

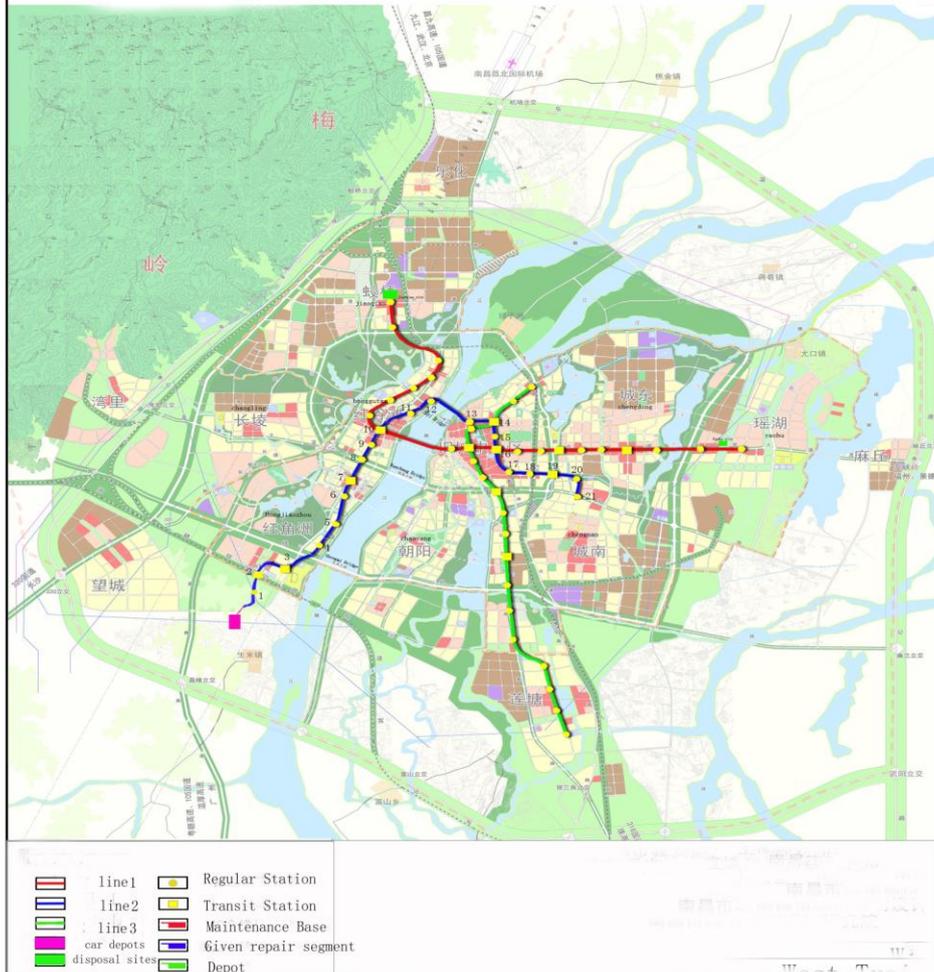
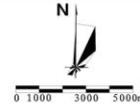
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**Nanchang Rail Transit Line2
Project**

**Environmental
and
Social Management
Plan**

**Environmental Protection Center of Ministry of Transportation Assessment
Certificate of National Environment Assessment: Jia Zi No. 1038
April 7, 2013 Beijing**

Nanchang Urban Rail System BY 2020



- (1) ZhanQianNanDaDao Station
- (2) Nanchang West Train Station
- (3) LongGang Station
- (4) International Sport Center Station
- (5) WoLongShan Station
- (6) LingBeiSanLu Station
- (7) QianHuDaDao Station
- (8) XueFuDaDao Station
- (9) CuiYuanLu Station
- (10) DiTieDaSha Station
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- (13) YangMingGongYuan Station
- (14) QingShanLuKou Station
- (15) FuZhouLu Station
- (16) BaYi Square Station
- (17) YongShuLu Station
- (18) DingGongNanLu Station
- (19) Nanchang Train Station
- (20) HongDuZhongDaDao Station
- (21) XinJiaAn Station

The Planning and Optimization Scheme of Nanchang Rail Rapid Transit Network in 2020

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1 Introduction

1.1 Background of the Project

In recent years, with continuously rapid development of urban economy of Nanchang, the urban area is expanded and the population increases continuously, and with the single-center urban development mode, centripetal radialized traffic flow is formed, which causes severe traffic jam in downtown area and inconvenient connection with peripheral areas, and the condition that “traffic jam and inconvenient to cross over the Ganjiang River” is serious, traffic supply and service level directly affect the new round construction and development of Nanchang. In order to get rid of the current traffic problem and prevent future traffic crisis, the municipal government absorbed successful experiences on solving traffic problems from domestic and abroad big cities, and determined to vigorously develop a public transit with rail transit being backbone and ground traffic being major means of transportation, thus study and planning for rail transit come to consideration. *Nanchang City Planning (2001-2010)* involves the planning of construction of 5 rail transit lines and puts forward the implementation plan of construction of line 1 and Line 2 project within the planning period.

In January 2008, based on *Notice on Strengthening Construction and Management of Urban Rail Rapid Transit* of the General Office of the State Council (GBF [2003] No. 81), Nanchang has entrusted Shanghai City Comprehensive Transportation Planning Institute with *The Plan of Nanchang Urban Rail Transit Network*. In July 2008, the planning was completed and was approved by people’s government of Nanchang in file HFTZ (2008) No. 163. The network planning scheme involves 5 lines with total length being 167.7km, and there will be two comprehensive vehicle bases, two periodically repair sections and three parking lots.

The plan is to construct Line1 phase 1 project and Line 2project between 2009 and 2016, and construct the X-shaped skeleton network composed of Line 1 phase 1 and Line 2 phase 2 in 2016. We will construct Line3 and the second phase of Line 1 and Line 2 between 2016 and 2020, and form the rail transit skeleton network composed of Line 1, Line 2 and Line 3 by 2020. The whole network will be gradually completed from 2020 to the vision years.

According to the network planning revision, Shanghai Tunnel Engineering and Rail Transit Design and Research Institute and Shanghai City Comprehensive Transportation Planning Institute co-compiled the *Nanchang Urban Rail Rapid Transit Construction Planning (2009-2016)*; in July 2009, the planning was approved by National Development and Reform Commission in FGJC (2009) No. 1978 *Notice*

on Printing and Distributing the Reply of NDRC on Immediate Nanchang Urban Rail Transit Construction Planning (2008-2016) (attachment).

According to the planning, a rail transit project with length being 50.6km will be built from 2009 to 2016, which includes line 1 phase 1 project and Line 2 project.

