

Document of  
**The World Bank**  
**FOR OFFICIAL USE ONLY**

Report No: ICR00005224

IMPLEMENTATION COMPLETION AND RESULTS REPORT

8262-CN

ON A

LOAN

IN THE AMOUNT OF US\$ 250 MILLION

TO THE

People's Republic of China

FOR THE

China: Nanchang Urban Rail Project  
12/31/2020

Transport Global Practice  
East Asia And Pacific Region

## CURRENCY EQUIVALENTS

(Exchange Rate Effective December 31, 2019)

Currency Unit =	RMB
6.9623 RMB =	US\$1
US\$ 0.1436 =	RMB 1

FISCAL YEAR  
July 1 - June 30

Regional Vice President: Victoria Kwakwa

Country Director: Martin Raiser

Regional Director: Ranjit J. Lamech

Practice Manager: Binyam Reja

Task Team Leader(s): Yi Yang, Antoine Avedis Kunth

ICR Main Contributor: Annika Berlin

## ABBREVIATIONS AND ACRONYMS

<b>AFC</b>	Automatic Fare Collection
<b>BCR</b>	Benefit Cost Ratio
<b>BRT</b>	Bus Rapid Transit
<b>CBA</b>	Cost Benefit Analysis
<b>CIA</b>	Cumulative Impact Assessment
<b>CPF</b>	Country Partnership Framework
<b>CPS</b>	Country Partnership Strategy
<b>DRB</b>	Dispute Resolution Board
<b>EIA</b>	Environmental Impact Assessment
<b>EIRR</b>	Economic Internal Rate of Return
<b>EMP</b>	Environmental Management Plan
<b>ESIA</b>	Environmental and Social Impact Assessment
<b>ESMP</b>	Environmental and Social Management Plan
<b>FM</b>	Financial Management
<b>FY</b>	Fiscal Year
<b>FYP</b>	Five Year Plan
<b>GDP</b>	Gross Domestic Product
<b>GEF</b>	Global Environmental Facility
<b>GHG</b>	Greenhouse Gas
<b>HSR</b>	High Speed Rail
<b>IBRD</b>	International Bank for Reconstruction and Development
<b>ICR</b>	Implementation Completion Report
<b>ISR</b>	Implementation Status and Results
<b>LVC</b>	Land Value Capture
<b>M&amp;E</b>	Monitoring and Evaluation
<b>MOHURD</b>	Ministry of Housing and Urban-Rural Development
<b>MTR</b>	Midterm Review
<b>NDC</b>	Nationally Determined Contribution
<b>NM</b>	Nanchang Municipality
<b>NMT</b>	Non-motorized Transport
<b>NPV</b>	Net Present Value
<b>NRTG</b>	Nanchang Railway Transit Group
<b>OD</b>	Origin - Destination
<b>OP/BP</b>	Operational Policy/Bank Policy
<b>PAD</b>	Project Appraisal Document
<b>PAP</b>	Project Affected People
<b>PDO</b>	Project Development Objective
<b>PLG</b>	Project Leadership Group
<b>PM</b>	Particulate Matter
<b>PMO</b>	Project Management Office
<b>RAP</b>	Resettlement Action Plan
<b>RPF</b>	Resettlement Policy Framework
<b>SCD</b>	Systematic Country Diagnostic

<b>TA</b>	Technical Assistance
<b>TDM</b>	Travel Demand Management
<b>TOD</b>	Transit Oriented Development
<b>TT</b>	Task Team
<b>URC</b>	Urban Rail Company

## TABLE OF CONTENTS

<b>DATA SHEET .....</b>	<b>1</b>
<b>I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES.....</b>	<b>5</b>
<b>A. CONTEXT AT APPRAISAL .....</b>	<b>5</b>
<b>B. SIGNIFICANT CHANGES DURING IMPLEMENTATION (IF APPLICABLE) .....</b>	<b>10</b>
<b>II. OUTCOME .....</b>	<b>10</b>
<b>A. ASSESSMENT OF RELEVANCE OF PDOS AND RATING .....</b>	<b>10</b>
<b>B. ACHIEVEMENT OF PDOs (EFFICACY) .....</b>	<b>14</b>
<b>C. EFFICIENCY .....</b>	<b>17</b>
<b>D. JUSTIFICATION OF OVERALL OUTCOME RATING .....</b>	<b>18</b>
<b>E. OTHER OUTCOMES AND IMPACTS (IF ANY).....</b>	<b>19</b>
<b>III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME.....</b>	<b>20</b>
<b>A. KEY FACTORS DURING PREPARATION .....</b>	<b>20</b>
<b>B. KEY FACTORS DURING IMPLEMENTATION .....</b>	<b>21</b>
<b>IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME ..</b>	<b>22</b>
<b>A. QUALITY OF MONITORING AND EVALUATION (M&amp;E) .....</b>	<b>22</b>
<b>B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE.....</b>	<b>23</b>
<b>C. BANK PERFORMANCE .....</b>	<b>25</b>
<b>D. RISK TO DEVELOPMENT OUTCOME .....</b>	<b>27</b>
<b>V. LESSONS AND RECOMMENDATIONS .....</b>	<b>27</b>
<b>ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS.....</b>	<b>29</b>
<b>ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION.....</b>	<b>36</b>
<b>ANNEX 3. PROJECT COST BY COMPONENT .....</b>	<b>38</b>
<b>ANNEX 4. EFFICIENCY ANALYSIS.....</b>	<b>39</b>
<b>ANNEX 5. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS ...</b>	<b>46</b>



**DATA SHEET**

**BASIC INFORMATION**

**Product Information**

Project ID	Project Name
P132154	China: Nanchang Urban Rail Project
Country	Financing Instrument
China	Investment Project Financing
Original EA Category	Revised EA Category
Full Assessment (A)	Full Assessment (A)

**Organizations**

Borrower	Implementing Agency
People's Republic of China	Nanchang Urban Rail Group Co.

**Project Development Objective (PDO)**

Original PDO

The proposed project development objective (PDO) is to provide an effective urban mass rapid transit system of appropriate quality along the Line 2 corridor from ZhanQianNanDaDao Station to XinJiaAn Station.



**FINANCING**

	Original Amount (US\$)	Revised Amount (US\$)	Actual Disbursed (US\$)
<b>World Bank Financing</b>			
IBRD-82620	250,000,000	189,492,846	189,492,846
<b>Total</b>	<b>250,000,000</b>	<b>189,492,846</b>	<b>189,492,846</b>
<b>Non-World Bank Financing</b>			
Borrower/Recipient	2,321,230,000	2,000,469,000	2,000,469,000
<b>Total</b>	<b>2,321,230,000</b>	<b>2,000,469,000</b>	<b>2,000,469,000</b>
<b>Total Project Cost</b>	<b>2,571,230,000</b>	<b>2,189,961,846</b>	<b>2,189,961,846</b>

**KEY DATES**

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
20-Jun-2013	21-Oct-2013	13-Feb-2017	31-Oct-2018	31-Dec-2019

**RESTRUCTURING AND/OR ADDITIONAL FINANCING**

Date(s)	Amount Disbursed (US\$M)	Key Revisions
17-Aug-2018	136.82	Change in Results Framework Change in Loan Closing Date(s) Change in Implementation Schedule

**KEY RATINGS**

Outcome	Bank Performance	M&E Quality
Satisfactory	Satisfactory	Substantial

**RATINGS OF PROJECT PERFORMANCE IN ISRs**

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US\$M)
01	15-Sep-2013	Satisfactory	Satisfactory	0



02	10-Feb-2014	Satisfactory	Satisfactory	25.00
03	01-Sep-2014	Satisfactory	Satisfactory	27.08
04	18-Jan-2015	Satisfactory	Satisfactory	28.40
05	08-Oct-2015	Satisfactory	Satisfactory	38.05
06	14-Mar-2016	Satisfactory	Satisfactory	55.05
07	26-Jul-2016	Satisfactory	Satisfactory	65.06
08	17-Dec-2016	Satisfactory	Satisfactory	75.13
09	08-May-2017	Satisfactory	Satisfactory	86.01
10	08-Dec-2017	Satisfactory	Satisfactory	104.89
11	25-Jun-2018	Satisfactory	Satisfactory	136.82
12	01-Jan-2019	Satisfactory	Satisfactory	144.83
13	25-Jun-2019	Satisfactory	Satisfactory	172.47
14	04-Oct-2019	Satisfactory	Satisfactory	176.62

## SECTORS AND THEMES

### Sectors

Major Sector/Sector (%)

**Transportation 100**

Urban Transport 100

### Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3) (%)

**Urban and Rural Development 100**

Urban Development 100

Urban Infrastructure and Service Delivery 100

**Environment and Natural Resource Management 100**

Climate change 100

Mitigation 100





**ADM STAFF**

Role	At Approval	At ICR
Regional Vice President:	Axel van Trotsenburg	Victoria Kwakwa
Country Director:	Klaus Rohland	Martin Raiser
Director:	John A. Roome	Ranjit J. Lamech
Practice Manager:	Mark R. Lundell	Binyam Reja
Task Team Leader(s):	Gerald Paul Ollivier	Yi Yang, Antoine Avedis Kunth
ICR Contributing Author:		Annika Berlin



## I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

### A. CONTEXT AT APPRAISAL

#### Context

##### Country context

- 1. At appraisal, China underwent unprecedented rapid urbanization that challenged urban transport across cities.** The increase in commuting distances and growth of personal incomes caused a shift from public transport and non-motorized transport (NMT) towards private motorization and thus increased air pollution and greenhouse gas (GHG) emissions<sup>1</sup>. As a response, the government has anchored sustainable urban transport in national policies governing local master plans and passed a State Council Directive on the Prioritization of Urban Public Transport Development in 2012. In addition, China's 12<sup>th</sup> Five Year Plan (FYP) (2011-2015) mandated increasing the public transport modal share to 40% for large cities and aimed at creating integrated transport systems. Within this plan, urban rail was prioritized in first to third tier cities' urban transport development. In 2010, only 10 cities were operating metros on 870 km of track, which increased to 2,286 km in 2012. The national goal was to have at least 6000 km of urban rail and 4000 metro stations in operation by 2020. These systems require substantial capital investment, and operation and maintenance need substantial cross-subsidies and innovative financing approaches because fare revenues are generally insufficient.
- 2. Fighting congestion, air pollution and GHG emissions which are growing at a fast pace due to increasing motorization are on top of the national agenda.** In 2012, there were 53 million cars in China, expected to grow to 80 million cars by 2020.<sup>2</sup> In this context, China's cities require a more compact form of urban development, aligned with well-connected transit networks and NMT infrastructure, thus preventing a shift to private car ownership. Major constraints to increasing public transport mode share include insufficient attention to the quality of services and multi-modal integration which lowers demand, and poor urban planning, which results in sprawl-type land use patterns that are not suitable for providing effective public transport services.

##### Project context

- 3. At the time of project preparation, the city of Nanchang covered an area of 618 square km with an urban population of 3.3 million in a 265 square km of built-up urban area.** The expansion of urban areas faster than that of population growth and the mismatch of residence and employment distribution led to a sharp increase in the average distance travelled by motorized vehicles from 4.6 km in 2002 to 9.36 km in 2010. Especially, the old city center in the east is routinely congested with average driving speed down to 11 km per hour during rush hour. Car traffic is expected to also grow rapidly in the newer western part of Nanchang since its urban design featuring wide roads and ample parking is amenable to car traffic, leading to higher air pollution, GHG emissions and road crashes. As a result, public transport accounted for only 13.5 % of total daily trips which is much lower than in other provincial capitals in central China such as Changsha (24.5 %) or Wuhan (23.4 %).<sup>3</sup>
- 4. In response to these challenges, Nanchang Municipality (NM) decided to develop an integrated urban transport system that tackles existing challenges and anticipates the needs arising from its new spatial**

<sup>1</sup> World Bank and Development Research Center of the State Council, 2014. Urban China: Towards Effective, Inclusive and Sustainable Urbanization

<sup>2</sup> IEG China Urban Transport Case Study November 21, 2016

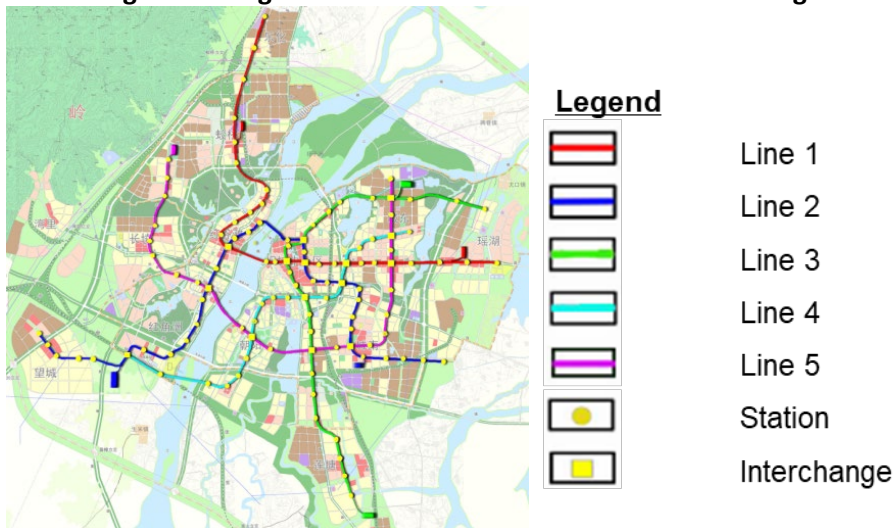
<sup>3</sup> Project Appraisal Document Nanchang Urban Rail Project 2013



**development pattern.** Nanchang’s master plan and policy documents consistently state the importance of an urban rail network and stations as the backbone of the integrated public transport system. The first stage, as set forth in the Nanchang Urban Rail Transit Construction Plan (2009-2016) includes the construction of Line 1 and Line 2. At appraisal, Nanchang had only one metro line under construction. Line 2 was planned to go through areas in western Nanchang that were then lightly populated but for which NM has drawn plans for major population growth over the period 2020-2030. Line 2 will also connect the new High Speed Rail (HSR) station to the urban core in the east and its existing rail station.

