects as a platform, the World Bank carried out comprehensive policy dialogue with authorities in charge of railway sector reforms, and provided support for institutional development. During the implementation period of the project, the World Bank produced 16 policy notes, briefs, and papers (Appendix D), covering core reform areas such as separation of policy and regulatory functions from commercial management of service provision, railway price regulation, and railway investment mobilization. China's railway sector has achieved significant reform progress in these areas, and it is understood that the World Bank's policy dialogue contributed to this achievement.

4.17 For example, a 2011 World Bank policy note introduced key elements of the experiences of eight countries in railway sector governance and institutional structure,

including having a Ministry of Transport overseeing the policy for all transport modes, separating commercial management of railway services from government regulatory function, using company structures for service delivery, separating freight and passenger transport, and having multiple service providers (Amos and Bullock 2011). IEG's PPAR mission learned from multiple experts that this note, along with some other policy advice, played an important role in supporting the Government of China's reform of the railway sector.

4.18 As part of the reform, in 2013 the Ministry of Railways was split into two. The government administrative functions were entrusted to the newly established Ministry of Transport, while provision of railway services was assigned to the new China Railway Corporation (CRC). IEG also learned from interviews with knowledgeable experts and government agencies that the reform resulted in a strengthened focus on commercial management of service delivery, on cost and revenues, and on a commitment to continued market-oriented management reform. Other examples of relevant policy and institutional development work included railway price regulation, private capital mobilization, business and financial management, and intermodal logistics and system integration.

4.19 Overall, there was a strong consensus among railway policy experts in research institutions and universities and among government officials in charge of the management of the World Bank's portfolio in China that the World Bank's policy dialogue was valuable and played an important role in informing the railway sector reform. Some experts specifically emphasized that the World Bank's policy support served as a unique, valuable platform for a collaborative and in-depth exchange of experiences on best practices with relevant experienced agencies in other countries.

### **Other achievements**

4.20 **Affordability.** The fares of the express trains are relatively inexpensive and affordable for the local middle class. For example, the ticket for a one-way second-class seat on the express train from Nanning to Guangzhou, a distance of 563 km (including 462 km of the project rail line) and a travel time of about four hours, costs about Y170 (US\$26), or 0.6 percent of the 2016 per capita annual disposable income of Y26,771 (US\$4,056) for urban households in Guigang (Guangxi Statistical Yearbook 2017), a medium-sized station city along the project line.

4.21 This compares to the Amtrak train ticket from Washington, DC to New York City, which is priced at \$152 for a value seat, the lowest class seat, on a 7 am departure train travelling 3 hours and 30 minutes,<sup>12</sup> for a distance of about 362 km. The Amtrak ticket price is about 0.6 percent of the 2016 per capita income of US\$23,696 in Philadelphia, Pennsylvania, which is a station city midway between Washington DC and New York,<sup>13</sup> but the train is slower and the distance is shorter than that of the Nanning to Guangzhou railway line<sup>14</sup>.

4.22 During its travel on the project line, IEG's PPAR mission also observed on the train it took and on the first departure station (Nanning East) that the majority of the passengers appeared to be local middle-class people. The mission learned from

discussions among passengers that they were mainly junior white-collar and working-class people, including migrant workers. Similarly, an onboard survey conducted by the World Bank project team in 2015 found that 44 percent of the passengers travelling on the trains on the project line had a monthly income of Y4,000 (US\$606) or less, and 73 percent of the passengers had a monthly income of Y6,000 (US\$909) or less. Only 9 percent of the passengers had an income of over Y10,000 (US\$1,515) per month (IEG calculation).

**4.23 Service quality.** People interviewed by the IEG PPAR mission generally acknowledged that the express trains were safe, punctual, and comfortable. Indeed, safety was mentioned by some experts as one of the key competitive edges the express trains have over long-distance buses. The IEG PPAR mission also personally experienced and observed the same when it travelled the project line.

**4.24 Inclusiveness.** The high-speed trains on the project line have accessible design, and it was observed that male and female passengers were generally equal in number. The IEG PPAR mission observed, for example, that in the middle of the train, there was a restroom specially designed for people with disabilities, as shown in an LED display board installed in each car of the train. Other express trains on the project line should have the same or similar design feature because they belong to the same model series and were produced by the same joint-venture company. A 2015 study by the World Bank found there were some gaps in accessibility at some smaller, intermediate stations on the project line. For example, the study found that passengers in Yunfu of Guangdong Province had to walk for a long distance from the station building to the parking lot or bus station, and passengers in Guigang of Guangxi had to climb many steep stairs to reach the station building because there was no ramp or elevator (Zhou et al. 2016). At the large Nanning station (Nanning East) and the Guangzhou station (Guangzhou South), however, the mission observed there were elevators marked “accessible elevators” to accommodate people with disabilities or in need.