Of which, The total length of Nanchang Rail Transit Line 2 Project will be about 23.78km, and there will be 21 stations which will all be underground stations with average station spacing being about 1.09km. The whole line is set with a comprehensive base which locates at southwest of South Avenue Station.

The project is from Nanchang West Railway Station to Xinjiaan Station, the route will go through the west railway station planning area, the Hongjiaozhou district, the Honggutuan new district, the center of the old town and the eastern district of the city, and it will connect the Nanchang west railway station, the International Sports Center, the College Town of Honggutuan, the Nanchang Central Business District, Yangming Road, Bayi Square, Nanchang Railway Station and some other passenger hubs, which not only connects the core areas of old town and new town, but also covers the most important area of south-north corridor between Changnan old town and Changbei new town.

In February 2010, Nanchang Rail Transit Co., Ltd entrusted Guangzhou Metro Design and Research Institute Co., Ltd with compilation of *Nanchang Rail Transit Line 2 Project Feasibility Study Report (February,2010)*, which is also the design consideration for *Environmental Impact report*.

Meanwhile, *Environmental Impact Report on Nanchang Rail Transit Line 2 Project* which was compiled by China Railway Forth Survey and Design Institute Group Co., Ltd under entrustment of Nanchang Rail Transit Co., Ltd was submitted to Ministry of Environmental Protection for approval; in September 2010, Ministry of Environmental Protection gave official reply to the environmental impact assessment in HS(2008) No. 284 *Reply of the Nanchang Rail Transit Line 2 Project about the Environmental Impact Report* and approved the construction of line 2 in line with measures listed in Environmental Impact Report.

Nanchang Rail Transit Line 2 Project was listed in World Bank Loan Project in 2012, and files such as Environmental Assessment Report (EA) and Environmental Assessment Summary and Management Plan (ESMP) which meet the World Bank's requirements shall be compiled, after being entrusted, through field research and relevant information and data collection, we organized experienced environmental assessment personnel and made supplement and improvement for contents including social impact assessment, cumulative impact assessment, alternative solution analysis, risk analysis, ESMP, immigrant relocation and arrangement and public participation etc which are concerned by the World Bank based on the original environmental impact assessment report approved by the Ministry of Environmental Protection. The compilation of this report was completed in September 2010.

1.2 The brief introduction of the project

Nanchang rail transit line 2 is the rail transit line connecting Changnan old town and Changbei new town, with its route being: South Avenue → West Railway Station → North Avenue → Fenghe Avenue → Chunhui Road → the Ganjiang River → Yangming Road → Bayi Avenue → Luoyang Road → Shunwai Road → Shanghai Road. The total length of Nanchang Rail Transit Line 2 Project will be about 23.78km, and there will be 22 stations which will all be underground stations with average station spacing being about 1.09km. The whole line is set with a comprehensive base which locates at southwest of South Avenue Station. Two 110KV traction substations are set respectively at the Xuefu Avenue station and the Qingshan Road station. Passengers can interchange to line 1, line 3 and line 1 respectively at Metro Mansion Station, Qingshan Road Station and Bayi Square Station.

The environmental protection investment of the project is 1317644000 yuan, and the estimated total investment of the project is 14846032400 yuan, thus the environmental protection investment/capital construction investment is 0.87%.

1.3 The composition of the project

1.3.1 Line

(I) Main technical standard of line

(1) Number of main line: double line

(2) The minimum curve radius of line plane

Main line of section: 300m for general section, and 250m for difficult section.

Auxiliary line: 200m for general section, and 150m for difficult section.

Yard track: 150m.

(3) Maximum grade

30‰ for general section and 35‰ for difficult section

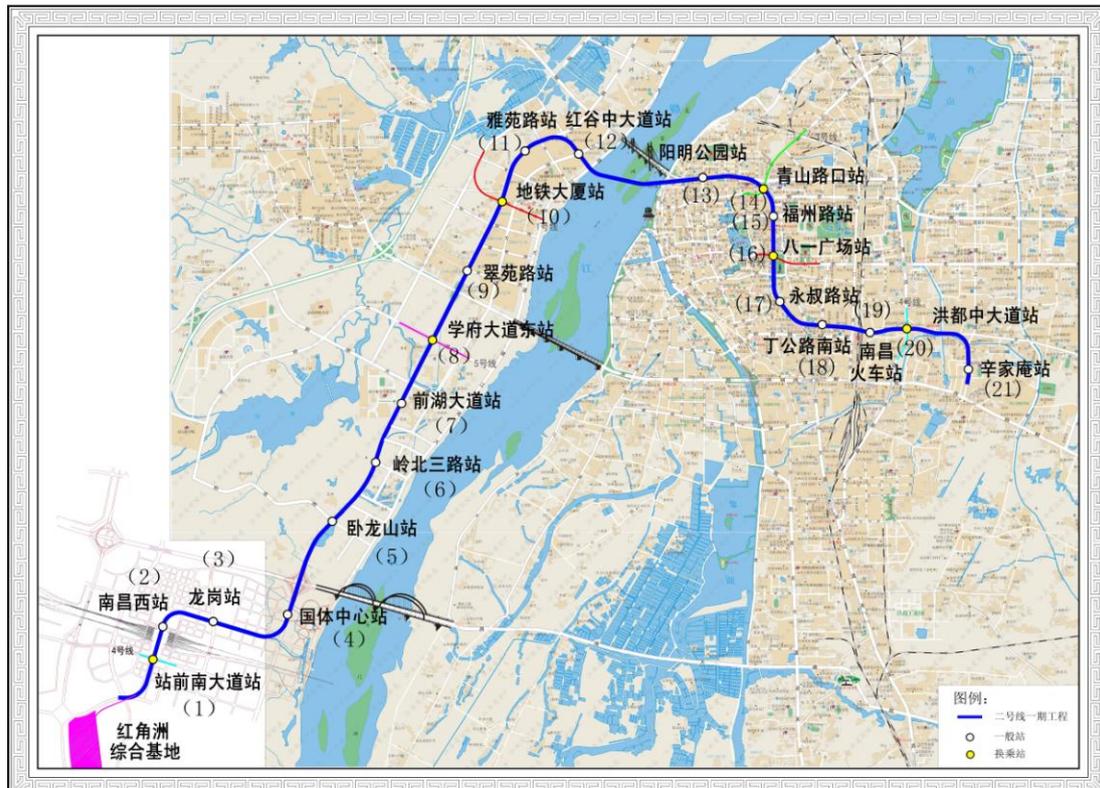
(II) Line route

(1) Main line

Line route: South Zhanqian Avenue Station→West Railway Station→North Zhanqian Avenue→Fenghe Avenue→Chunhui Road→Ganjiang River→Yangming Road→Bayi Avenue→Luoyang Road→Shunwai Road→Shanghai Road. Line route refers to

Figure 1.3-1.