5. **By building Line 2 in anticipation of future urban development, NM aims to guide its urban structure and optimize its urban space layout by applying transit-oriented development (TOD) concepts to these new urban areas.** NM plans to draw on the increase in land value in the city as a result of better public transport to support the project financing, by transferring development rights to the municipality-owned Urban Rail Company (URC).<sup>4</sup> The established process of master planning, transport planning, and urban rail network planning helps ensure consistency between the investment programs of different modes within the city. In 2012, Nanchang completed the Development Plan of Nanchang Low Carbon City, which includes action plans related to urban structure, low-carbon transport and ecological environment.

**Figure 1: Long-term Urban Rail Network Plan of Nanchang Urban Rail Transit**



### Rationale for Bank Involvement

6. **The project drew on the World Bank’s global experience in urban rail and TOD projects.** Urban rail projects can achieve desired compact growth patterns only as a part of an integrated package of activities that actively manage automobiles and integrate all modes of transport into a seamless system. While Chinese design institutes and construction companies have accumulated extensive experience in building urban rail lines, the design and implementation of seamless transfers across modes and related technologies and policies have remained an institutional challenge. Thus, the rail transit system often fails to achieve efficient operation and attain its maximum benefit by serving different user groups. NM has started to adjust its approach with the

<sup>4</sup> Project Appraisal Document Nanchang Urban Rail Project 2013



long-term urban rail construction plan, plans to increase density around stations, and a public transport integration plan which includes several interchange locations between bus and rail along the network.

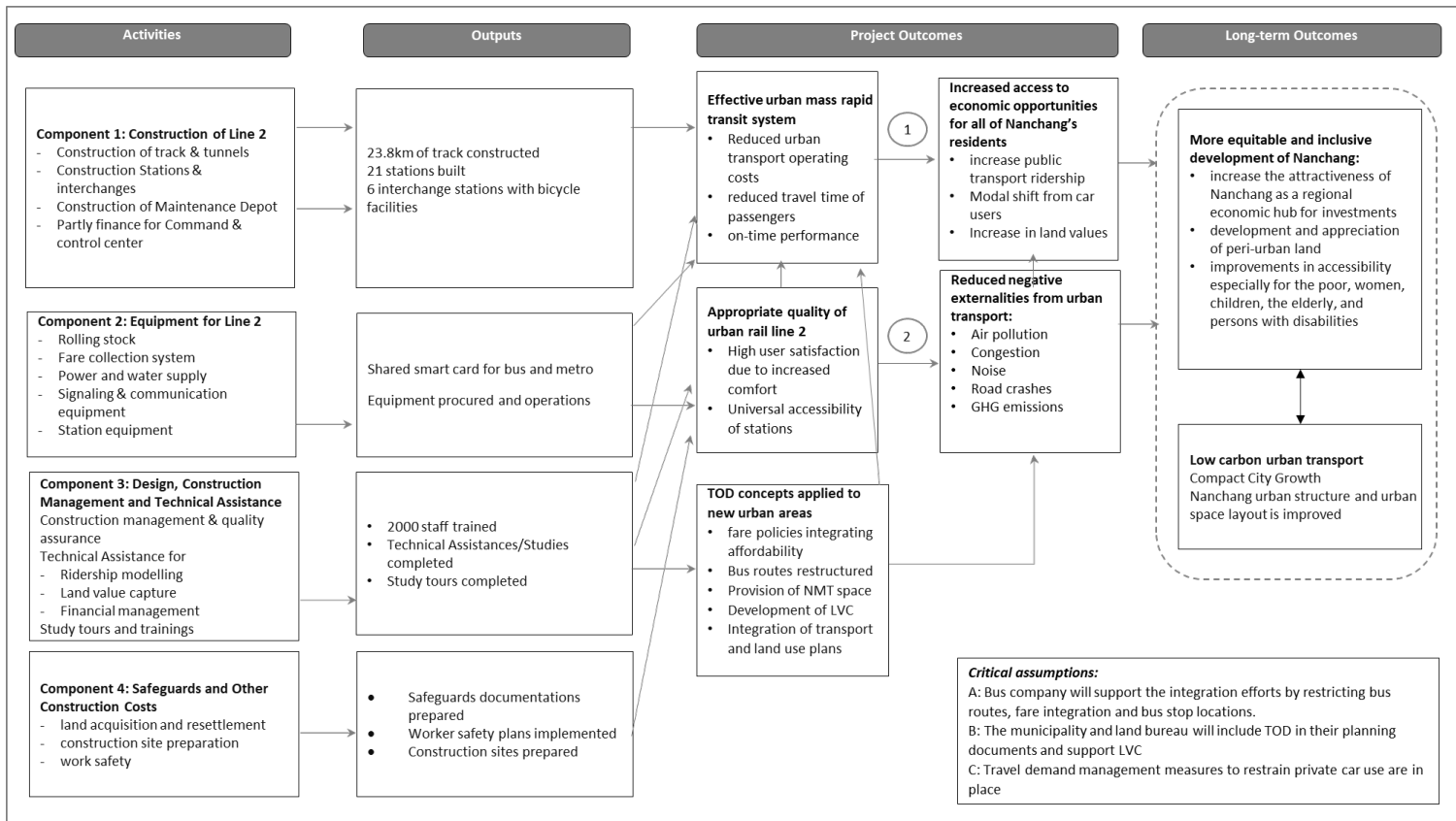
- This approach was consistent with the World Bank Group's 2013-2016 Country Partnership Strategy (CPS) for China's strategic theme 1: *Supporting Greener Growth*, specifically goal 1.3 *Promoting low-carbon urban transport*.** Piloting institutional and technological innovations that have potential for scale up in cities throughout China, such as public transport integration, TOD, travel demand management (TDM), and sustainable municipal financing mechanisms was an important aspect of the CPS. At appraisal, the Bank was supporting urban transport improvements in about 30 of China's 700 cities including smaller cities, where there is weak institutional capacity. In Nanchang, the Bank can help strengthen urban transport planning, institutional coordination, infrastructure financing and asset management, multimodal integration and accessibility to set the stage for sustainable, low-carbon urban transport development. The Nanchang urban rail line 2 provides safe, clean and affordable transport services to a broad range of urban citizens, in line with the Bank's transport strategy at appraisal which focuses on 'safe, clean, affordable' transport services to serve as anchors for development.

### Theory of Change (Results Chain)

- The Theory of Change predicated that the civil works and associated equipment implemented under this project would create an effective, high quality urban rail asset for Nanchang.** Line 2 will reduce travel time, increase public transport ridership, and through high quality features result in user satisfaction. Significant improvement in the quality of public transport services (i.e. speed, flexibility, comfort, cleanliness, and safety) as well as reduced travel cost will also attract the car-owning households to shift to the urban rail system.
- The direct beneficiaries of the project are the individuals who live, work or commute along the catchment area that Line 2 will serve (about 506,000 in 2020).** Public transport users will experience significant improvement in mobility and accessibility to jobs and urban services in terms of speed, safety and commuting quality. Nanchang residents benefit from the project as a result of a slowdown in the growth rate in passenger car use. This will reduce the negative externalities caused by private car traffic (principally GHG emissions, air pollution, congestion and traffic accidents). Businesses in the catchment area will also benefit from improved accessibility.
- In the longer term, such improvement in transport infrastructure will improve the attractiveness of the city as an economic hub for the region, attracting investments and creating opportunities for residents.** Line 2 will enable a direct transit connection between the new HSR station, the new Central Business District on the west side of the river, the existing city center and the existing rail station. This will help integrate a variety of critical modes of transport at both urban and regional scales, providing benefits to long distance and regional passengers.



**Figure 2: Theory of change**



**Project Development Objectives (PDOs)**

11. The Project Development Objective (PDO) is to provide an effective urban mass rapid transit system of appropriate quality along the Line 2 corridor from ZhanQianNanDaDao Station to XinJiaAn Station.

**Key Expected Outcomes and Outcome Indicators**

12. The PDO indicators were:

Outcomes	Indicators
<b>PDO 1: Effective urban mass rapid transit system</b>	Ridership level compared to forecast: Passenger trips per weekday
	Travel time for users measured at peak time (expected wait + travel), between 3 O/D pairs along line 2, by bus before opening of line 2 and by urban rail after opening
	Proportion of urban rail commuters along Line 2 with access to a car, measured by surveying public transport users along line 2 before opening and 1 year after opening
<b>PDO 2: Urban mass rapid transit</b>	Proportion of users that rate the service as satisfactory on average or better



system of appropriate quality	by gender in passenger satisfaction survey on line 2 one year after opening
-------------------------------	---

13. Intermediate results indicators were used to monitor
- i) the progress of construction activities (tunnels and stations)
  - ii) level of integration with bus/ bike (facilities, routes and payment)
  - iii) accessibility of stations
  - iv) number of Technical Assistance studies (TAs)

**Components**

Component	Description	Financing allocation at Appraisal (US\$ million)
<b>Component 1: Construction of Line 2</b>	This component includes all construction activities for 23.8 km of track and 21 stations of the Urban Rail Line 2 which connects western and eastern Nanchang. The Bank is financing civil construction Contract No.5, 6 & 7 which include 8 stations and 8 tunnel sections. The stations include three interchange stations with the planned Line 3 and future Line 4, and an interchange with Nanchang east railway station. The project contributes partially to the cost of a command and control center for the urban rail network.	IBRD: 249.37 Borrower: 889.67  Total: 1139.04
<b>Component 2: Equipment for Line 2</b>	This component includes all the equipment necessary to the successful operation of Line 2 such as rolling stock, power supply, control system, signaling system, communication system, monitoring system, fare collection system, safety and security system, ventilation and air conditioning system, water supply, sewerage and fire protection system, and station auxiliary equipment.	IBRD: 0 Borrower: 624.99  Total: 624.99
<b>Component 3: Design, Construction Management and Technical Assistance</b>	This component includes all activities for design and preparation of the project; construction management and quality assurance as well as technical assistance (TA) and capacity building to relevant staff in NM and the URC. The TAs include: <ul style="list-style-type: none"> <li>○ ridership modeling, scenario testing, fare integration</li> <li>○ land value capture around stations, and</li> <li>○ financial management and internal audit functions for the Nanchang URC</li> </ul>	IBRD: 0 Borrower: 185.48  Total: 185.48
<b>Component 4: Safeguards and Other Construction Costs</b>	This component includes land acquisition and resettlement costs, construction site preparation (environmental mitigation measures) as well as other project related construction costs such as engineering insurance, work safety assurance, inspection and acceptance, and project cost estimation.	IBRD: 0 Borrower: 370.65  Total: 370.65
<b>Subtotal Project costs (including IBRD front end fee, contingencies, interest and working capital)</b>		IBRD: \$ 250 Borrower: \$2,321.23
<b>Total Project Cost</b>		<b>\$2,571.23</b>



## B. SIGNIFICANT CHANGES DURING IMPLEMENTATION (IF APPLICABLE)

### Revised PDOs and Outcome Targets

14. The PDO remained unchanged throughout the project implementation.

### Revised PDO Indicators

15. While the PDO Indicators were not changed, the results framework was adjusted to reflect changes in the implementation schedule and the revised plan to open Line 2 in two stages: (i) one sub-indicator was added on travel time savings along the Stage I section of Line 2 between HSR Station and Metro Mansion Station; (ii) ridership target was updated for Stage I opening; (iii) timeline was updated in accordance with the latest construction schedule

### Revised Components

16. The components were not changed during the project.

### Other Changes

17. The project was restructured on August 17, 2018 to extend the loan closing date by 14 months to December 31, 2019 to allow for completion of all Line 2 activities and amend the results framework.