**4.25 Integration with other transport modes and with city development.** While many high-speed rail stations were located several kilometers away from existing city centers, and for some of them, integration with other transport modes had not yet been achieved fully, the IEG PPAR mission observed in the field and learned from the interviews with local experts that the situation in large cities was much better. For example, both Nanning East station and Guangzhou South station are integrated with their respective city’s metro train systems. Guangzhou South station is also integrated with long-distance bus transportation, while near the Nanning East station a long-distance bus station is under construction. The mission also learned through interviewing experts that intermodal integration at stations in smaller cities is catching up, because of investments by local governments and/or the private sector.

**4.26** Indeed, the IEG mission was informed that the governments of cities connected to a high-speed railway and with a station across China as well as along the NanGuang project line attach great importance to leveraging access to the line to boost local economic development. Many have either completed or are in the process of preparing a development plan. Such a plan usually includes integrating high-speed rail with other transport modes, investment in local transport infrastructure to improve connections with

high-speed rail, development of integrated logistics centers, and development of priority industries in the station areas. Several experts who are familiar with CRC operations mentioned that CRC reviews local development plans and consults with local development planning officials when selecting the route and station sites for a proposed high-speed rail line, to ensure connection with local economic development centers.

## 5. Efficiency

5.1 **Economic Analysis.** The Project Appraisal Document and ICR undertook economic analyses (resulting in estimates of the project's net present value and economic rate of return) for the 400-km railway line from Litang West and New Zhaoqing constructed under the project (the NanGuang line), at both appraisal and completion, based on a project life cycle of 30 years and a social discount rate of 12 percent. At appraisal, the project was expected to achieve an economic rate of return (ERR) of 13.5 percent<sup>15</sup> and a net present value (NPV) of Y11 billion (US\$1.4 billion) at 2007 prices. At completion, the ERR was estimated to be 15.2 percent and the NPV Y29 billion (US\$4.7 billion) at 2015 prices.

5.2 The analyses assumed the project benefits would include reduction in travel time and distance for passengers, freeing up capacity in the existing network to handle projected traffic increases, and wider economic, social and environmental benefits, such as reductions in road accidents and congestion, reduction of vehicle emissions and greenhouse gas emissions, agglomeration benefits coming from more closely connected economic activities and markets, knowledge sharing, and greater productivity from increased competition (World Bank 2015, Annex 3).

5.3 The NanGuang line has achieved a traffic density level and a reduction of travel time necessary for being economically efficient. IEG estimates the average travel time of the express trains on the NanGuang line to be around 147 minutes, compared to 171 minutes assumed in the ICR ERR analysis. As noted already, IEG estimates the traffic density of the NanGuang line for 2018 to be about 20 million passengers, or about 5 percent lower than the ICR forecast for the same year (21 million, as used in the ERR calculation at project closure).

5.4 Assuming travel density forecasts for other years to be lower than the ICR forecasts by the same proportion as for year 2008, namely by 5 percent, and using the updated average travel time of 147 minutes, with other ICR assumptions remaining unchanged, IEG estimates that the ERR would decrease slightly from the ICR estimate of 15.2 percent to 15.0 percent, still higher than the ERR of 13.5 percent as estimated at appraisal, and that the NPV, based on the same discount rate of 12 percent, would decrease only slightly as well, from Y29 billion (US\$4.7 billion), estimated at project closure, to Y27 billion (US\$4.2 billion), both at 2015 prices. IEG's estimate is based on the ERR calculation model used in the ICR, as provided to IEG by the World Bank project team.

5.5 **Agglomeration Benefits.** About half of the project benefits were estimated at the ICR stage to be from agglomeration effects, assuming conservatively that these effects comprise mainly the impacts in four relatively large cities: Nanning, Guigang, and

Wuzhou in Guangxi Zhuang Autonomous Region and Kunming in Yunnan Province, excluding the impacts in cities in the more advanced Guangdong Province. The ERR analysis was also conservative in attributing the benefits to the NanGuang line, such as in the case of Nanning and Kunming, where the benefits attributable to the effects of existing transport services were excluded. In addition, it included only cost and time savings to companies directly attributable to the project line and did not include the potential efficiency gains that other companies can gain as a result of the savings (World Bank 2015, Annex 3).

5.6 This method of analysis was developed from the World Bank project team's field work, and was consistent with findings from the literature, which indicates that agglomeration effects of high-speed rail are more likely to be significant in relatively large cities and in urban centers near megacities, and to depend on local circumstances, such as industry structure, local resources, infrastructure, and governance (Blanquart and Koning 2017, and Sun and Mansury 2016).

5.7 The above assumptions for estimating the agglomeration effects are consistent with findings from IEG's interviews with local experts and observations during the mission's field trip. For example, the IEG PPAR mission learned from economic and management experts in Nanning that Nanning had seen fast growth and benefited from more investment in service industry from Guangdong since the NanGuang line was opened to traffic, and that Guigang had developed faster than a very comparable city which was of similar size and similar distance to Nanning but had no access to any express railways. In its field trip for this PPAR, IEG observed signs of fast development in Guigang and Wuzhou along the NanGuang line, reflected in busy streets and significant real estate development.