南昌市轨道交通二号线一期工程线路示意图



- | | |
|-------------------------------|--|
| (1) ZhanQianNanDaDao Station | (2) Nanchang West Train Station |
| (3) LongGang Station | (4) International Sport Center Station |
| (5) WoLongShan Station | (6) LingBeiSanLu Station |
| (7) QianHuDaDao Station | (8) XueFuDaDao Station |
| (9) CuiYuanLu Station | (10) DiTieDaSha Station |
| (11) YaYuanLu Station | (12) HongGuZhongDaDao Station |
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| (19) Nanchang Train Station | (20) HongDuZhongDaDao Station |
| (21) XinJiaAn Station | |

Figure 1.3-1 Schematic Diagram for Line Route of Phase I Project of Nanchang Rail Transit Line 2

(2) Connecting line

Connecting line with Line 1 is set at Metro Mansion Station and in northwestern quadrant; connecting line with Line 3 is set at Qingshan Road Station and in northeastern quadrant. Connecting line at Metro Mansion Station has length of about 250m, speed of about 60km/h and buried depth of about 15m. Connecting line at Qingshan Road Station has length of about 450m, speed of about 60km/h and buried depth of about 20.6m. Details refer to Figure 1.3-2 and Figure 1.3-3.

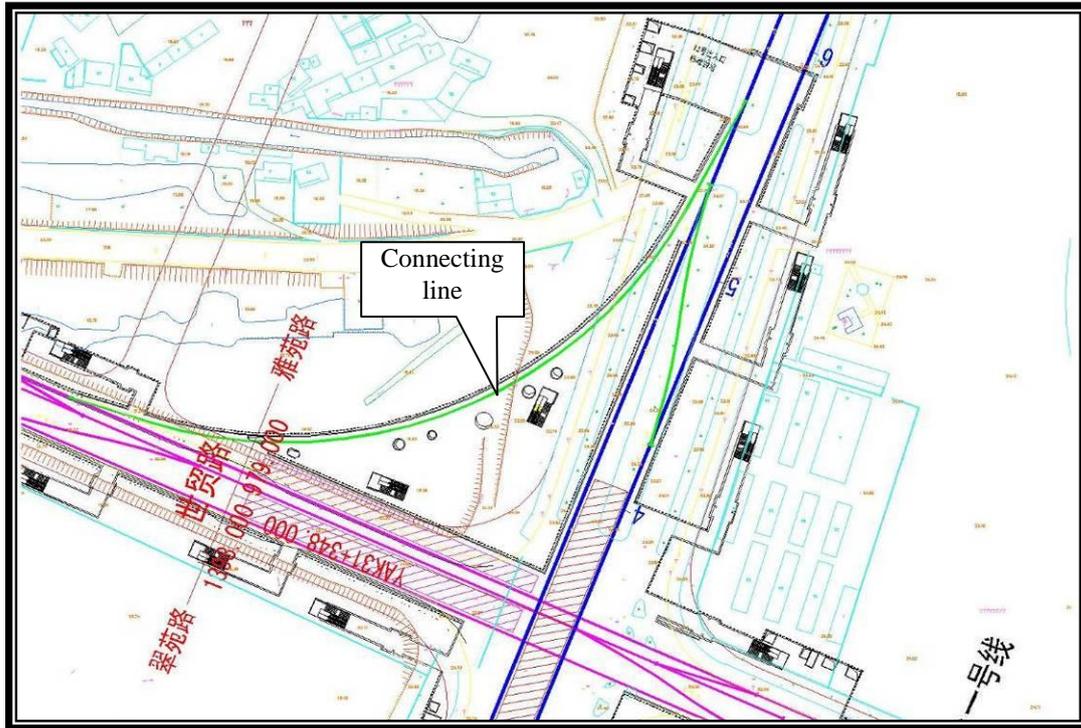


Figure 1.3-2 Schematic Diagram for Location of Connecting Line at Metro Mansion Station

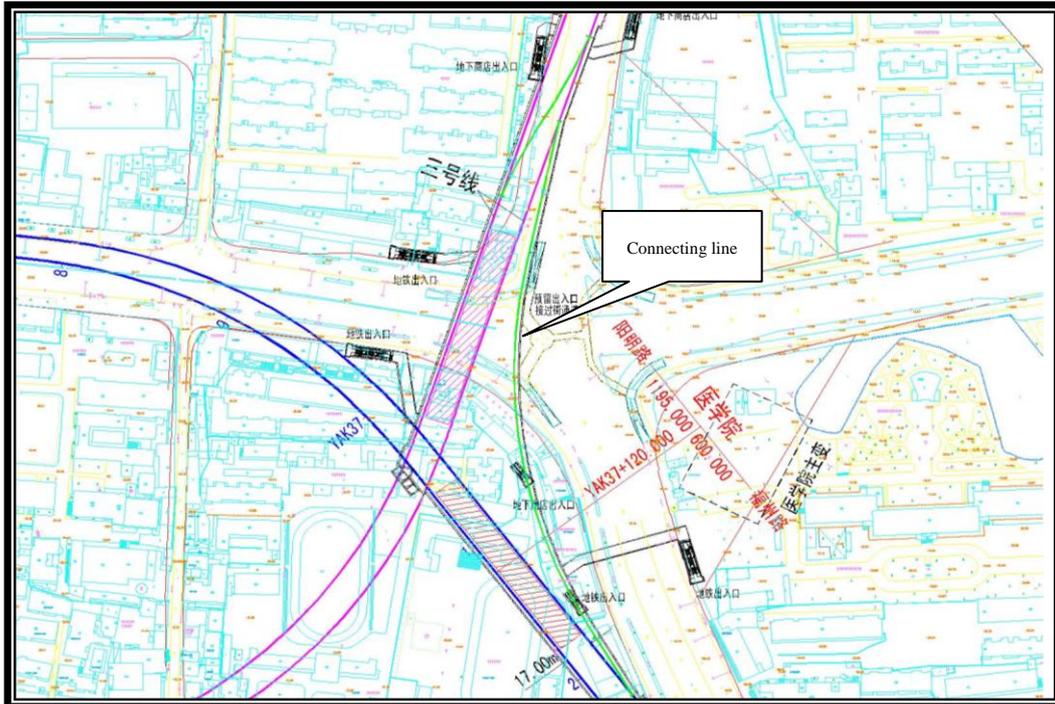


Figure 1.3-3 Schematic Diagram for Location of Connecting Line at Qingshan Road Station

1.3.2 Station

Project of Line 2 sets 21 underground stations in total: South Zhanqian Avenue Station, Nanchang West Railway Station, Longgang Station, International Sports Center Station, Wolongshan Station, No. 3 Lingbei Road Station, Qianhu Avenue Station, Xuefu Avenue Station, Cuiyuan Road Station, Metro Mansion Station, Yayuan Road Station, Hongguzhong Avenue Station, Yangming Park Station, Qingshan Road Station, Fuzhou Road Station, Bayi Square Station, Yongshu Road Station, South Dinggong Road Station, Nanchang Railway Station, Hongduzhong Avenue Station and Xinjiaan Station.