### Rationale for Changes and Their Implication on the Original Theory of Change

18. The restructuring did not affect the projects theory of change. The main reasons for the delay in implementation were:

- i) Issues with utility relocation
- ii) Parallel construction of Metro Lines 3 and 4
- iii) Resettlement of commercial entities along Line 2.

## II. OUTCOME

### A. ASSESSMENT OF RELEVANCE OF PDOS AND RATING

#### Bank Strategy

19. **The PDO is aligned with the new China Country Partnership Framework (CPF) 2020-2025.** Its engagement area 2, “supporting greener growth”, which includes *2.5 promoting low-carbon transport and cities* aims to mitigate GHG emissions and environmental impacts from transport through integrated planning of transport and urbanization. Relevant CPF indicators include *Increased public transport ridership* as well as *Cities incorporating TOD strategies into their future urban and transit plans by 2022*. The Intervention Logic of this objective specifically mentions “Projects that promote public transit and demonstrate good practice that can be replicated will be supported”. The construction of urban rail promotes compact city growth and multi-modal integration that support greener urban growth. By supporting China’s shift to low-carbon transport, the project also meets the capital increase conditions of contributing to global public goods.

20. **There has been an evolution of the Bank engagement in urban transport in China.** Prior to FY07, the Bank support for roads was in 100% of the projects, decreasing to 54% in FY12-16. During FY12–16, metro projects were about 23% of the urban transport portfolio. Specifically, six urban transport



projects promoted TOD: Zhengzhou Urban Rail (P128919), Kunming Urban Rail (P117656), Tianjin Urban Transport Improvement (P148129), GEF China Sustainable Cities (P156507) and this project. The Bank used its leverage from transport infrastructure financing to catalyze institutional changes towards more sustainable urban development in China, as exemplified by this project.

21. **In line with the new CPF, the project also helped the institutional strengthening through capacity building, operational and administrative advice, and support for planning and policies funded by the counterpart.** The project approach also reflected policy recommendations from the World Bank's joint flagship study on 'Urban China' (2014). The Bank's 'China Systematic Country Diagnostic (SCD) 2017' prioritizes the reduction of disparity in access to public services, mitigation of climate change and air pollution, and promotion of green growth, which are in line with developing a high-quality public transport system. China has learnt from projects like Nanchang and applies Bank policies on similar projects without Bank financing. The experiences are also very relevant for the Bank's engagement in other countries that look to learn from China on public transport infrastructure construction and urban transit development, especially TOD and station development as evidenced by Nanchang hosting a delegation of Indian officials to discuss and learn about urban rail development.
22. **The PDO is also well aligned with the Bank's global efforts in promoting low-carbon urban transport and its new global transport strategy as expressed in the Sustainable Mobility for All initiative by accelerating the shift to public transport.** The transport sector is a major contributor of energy consumption and GHG emissions in China.<sup>5</sup> Its share continues to increase with the highest growth rate among all sectors (+20% in recent five years from 2012 to 2017). With rising incomes, steady urbanization and soaring motorization passenger travel in China is expected to continue growing exponentially, without strong investment and policy shifts in favor of low carbon transport modes such as urban rail. Besides providing accessibility benefits, how urban mobility is planned and operated is critical to guide growth, as the inter-linkages between transport infrastructure and the built environment establish path dependencies, mobility patterns, and settlement, which ultimately can impact mitigation options.<sup>6</sup>

### **Country Strategy**

23. **The PDO remains highly consistent with China's long-term urbanization strategy and 13<sup>th</sup> FYP (2016-2020).** Chapter 29 in the FYP aims to "develop better modern comprehensive transportation systems" by promoting efficient, integrated, low carbon, smart and safe transportation services. In its chapter 34, the FYP aims to "construct harmonious and pleasant cities". Specific to urban rail networks the plan aims to accelerate its construction in cities with a population of more than 3 million, and building more than 30,000 km of urban rail connections.<sup>7</sup> Since the beginning of the 13<sup>th</sup> FYP, more than 100 cities have formulated plans for construction of urban rail and more than 40 cities are operating at least 2 lines<sup>8</sup>. The total length of rail transit operated has

<sup>5</sup> The transport sector accounted for 11% of total carbon emissions in China in 2018. Data source: GIZ, CATS

<sup>6</sup> Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

<sup>7</sup> F. Strompen. May 2016. China's 13th Five-Year Plan – An Outlook for the Transport Sector, on <http://sustainabletransport.org/13-five-year-plan/>

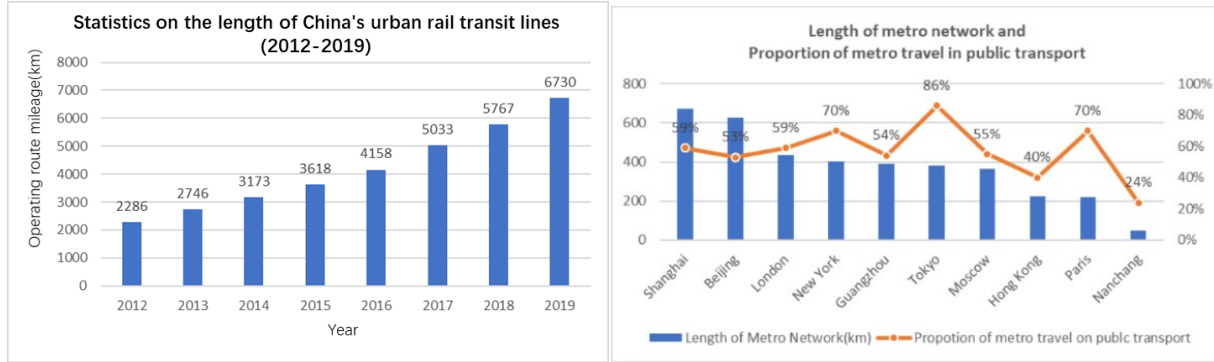
<sup>8</sup> Urban Rail Transit Present Situation and Future Development Trends in China: Overall Analysis Based on National Policies and Strategic Plans in 2016–2020 in Urban Rail Transit (2018)





increased from 2,286 km in 2012 to 6,730 km in 2019, with an average annual growth rate of 16.7%.<sup>9</sup>

Figure 3: Statistics Urban Rail in China



Source: GEF 2020: Rail Transit TOD Planning and Design for Nanchang

- 24. **Approaching the end of the 13th FYP, almost 60% of China’s population is living in cities and the motorization rate keeps growing exponentially.** An additional 300 million people will be moving to China’s cities by 2030, taking the country’s urbanization rate to about 70%. This will require new urban planning approaches and institutional capacity building, particularly in secondary cities. Therefore, the government of China issued the New Urbanization Plan (2014-2020) to guide local governments to develop more ‘compact, green, smart, human and transit-oriented cities. It also highlighted the need for accelerating the development of mass transit, such as urban rail and bus rapid transit (BRT), to build an integrated low-carbon urban transport system. In 2015 the Ministry of Housing and Urban-Rural Development (MOHURD) issued guidelines on the planning and design of areas along urban rail transit, which are essentially TOD guidelines covering three levels of planning: (i) urban planning; (ii) route planning; and (iii) station planning and design.
- 25. **The project also supported the low carbon transport path needed for China to meet its Nationally Determined Contribution (NDC)** which targets a 60-65% reduction in carbon intensity by 2030, compared to 2005. GHG emissions from the transport sector continue to grow at a faster rate than other sectors, adding urgency to the development of low-carbon transport. Although the PDO does not include GHG emission reduction, the project contributed to promoting efficient land use aligned with public transit and supported Nanchang’s transition to low-carbon development by avoiding a shift to private mobility modes and urban sprawl.

**Local Strategy**

- 26. **The PDO also remains highly consistent with Nanchang’s urban development priorities.** As of October 2019, the population of the city was 5.36 million, with an urbanization rate of 75% projected to reach 83% by 2030. The number of private cars in Nanchang has reached 1.17 million, at an average annual growth rate of 13% from 2013 to 2019. Nanchang’s social and economic development, coupled with the expansion of the city’s scale and increase in travel distances, will continue to put pressure on the urban area<sup>10</sup>. Therefore, urban rail development continues to be on top of Nanchang’s agenda for infrastructure development, with

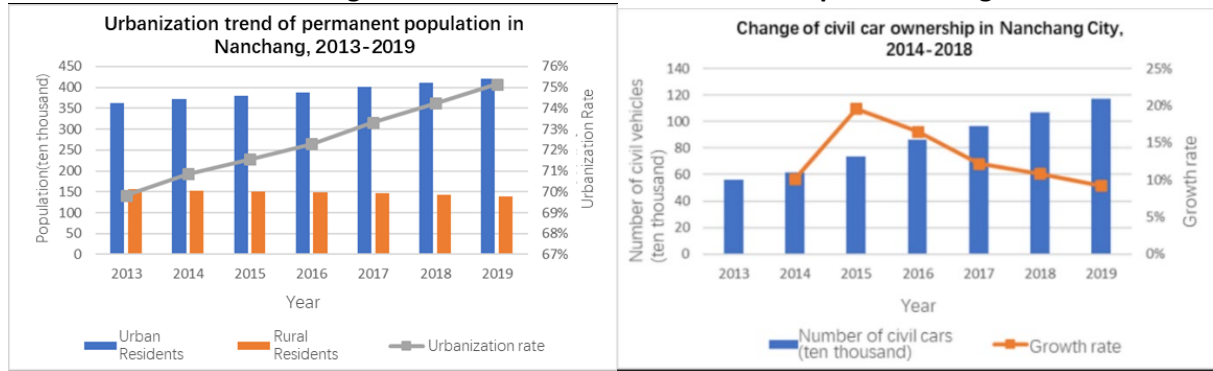
<sup>9</sup> GEF 2020: Rail Transit TOD Planning and Design for Nanchang

<sup>10</sup> Second phase of Nanchang urban rail transit development Plan (2015-2021)



support from both the provincial and the national level. The second phase of urban rail transit in Nanchang (2015-2021) includes the east extension of Line 1 and the south extension of Line 2 as well as extensions for line 3 and 4. At the end of December 2019, the rail lines under construction in Nanchang include the first phase of line 3 and line 4, with a total length of 68.29km and 51 stations<sup>11</sup>.

Figure 4: Urbanization and Car Ownership in Nanchang



Source: GEF 2020: Rail Transit TOD Planning and Design for Nanchang

**Relevance of Design and Implementation**

- 27. **The Urban Rail Line 2 has become the backbone of Nanchang’s urban transport network** connecting the Eastern and Western part of the city, a new government complex, two major railway stations, sport and cultural centers to the rest of the city. Line 2 is the main passenger transportation channel for the new and old cities of Changbei and Changnan and several business districts, which eases the pressure of urban cross-river traffic, and at the same time guides the efficient development of the urban spatial layout. The Bank loan financed a few, but key stations that facilitate good intermodal integration and were the technically most complex stations to build, providing lessons for other stations and lines.
- 28. **TOD and Land Value Capture (LVC) are powerful tools capable of driving China’s sustainable urban development.** However, the lack of coordination between the financing and planning of transit projects and nearby property developments means that the land-value increments are often not effectively captured and redistributed. Therefore, the projects approach in better integrating transport and land use planning as well as using development based LVC is highly relevant for NM to increase the sustainability of urban rail construction. The projects lessons on the financing of transit and TOD are also important to enhance national policy guidelines which feed into future urban and transit plans in China and were also captured in an international guidebook on LVC<sup>12</sup> for a global audience. This approach is also supported by the GEF Sustainable Cities Integrated Approach Pilot Project (GEF SCIAP) which chose Nanchang as one of its pilot cities, based on the Banks engagement through this project.
- 29. **Most of the design features were appropriate for the fact that urban rail systems compete effectively with car transport only when well-integrated** with other modes of transport and coupled with policies

<sup>11</sup> Second phase of Nanchang urban rail transit development Plan (2015-2021)

<sup>12</sup> Suzuki, Hiroaki, Jin Murakami, Yu-Hung Hong, and Beth Tamayose. 2015. Financing Transit-Oriented Development with Land Values: Adapting Land Value Capture in Developing Countries. Urban Development Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-0149-5.



that restrict car use. While multi-modal integration was central to the projects approach, the implementation of car restriction activities and TDM was not part of its scope. In addition, to achieve a more inclusive development, extensive consultation with economically disadvantaged groups has been conducted to inform project design and implementation. While the metro fare is affordable to low income groups, an analysis of the project's impact on low income groups was not conducted.

- 30. **The PDO remains highly relevant to China’s priorities and to the Bank’s development strategies.** As additional evidence, according to the PMO the alignment of line 2 was very well chosen since it went back to normal quickly after the COVID-19 pandemic and the line will be further extended to serve more of Nanchang’s urban population. The relevance is therefore rated as high.