5.8 To further assess the robustness of the ICR estimate of the agglomeration effects, IEG recalculated the ERR by assuming the agglomeration effects to be reduced by 30 percent. This resulted in an NPV of Y18 billion (US\$2.9) and an ERR of 14.1 percent that is still higher than the ERR of 13.5 percent estimated at appraisal.

5.9 The Project Appraisal Document and the ICR estimated the benefits from agglomeration effects using an approach developed by the United Kingdom Department for Transport. The approach is based on a comparison of the economic mass with and without a project, and had been used to quantify agglomeration benefits in a number of transport projects in the United Kingdom; among them railway projects connecting the main urban center and its hinterland (World Bank 2009, Annex 9). The ICR and Project Appraisal Document analysis used the same parameter values as empirically estimated in the models used in the UK studies, and obtained an estimate of the project's agglomeration benefits that was robust to a sensitivity analysis using parameter values well outside the range of the UK values. The estimate was also consistent with similar results obtained in the UK studies—the agglomeration benefits were about half of the total project benefits. Subsequent assessment on the impact of expressways on regional economic development in Guangdong Province confirmed the general suitability of using these values for projects in China. (World Bank 2015, Annex 3).

5.10 **Financial Analysis.** A financial analysis at project completion estimated that the revenues of the NanGuang line would be able to cover its operation and maintenance costs. For example, the ratio of operation and maintenance cost to operation revenue was estimated to be 82 percent in 2018 and 78 percent in 2027, decreasing further to 73 percent in 2043–45. The revenues would also be able to cover the annual interest payment which was estimated to be about Y1.2 billion (US\$194 million), if it is paid before the payment of the maintenance cost. The local CRCs as shareholders would probably have to cover the maintenance cost from their other operations in order for the NanGuang line to be able to pay the interest on its debt. In addition, the debt would need to be restructured to make it possible to pay the principals, because of the mismatch between the maturities of the commercial loans and the life of the asset and the need for the traffic volume to increase (World Bank 2015, Annex 3).

5.11 According to the project design, the maximum speed of the trains is 250 km per hour and the trains can be up to 16 cars long, compared to the current operating speed of maximum 200 km per hour and the lengths of the trains, mostly 8 cars long. The project therefore has considerable potential for further traffic increases, as forecasted at project completion. It is unlikely that CRC would not arrange for refinancing for the project line given its positive cash flows, strategic importance, and strong public finance nature, to be discussed in detail in the Risk to Development Outcome section below.

5.12 One of the key assumptions of the financial analysis is about traffic density growth, which this assessment finds to be realistic. This assessment conservatively estimates that the current traffic density for 2018 is 20 million passengers, very close to the forecast of 21 million passengers made in the financial analysis. Based on the new traffic density figure, and using the same model as the World Bank project team used, IEG estimates that the operation and maintenance cost to operation revenue ratios would be no more than 1 percent higher than estimated in the financial analysis at the project's close; for instance, 83 percent in 2018 and 78 percent in 2027.

5.13 **Administrative Efficiency.** The project has been implemented with high administrative efficiency. The actual project cost was only 0.4 percent less than appraisal estimate in local currency terms, which is highly satisfactory given the large size and high technical complexity of the project (World Bank 2015, Annex 3). The project management cost was included in the “other” item in Annex 1 of the ICR, based on a clarification from the project team. This item is 11 percent of the project's actual total cost. Hence, the actual project management cost was no more than 11 percent of the project's total cost. The project completion date was extended for only half a year. The NanGuang line was completed and opened to traffic in December 2014, ahead of the originally scheduled loan closing date of December 31, 2015. The project's unit cost is US\$14.5 million

5.14 per km, among the lowest in the world (World Bank 2015, para 42), especially considering 65 percent of the track was laid on bridges and viaducts and in tunnels.

5.15 This report rates the efficiency of the project as High.

## 6. Ratings

### Outcome

6.1 The project development objectives were highly relevant to China's development strategy and to the World Bank's Country Partnership Strategy for China at appraisal, and remained so at project completion. The relevance of the project design was substantial. The efficacy of the first objective—to provide additional transport capacity—was high. The efficacy of the second objective, reducing travel time, was substantial. And the project contributed to the World Bank's policy engagements with the government, which led to significant progress on sector-level reforms and institutional development. The project was implemented with high efficiency, with a unit cost among the lowest in the world and the ex post ERR exceeding both the ex-ante ERR and the social discount rate.

6.2 Together, these ratings lead to an overall outcome rating of Satisfactory.

### Risk to Development Outcome

6.3 The project constructed a well-built, high-quality railway system based on mature technology and management. It is part of a major national high-speed rail network and plays an important role in addressing transport bottlenecks, promoting social and economic development, and in reducing poverty in the populous, less developed Southwest China region. The project's outcomes do, however, face some potential risks.

6.4 **Financial Risk:** The NanGuang line generates positive cash flows and is part of the national Eight Vertical and Eight Horizontal HSR Network. Although the company will need to restructure its debt when repayment of the principal begins, due to the difference in maturities between the commercial loans and the life of the asset and the need for traffic to ramp up, CRC has probably arranged for the refinancing of such a strategically important line, which generates positive cash flows and has a lot of potential for further traffic growth (World Bank 2015, para 41). Based on these considerations and achievements, the project's financial risk is rated as Low to Negligible.