1.3.3 Track

(I) Track gauge: 1,435mm

(II) Steel rail and turnout

Main line, test track and entrance & exit depot line all adopt 60kg/m steel rail and jointless track laying at one time, and yard track adopts 50kg/m steel rail.

Turnout: main line and auxiliary line adopt No. 9 turnout; yard track adopts No. 7 turnout.

(III) Rail fastening

Elastic rail fastening

(IV) Sleeper and ballast bed

Main line: long-sleeper integrated ballast bed structure is adopted.

Yard track: crushed stone ballast bed and concrete long-sleeper are generally adopted outside the yard track depot; integrated ballast bed or integrated ballast bed over inspection pit is adopted in the depot according to technological requirements.

1.3.4 Vehicle

(I) Vehicle type selection

Btype vehicle is adopted.

(II) Size of vehicle

Vehicle body is 19.00m in length and 2.8m in width, height of vehicle body (hoop-drop) is 3.81m.

(III) Traction performance of train

Maximum driving speed: 80km/h

(IV) Marshalling

Marshalling form of six-car metro train including four motor cars and two trailers in initial stage, short-term and long-term, and length of train is about 140m.

1.3.5 Power supply

(I) Power source

Adopt 110/35kV two-step voltage centralized power supply system, set main transformer station exclusively for subway, lead in 110kV power supply of urban power network, and supply power to subway after step-down.

External power supply switching scheme: two special lines of two 110KV power supplies of Xuefu Avenue Main Transformer Station are led from main transformer station in urban area. Installed capacity of main transformer station is designed to be 2×63MVA.

Two special lines of two 110KV power supplies of Medical College Main Transformer Station are led from main transformer station in urban area. Installed capacity of main transformer station is designed to be 2×63MVA.

(II) Main transformer station

Function: two 110kV high-voltage AC power supplies led from urban electricity system are switched to 35kV AC power supplies used by subway power supply system through step-down, subway power supply system network distributes electric energy to each station as well as traction substation and step-down substation in comprehensive base.

According to planning scheme for main transformer station resource sharing of Nanchang rail transit line network, Phase I project of Line 2 sets two above-ground 110kV main transformer stations near Xuefu Avenue Station and Qingshan Road Station. Details refer to Figure 1.3-4 and Figure 1.3-5.

(III) Traction network system

Traction network adopts DC1500V overhead contact line for power supply and running rail return.

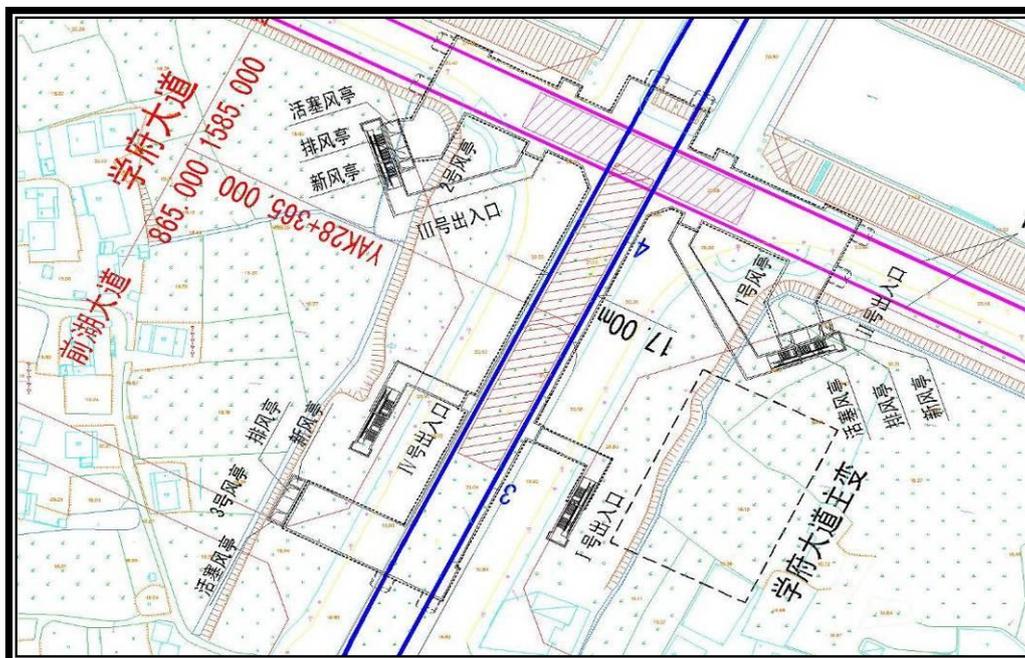


Figure 1.3-4 Schematic Diagram for Location of Xuefu Avenue Main Transformer



Station

Figure 1.3-5 Schematic Diagram for Location of Qingshan Road Main Transformer Station

1.3.6 Ventilation and air conditioning

(1) System mode

Ventilation and air conditioning system with platform screen door is adopted.

(2) System constituent

Ventilation and air conditioning system with platform screen door is mainly composed of tunnel ventilation system and station ventilation and air conditioning system, in which tunnel ventilation system consists of running tunnel ventilation system and heat extraction system at driving area of station; station ventilation and air conditioning system consists of ventilation, air conditioning and smoke extraction system (large scale system for short) in public zone of station, ventilation, air conditioning and smoke extraction system (small scale system for short) in rooms for equipment management, and air-conditioning refrigeration system (water system for short) at station.

Air conditioning system includes air conditioning water system and air system. Air conditioning water system includes chilled water system and cooling water system. Chilled water system is composed of water-cooled chiller unit, chilled water pump, pipeline and corresponding parts and components. Cooling water system is composed of cooling tower, cooling water pump, pipeline and corresponding parts and components. Air system includes air system in public zone of station and air system in rooms for equipment management. Air conditioning system is composed of air treatment box, air handling unit, new fan, return fan/exhaust fan, air pipe, air valve and silencer.

Ventilation system is composed of air blower/exhaust fan, air pipe, air valve and silencer.

Smoke extraction system is composed of smoke exhaust fan, smoke exhaust pipe and valves.

1.3.7 Water supply & drainage and fire protection

(1) Water supply

Water source is from urban tap water network, and two lines of water main are set.

(2) Drainage

Fecal sewage of stations along the line shall be discharged with ordinary domestic sewage into nearby urban sewage system after treatment in septic tank; waste water from fire protection and washing shall be discharged into urban rain water system through natural flow or pumping.