## B. ACHIEVEMENT OF PDOs (EFFICACY)

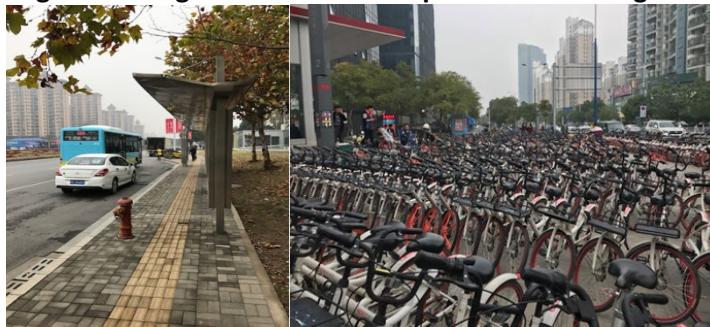
### Assessment of Achievement of Each Objective/Outcome

- 31. While the PDO was to provide an effective and high-quality urban rail line, the underlying desired outcome was to improve overall transport quality and accessibility along the corridor where the metro lies. Therefore, the evaluation of the project outcome will first evaluate the 2 aspects of the PDO (effective and high quality transport) and use additional evidence for the project’s broader outcomes in terms of TOD and infrastructure financing.

#### **PDO 1: Effective urban mass rapid transit system – Rating: substantial**

- 32. **URC has completed the construction of all 23.8 km of Line 2** (from ZhanQianNanDaDao Station to Xinja’an Station), 21 underground stations, tunnels, tracks, parking lots and maintenance sections, as well as the procurement, installation and commissioning of all rolling stock systems and operating supporting equipment. Line 2 was revised to open to traffic in two stages, of which Stage I (ZhanQianNanDaDao to Metro Central Station) opened on August 18, 2017, and Stage II on June 30, 2019 with a one-year delay.
- 33. **Transport modal integration contributed to the effectiveness of the urban mass rapid transit system.** Line 2 was integrated with other modes of urban transport such as buses, other metro lines and NMT by (i) ensuring that station designs incorporate the land required for physical interchanges with other transport modes (ii) conducting an accessibility assessment of all stations along line 1 and 2 to improve seamless transfers and safe crossings around and movement within stations and testing the design with people of reduced mobility and (iii) the development and implementation of a Bus-Rail Integration Plan.

**Figure 5: Integration with Bus Stop and Bike Parking Area**





34. **The primary outcome indicator was the average daily ridership after six months of operation.** With the full opening of Line 2 in June 2019 average daily passenger volume quickly reached 189,500 rides, an increase of 1.5 times compared with the 76,100 rides in Stage I. According to the statistics of the operating company, by October 2019, the average daily passenger ridership exceeded the target of 200,000, reaching 206,800 6 months after Stage II opening. In addition, the average daily passenger volume of Line 1 increased by about 6.6% because of Line 2 transfers. The total passenger volume of Lines 1 and 2 reached 508 million passengers and has potential for development which is why the lines are being extended.<sup>13</sup> Ridership on buses also increased due to better integration which the Bank has supported through TA and examples from international experience.
35. **Travel time on public transport modes along Line 2 corridor,** considering factors such as traffic congestion during peak hours, bus transfers, walking time to the station and waiting time at the station was the second indicator for PDO 1. The indicator was monitored along three Origin destination (OD) pairs and met or exceeded its target values at all three monitored sections. In addition, in September 2019, the travel interval of Line 2 was shortened from 8 minutes to 6 minutes and 30 seconds.
36. **The percentage of urban rail commuters along Line 2 with access to a car was used to measure how effective the system was to attract car users to public transit.** The target was to attract 15%, while the project achieved to attract 39.9% passengers to urban rail whose household own a car in 2019. Survey participants indicated that they gave up their private cars and switched to line 2 because it is more affordable, faster and comfortable to ride. This indicator also shows the quality of the systems since users that have the option to use a private car will only use public transport if it provides better quality of service. According to the latest survey in 2018, public transport mode share rose from 13.5% at preparation to 16.4% of total urban trips, including 13.2% by bus and 3.2% by metro. This also evidences the mid-term outcomes of increasing access to economic opportunities for Nanchang's residents while reducing traffic congestion through increase public transport ridership and a modal shift from car users.

**PDO 2: Urban rail system of appropriate quality – Rating: substantial**

37. **Line 2 provides high quality transit service conforming with international standards, as evidenced by significantly reduced travel time, excellent service reliability and very high user satisfaction.** The user survey contains 7 criteria, namely the comfort level in the train, service quality, transfer convenience, travel information service, waiting environment, riding comfort and waiting time. Due to coordination efforts between URC, the traffic police, the urban bureau and bus company to improve universal accessibility of stations, the satisfaction ratio for universal access facilities increased from 82.97% in 2019 to 91.30% in 2020 and the satisfaction ratio for integration/ease of transfer increased from 77.84% in 2019 to 89.47% in 2020. Overall user satisfaction with line 2 quality at project closure was 92.45% for males and 92.98% for females, exceeding the original target of 80%. The high quality standard is also evidenced by the high number of private car owners who switched to metro.
38. **All stations of Line 2 are air conditioned and designed for universal access for the disabled and elderly.** Barrier-free facilities are provided with elevators that directly pass through the station hall and seamlessly connect with the surrounding municipal road barrier-free facilities. Station design and facilities were reviewed and tested with people of reduced mobility, to address shortcomings before and after station opening. Other

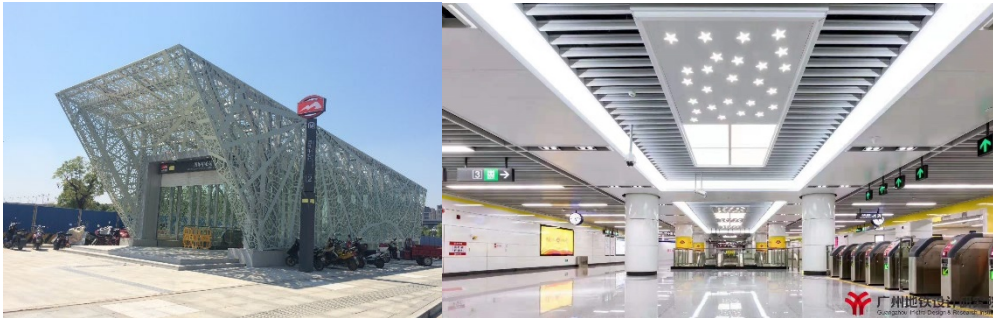
<sup>13</sup> New metro development plan Nanchang Urban Rail Transit Phase II Construction Planning Adjustment (2020-2025)



quality elements not measured by indicators that were achieved include:

- Gender aware design: Some large stations are equipped with baby diaper change boards and have feeding rooms for women. The bathroom facility ratio men to women was adjusted to 1:2.
- Culturally informed design of station environment: Station decoration incorporates regional culture and the surrounding environment improves pedestrian experience
- Line 2 also adopted energy-saving and environmentally friendly measures such as natural ventilation shafts, acoustical dampers LED lights, energy saving escalators and higher vibration reduction measures.

Figure 6: Station design Line 2



39. **The project also contributed to the establishment of a solid foundation for TOD, going beyond the PDO of providing an effective urban rail line.** Nanchang URC worked with the urban planning department to identify opportunities along the metro network for up-zoning to support a compact city development with dense, mixed land use development along the entire alignment for the metro. The Bank supported capacity building measures for government officials, helped review the detailed designs of TOD schemes and engaged the planning department in these discussions. This helped URC to plan, design and develop several TOD sites along Line 1&2 (Metro Mansion Station, Times Square Complex, Bayi Square Station and Qingshanlukou). According to the new metro development plan, more than 700,000 m<sup>2</sup> of property projects in subway communities such as Zhongshan Road and Jiaoqiao Parking Lot have been initiated. This not only improves the accessibility around metro stations and captures more ridership, but also generates more revenue from property development for URC to support metro development. While the TOD process was slow at project start due to policy constraints, the government now places more attention to TOD and is developing a city-wide TOD framework applicable to the entire urban rail network. Although many of these activities are beyond the control of this project, the follow-up engagement under the GEF SCIAP project will further support TOD development in Nanchang.
40. **The projects supervision and the TA recommendations on complete street design, LVC and TOD schemes helped achieve second order benefits such as reducing GHG emissions and sustainable infrastructure financing.** Most of the world's urban mass transit systems cannot cover operating costs through fare box revenues, let alone capital expenses. Therefore, financial mechanisms to capture land value have been recommended by the World Bank such as the development of retail facilities above and below ground; real estate development near stations and land transfer fees. NM adopted the development based LVC<sup>14</sup> financing

<sup>14</sup> Development-based LVC is a value creation exercise rather than a simple sale of public land or lease of land use rights. Unlike taxes and fees, development-based instruments capture land value increments by selling or leasing land, development rights, and air rights. Under such schemes, governments, transit agencies, developers, and landowners jointly increase land values by exploring development opportunities of transit station areas and sharing increments in land values



method to recoup land value increments generated by its metro investment to pay for some of the construction and operating costs. URC real estate subsidiary will obtain long-term revenues by developing the commercial space below and above ground at metro stations - different from the traditional one-time land transfer fee. URC is following similar approaches with the construction of Line 3 which prevents urban sprawl and therefore rising GHG emissions from increased travel distances.

### Justification of Overall Efficacy Rating

41. **Nanchang's Line 2 is an effective and high-quality urban rail system.** The project achieved all its PDO indicators, surpassing several of them by a significant margin. In addition, the project contributed to compact urban development and introduced sustainable infrastructure financing mechanisms to Nanchang. The efficacy is therefore rated as substantial.

## C. EFFICIENCY

42. **At appraisal, a cost benefit analysis (CBA) was carried out for the physical investment components of the project.** The estimated investment covers construction, equipment, safeguards and other construction costs of the project and accounts for 90.2 percent of the proposed total project cost at project appraisal. The economic internal rate of return (EIRR) for the project was estimated as 9.6% and the net present value (NPV) at 8% discount rate was estimated to be RMB 3,339 million at appraisal. The sensitivity analysis assumed a 50% increase of investment costs, halving traffic growth rates from 2018 to 2030, and excluding external benefits. The worst case scenario resulted in an EIRR of 7.1%, showing that the project was economically robust.
43. Three types of benefits were measured for the Nanchang Metro line 2:
- changes in user benefits for metro passengers, measured as savings in travel time net of any change in fares, together with any benefits from more frequent service and reduced transfers
  - changes in operating costs of urban transport measured as cost for the metro net of the change in urban bus network operating cost as well as the operating costs of car users who transfer to metro
  - changes in the external costs of the urban transport system, including accident, congestion, air pollution and GHG emission costs
44. At project completion, the investment analyzed accounted for 85.8 percent of total project investment and the following the adjustments were made for the CBA:
- The project life was shifted according to the extended closing date from 2020 to 2049.
  - The final cost of the project was significantly lower than estimated in at appraisal.
  - The economic efficiency was reevaluated considering changes in the economic and social context: updated population, employment and GDP projections and a ridership ramp-up period.
45. The NPV of the total net economic benefits of the project at completion is estimated to be 8 billion RMB with an EIRR of 11.93%. The benefit-cost ratio (BCR) is 1.6. Under the sensitivity analysis the project's EIRR reduces to 9.2% showing that even in the worst case scenario the EIRR is higher than the discount rate.



**Results of the Ex-Post Economic Analysis**

Components	Baseline			Sensitivity Analysis (halving traffic growth rates from 2017-2030)			Sensitivity Analysis (50% cost increase)			Sensitivity Analysis (excluding external benefits)		
	NPV (mln RMB)	EIRR	B/C Ratio	NPV (mln RMB)	EIRR	BCR	NPV (mln RMB)	EIRR	BCR	NPV (mln RMB)	EIRR	BCR
ICR	8,000	11.93%	1.60	4,476	10.48%	1.34	3,163	9.20%	1.17	2,127	9.21%	1.16
PAD	3,339	9.6%	1.21	1,162	8.6%	1.08	-2,590	7.1%	0.9	-1,698	7.1%	0.89

**Design and Implementation Efficiency**

46. The project was prepared and appraised in only 11 months from identification (July 2012) to Board approval (June 2013) and implemented over six years. The first disbursement took place within one month of project effectiveness. The planned schedule for start of operations in 2017 was set too tight, requiring a 14-months extension of the original loan closing date. The project had some procurement/contract management issues which reduced the loan disbursement and the procurement rating was downgraded to moderately unsatisfactory before the restructuring due to the persisting delays on processing claims.
47. However, the PDO and planned activities were fully completed by the revised closing date with only 85% of the planned funds. The project extension did not negatively affect efficiency since overall cost decreased and half of the line was put into operation as scheduled, resulting in an EIRR over 4% higher than at appraisal. This is an indication of implementation efficiency since the costs of most urban rail projects are underestimated and the actual cost is on average 45 % higher than the original estimate.<sup>15</sup> Factors that lead to cost savings include the strong supervision support from the safeguards team, optimization in technical design and an effective implementation organization.