6.5 **Technical Risk:** Although the project line is based on complex modern technology and management systems, similar railway lines have been operating with high levels of reliability in China since 2007. According to project documentation, CRC has introduced effective maintenance systems for China's very intensively used high-speed rail systems. Under this project, a sufficient number of technicians has been trained to conduct maintenance for the rails and the rolling stock. The institutional arrangements as well as the maintenance of the infrastructure are adequate for the foreseeable future (World Bank 2015, para 57 and para 32). The technical risk is therefore rated as Low to Negligible.

6.6 **The Risk of Reduced Government Commitment:** Railways are a big and strategically important sector in China and play a fundamental role in China's social and economic development. The government is committed to providing support to the railway sector and CRC when such support becomes essential. Owing to the project's strategic importance in the railway network and in the economic and social development of an

important region, the government, through CRC, is also committed to providing essential support to this project when necessary. The risk of reduced government commitment to this project line is rated as Negligible.

6.7 In summary, the overall risk to development outcome is rated Negligible.

### **Bank Performance**

6.8 IEG found that the World Bank's performance in ensuring quality at entry and the quality of its supervision of the project implementation were both satisfactory. Together, these ratings combined into an overall rating of Satisfactory World Bank performance.

### **QUALITY AT ENTRY**

6.9 The project development objectives (PDOs) were clear and measurable and were highly consistent with World Bank Country Partnership Strategies for China and China's national development strategies, as well as with relevant sector strategies. The project activities were very relevant to the achievement of the PDOs. The World Bank provided guidance and support to ensure that the feasibility studies, especially with respect to technical and environmental specifications and poverty reduction considerations, were prepared with high quality and on a timely basis. For example, the project preparation involved an effort to identify the poorest cities and the poverty reduction impact of the project line (World Bank 2015, para 60). The World Bank quantitatively assessed the potential agglomeration effects of the project in the project's economic analysis at appraisal. The World Bank's assessment of the project's social and environmental impacts was sound, and effective mitigation plans were developed accordingly.

6.10 The project design envisaged the formation of a project company as the implementing agency as well as the company for future operations. This proved helpful for strengthening the ownership of the project by relevant parties, especially by local governments, for improved implementation and operations, particularly in land acquisition and resettlement that involved a lot of coordination with local governments, according to IEG's PPAR mission interviews with relevant experts. This arrangement also helped mobilize financing paid in the form of land from local governments. The selection of FCTIC in the Ministry of Railways as the World Bank's direct counterpart responsible for management of the World Bank loan, including financial and procurement management, contributed to an efficient and cost-effective implementation because FCTIC had strong relevant experience.

6.11 The project design should have included outcome indicators to measure train capacity and occupancy. In addition, the project design lacked an activity that provided support for improved station accessibility.

6.12 Taken as a whole, the quality at entry is rated by this report as Satisfactory.

### **Quality of Supervision**

6.13 The World Bank team worked closely with the Ministry of Railways, CRC and the implementing agencies and conducted implementation supervisions of this

megaproject diligently and with the required expertise. The project team met the MOR/CRC every six weeks rather than every six months, according to clarifications from the World Bank project team (World Bank 2016). This enabled a much more frequent engagement than usual on the project's progress and possible issues to be resolved during implementation. The PPAR mission learned from CRC that the World Bank's supervision on social and fiduciary safeguards compliance was very strict.

6.14 The Implementation Status Reports (ISRs) were prepared every six months and were, in the judgment of the IEG's PPAR mission, of good quality. The ratings given in the ISRs were candid and appropriate. Risk ratings and risk management status ratings were updated in all ISRs, a useful practice that received commendation from World Bank Management (World Bank 2015, para 62). The World Bank team also carried out studies to identify the project's benefits and impacts and drew lessons that could be used by this and other similar projects, as reflected in the production of research notes and papers in such areas as traffic profiles, environmental management, construction costs, and wider economic impact analysis. The World Bank's policy engagements with the government were productive and contributed significantly to China's railway sector reforms.

6.15 The results framework was not revised to reflect the government's decision to operate only passenger trains on the project line, mainly because the decision was made at a time very close to project completion when such a revision would not add much value.

6.16 Overall, the World Bank project team worked closely with MOR/CRC and the implementing agencies to ensure this complex project was completed on time, within budget, and to high quality standards, despite the World Bank financing of only 5 percent of the total project cost (World Bank 2015, para 61). This report rates the quality of World Bank supervision as Satisfactory.

### **Borrower Performance**

6.17 This assessment rates government performance on the project as highly satisfactory and the implementing agency performance as satisfactory. Overall borrower performance is Satisfactory.