Waste water from car washing in car depot, overhaul and protection technology shall be discharged into nearby municipal supporting pipelines after treatment and coming up to standard.

(3) Fire protection

Fire protection water system is set in stations and fire hydrant system is set in underground sections.

1.3.8 Car depot

Site selection of Hongjiaozhou car depot of Line 2 is located at the east of Nanchang-Zhangshu Expressway at the western end of the line and at southwestern plot of High-Speed Passenger West Railway Station, planning land area of this plot is about 42.11hm², and planning land area of car depot of Line 4 is about 27.8 hm². Current site selection of car depot is mountain land with flat terrain, most of them are dry farmlands, west side of car depot is villages, and there are a few houses within the scope of land usage.

(1) Plane layout

① Entrance & Exit depot line

High-Speed Passenger West Railway Station adopts underground island station. The whole length from starting point (CAK0+000/ RAK0+000) of entrance & exit depot line to end point (CAK2+266/RAK2+269) is about 2.27km.

Underground section: the section from starting point (CAK0+000) of entrance & exit depot line to CAK1+619 is underground section, and the others are underground ones with buried depth of 6-21m.

② General layout

Flip-over layout is adopted. Application depot is combined by three-month examination/double-week examination depot, underfloor lathe depot and parking and train examination depot, and located at west of car depot.

Car washing track is set at entrance & exit depot in the south of joint examination depot, and through car washing form is adopted.

Test track is located at the north of car depot with length of about 1,250m, meeting requirement of full speed test at 80km/h.

General arrangement plan refers to Figure 1.3-6.

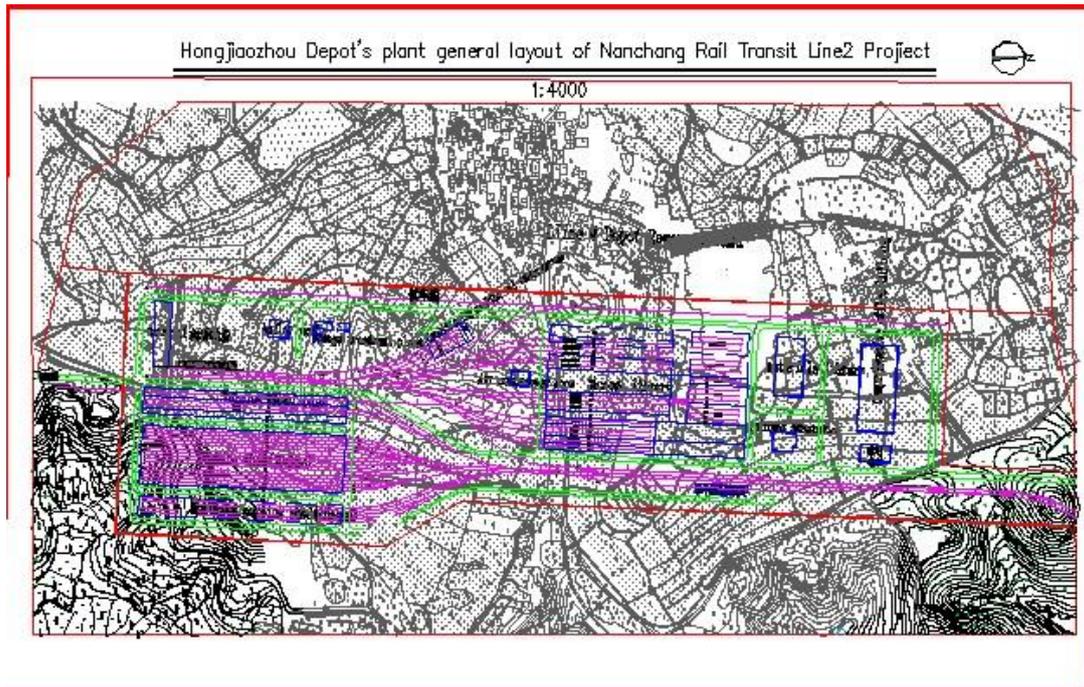


Figure 1.3-6 General Arrangement Plan of Hongjiaozhou Car Depot

(2) Operation property and scale

Functions and main tasks of the car depot are: to assume intermediate repair of vehicles of Line 1, Line 2 and Line 3; to reserve intermediate repair conditions for Line 4 and Line 5, and to be used as intermediate repair base of five lines of whole line network; to assume daily maintenance and care such as periodical repair, temporary repair, three-month examination, double-week examination, train examination, parking and cleaning of trains of this line; to assume passenger transport of trains of this line; to assume rescue operation in case of accident of trains of this line; to be responsible for material supply of car depot and maintenance of equipment and implements in the depot as well as daily maintenance of shunting locomotive; to be responsible for administrative and technical work as well as logistics management of car depot.

Functions and main tasks of parking lot are: to assume daily maintenance and care such as three-month examination, double-week examination, train examination, parking and cleaning of trains of this line; to assume passenger transport of trains of this line; to assume rescue operation in case of accident of trains of this line; to be responsible for material supply of parking lot and maintenance of equipment and implements in the lot as well as daily maintenance of shunting locomotive; to be responsible for administrative and technical work as well as logistics management of parking lot.

Table 1.3-1 Designed Scale of Hongjiaozhou Car Depot and Comprehensive Base (Slot)

Design year Items	Hongjiaozhou car depot		Parking lot
	Short-term (2026)	Long-term (2041)	Long-term
Overhaul	3	7	
Intermediate repair			
Periodical repair	2	2	
Temporary repair	1	1	
Three-month examination	4	4	3
Double-week examination			
Parking	32	32	32

1.3.9 Control center

To realize line network resources sharing, provide convenience for operating management and maintenance, and save construction investment, the control center for the five lines planned by Nanchang Rail Transit will be set at Shimao Road Station which is transfer station of Line 1 and Line 2 to realize unified scheduling and

command of five lines.

Estimation and control center building area: central control room: 300m²; management of office space: 150m²; AFC: 350m²; communication, real signal, PIS, ISCS, system equipment repair work area for housing housing and management room (including office and meeting room): 1800m².