**Assessment of Efficiency and Rating**

48. **The projects EIRR of 11.93% is relatively high for an urban rail project** considering that the World Bank Urban Rail Development Handbook, 2018 suggests that complex metro projects can be supported with EIRRs even lower than 8 % taking into account other factors including poverty reduction and access to jobs, land values, reducing energy intensity and improvements in economic growth due to a concentration of economic activity and the facilitation of business connections. Efficiency is therefore rated as substantial.

**D. JUSTIFICATION OF OVERALL OUTCOME RATING**

49. The PDO was well aligned with national and local priorities and relevant to the China CPF. The project fully achieved its objective of providing an effective and high-quality public transport system. The project’s EIRR was 4% higher at completion, resulting in the following ratings:

Category	Rating
Project relevance	High
Project efficacy	Substantial

<sup>15</sup> Pulido, Daniel; Darido, Georges; Munoz-Raskin, Ramon; Moody, Joanna. 2018. The Urban Rail Development Handbook. Washington, DC: World Bank <https://openknowledge.worldbank.org/handle/10986/30392>



Project efficiency	Substantial
Overall project	Satisfactory

## E. OTHER OUTCOMES AND IMPACTS (IF ANY)

### Gender

50. **All benefits achieved via the project benefited both women and men.** Transport literature indicates that women often make more complicated journeys and use more public transport than men which is why the projects focus on public transport integration benefits female travelers.<sup>16</sup> The URC’s approach was also gender orientated. During project design the URC ensured there were enough women participants to public consultations. The station design included revised provision ratios of male and female bathroom facilities in all stations and diaper changing at stations based on its projected passenger profile. The passenger satisfaction survey conducted to measure indicator 4 of the result framework ensures that women are well represented as respondents. According to the survey results, female users of line 2 give a high rating to safety and security aspects and a slightly higher rating than men in terms of overall satisfaction. The Bank also advised that considerations for women (like chained trips) and vulnerable groups should be incorporated into the fare policy.

### Institutional Strengthening

51. **The project helped not only financing physical infrastructure, but also introduced advanced project management practices** including construction management, international bidding and contracting, safeguards and performance measurement. Due to successful project implementation, Nanchang gained substantial experience on these topics important for any large-scale infrastructure project financed by an international financial institution loan. Due to the initially limited experience of the PMO, trainings on all aspects of project implementation and support and advice was provided during the bi-annual supervision missions. TA and capacity building measures directly financed by the project improved management practices and understanding of low carbon city development. The project also helped improving the cooperation between agencies such as bus and metro companies as well as urban planning and transport departments. In total 13 capacity building programs for the technical staff of the municipal agencies and the PMO team were conducted and 2,000 people participated in the trainings. A few examples of capacity building activities and study tours completed are:

- International Workshop on “Land Value Capture for Transit” whose results were captured as part of a Guidebook on LVC for Transit<sup>17</sup> and shared with TransFORM, the China-World Bank Knowledge Hub
- TOD Property Inspection visit to Japan Rail Transit
- Joint seminar in Urumqi on smart urban transportation and professional housing development
- China Rail Transit Property Development Seminar in Chengdu
- Environmental and social management and monitoring training

52. **Strong leadership by the mayor and vice mayors facilitated interdepartmental coordination and cooperation.** NM established the Nanchang Railway Transit Group (NRTG), wholly city owned, to build and operate the metro system. To better leverage the private sector’s expertise, NRTG set up a special property management division

<sup>16</sup> Leaders in Urban Transport Planning (LUTP) training program reading materials, Cluster 7: Social and Environmental issues. Module 4: The Socio-economic Dimensions of Urban Transport. 2012. The World Bank Group

<sup>17</sup> Suzuki, Hiroaki, Jin Murakami, Yu-Hung Hong, and Beth Tamayose. 2015. Financing Transit-Oriented Development with Land Values: Adapting Land Value Capture in Developing Countries. Urban Development Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-0149-5.





with key staff recruited from the private sector to manage all real estate assets owned by the company. It also acts as a key liaison between government agencies to coordinate their planning and reviews metro and bus investments and projects. This was advised by the project team and is very valuable for the ongoing construction of urban rail lines in Nanchang.

### Mobilizing Private Sector Financing

n/a

### Poverty Reduction and Shared Prosperity

53. A high-quality public transport system with affordable service connectivity to economic opportunities contributes to economic growth and poverty reduction. Empirical evidence illustrates that well-planned TOD increases accessibility to jobs and other development opportunities for people with lower incomes, whose mobility largely relies on public transit and NMT<sup>18</sup>. As cities grow horizontally, transport costs increase for the lower income groups on the city periphery given the longer distances to reach their desired destination. Line 2 connects the outer areas to the urban core where health care, jobs and education are mostly located. In addition, design for universal accessibility targets vulnerable users such as people with disabilities, elderly and pregnant women.
54. The metro is also a relatively cheap and fast commute option which is enhanced through its physical integration that minimizes vertical and horizontal distances when transferring between rail and other modes. Line 2, like all metro lines in Nanchang, offers discounted fares for special groups such as students and the elderly. However, the lack of indicators that disaggregates ridership by income groups makes an evaluation of beneficiaries difficult. No Poverty and Social Impact Analysis (PSIA) was carried out during system and corridor planning to assess the distributional and social impacts of the line on low-income and other vulnerable groups.

### Other Unintended Outcomes and Impacts

n/a

## III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

### A. KEY FACTORS DURING PREPARATION

#### Project Design

55. **The project had a relevant objective, realistic indicators and clearly structured components.** This simple design was suitable given the complexity of urban transport projects and the clients unfamiliarity with World Bank projects. The Bank financing was dedicated 100% for infrastructure under component 1 because with only three work contracts it was easier to manage for the Bank and the client. Nonetheless, the Bank supported multimodal integration, TOD and the strengthening of urban transport institutional aspects through the deep engagement with the client throughout the project. However, since the counterpart financed all TAs, it might have reduced the Banks influence on the implementation of some TA recommendations such as the fare policy.
56. **The project benefited from a strong leadership by NM.** A project leading group (PLG) chaired by the Vice

<sup>18</sup> Pulido, Daniel; Darido, Georges; Munoz-Raskin, Ramon; Moody, Joanna. 2018. The Urban Rail Development Handbook. Washington, DC: World Bank <https://openknowledge.worldbank.org/handle/10986/30392>



Mayor has been established by NM comprising senior officials from relevant municipal agencies and the Bus Company to oversee the preparation and implementation of the project. They met regularly to resolve coordination issues between the metro and national railway company, as well as utilities, which ensured the smooth implementation of construction works. In addition, the PLG lead the coordination for TOD for which land use and zoning changes require support and approval from the planning and land administration department. Issues related to bus route optimization and multimodal integration were also discussed during the PLG meetings to clarify the respective responsibilities of various agencies.

### **Adequacy of Risk Assessment**

57. **Analysis of risks during project preparation and their mitigation measures were appropriate.** The overall implementation risk rating was substantial due to the PMO's first engagement with the Bank, the technical complexity of urban rail construction, the need for institutional coordination and a tight schedule. Specific risks identified as Substantial included those related to client capacity, lack of counterpart funds, stakeholder coordination and complexity of stations design and construction. The project established mitigation measures such as training on Bank policies, establishment of a PLG to coordinate the various municipal agencies, a thorough fiscal capacity assessment and a construction risk management system.
58. **Social and Environmental safeguard risks were adequately identified as Substantial due to the large project scale in an urban setting.** The project is located in a densely populated area to provide direct accessibility for a large part of the urban population and therefore incorporated intensive and frequent public participation and information disclosure activities. In addition, the geographical location along and across the Gan River, together with geotechnical and hydro-geological difficulties create engineering challenges, and potentially significant safety concerns. The environmental and social impact assessment (ESIA) addressed these challenges in an integrated way through screening and scoping, alternatives analysis, impact analysis, the development of mitigation measures, public consultation, and thorough monitoring.

### **B. KEY FACTORS DURING IMPLEMENTATION**

59. **URC faced multiple challenges in construction management and coordination.** This was only the second metro line in Nanchang and URC is inexperienced in managing large and complex infrastructure projects. As the result, they failed to coordinate utility relocation and traffic diversion in an effective manner, which led to implementation delays. Due to this delay, the project had to be extended by 14 months and the metro line opened in two stages. The revised timeline was agreed at the MTR in October 2016 and the restructuring was completed in August 2018. In order to ensure that the new timeline for the opening of Stage II was met, the Bank hired an experienced engineer from Beijing Metro to assist URC with construction management and sequencing. The decision to open the Western section of line 2 first, allowed to capture part of the project benefits already since 2017 and partially mitigated the negative economic impact from the overall delay in opening the entire line.
60. **URC was unfamiliar with procurement and contract management procedures of the World Bank.** URC did not adequately process the claims and contract variations resulting from the delays on the part of URC (resettlement, utility relocation, etc.), price increase in building materials and other policy changes (environmental restrictions). It also did not foresee other institutional challenges such as the



coordination with the railway sector. Therefore, URC took tunneling under the Nanchang Railway Station, construction of Qingshanlukou Station and tunneling of the Fu-Ba section out of the Bank-financed contract and hired a separate contractor to make up for the construction delays. The TT made the timely settling of claims a top priority. Subsequently, URC developed a timeline for settling each claim, streamlined its internal procedures and hired an experienced fiduciary expert to settle the remaining claims in accordance with the contract terms. However, some of these claims were not resolved at the writing of the ICR.

61. **NM established a coordination mechanism for multi-modal integration, which is critical for an urban rail system to achieve its potential as a mass transit mode.** URC, in consultation with all concerned agencies, prepared the Line 2 Integration Plan and worked with the Bus Company to develop the bus route optimization plan. The PLG was maintained throughout project implementation to coordinate multi-agency activities. URC's primary focus on delivering on schedule for Stage I resulted in some shortcomings in accessibility and integration. These shortcomings were identified during the Bank's site visit and corrected prior to the Stage II opening, as evidenced by the user satisfaction survey results described in paragraph 37.
62. **URC introduced innovative financing mechanisms for urban rail development through LVC.** The project provided capacity building for NM and URC on TOD and LVC. URC was proactive to explore opportunities in applying lean international best practices to the local context and incorporated engineering features in its station design which accommodate future development on top of the stations. Its real estate subsidiary implemented two successful TOD sites along the Line 2 alignment, which can generate long-term revenue to support urban rail construction and operations. Due to these activities and engagements, Nanchang was selected as one pilot city under the GEF SCIAP program.

## IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

### A. QUALITY OF MONITORING AND EVALUATION (M&E)

#### M&E Design

63. **The M&E framework was designed concise and simple with few but well-chosen indicators.** While the 4 PDO indicators encompassed all outcomes of the PDO, the 7 intermediate indicators mostly covered the construction process and integration aspects in component 1 but did not measure any outputs from component 2 and 4 (financed by counterpart, but within the scope of the project). The indicator on urban rail passengers with access to a car was innovative and well-chosen since it captures both the effectiveness and quality of the urban rail system. The indicator could also be used to measure the reduction of GHG emissions from modal shift to public transport.
64. The Theory of Change indicates that the investments in urban rail in the longer term will lead to a more compact and transit-orientated urban development along the Line 2. However, evidence supporting the incorporation of TOD related activities as part of the project activities was not included in the M&E system. This made it difficult to assess the Bank's contribution in providing guidance on developing TOD in Nanchang and to capture the project's achievements on this important aspect. In addition, an indicator on the number of people benefiting



from improved accessibility such as percentage of low income people within 500m of metro stations or number of jobs accessible to them within a 45- or 60-minutes could have been used to evaluate the projects impact on inclusive development.

#### M&E Implementation

65. The PMO regularly provided Bank missions with data and information that allowed the TT to make judgments on progress toward achieving the PDO and the project's overall implementation. This information was consistently reported on by the Bank in Aide-memoires and Implementation Status and Results (ISRs) reports.
66. The M&E framework was updated during the restructuring in 2018 to reflect changes in project implementation. A sub-indicator was added on travel time savings along the Stage I section of Line 2 between HSR Station and Metro Mansion Station, the ridership target was updated for Stage I opening and the timeline was updated in accordance with the latest construction schedule. The opportunity was missed to include an indicator to measure TOD which may have affected the dialogue with the municipality on the importance of transport and land use integration.

#### M&E Utilization

67. The information collected was useful in assessing the progress on project implementation. Data collection did not pose an undue burden and will probably be continued after project closure. The Passenger Satisfaction Survey was conducted by URC on an ongoing basis to evaluate metro operations and inform improvement proposals. The TA on ridership modelling helped the URC in the preparation of independent, updated ridership forecasts that allow for a more refined analysis of critical variables that support metro ridership, including the level of bus and rail integration, changes in fares, pace of land development and the impact of restrictions on car use. This is crucial for the future monitoring of project outcomes.