### **Government Performance**

6.18 **Government performance is rated Highly Satisfactory.** The government was highly committed to this project. MOR/CRC mobilized the needed resources to complete the project design and construction on time, at a low unit cost, and with high quality. As a result, for example, the project's preliminary design was good, control over compliance with standards and specifications was strict, contractors were reliable and responsible, and planning and control of critical activities were meticulous (World Bank 2015, p17). The CRC/MOR also provided counterpart funds for the project in a timely manner. The Ministry of Railways's efforts in forming the shareholding project company for the implementation of the project ensured smooth and successful cooperation and coordination with local governments, especially on land acquisition and resettlement, and in mobilizing additional counterpart financing. The Ministry of Railways collaborated

with the World Bank on the World Bank's policy work regarding railway sector reforms and took into account World Bank inputs during the reform process (World Bank 2015, para 65).

### **Implementing Agency Performance**

6.19 **The project implementing agency performance is rated Satisfactory.** As the World Bank's direct counterpart, the Foreign Capital Technology Import Center (FCTIC) under the Ministry of Railways and CRC managed the World Bank loan effectively, especially in ensuring sound financial management and procurement in accordance with World Bank guidelines and without any delays. FCTIC also provided progress reports and other reports on time, monitored environmental and social safeguards compliance effectively, and made suggestions on measures for improving implementation in relevant areas.

6.20 The Nanning-Guangzhou Railway Company Ltd (NGRC) and the Guiyang-Guangzhou Railway Company Ltd (GGRC) managed the resettlement under the project effectively. They coordinated with local governments and ensured the timely payment of compensation to affected households. NGRC and GGRC were also instrumental in working with local governments to find options on improving connectivity with the new stations of the project line. They provided data on the project's performance in accordance with the requirements of the project documentation.

6.21 Overall, FCTIC and the two companies responded on all project implementation issues efficiently, followed World Bank requirements, and engaged with World Bank missions, deserving a major credit for the successful implementation of this massive railway project (World Bank 2015, para 66). A minor shortcoming was that the project's technical assistance (whose scope was planned to be identified during the project's implementation) was not pursued, as mentioned above, although US\$300,000 from the World Bank loan was allocated to this subcomponent.

### **Monitoring and Evaluation**

6.22 **Design.** The Project Appraisal Document provided no statement on the design of a monitoring and evaluation (M&E) system for this project other than the plan that "FCTIC would furnish implementation progress reports every half year along with action plans to remedy issues that arise in project implementation" (para 35). There were three outcome indicators, namely (a) the average number of pairs of express passenger trains per day; (b) average number of freight trains per day; and (c) average travel time of express trains travelling at a maximum speed of 200 km per hour. Though these outcome indicators were necessary, clear and measurable, and had baseline values and targets, they could have been supplemented by indicators that reflected not only the number of pairs of trains but also their capacity and occupancy. The M&E system had only one intermediate outcome indicator "Progress rate of works and procurement of goods (%)," which was not well defined, because it was unclear whether it was designed to measure physical progress or progress in terms of investment amount completed, or both (World Bank 2016).

6.23 **Implementation.** The FCTIC under the Ministry of Railways and the CRC provided data on baseline values, final targets, and intermediate values, and reported on project progress, including achievements of key outcome targets, in accordance with the requirements specified in project documentation. This information was complemented by several World Bank policy notes and papers, including assessments of intermediate outcomes for this project as well as for several other World Bank–financed railway projects, such as assessments of passenger profiles, intermodal integration status, and agglomeration effects. However, the outcome indicator on the number of pairs of freight trains was not revised when the government confirmed its decision to postpone the use of the project line for freight trains.

6.24 **Utilization.** According to project documentation, the CRC used the M&E framework as one of its tools to conduct evaluation to inform relevant decision making. The World Bank’s policy notes and papers on intermodal integration and agglomeration effects analysis, which were partly based on assessing experience from this project, have informed relevant railway development policy and strategy, interviews with experts suggest.

6.25 In sum, the project M&E system had shortcomings in both design and restructuring regarding outcome indicators, although some M&E results have informed policy formulation. The project M&E is thus rated Modest.

## 7. Lessons

- **Sound technical design, project preparation, and implementation management, combined with a strong financial capacity, are a recipe for success for a high-speed railway project.** The NanGuang Railway Project was completed on time, with high quality, and at a relatively low cost. Evidence from the project shows that its success was attributable to good preliminary design, meticulous planning, strict control over compliance with standards and specifications, and reliable and responsible contractors. China Railway Corporation (CRC) and Ministry of Railways deserve major credit for these achievements. Their success was also attributable to the smooth coordination of the Ministry of Railways and CRC with local governments on land acquisition and timely provision of counterpart financing. The World Bank contributed to the success through providing guidance and support to ensure the project’s preparation and implementation met high standards, especially in technical and environmental specifications and in achieving economic benefits in China’s less developed regions.
- **Agglomeration effects are an important benefit of high-speed rail development, and should be incorporated in the cost-benefit analysis of such projects.** In addition to conventional benefits, such as user time savings, operating cost savings for traffic diverted from the conventional lines, and reductions in environmental externalities, this project has confirmed that a high-speed rail project also has significant agglomeration benefits, coming from more closely connected economic activities and markets, better knowledge sharing, and greater productivity owing to increased competition between spatially closer markets as a result of high-speed rail connections. The magnitude of agglomeration benefits depends on local circumstances, such as industry structure, local

conditions, and governance. It is important to identify and quantify agglomeration benefits in feasibility studies to better inform the selection of rail routes and stations.