1.3.10 Transport capacity and operating plan

(1) Designed year

Initial stage: 2019; short-term: 2026; long-term: 2041

(2) Passenger flow volume

Table 1.3-2 Predicted Passenger Flow of Nanchang Subway Line 2

	2019	2026	2041
Operating scope	High-Speed Passenger West Railway Station-Yudai River Station	High-Speed Passenger West Railway Station-Changnan Market	No. 1 Wangcheng Station-Luojia Station
Line length (km)	22.5	27.20	40.85
Total passenger traffic volume of all day (10,000 person-time/day)	24.98	50.4	90
Passenger person-kilometers(10,000 person-time/km)	215.75	460	827.7
Average riding distance (km)	8.64	9.12	9.20
Passenger transport intensity (10,000 person-time/km)	1.12	1.85	2.20
Maximum section of passenger flow of all day(10,000 person-time)	7.99	13.7	20.28
Maximum section of passenger flow in the peak	1.15	2.05	3.14
Location of section	Shimao Road Station-Cuiyuan Road Station	Shimao Road Station-Cuiyuan Road Station	Qianhu Avenue-Xuefu Avenue Station

(3) Traffic organization

①Marshalling

Six-vehicle marshalling is adopted in initial stage, short-term and long-term.

②Operating time

Operating time in the whole day is 18 hours from 5 o'clock to 23 o'clock.

③Number of trains

In initial stage: 166/day; in short-term: 206/day; in long-term: 280/day.

④ Operating plan

Table 1.3-3 Driving Plan of Whole Day (number of trains/day)

Year Time period	Initial stage	Short term	Long term	
			Whole line	Part of whole line
5:00-5:00	6	6	6	
6:00-7:00	10	12	15	5
7:00-8:00	12	18	15	15
8:00-9:00	10	14	15	10
9:00-10:00	10	12	15	
10:00-11:00	10	12	15	
11:00-12:00	10	12	15	
12:00-13:00	10	12	15	
13:00-14:00	10	12	15	
14:00-15:00	10	12	15	
15:00-16:00	10	12	15	
16:00-17:00	10	12	15	
17:00-18:00	12	18	15	15
18:00-19:00	10	12	10	5
19:00-20:00	8	10	10	
20:00-21:00	6	8	10	
21:00-22:00	6	6	8	
22:00-23:00	6	6	6	
Total	166	206	230	50

1.3.11 Management organization and seating capacity

This project will be managed by Nanchang Rail Transit Co., Ltd. after completion. According to the design document and line length as well as quantity of stations, seating capacity required by operating agency of Line 2 is taken as 62 persons/km and 69 persons/station in the initial stage; and taken as 66 persons/km and 72 persons/station in short-term; and taken as 73 persons/km and 87 persons/station in long-term for calculation. According to calculation by the above principle, quantity of operating management personnel of Line 2 is 1,385 in initial stage, 1,795 in short-term and 2,980 in long-term.

1.4 Purpose of Environmental and Social Management Plan

Environmental management is part of engineering management, and an important link for effective implementation of engineering environmental protection. Environment management for project of Rail Transit Line 2 of Nanchang City is intended to guarantee smooth implementation of various environmental protection measures of the project, and reduce the adverse influences caused by project construction on

environment, guarantee smooth implementation of environmental protection in the project zone and resettlement zone so as to coordinate project construction, ecological environmental protection and economic development.

1.5 The preparation of the Environmental and Social Management Plan

The Environmental and Social Management Plan of Rail Transit Line 2 of Nanchang City is compiled based on environmental impact assessment, and the major contents include environmental management system, environmental management training, and environmental protection measures for the adverse influences during environmental impact assessment, and estimation of investment on environmental protection. At the same time, according to the measures taken against the construction and operation period's impact to the social and natural environment, 《World Bank loans Nanchang rail transit Line 2 project social management plan》 (ESMP) is also developed separately.

2 Policies, laws and regulations framework and compilation basis

2.1 Laws and regulations

(1) *Environmental Protection Law of the People's Republic of China* (implemented on 1989.12.26)

(2) *Environmental Impact Assessment Law of the People's Republic of China* (implemented on 2003.9.1)

(3) *Air Pollution Prevention Law of the People's Republic of China* (implemented on 2000.9.1)

(4) *Environmental Noise Pollution Prevention Law of the People's Republic of China* (implemented on 1997.3.1)

(5) *Water Pollution Prevention Law of the People's Republic of China* (revised on February 28, 2008, implemented on June 1, 2008)

(6) *Solid Waste Pollution Prevention Law of the People's Republic of China* (implemented on 2005.4.1)

(7) *Urban and Rural Planning Law of the People's Republic of China* (implemented

on 2008.1.1)

(8) *Soil and Water Conservation Act of the People's Republic of China* (implemented on 1991.6.29)

(9) *Cultural Relics Protection Law of the People's Republic of China* (implemented on 2007.12.29)

(10) *Cleaner Production Promotion Law of the People's Republic of China* (implemented on 2003.1.1)

(11) *Energy Conservation Law of the People's Republic of China* (implemented on 2008.4.1)

(12) State Council of the People's Republic of China (1998) Decree No. 253 *Construction Project Environmental Protection Management Regulations* (1998.12.12)

(13) State Council of the People's Republic of China (2001), No. 305 *Urban Housing Demolition Management Regulations* (2001.11.1); Ministry of Construction of the People's Republic of China *Urban Housing Units Specification for Administrative Adjudication* (implemented on 2004.3.1)

(14) The People's Republic of China State Council Order No. 257 of the *Basic Farmland Protection Ordinance* (implemented on 1999.1.1)

(15) State [2005] No. 39 *Decision to Strengthen Environmental Protection by the State Council on the Implementation of the Scientific Concept of Development*;

(16) SEPA UNCED [2002] No. 193 *State Environmental Protection 11th Five-Year Plan*, 2001;

(17) SEPA UNCED [2006] No. 28 *Interim Measures for environmental impact assessment of public participation* (implemented on 2006.3.18)

(18) *State Environmental Protection Administration Decree 14 "Construction Project Environmental Impact Assessment Classification Catalogue* (implemented on 2008.10.1)

(19) SEPA 18 orders *Electromagnetic Radiation Environmental Protection Management Approach* (implemented on 1997.3.25)

(20) General Office [2003] No. 81, *Notice on the General Office of the State Council on Strengthening Urban Rapid Rail Transit Construction Management* (2003.9.27)

(21) *Implementation approaches of the Water Law of the People's Republic of China in Jiangxi Province* (1992)

- (22) *Jiangxi Province Cultural Relics Protection Ordinance* (2006.12)
- (23) *Environmental Pollution Prevention Regulations of Jiangxi Province* (2001.3.1)
- (24) *Jiangxi Province Drinking Water Source Pollution Prevention Methods* (2006.8)
- (25) *Jiangxi Province Old and Valuable Trees Protection Ordinance* (2004.11)
- (26) *Nanchang Urban Planning Management Regulations* (1997.5)
- (27) *Nanchang Urban Lake Management Regulations* (1997.12)
- (28) *Nanchang Ganjiang Drinking Water Source Protection Ordinance* (amendment) (2003.12)
- (29) *Nanchang Urban Greening Management Provisions* (amendment) (2005.5)
- (30) *Nanchang Regulations on the Protection of Urban Lakes* (2006.5.1)
- (31) *Nanchang Soil and Water Conservation Ordinance* (2005.3)