#### Justification of Overall Rating of Quality of M&E

68. The overall quality of M&E is rated high.

## B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

#### Environmental Safeguards

69. **The project was classified as Category A due to the scale of civil works and potential environmental and social impacts from construction and operation of a metro line in an urban context.** Bank policies OP/BP 4.01 on Environmental Assessment and OP/BP 4.11 on Physical Cultural Resources were triggered given the potential risk of impact from tunnel excavation during construction and vibration during operation. The EIA, EA and ESMP reports were disclosed in Infoshop and on the website of the URC in February 2013.
70. Two rounds of public consultations including expert consultations, questionnaires, and interviews were conducted with the different stakeholders during EIA preparation. The environmental impacts of primary concern identified through the consultation include the physical cultural heritages, vibration, spoil and safety issues in either construction or operation stages. These potential impacts were carefully addressed through mitigation measures in project design, alignment optimization and construction management.
71. Due to the PMOs inexperience with Bank's safeguards policies, environmental management



responsibility was built into the project management structure, with dedicated staff. The PLG ensured the necessary commitment and functioned as an effective platform for communication between the institutions to help improve their actions to implement the mitigation measures and mobilize the necessary resources. The project also conducted the first Cumulative Impact Assessment (CIA) for an urban rail project in China and assessed the significance of valued ecosystem components. This led to enhanced mitigation measures during design which would have been too expensive or disruptive to adopt during operations.

72. **The overall environmental safeguards performance was rated highly satisfactory and recognized by the Bank as a best practice for an urban transport project.** EMP requirements were incorporated in bidding documents and contracts and the construction sites were well organized. Good practice in worker and community health and safety was maintained, and there were no reports on human worksite accidents. At the project site, the URC put resources into strengthening its own and the capacity of contractors in risk and safety management and designed and carried out a four-layer structure of institutional arrangements to ensure continued good noise and vibration monitoring and control of the early warning system.

#### Social safeguards

73. **The project triggered the Bank Involuntary Resettlement policy OP/BP 4.12** and a comprehensive assessment of project-affected people (PAP) was carried out and a Resettlement Action Plan (RAP) was prepared. The RAP and the RPF were disclosed at the URC in January 2013 and in Infoshop in February 2013. The resettlement work started in April 2013 and the demolition of private houses and concerned resettlement work was fully completed by August 2014 and the enterprise structures by the end of 2017.
74. Altogether 1344 urban families, 130 enterprises and 41 rural families were affected and 170,468.13m<sup>2</sup> of land was acquired. Multiple mitigation measures such as cash compensation and resettlement relocation housing were provided to the displaced families. Due to the project 27% of affected families gained an improvement of their living environment. The total cost of implementing the RAP was US\$ 514 million – more than twice the amount estimated at appraisal (US\$ 193 million), funded entirely by the client.
75. **The final World Bank supervision mission concluded that the social safeguards are satisfactory.** The relocation of the No. 28 High school was selected as best practice for the World Bank Urban Rail Handbook due to its measures mitigating disruption to commuting habits and classroom schedules. The 9 external monitoring reports confirm the satisfaction of the PAP with the process. According to the PMO report, they also applied the Bank's compensation and resettlement concepts for line 3 and 4 which are already completed and received high satisfaction ratings by the PAP.

#### Procurement and contract management

76. **At appraisal the procurement capacity assessment rated procurement risk as moderate.** The key risks identified include: (i) the domestic practice of inviting bids on the basis of preliminary rather than detailed designs; (ii) inaccurate cost estimates; (iii) delays in processing procurement due to differences between Bank and domestic procurement guidelines; and (iv) inadequate contract management practices. In order to ensure a smooth procurement cycle, the Bank worked closely with the client at all stages, including the following risk mitigation measures: (i) the appointment of a procurement agent with World Bank experience; (ii) selection of a consulting firm by the URC to review all civil work designs; (iii)



hands-on and just-in-time training of URC procurement staff; (iv) a procurement management manual; and (v) a procurement plan that contained only a few large contract packages.

77. The World Bank loan of US \$ 250 million was used for civil works at 8 sections from Yangming Park Station to Xinja'an Station (Stage II) and divided into 3 contract packages. All contracts were signed in December 2013 using advance procurement, only two months after project effectiveness. While the contracts were procured in a timely manner, the client was slow in reviewing, responding and handling the claims. The Bank requested that a Dispute Resolution Board should be established, and an experienced contract expert should be hired to help URC to handle the claims. However, both recommendations have not been implemented.
78. Procurement during project implementation was rated Moderately Unsatisfactory in 2018 but upgraded to moderately satisfactory before project completion. During project implementation, the original scope of the contracts financed by the Bank loan was reduced leading to a lower withdrawal rate. For Contract No.: HG2013-2B-TJ-006 the works for the section from Dinggonglunan Station to Nanchang Railway Station were changed to be financed by counterpart funds, in Contract No.: HG2013-2B-TJ-005, the Qing-Fu Section was taken out from the original scope and the amount for Contract No.: HG2013-2B-TJ-005, was reduced by CNY62,593,205. These three major reductions amounted to USD 14 million and the Bank issued no objection to the amendments in 2016.

### **Financial Management**

79. Prior to appraisal, the project's financial management (FM) system was assessed as meeting the Banks requirements stipulated in OP/BP 10.02. The FM capacity assessment identified the following principal risks: (i) the PMO is new to Bank projects; (ii) since the Bank loan accounts for only about 10% of total investment, management of counterpart funds might not be as strict as the Bank loan creating reputational risks; and (iii) the internal audit unit is only staffed with two people with a limited scope of work. Mitigation measures, to address the risks, included: (i) FM/disbursement training (formal and ad hoc) to project staff; (ii) close monitoring and guidance from the Nanchang Municipal Finance Bureau; (iii) use of the PMO's existing FM system with uniform FM requirements applied for both Bank loan and counterpart funds; and (iv) a capacity building activity within the TA component to strengthen the internal audit function within URC.
80. Except for some minor delays in reviewing and processing the physical progress certificate and interim payment request, the project maintained adequate financial management arrangements throughout the project. The interim financial reports were submitted on time, and annual financial reports were audited and came out as "unqualified". Overall, the FM performance of the project was satisfactory.

## **C. BANK PERFORMANCE**

### **Quality at Entry**

81. The development of the project concept benefited from the World Bank's understanding of the national sector context and priorities developed over decades of successful collaboration with Chinese cities. Lessons learnt from the Bank's portfolio of urban transport projects especially the importance of physical and service integration of public transport with other transport modes which depends significantly on the effective coordination among different line agencies have been integrated. Since it was only the second urban rail project



in China and the Kunming project had just started during project appraisal, lessons from its implementation could not be considered.

82. Environmental and social safeguards as well as the procurement plan were prepared diligently, with extensive consultation. This is remarkable given the clients unfamiliarity with World Bank policies showing the Banks strong support at preparation. Drivers of success included a procurement strategy driven by market analysis of contractor capacity, effective communications between Bank and Client, the PMOs willingness to learn and apply knowledge transferred by the Bank, effective coordination between the Bank team members and very quick processing of internal clearances.
83. Technical, financial, and economic analyses for project appraisal were well developed and detailed. The PMO benefitted from the Bank's inputs on engineering, policy and institutional aspects, and in the development of innovative tools and methodology to forecast urban rail demand. NM, URC and the Bank discussed international and domestic practice to improve track alignment, station design and urban planning as part of project preparation. In addition, project preparation entailed detailed discussions with URC and NM regarding the needs for municipal financial contributions for Line 2. A financial model was developed to determine the project's financial sustainability.

#### **Quality of Supervision**

84. During project implementation, the Bank team monitored implementation progress and compliance with FM, procurement, and safeguards guidelines closely through biannual implementation support missions (11 in total). Mission findings were candidly documented in Aide Memoires and the project ratings in the ISRs were appropriate.
85. Technical advisory support provided by the TT and its consultants were well appreciated by the client, as indicated in the borrower's ICR. During project implementation the TT continued to emphasize the importance of transport integration. The project consultants conducted a field survey of stations open in Stage I with interviews of pedestrians to assess station accessibility, level of security, intersection conditions, comfort and availability of sidewalk facilities. The TT presented the issues identified to the URC management and ensured that corrective measures are taken prior to Stage II opening. In addition, the TT leveraged the Banks TOD engagement in over 30 cities to support Nanchang's TOD program. The recommendations for improvements in urban design to create a walkable environment around stations have been adopted by the client.
86. Due to exchange rate fluctuation, procurement savings and removal of activities from the original works contract, there were about \$60 million loan savings. Despite efforts made by the Bank to use the remaining funds to support implementation of TOD or public transport integration, the savings were eventually cancelled upon client's request. While the project delay was largely outside of the TT's control, they could possibly have been reduced had the TT more proactively discussed the issues with local and provincial authorities during the first years of project implementation. The Aide-Memoire from the final Implementation Support Mission is missing. Due to worldwide COVID-19 related travel restrictions the ICR mission was conducted virtually from September 27<sup>th</sup> to 29<sup>th</sup>, 2020.



### Justification of Overall Rating of Bank Performance

87. The Bank's value added was not limited to the urban rail infrastructure itself but also in terms of advanced project management procedures, economic and financial analysis, safeguards policies, contract management processes, policy dialogue, and innovative approaches to urban planning as indicated by the borrower during the ICR mission. The overall rating of the World Bank performance is therefore rated Satisfactory.

### D. RISK TO DEVELOPMENT OUTCOME

88. **Long-term financial sustainability** of the urban rail system requires substantial and continued resource allocation by NM to maintain the quality of the rail line. Therefore, the financial sustainability of the project has been tested under multiple scenarios and even under a pessimistic scenario of low ridership and high operations and maintenance costs, the required contributions to support the project are not expected to exceed 1.2 percent of NM's disposable income. URC has been trained to use the model and is committed to ensure that NM is fully aware of the commitments required to ensure sustained effective operations.

89. **NM aims to maximize revenues from real estate development around the five subway lines by adopting a development-based LVC.** Although Nanchang possesses the preconditions for applying LVC, potential risks include overreliance on land financing that exposes NM to overheated real estate markets, unaffordable housing due to gentrification of transit station areas and lack of public-private experience in jointly delivering property development projects alongside complex LVC procedures.<sup>19</sup> However, rising land prices for mixed use present a favorable condition for adopting development-based LVC. In 2016, Nanchang received a 5 million USD grant from GEF SCIAP, which would support TOD planning at the municipality level, as well as along station of Line 2, and feed into the next version of the Nanchang Masterplan.

90. **Sustainability of achieved high-quality urban rail.** There is little doubt that the city will continue to give its full support to the operations and maintenance of the project infrastructure. Fleet maintenance follows industry standards that include daily, monthly, quarterly, annually inspections. The Bank team gauged URC staff on rail asset management, noting that while the Nanchang Metro is a new system, the URC could face costly asset reinvestment in five to ten years due to asset aging and wear and tear. The Bank's metro specialist gave a presentation on public transport asset management. The URC team indicated during the ICR mission that they are developing a comprehensive information system for asset management.

### V. LESSONS AND RECOMMENDATIONS

91. **The main lessons in terms of the design of bank operations is that infrastructure financing is as a strong lever for institutional strengthening and sustainable urban development.** The World Bank through projects like this urban rail project in Nanchang is having an influence on broader urban development in China. This can be a model to consider for other higher-capacity countries as the client

<sup>19</sup> Suzuki, Hiroaki, Jin Murakami, Yu-Hung Hong, and Beth Tamayose. 2015. Financing Transit-Oriented Development with Land Values: Adapting Land Value Capture in Developing Countries. Urban Development Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-0149-5. License: Creative Commons Attribution CC BY 3.0 IGO





gains knowledge and the required capacity to institute changes through the Banks advisory support going beyond the construction of a metro line. In addition, as a large-scale urban development project, the resettlement and environmental management of this project accumulated many good practices and experiences. These include strong leadership, professional resettlement staff, meaningful and continuous public consultation, interagency cooperation, functional compliant handling mechanism and timely and continuous monitoring. Best practice notes have been prepared for these aspects by safeguard specialists to be shared with other bank clients.