- **Successful reforms in large and complex infrastructure sectors such as railways in China require sustained policy dialogue and engagements.** By the time of the project approval, China had pursued reforms in the railway sector for about 10–15 years, and had achieved solid progress in core reform areas. The World Bank contributed to this process through its provision of support on capacity building and institutional development in multiple dimensions across the system. To promote further reforms, the government asked the World Bank’s advice on relevant international experience in railway development. Using this project and the other five high-speed rail projects as a platform, the World Bank continued its policy engagements with the government, including an introduction to the experience in railway sector governance in eight countries. These engagements played an important role in informing relevant reforms in China’s railway sector, especially the 2013 landmark reform, which separated the commercial management of railway services from the railway regulatory function, and established corporations for railway services delivery.
- **Good connections of high-speed railway lines with other transport modes and between the rail stations and urban centers are critical to achieving the full benefits of high-speed trains.** This project’s experience shows that a high-speed railway line often entails a major investment, requiring high traffic density for it to be economically viable. Integration of the railways with other transport modes is important to achieving a high traffic density throughout the system. It is therefore necessary to take measures at the design stage to ensure that rail station cities have concrete plans for a timely buildup of complementary infrastructure and the provision of services necessary for good local transport connections to the railway stations, such as reliable and safe public transport and taxi services.

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<sup>2</sup> Much of the information in this section is based on the Project Appraisal Document for the NanGuang project and other related project documents.

<sup>3</sup> A passenger-kilometer is a unit of measurement used to measure traffic volume, representing the transport of one passenger travelling one kilometer.

<sup>4</sup> [http://www.china.com.cn/policy/txt/2011-03/16/content\\_22156007.htm](http://www.china.com.cn/policy/txt/2011-03/16/content_22156007.htm)

<sup>5</sup> There are no data on cost by project component in project documentation. A table on the cost estimates by expenditure category is attached in Appendix C.

<sup>6</sup> The World Bank’s Operations Portal.

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<sup>7</sup> <https://zh.wikipedia.org/wiki/%E5%8D%97%E5%B9%BF%E9%93%81%E8%B7%AF> (dated Feb. 23, 2018)

<sup>8</sup> <http://www.12306.cn/mormhweb/hyfw/>.

<sup>9</sup> Average number of passengers occupying per kilometer of route, measured by passenger-kilometers per route kilometer.

<sup>10</sup> <http://www.ctrip.com/>

<sup>11</sup> Based on the latest available annual average exchange rate of 2016, from the World Development Indicators database.

<sup>12</sup> <https://tickets.amtrak.com/itd/amtrak#>

<sup>13</sup> <https://www.census.gov/quickfacts/fact/table/philadelphiacitypennsylvania,districtofcolumbiadistrictofcolumbia,baltimorecitymaryland,US/PST045217>

<sup>14</sup> The IEG mission was not able to obtain information on the extent to which CRC or Amtrak tickets were subsidized by the governments.

<sup>15</sup> The Implementation, Completion, and Results Report found an error in the calculation of the ERR at appraisal and corrected it. The original economic rate of return in the Project Appraisal Document at appraisal was 13 percent.

## Appendix A. Basic Data Sheet

### NANGUANG RAILWAY PROJECT (IBRD-77220)

#### Key Project Data (amounts in US\$ million)

	<i>Appraisal estimate</i>	<i>Actual or current estimate</i>	<i>Actual as % of appraisal estimate</i>
Total project costs	5,984.79	6,495.65	109
Loan amount	300	297.54	99.2
Cofinancing			
Cancellation			

#### Cumulative Estimated and Actual Disbursements

	<i>FY12</i>	<i>FY13</i>	<i>FY14</i>	<i>FY15</i>
Appraisal estimate (US\$M)	100	170	240	300
Actual (US\$M)	46	149	226	264
Actual as % of appraisal	46	88	94	88
Date of final disbursement: 2016				

#### Project Dates

	<i>Original</i>	<i>Actual</i>
Initiating memorandum	11/15/2008	01/22/2009
Negotiations	05/11/2009	05/18/2009
Board approval	04/07/2010	06/24/2009
Signing	09/18/2009	08/31/2009
Effectiveness	12/21/2009	12/21/2009
Closing date	12/31/2014	06/30/2015

Source: ICR Annex 4.