2.2 Technical regulations and standards

- (1) The People's Republic of China Environmental Protection Industry Standard *Environmental Impact Assessment Technology Guidelines – Master* HJ/T2.1-93
- (2) The People's Republic of China Environmental Protection Industry Standard *Technical Guidelines on Environmental Impact Assessment - Atmospheric Environment* HJ2.2-2008
- (3) The People's Republic of China Environmental Protection Industry Standard *Environmental Impact Assessment Technology Guidelines - Surface Water Environment* HJ/T2.3-93
- (4) The People's Republic of China Environmental Protection Industry Standard *Environmental Impact Assessment Technology Guidelines - Sound Environment* HJ2.4-2009
- (5) The People's Republic of China Environmental Protection Industry Standard "Environmental Impact Assessment Technology Guidelines - Non - ecological impact" HJ/T19 - 1997
- (6) The People's Republic of China Environmental Protection Industry Standard *Environmental Impact Assessment Of Electromagnetic Radiation Of 500kv High Pressure Transmission And Distribution Project* HJ/T24-1998
- (7) The People's Republic of China Environmental Protection Industry Standard *Guidelines for Environmental Management of radiation- Electromagnetic Radiation, Environmental Impact Assessment Methods and Standards* HJ/T10.3-1996

(8) The People's Republic of China Environmental Protection Industry Standard *Division of application technical specification of environmental noise of urban area* GB/T15190-94

(9) The People's Republic of China Environmental Protection Industry Standard *Environmental Impact Assessment Technology Guidelines - Urban Mass Transit* HJ453-2008

(10) The People's Republic of China Environmental Protection Industry Standard *Environmental Impact Assessment Technology Guidelines – Ground Water Environment* HJ/T2.3-93

2.3 Safety insurance policies of the World Bank

In this environment impact assessment, analyze the relationship between World Bank loan part and related projects of Nanchang rail transit line 2 project and World Bank security policy/procedures, and list the results in table 2.3-1.

Table 2.3-1 Schedule of relationship between Nanchang Rail Transit Line 2 project and World Bank security policy/procedures

Policy/procedure	Nanchang Rail Transit Line 2 Project
World Bank business policy/procedure Environment Assessment (OP/BP4.01)	Relevant
World Bank business policy/procedure Natural Habitats (OP/BP4.04)	Irrelevant
World Bank business policy/procedure Involuntary Resettlement (OP/BP4.12)	Relevant
World Bank business policy/procedure Pest Management Irrelevant	Irrelevant
World Bank business policy/procedure Physical Cultural Resources (OP4.11)	Relevant
World Bank business policy/procedure Dam Safety (OP/BP4.37)	Irrelevant
World Bank business policy/procedure Minority Nationalities (OP/BP 4.10)	Irrelevant
World Bank business policy/procedure Forest (OP 4.36)	Irrelevant
World Bank business policy/procedure International Watercourses (OP7.50)	Irrelevant
World Bank business policy/procedure Projects in Disputed Areas (OP7.60)	Irrelevant
World Bank business policy/procedure Projects in Disputed Areas (OP7.60)	Relevant

2.4 Assessment standard

2.4.1 Noise standard

Comment of Jiangxi Environmental Protection Office has been obtained for the implemented standard of this project during assessment process, and Jiangxi Environmental Protection Office confirmed the implemented standard of this project on December 30, 2009. See table 2.4-1 for the noise assessment standard of this

assessment.

Table 2.4-1 Summary table of acoustic environmental impact assessment

No. of standard	Name of standard	Scope of application		Standard value and grade (type)
GB3096-2008	<i>Environmental Quality Standard for Noise</i>	The scope of application of type 4 zones on both sides of road arterial traffic is as below: (I) Roadside buildings higher than three-storey (three-storey included), area on the side of the first row of buildings facing the road; (II) Roadside buildings lower than three-storey (unenclosed ground included), if adjacent to standard scope of application of type 1 and 2 zones, it will be the areas 45m and 30m respectively from the boundary lines of road.		Type 4a: Daytime 70dB Nighttime 55dB
		The scope of application of type 2 zones: The area on both sides of the section from the start point of design to the intersection of Outer Ring Road and South Fenghe Avenue (YAK24+200), right side of the section from the intersection of Outer Ring Road and South Fenghe Avenue (YAK24+200) to the intersection of Qianhu Avenue and South Fenghe Avenue (YAK27+500), both sides of the section from the intersection of Qianhu Avenue and South Fenghe Avenue (YAK27+500) to the intersection of Nanchang-Skopje Friendship Road and South Fenghe Avenue (YAK29+500), left side of the section from the intersection of Nanchang-Skopje Friendship Road and South Fenghe Avenue (YAK29+500) to the intersection of Chunhui Road and Middle Fenghe Avenue (YAK33+000), right side of the section from the intersection of Shengli Road and Yangming Road (YAK35+500) to the intersection of Yangming Road and Bayi Avenue (YAK37+120), and both sides of the section from the intersection of Yangming Road and Bayi Avenue (YAK37+120) to the terminal point of design. And the area outside the plant boundary at Hongjiaozhou car depot.		Type 2: Daytime 60dB Nighttime 50dB
		The scope of application of type 1 zones: The area on left side of the section from the intersection of Outer Ring Road and South Fenghe Avenue (YAK24+200) to the intersection of Qianhu Avenue and South Fenghe Avenue (YAK27+500), right side of the section from the intersection of Nanchang-Skopje Friendship Road and South Fenghe Avenue (YAK29+500) to the intersection of Chunhui Road and Middle Fenghe Avenue (YAK33+000), both sides of the section from the intersection of Chunhui Road and Middle Fenghe Avenue (YAK33+000) to the intersection of Chunhui Road and Middle Ganjiang Avenue (YAK33+800), and left side of the section from the intersection of Shengli Road and Yangming Road (YAK35+500) to the intersection of Yangming Road and Bayi Avenue (YAK37+120).		Type 1: Daytime 55dB Nighttime 45dB
HF [2003]No. 94	<i>Notice on Problems Relevant to Ambient Noise during Environmental Impact Assessment of Projects including Highway, Railway (including light rail) etc</i>	There is no acoustic environmental functional zoning designated within the range of assessment and special sensitive buildings including schools and hospitals (sanatorium, homes for the aged) within areas applying type 4 standard. Note: if there is no students and teachers in residence at schools and no in-patient department in hospitals, no benchmarking in the night.		Daytime 60dB Nighttime 50dB
GB12348-2008	<i>Emission Standard for Industrial Enterprises Noise at Boundary</i>	Hongjiaozhou car depot	1m outside the plant boundary	Type 2: Daytime 60dB Nighttime 50dB
GB12523-90	<i>Noise Limits for Construction Site</i>	Construction site		

At the same time, according to General Guide on Environment, Health and Safety, the noise should not exceed relevant requirements of Table 2.4-1, or the increase of noise of the nearest receiving point outside the construction site should not exceed 3 db (A).