92. **The successful implementation of an urban rail project is largely dependent on the efficient inter-agency cooperation, which remains a challenge for most cities.** Many of the integration issues facing the urban transport network are not within the URCs jurisdiction, such as land use, parking, bus stop relocation and access. The main lessons learned in rail plus property projects show that when feasibility studies for metro lines are developed, land use around stations should be reviewed and approved as part of the feasibility study process by all relevant agencies. However, the higher implementation complexity of using a different project institutional arrangement that allows the Bank loan to be used not just by the rail company needs to be weighed against its benefits.
93. **Multi-modal integration is critical for an urban rail system to achieve its potential as a mass transit mode.** Full integration requires the simultaneous achievement of three objectives: (1) physical integration (interconnection between different transport infrastructure); (2) operational integration (multimodal service planning); and (3) fare integration (interoperable fare technology as well as comprehensive fare and subsidy policy across the entire transit system). Having these three dimensions of integration is fundamental for maximizing the benefits of accessibility and ensuring long-term sustainability<sup>20</sup>. For seamless intermodal integration to work, effective coordination is required and is in the best interests of the rail operator - requiring sustained effort on its part. In Nanchang a PLG has been established to coordinate among the various municipal agencies for project preparation and implementation, but without implementation authority. Even better would be an urban/metropolitan transport authority which oversees and coordinates all transport activities in the city, taking decisions that facilitate policy integration and long-term changes.
94. **Urban rail projects need to be developed as part of a broader transport and land use strategy to result in changes in the cities transportation system.** To achieve a compact urban development there is the need of having deregulated land use towards higher density and mixed land use along the entire alignment of the metro. New urban rail lines will only deliver premium in property values in their area of influence if it is integrated with the stations and surrounding space, forming a station-centric transportation, housing, catering, shopping, and entertainment and culture space. While higher public transport ridership gives indication of progress on TOD in the short term, these urban developments are planned long term by the city and are difficult to attribute to the impact of one rail line project. The ongoing GEF SCIAP project will be crucial to continue the policy level engagement on TOD in Nanchang and China in general.

---

<sup>20</sup> Pulido, Daniel; Darido, Georges; Munoz-Raskin, Ramon; Moody, Joanna. 2018. The Urban Rail Development Handbook. Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/30392>



ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Objective/Outcome: Effective urban mass rapid transit system

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Indicator One: Line 2 Ridership (Passenger-trips per weekday)	Number	0 31-Jan-2013	200,000 31-Jan-2013		206,800 31-Dec-2019

Comments (achievements against targets):  
Target overachieved

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Indicator Two: Reduced travel time on public transport modes along Line 2 corridor	Minutes	0 31-Jan-2013	22 31-Jan-2013		23 31-Dec-2019



Sub-Indicator One: Reduced travel time on public transport modes along High Speed Rail station to Nanchang Railway station	Minutes	0 31-Jan-2013	25 31-Jan-2013		25 31-Dec-2019
Sub-Indicator Two: Reduced travel time on public transport modes along XinJiaAn station to WoLongShan station	Minutes	0 31-Jan-2013	25 31-Jan-2013		27 31-Dec-2019
Sub-Indicator Three: Reduced travel time on public transport modes along High Speed Rail station to Metro Mansion station	Minutes	0 31-Jan-2013	15 31-Jan-2013		17 31-Dec-2019
<b>Comments (achievements against targets):</b> This is just the umbrella indicator name, not to be evaluated (numbers present the average of the 3 subindicators)					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Indicator Three: Percentage	Percentage	0	15		40



of urban rail commuters along Line 2 with access to a car		31-Jan-2013	31-Jan-2013		31-Dec-2019
<b>Comments (achievements against targets):</b> target overachieved by far indicating high attractiveness of urban rail (also quality indicator)					

**Objective/Outcome:** Quality service

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Indicator Four: Percentage of users that rate the service “satisfactory” on average (also recorded for each gender for reference)	Percentage	0 31-Jan-2013	70 31-Jan-2013		91 31-Dec-2019

**Comments (achievements against targets):**

**A.2 Intermediate Results Indicators**

**Component:** Construction of Line 2

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
----------------	-----------------	----------	-----------------	-------------------------	-------------------------------



Intermediate Result Indicator One: Percentage of construction of stations (in value)	Percentage	0 31-Jan-2013	100 30-Nov-2018		100 31-Dec-2019
--	------------	------------------	--------------------	--	--------------------

**Comments (achievements against targets):**

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Intermediate Result Indicator Two: Percentage of completion of tunnels (in value)	Percentage	0 31-Jan-2013	100 30-Nov-2018		100 31-Dec-2019

**Comments (achievements against targets):**

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Intermediate Result Indicator Three: Level of integration in terms of facilities for bus/rail/bike transfer designed and constructed in line with integration plan	Percentage	0 31-Jan-2013	90 31-Jan-2013	100 14-Aug-2018	100 31-Dec-2019



Comments (achievements against targets):

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Intermediate Result Indicator Four: Level of integration in terms of bus routes reorganized to reflect Line 2 opening	Text	no 31-Jan-2012	plan developed and communicated 14-Jun-2019		routes reorganized 31-Dec-2019

Comments (achievements against targets):

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Intermediate Result Indicator Five: Level of integration in terms of availability of a single payment card for rail and bus	Text	no 31-Jan-2013	Yes 14-Jun-2019		Yes 31-Dec-2019

Comments (achievements against targets):

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
----------------	-----------------	----------	-----------------	-------------------------	-------------------------------



Intermediate Result Indicator Six: Accessibility – percentage of stations with barrier-free accessibility to the wheel-chair bound and sight impaired	Percentage	0 31-Jan-2012	100 14-Jun-2019		100 31-Dec-2019
---	------------	------------------	--------------------	--	--------------------

Comments (achievements against targets):

**Component:** Technical Assistance and Capacity Building

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Intermediate Result Indicator Seven: Number of TAs completed (cumulative)	Text	0 31-Jan-2012	3 14-Jun-2019		3 31-Dec-2019

Comments (achievements against targets):



**B. KEY OUTPUTS BY COMPONENT**

<b>Objective/Outcome 1</b>	
Outcome Indicators	<ol style="list-style-type: none"> <li>1. Ridership level compared to forecast: Passenger trips per weekday</li> <li>2. Travel time for users measured at peak time</li> <li>3. Proportion of urban rail commuters along Line 2 with access to a car</li> </ol>
Intermediate Results Indicators	<ol style="list-style-type: none"> <li>1. progress of construction activities (stations)</li> <li>2. progress of construction activities (tunnels)</li> <li>3. level of integration with bus/ bike (facilities)</li> <li>4. level of integration with bus/ bike (routes reorganized)</li> <li>5. level of integration with bus/ bike (fare policy)</li> </ol>
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	<ol style="list-style-type: none"> <li>1. 23.8 km of rail track</li> <li>2. 21 stations</li> <li>3. equipment and rolling stock</li> <li>4. provision of physical interchange facilities</li> <li>5. introduction of integrated fare payment</li> <li>6. restructuring of bus routes</li> </ol>
<b>Objective/Outcome 2</b>	
Outcome Indicators	<ol style="list-style-type: none"> <li>1. Proportion of users that rate the service as satisfactory</li> </ol>
Intermediate Results Indicators	<ol style="list-style-type: none"> <li>1. accessibility of stations</li> <li>2. number of TAs</li> </ol>
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	<ol style="list-style-type: none"> <li>1. TA to improve ridership modeling and fare setting</li> <li>2. TA on land value capture and integration</li> <li>3. TA on financial management and internal audit functions</li> <li>4. study tours, e.g. Guangzhou, Urumqui, Shanghai</li> </ol>





**ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION**

**A. TASK TEAM MEMBERS**

<b>Name</b>	<b>Role</b>
<b>Preparation</b>	
Gerald Paul Ollivier	Task Team Leader(s)
Guoping Yu	Procurement Specialist(s)
Yi Dong	Financial Management Specialist
Yiren Feng	Social Specialist
Jun Zeng	Social Specialist
<b>Supervision/ICR</b>	
Yi Yang, Antoine Avedis Kunth	Task Team Leader(s)
Guoping Yu	Procurement Specialist(s)
Yi Dong	Financial Management Specialist
Zhefu Liu	Social Specialist
Lien Thi Bich Nguyen	Team Member
Yan Zhang	Procurement Team
Yiren Feng	Environmental Specialist
Ruifeng Yuan	Team Member
Aimin Hao	Social Specialist
Annika Berlin	Team Member



**B. STAFF TIME AND COST**

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US\$ (including travel and consultant costs)
<b>Preparation</b>		
FY13	33.435	347,515.99
FY15	0	0.00
<b>Total</b>	<b>33.44</b>	<b>347,515.99</b>
<b>Supervision/ICR</b>		
FY14	11.970	57,381.76
FY15	11.261	41,727.61
FY16	13.202	54,994.10
FY17	15.727	62,742.55
FY18	19.445	116,577.37
FY19	17.528	103,142.84
FY20	24.446	106,286.77
<b>Total</b>	<b>113.58</b>	<b>542,853.00</b>



**ANNEX 3. PROJECT COST BY COMPONENT**

<b>Components</b>	<b>Amount at Approval (US\$M)</b>	<b>Actual at Project Closing (US\$M)</b>	<b>Percentage of Approval (US\$M)</b>
Component 1: Construction of Line 2	1139.04	957.132	84.03
Component 2: Equipment for Line 2	624.99	347.526	55.61
Component 3: Design, Construction Management and Technical Assistance	185.48	62.268	33.57
Component 4: Safeguards and Other Construction Costs	370.65	674.97	182.1
Physical and Price Contingencies	100.87	0	0
Interest During Construction and Initial Working Capital	147.44	147.44	100
Front-end Fee	.63	.63	100
<b>Total</b>	<b>2,569.10</b>	<b>2,189.962</b>	<b>85.24</b>



## ANNEX 4. EFFICIENCY ANALYSIS

### Methodology at Project Appraisal

Cost-benefit analysis was employed to evaluate the economic viability of the construction of Line 2 of the Nanchang Urban Rail System. The estimated investment mainly covers the construction, equipment, safeguards and other construction costs of the project and accounts for 90.2 percent of the total project cost at project appraisal. The main benefits of the project activities are related to mobility and environmental improvements. They include a) passenger benefits, b) saving in operating costs of urban transport, c) external benefits, such as the reduction in accidents, congestion, noise, pollution, and GHG emissions. Other benefits which are not quantified include improved transport accessibility and compact city growth. The economic costs of the project are capital investment costs, maintenance cost, management expenses, utility, and other. The economic internal rate of return (EIRR) for the project was estimated as 9.6%. The NPV at 8% discount rate was estimated to be RMB 3,339 million. Sensitivity analysis assumed a 50% increase of the investment costs, halving traffic growth rates from 2018 to 2030, and exclusion of external benefits. The worst scenario had an EIRR of 7.1%, indicating that the project economically robust.

A project extension and some adjustments to the result framework were approved in a project restructuring. The PDO of the project remained the same, but some project activities were slightly changed. For example, the construction part of Qingshan Road Intersection Station and Fu-Ba Section was taken out which reduced the contract price to approximately 62.592 million yuan. The economic analysis was not revised for the Restructuring.

### Economic Analysis at Project Completion

The PDO remained the same throughout project implementation. The economic analysis at project completion uses the same methodology as the PAD to estimate the benefits and costs of the project. The investment analyzed account for 85.8 percent of total project investment at completion of the project. Compared to the economic analysis in PAD, the economic analysis in ICR incorporates the following adjustments:

1. The completion of project construction was postponed from October 2018 to December 2019. The project lifetime is now assumed from 2020 to 2049 instead of 2018 to 2047 in PAD. The inflow of the project benefit is delayed for two calendar years while the project investment is distributed over seven years of project construction instead of five years as planned in PAD.
2. According to the monitoring and evaluation indicators, the impact of the project is better than targeted. At the end of project implementation, 1) Line 2 ridership has reached 206,800 passenger-trips/weekday which is higher than 200,000 passenger-trips/weekday as expected, 2) travel time on public transport modes along Line 2 corridor was more significantly reduced than the bottom line set in the targets, and 3) percentage of urban rail commuters along Line 2 with access to a car was significantly higher than expected; the target was to attract 15% car riders of 200,000 trips on urban rail, while the project has already attracted 39.9% of 206,800 urban rail trips in 2019.
3. The final cost of the project is significantly lower than estimated in the PAD which influences the economic efficiency. The main reasons leading to the change in project cost include 1) the competitive bidding procedure during project implementation achieving a lower contract price comparing to



expected at project appraisal; 2) construction activities at Qingshan Road Intersection Station and Fu-Ba Section were removed from the WB-financed contract but nonetheless carried out using counterpart funds; and 3) the exchange rate from RMB to USD increased from 6.2 at project appraisal to 7.0 at project completion. The change in exchange rate influences NPV valued in USD but does not affect the value of EIRR.

## Cost-Benefit Analysis

### *Non-project Scenario*

The baseline is based on the assumption of a “non-project scenario” in which: (a) the city is in shortage of essential public transport services, especially in urban rail and increasing motorization of the city brought increases in traffic congestion, air pollution, fossil fuel consumption, greenhouse gas emissions and road accidents; (b) common transport modes of citizens include walking, bicycle, car, and bus; 67 percent of daily trips are by bicycle or walking; only 13.5 percent of total daily trips are public transport; (c) due to traffic congestion, the speed of travelling is slow and the travel time of the residents is long; and (d) since the unit operational cost of car and bus is significantly higher than rail, the average operational cost of trips in general is high. Considering the traffic demand grows rapidly with economic growth, without rail service it is assumed that the situation will become worse.

### *Project Scenario*

In the project scenario Nanchang’s urban transport system is significantly improved. The urban rail system leads to increased capacity and efficiency of the transport network in the city. The increased availability of transport options benefits all passengers and reduces travel time. Several new public transport users are induced due to access to urban rail. Growth in private car use is slowed down which reduces traffic congestion, air and noise pollution and GHG emissions. Improved traffic flow also reduces road crashes due to the reduced travel on the road network.