**Task Team Members**

<i>Name</i>	<i>Title (at time of appraisal and closure, respectively)</i>	<i>Unit</i>	<i>Responsibility/Specialty</i>
<b>Lending</b>			
Syed I. Ahmed	Lead Counsel	LEGAM	
John Scales	Lead Transport Specialist	GTIDR	Team Leader
Paul Amos	Consultant	GTIDR	
Richard G. Bullock	HQ Consultant ST	GTIDR	
Jianjun Guo	Senior Procurement Specialist	GGODR	
Ying Jin	HQ Consultant ST	GSURR	
Maria Luisa G. Juico	Program Assistant	GTIDR	
Juan D. Quintero	Consultant	GENDR	
Jitendra Sondhi	HQ Consultant ST	GTIDR	
Peishen Wang	Consultant	GENDR	
Lei Wu	Program Assistant	EACCF	
Songling Yao	Senior Social Development Specialist	GSURR	
Chaohua Zhang	Lead Social Development Specialist	GSURR	
<b>Supervision/ICR</b>			
Gerald Paul Ollivier	Senior Infrastructure Specialist	GTIDR	Team Leader
Martha B. Lawrence		GTIDR	Co Team Leader
Syed I. Ahmed	Lead Counsel	LEGAM	
Richard G. Bullock	HQ Consultant ST	GTIDR	
Wanli Fang	Consultant	GSURR	
Yi Geng	Senior Financial Management Specialist	GGODR	
Jianjun Guo	Senior Procurement Specialist	GGODR	
Maria Luisa G. Juico	Program Assistant	GTIDR	
Jitendra Sondhi	HQ Consultant ST	GTIDR	
Ye Song	Consultant	EASCS	
Peishen Wang	Consultant	GENDR	
Lei Wu	Program Assistant	EACCF	
Ning Yang	Senior Environmental Specialist	GENDR	
Songling Yao	Senior Social Development Spec	GSURR	
Nanyan Zhou	Consultant ST	GTIDR	
Romain Pison	Transport Specialist	GTIDR	
Fatima Arroyo Arroyo	Operations Analyst	GTIDR	

## Appendix B. Bank supported six high-speed railway projects in China

Project	Max. Speed (kph)	Length Km	Project Cost at appraisal (US\$ m)	Bank loan amount (US\$ m)	Bank loan approval year
<b>ShiZheng Railway</b>	350	355	6,109	300	2008
<b>Guiyang Guangzhou Railway</b>	250	857	12,527	300	2009
<b>JiTuHu Railway</b>	250	360	6,303	200	2011
<b>ZhangHu Railway</b>	250	286	4,682	200	2012
<b>NanGuang Railway</b>	200	462	5,984	300	2009
<b>HaJia Railway</b>	200	343	5,566	300	2014

Source: World Bank Office in Beijing (Ollivier et al. 2014).

## Appendix C. Cost by expenditure category of project activities

### (a) Project cost by category of activities (in US\$, millions equivalent)

Category of Activities	Appraisal Estimate	Actual/Latest Estimate	Percentage of Appraisal
Civil works	3,255.44	3,748.57	115
Goods	864.27	811.27	94
Land acquisition and resettlement	455.48	412.71	91
Other	278.80	706.85	254
Consulting services	0.30	0.30	100
<b>Total Baseline Cost</b>	<b>4,854.29</b>	<b>5,679.70</b>	<b>117</b>
Physical contingencies	484.58	439.18	91
<b>Total Project Costs</b>	<b>5,338.87</b>	<b>6,118.88</b>	<b>115</b>
Interest during construction	353.20	376.02	106
Rolling stock	291.97	0.00	0
Front-end fee IBRD	0.75	0.75	100
<b>Total Financing Required</b>	<b>5,984.79</b>	<b>6,495.65</b>	<b>109</b>

Source: World Bank 2015, Annex 1

### (b) Project cost by category of activities (in RMB, millions equivalent)

Category of Activities	Appraisal Estimate	Actual/Latest Estimate	Percentage of Appraisal
Civil works	22,299.75	23,241.13	104
Goods	5,920.22	5,029.87	85
Land acquisition and resettlement	3,120.02	2,823.98	91
Other	1,909.77	4,382.47	229
Consulting services	2.06	1.86	90
<b>Total Baseline Cost</b>	<b>33,251.82</b>	<b>35,479.31</b>	<b>107</b>
Physical contingencies	3,319.37	3,004.40	91
<b>Total Project Costs</b>	<b>36,571.19</b>	<b>38,483.71</b>	<b>105</b>
Interest during construction	2,419.42	2,332.44	96
Rolling stock	2,000.00	0.00	0
Front-end fee IBRD	5.14	4.65	90
<b>Total Financing Required</b>	<b>40,995.75</b>	<b>40,820.80</b>	<b>100</b>

Source: World Bank 2015, Annex 1

## Appendix D. List of relevant papers published by the World Bank on China Railways

The following research briefs, policy notes and papers have been (??) published by the World Bank on China Railways, reflecting the World Bank's policy dialogue work conducted during the implementation period of the project. Also available at the [OpenKnowledge](#).

- High-Speed Rail: The Fast Track to Economic Development? 2010, by Paul Amos, Richard Bullock, and Jitendra Sondhi. <http://documents.worldbank.org/curated/en/680601468217156004/High-speed-rail-the-fast-track-to-economic-development>
- Railway price regulation in China: time for a rethink? 2011, By John Scales, Gerald Ollivier and Paul Amos. <http://documents.worldbank.org/curated/en/103931468010857398/pdf/660370BRI0P12500Pricing0Final0Dec11.pdf>
- Governance and structure of the railway industry: three pillars, 2011, by Paul Amos and Richard Bullock. <http://documents.worldbank.org/curated/en/272791468025222951/Governance-and-structure-of-the-railway-industry-three-pillars>
- Fast and Focused - Building China's Railways, 2012, by John Scales, Jitendra Sondhi and Paul Amos. <http://documents.worldbank.org/curated/en/352931468219292293/Fast-and-focused-building-Chinas-railways>
- High-Speed Rail: the first three years taking the pulse of China's emerging program, 2012, by Richard Bullock, Ying Jin, and Andrew Salzberg. <http://documents.worldbank.org/curated/en/899391468218992240/High-speed-rail-the-first-three-years-taking-the-pulse-of-Chinas-emerging-program>
- China: The environmental challenger of railway development, 2012, by **Peishen Wang, Ning Yang and Juan D. Quintero**. <http://documents.worldbank.org/curated/en/158391468018624231/pdf/694910BRI00P120Environment0EN0final.pdf>
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- High-Speed Railways in China: A Look at Construction Costs, 2014, by Gerald Ollivier, Jitendra Sondhi, and Nanyan Zhou. <http://documents.worldbank.org/curated/en/695111468024545450/pdf/892000BRI0Box3000china0transport09.pdf>
- High-Speed Railways in China: A Look at Traffic, 2014, by Gerald Ollivier, Richard Bullock, Ying Jin, and Nanyan Zhou. <http://documents.worldbank.org/curated/en/451551468241176543/High-speed-railways-in-China-a-look-at-traffic>
- Regional Economic Impact Analysis of High Speed Rail in China, June 2014, Report No. ACS9734, the World Bank. <http://documents.worldbank.org/curated/en/334931468011142903/Main-report>
- Attracting Capital for Railway Development in China, 2015, by Martha B. Lawrence and Gerald Ollivier. <http://documents.worldbank.org/curated/en/370861468184791230/Attracting-capital-for-railway-development-in-China>

Public transport service optimization and system integration, 2015, by Ke Fang and Samuel Zimmerman.

<http://documents.worldbank.org/curated/en/322961468019179668/Public-transport-service-optimization-and-system-integration>

Customer-driven rail intermodal logistics: unlocking a new source of value for China, 2015, by Luis Blancas Mendivil, Richard Bullock, and Gerald Paul Ollivier.

<http://documents.worldbank.org/curated/en/326271468018548105/Customer-driven-rail-intermodal-logistics-unlocking-a-new-source-of-value-for-China>

Integrated logistics centers: experience from North America and options for China, 2015, by Luis Blancas Mendivil, Richard Bullock, and Gerald Paul Ollivier.

<http://documents.worldbank.org/curated/en/626271468240015854/Integrated-logistic-centers-experience-from-North-America-and-options-for-China>

High-Speed Railways in China: an update on passenger profiles, 2016, by Gerald Ollivier, Nanyan Zhou, Richard Bullock, Ying Jin, and Martha B. Lawrence.

<http://documents.worldbank.org/curated/en/918651467988871005/High-speed-railways-in-China-an-update-on-passenger-profiles>

## Appendix E. List of Persons Met

<b>Name</b>	<b>Title</b>	<b>Institution</b>
<b>Government of China and the Implementing Agency</b>		
Mr. Lei Zhang	Deputy Director International Economic and Financial Cooperation Department	Ministry of Finance
Mr. Baoshan Feng	Director, Foreign Capital Utilization and Overseas Investment Department (FCUOID)	National Development and Reform Commission
Mr. Bo Tian	Principal Officer, FCUOID	National Development and Reform Commission
Mr. Haoyong Dong	Deputy Director, Material Management Department	China Railway Corporation
Ms. Hong Zhu	Deputy General Manager, 7 <sup>th</sup> Business Division	China International Tendering Co., LTD
<b>Universities and Research Institutes</b>		
Dr. Lixin Shi	Director/Professor, Infrastructure Research Center	Institute of Economic System and Management, National Development and Reform Commission
Dr. Dan Zheng	Lecturer, School of Economics and Management	University of Chinese Academy of Sciences
Mr. Jianping Zhang	Independent Consultant	Retired director of China Railway Corporation and National Development and Reform Commission
Dr. Minjun Shi	Professor in Economics, School of Economics	Remin University of China, Beijing, China
Dr. Peihong Chen	Associate Professor in Economics, School of Economics and Management	Beijing Jiaotong University
Dr. Zhi Liu	Director, Center for Urban Development and Land Policy	Peking University. Lincoln Institute
Dr. Tie Wei	Professor in Management, School of Business	Guangxi University
Mr. Jingye Yuan	Associate Professor in Technical Economics, School of Physics	Guangxi University
Dr. Zaiqi Chen	Director and Professor, Macroeconomic Research Institute	Guangdong Social Science Academy
Dr. Zonghong Song	Associate Professor, Macroeconomic Research Institute	Guangdong Social Science Academy

Mr. Zheng Li	Assistant Professor, Macroeconomic Research Institute	Guangdong Social Science Academy
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