Other benefits not quantified in EIRR include the increased comfort of rail and bus passengers, more inclusive development by introducing fare policies that improve affordability. In addition, building Line 2 promotes urban development of especially western Nanchang by applying transit-oriented development concepts to these new urban areas. The land value is increased as a result of better public transport.

## Main Assumptions

1. The evaluated operation period of the project is 30 years from completion of the construction in 2019. The infrastructure is designed to serve for 60 years. 50 percent of residual value is assumed at the end of the analyzed operation period. Rolling stock is assumed to fully depreciate over 30 years of operation. Other equipment needs replacement at the 17<sup>th</sup> year of operation. The discount rate adopted in this analysis is 8% as used in PAD.
2. The traffic demand of the city is largely driven by economic growth and its accompanied economic activities. Economic growth rate is assumed to be 5 percent from 2019 to 2030 and 4 percent from 2031 to 2049 following OECD’s economic outlook for China. Traffic demand growth rate is assumed to be 5.3 percent from 2019 to 2030 and 2.5 percent from 2031 to 2049 as adopted in economic analysis in the PAD. In the non-project scenario, the proportion of the citizens daily trip using bus, rail, bicycle and car in terms of person kilometer was estimated to be 27: 4: 44: 25 for Nanchang in 2020 according to the FSR. The travel mode proportion with the project was projected to be 25: 8: 43: 24. Transfer



from bus to bus, bus to rail, and rail to rail is assumed to be 5 minutes on average in a mode-combined travel option.

Table X.1 Projection of Traffic Demand under Non-project and Project Scenario

Traffic Demand (million pkm/day)		2017	2020	2025	2030	2035	2040	2045	2049
Non- Project Scenario	Rail	3.3	3.8	5.0	6.4	7.3	8.2	9.3	10.3
	Bus	20.5	24.2	31.3	40.5	45.9	51.9	58.7	64.8
	Car	18.8	22.2	28.7	37.1	42.0	47.5	53.8	59.4
	Bicycle	22.1	26.1	33.8	43.7	49.4	55.9	63.3	69.9
	Total	64.8	76.3	98.7	127.8	144.6	163.6	185.1	204.3
Project Scenario	Rail	5.2	6.1	7.9	10.3	11.6	13.2	14.9	16.4
	Bus	19.2	22.6	29.3	37.9	42.9	48.6	54.9	60.6
	Car	18.4	21.7	28.1	36.4	41.2	46.6	52.7	58.2
	Bicycle	22.0	25.9	33.5	43.4	49.1	55.6	62.9	69.4
	Total	64.9	76.4	98.9	128.0	144.8	163.9	185.4	204.6

- Variable operational cost of rail is significantly lower than bus and car which leads to savings in operational cost. Operational cost of rail contains a fixed part and a variable part. The variable operational cost is estimated to be 0.2 RMB/paxkm, including utility cost at 0.2 RMB/paxkm and operating cost at 0.009 RMB/paxkm. Fixed cost is estimated to be 220.2 million RMB per year, including wages and welfare at 183.9 million RMB and other fixed cost at 36.3 million RMB in 2020. Operational cost of bus and car is estimated at 0.4 and 1.1 RMB/paxkm, respectively. The costs for period from 2020 to 2049 will grow with the projected economic growth rate.

Table X.2 Operational Cost of Different Traffic Modes

Operational Cost	2017	2020	2025	2030	2035	2040	2045	2049
<b>Rail</b>								
Variable Cost	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7
Fuel and purchased power	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7
Operating Costs	0.007	0.009	0.012	0.015	0.018	0.022	0.026	0.031
Fixed Cost (mio RMB)	172.8	220.2	274.4	342.0	416.1	506.2	615.9	720.5
Wages and welfare	144.3	183.9	229.2	285.6	347.5	422.8	514.4	601.8
Other costs	28.5	36.3	45.2	56.4	68.6	83.4	101.5	118.8
<b>Bus</b>								
RMB per vehicle*km	6.6	8.4	10.5	13.1	15.9	19.4	23.6	27.6
Occupancy	26.4	33.7	42.0	52.3	63.7	77.5	94.3	110.3
Total Cost (RMB/paxkm)	0.3	0.4	0.5	0.6	0.7	0.9	1.1	1.3
<b>Car</b>								
Fuel cost (RMB/km)	1.0	1.2	1.6	1.9	2.4	2.9	3.5	4.1
Non Fuel Costs (RMB/km)	0.5	0.6	0.8	1.0	1.2	1.4	1.7	2.0
Occupancy	2.0	2.6	3.2	4.0	4.9	6.0	7.3	8.5
Total Cost (RMB/paxkm)	0.9	1.1	1.4	1.7	2.1	2.5	3.1	3.6

- Value of time of passengers is 0.25 RMB/min on average in 2020. The weighted average benefit per



expected rail passenger is calculated as total passenger time saved multiplying average time value and dividing by increased rail ridership brought by the project. The total passenger time saved is estimated based on traffic mode split in project and non-project scenario. The total traffic volume includes riders without the project and the induced passengers by the project. Benefit of passengers is calculated to be 0.63 RMB per rail pax-km. It increases with economic growth from 2020 to 2049. The GDP per capita, average value of time and benefit per passenger used for typical years are listed in Table X.3.

Table X.3 GDP per capita and value of passenger time

	2020	2025	2030	2035	2040	2045	2049
GPD Per capita (RMB)	106439.9	137799.1	178397.3	201840.1	228363.6	258372.4	285194.8
Value of time (RMB/minute)	0.25	0.33	0.43	0.49	0.55	0.62	0.69
Benefit per passenger (RMB/pkm)	0.63	0.82	1.06	1.20	1.36	1.54	1.70

5. The avoided externality cost of bus, car and bicycle are quantified as benefit of the project. The externality considered includes accident cost, congestion, noise, climate change and pollution. The unit externality cost of bus, car and bicycle under each item are estimated based on the World Bank's Social Costs of Transport in China (SCTC) Report in 2009 and incorporated cost growth following economic growth pattern. The total externality cost of the traffic modes is calculated as the estimated unit cost of each traffic mode multiplying corresponding traffic demand for the traffic modes. Detailed value of the unit externality cost used in typical years is listed in table X.4.

Table X.4 Unit Externality Cost of Bus, Car and Bicycle

Externalities (RMB/pax km)		2017	2020	2025	2030	2035	2040	2045	2049
Accident	Bus	0.075	0.096	0.119	0.149	0.181	0.220	0.268	0.314
	Car	0.322	0.410	0.511	0.637	0.775	0.942	1.147	1.341
	Bicycle	0.040	0.051	0.062	0.078	0.095	0.115	0.140	0.164
Congestion	Bus	0.113	0.144	0.179	0.223	0.272	0.330	0.402	0.470
	Car	0.616	0.785	0.973	1.213	1.476	1.795	2.184	2.555
	Bicycle	0.314	0.400	0.487	0.607	0.738	0.898	1.093	1.279
Noise	Bus	0.003	0.003	0.004	0.005	0.006	0.007	0.009	0.011
	Car	0.006	0.007	0.009	0.011	0.013	0.016	0.020	0.023
	Bicycle	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000



Climate change	Bus	0.010	0.013	0.016	0.020	0.025	0.030	0.037	0.043
	Car	0.022	0.028	0.034	0.043	0.052	0.064	0.077	0.090
	Bicycle	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pollution	Bus	0.033	0.042	0.053	0.066	0.080	0.098	0.119	0.139
	Car	0.025	0.031	0.038	0.048	0.058	0.071	0.086	0.100
	Bicycle	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

6. The economic cost of the project is estimated to be 13.363 billion RMB at 2012 prices. Infrastructure investment from 2013 to 2019 happens in the proportion of 10%, 15%, 25%, 25%, 15%, 5% and 5%. Equipment, rolling stock and other investment happened from 2015 to 2019 in at 5%, 10%, 25%, 25% and 35% respectively. Maintenance cost of the rail contains the fixed maintenance cost of 178.8 million RMB per year in 2020 and the variable vehicle maintenance cost at 0.012 RMB/vkm. The operational costs are listed in table X.5.

Table X.5 Maintenance Cost

Metro Maintenance Cost	2017	2020	2025	2030	2035	2040	2045	2049
Variable Vehicle Maintenance	0.009	0.012	0.015	0.019	0.023	0.028	0.034	0.039
Fixed Cost (mln RMB)	140.3	178.8	222.8	277.6	337.8	410.9	500.0	584.9
Vehicle Maintenance	20.0	25.5	31.8	39.6	48.1	58.6	71.3	83.4
Other Maintenance	120.3	153.3	191.0	238.0	289.6	352.4	428.7	501.5

The benefit and cost of the project throughout project operating years is summarized in table X6.





Table X6: Benefit and Cost Summary

Discount Rate: 8% (Unit: million RMB)	PV in 2012	Construction Period							Operation Period						
		2013	2014	2015	2016	2017	2018	2019	2020	2025	2030	2035	2040	2045	2049
<b>Economic Benefits</b>															
a) Operator revenue	4,913	0	0	0	0	17	53	227	430	556	720	815	922	1,043	1,151
b) User benefit	10,578	0	0	0	0	19	64	284	550	887	1,430	1,969	2,710	3,731	4,817
c) Externalities	5,872	0	0	0	0	11	35	157	305	492	794	1,093	1,505	2,071	2,674
Accident	1,808	0	0	0	0	3	11	48	94	152	244	337	463	638	823
Congestion	3,461	0	0	0	0	6	21	93	180	290	468	644	887	1,220	1,576
Noise	42	0	0	0	0	0	0	1	2	4	6	8	11	15	19
Climate	169	0	0	0	0	0	1	5	9	14	23	31	43	59	77
Pollution	393	0	0	0	0	1	2	11	20	33	53	73	101	138	179
<b>Sub-total</b>	<b>21,364</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>47</b>	<b>152</b>	<b>669</b>	<b>1,284</b>	<b>1,935</b>	<b>2,944</b>	<b>3,877</b>	<b>5,136</b>	<b>6,845</b>	<b>8,643</b>
<b>Economic Costs</b>															
a) Capital investment	9,865	1,665	846	1,489	1,995	2,426	1,898	2,034	333	0	0	0	0	0	-2,965
b) Maintenance expense	991	0	0	0	0	6	17	70	127	129	132	134	135	137	139
c) Management expense	1,001	0	0	0	0	6	18	71	129	131	133	134	136	137	138
e) Utility	1,321	0	0	0	0	4	14	60	116	150	194	219	248	281	310
f) Other	185	0	0	0	0	1	3	14	24	24	24	24	24	24	24
<b>Sub-total</b>	<b>13,363</b>	<b>1,665</b>	<b>846</b>	<b>1,489</b>	<b>1,995</b>	<b>2,444</b>	<b>1,950</b>	<b>2,249</b>	<b>730</b>	<b>435</b>	<b>483</b>	<b>511</b>	<b>543</b>	<b>579</b>	<b>-2,354</b>

**Results.** The net present value (NPV) of the total net economic benefits of the Project is estimated to be 8,000 million RMB and the economic internal rate of return (EIRR) of the Project is 11.93%. The benefit-



cost ratio (BCR) is 1.60. Results of the analysis are presented in table X7. Sensitivity analysis assumes a 50% increase of investment costs, halving traffic growth rates from 2020 to 2032, and exclusion of external benefits. EIRR of the whole project reduces to 10.48%, 9.20% and 9.21%, respectively, at different scenarios. The rate at the worst scenario is still higher than the discount rate.

Table X7: Economic Evaluation Summary

Compo nents	Baseline			Sensitivity Analysis (halving traffic growth rates from 2017-2030)			Sensitivity Analysis (50% cost increase)			Sensitivity Analysis (excluding the external benefits)		
	NPV (mln RMB)	EIRR	B/C Ratio	NPV (mln RMB)	EIRR	BCR	NPV (mln RMB)	EIRR	BCR	NPV (mln RMB)	EIRR	BCR
ICR	8,000.3	11.93%	1.60	4476.3	10.48%	1.34	3163.4	9.20%	1.17	2127.8	9.21%	1.16
PAD	3339	9.6%	1.21	1,162	8.6%	1.08	-2,590	7.1%	0.9%	-1,698	7.1%	0.89



**ANNEX 5. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS**

**Approval of ICR by Nanchang PMO upon review without further comments:**

杨怡，

世行项目完工报告已收悉，经我集团各相关部门研究，同意世行ICR报告的总体评价，定稿后会发至各部门参考。

南昌轨道交通集团有限公司  
欧碧微

Dear TTL,

We have received the World Bank's ICR. After the review by different departments of the Urban Rail Company, we agree with the overall assessment of the ICR. We will share it for internal reference by all departments after receiving the final version.

Nanchang Urban Rail Company