Continue to Table 2.4-1 General Guide on Environment, Health and Safety

Receiver	dB (A)2/h	
	Day 07:00-22:00	Night 22:00-07:00
Residence, office, school	55	45
Industry, business facilities	70	70

The above two tables show that the class 1 standard of Acoustic Environmental Quality Standard is the same as the standard limit of residence, office and school in General Guide on Environment, Health and Safety. The function zoning of class 2, 3, 4 standards of Acoustic Environmental Quality Standard is the same as the industry and business facilities function zoning in General Guide on Environment, Health and Safety, that is, they have same standard implementation scope. The standard limit of the class 2, 3, 4 standards of Acoustic Environmental Quality Standard is stricter than that of the industry and business facilities in General Guide on Environment, Health and Safety. So, in the process of analysis and evaluation, Acoustic Environmental Quality Standard is taken as the basis for the evaluation.

2.4.2 Vibration standard

(1) Executive standard

Refer to Table 2.4-2 for executive standard of vibration environmental impact assessment.

Table 2.4-2 Executive standard of vibration environmental impact assessment

Name of standard	Type of standard	Standard value (dB)		Scope of application	Remarks
		Daytime	nighttime		
GB10070-88 <i>Standard of Vibration in Urban Area Environment</i>	Residence and cultural and educational area standard	70	67	Sensitive spots within type 1 acoustic functional zone	Confirm in accordance with type of acoustic functional zone
	Mixing area and central business district	75	72	Sensitive spots within type 2 acoustic functional zone	
	Both sides of arterial traffic standard	75	72	Sensitive spots within type 4 acoustic functional zone	

(2) Reference standard

According to GB/T50452-2008 *Technical Specifications for Protection of Historic Buildings against Man-made Vibration* and the structural features of cultural relics along the project, permissible vibration velocity limit standard for brick masonry structure of historic buildings is implemented for impact of vibration of subway operation on cultural relics, refer to Table 2.4-3 for details.

Table 2.4-3 Permissible vibration velocities of brick masonry structure of historic buildings

Level of protection	Position of control point	Direction of control point	Permissible vibration velocity [v] (mm/s)		
			$V_P < 1600$ m/s	$1600 \text{ m/s} < V_P < 2100$ m/s	$V_P > 2100$ m/s
National key cultural relic protection unit	Highest position of bearing structure	Horizontal	0.15	0.15-0.20	0.20
Provincial level cultural relic protection unit	Highest position of bearing structure	Horizontal	0.27	0.27-0.36	0.36
Municipal and county level cultural relic protection unit	Highest position of bearing structure	Horizontal	0.45	0.45-0.60	0.60

(3) Reference Standard

According to GBJ118-88 *Code for Design of Sound Insulation of Civil Buildings*, the primary standard of residential bedrooms, special rooms requiring quiet environment at schools and hospital wards is: the indoor noise in residences, classrooms and hospitals shall be lower than or equal to 40dB(A). As for secondary structural noise, the standard applied in the assessment is: the indoor secondary structural noise caused by vibration of subway shall be lower than or equal to 40dB (A).

2.4.3 Water Standard

The sewage of the vehicle base and the stations has conditions to be included in the existing or planned drainage pipe network, entering relevant urban sewage treatment plant. The sewage discharge of the vehicle base and the stations perform the standard of urban sewage treatment plant, class 3 standard of Sewage Discharge Standard (GB8978-1996). See table 2.4-4 for the details. The sewage will be discharged after the treatment by the sewage treatment plant and the discharge standard of the plant is one of the standard which is recognized and recommended by the World Bank.

Table 2.4-4 *Integrated Wastewater Discharge Standard*

Primary standard value	pH value	SS (mg/L)	BOD ₅ (mg/L)	COD _{Cr} (mg/L)	Oil (mg/L)	Animal and vegetable oils (mg/L)	Ammonia nitrogen (mg/L)
Level three	6-9	400	300	500	20	100	/

2.4.4 Ambient air Standard

(1)

According to ambient air quality functional zone classification, the project site belongs to the class 2 area, so within the scope of the evaluation, the ambient air quality standard is level 2 standard of Ambient Air Quality Standard (GB3095-2012). See Table 2.4-5 for standard values.

Table 2.4-5 Level 2 Standard of Ambient Air Quality Standard (GB3095-2012)

Pollutants	Concentration limit		
	Hourly mean	Daily mean	Annually mean
SO ₂ (μg/m ³)	500	150	60
NO ₂ (μg/m ³)	314	80	40
PM ₁₀ (μg/m ³)		150	70
PM _{2.5} (μg/m ³)		75	35

(2) Emission Standard for Odor Pollutants (GB14554-93) is referred and implemented for air exhaust of ventilation system of stations.

2.4.5 Electromagnetic radiation

(1) The strength of power frequency electric field and magnetic field of power transmission and transfer facilities is in accordance with stipulations in *Technical Regulations on Environmental Impact Assessment of Electromagnetic Radiation Produced by 500 KV Ultrahigh Voltage Transmission and Transfer Power Engineering* (HJ/T24-1998), it's recommended that take 4kV/m as the assessment standard for power frequency electric field of residential area and take 0.1mT which is the power frequency limit value for public being exposed all day long stipulated by National Radiation Protection Association as the assessment standard for magnetic induction.

(2) For impact of electromagnetic interference at entrance-exit ground section on quality of television reception, take the damage measuring method recommended by International Radio Consultative Committee (CCIR) as reference, and the assessment standard is 35dB higher than signal to noise ratio.

3 Environmental Management System

3.1 Set of Environmental Management System

Environmental management for phase I project of Rail Transit Line 2 of Nanchang includes external management and internal management. The management period is

divided into three phases of first phase of construction, construction period and operation period.

(1) External management: Various environmental management administrative departments and World Bank will carry out external management, and will determine the corresponding standards and requirements environmental protection of the construction project shall reach based on the relevant World Bank and state laws and rules, take charge of irregular supervision, inspection of work in various phases, and completion acceptance etc. of the environmental protection project.

(2) Internal management: The owner shall take charge of organizing implementation of internal management, and optimize, organize and implement environmental protection measures of the project, and guarantee the requirements of environmental protection for World Bank and state construction project, and local environmental protection department are reached. The internal environmental management system of the project is managed by the owner, supervisory unit (project supervisory unit) and contractor respectively. Meanwhile, the design unit, environment assessment unit, risk consultation unit, safety monitoring and environment monitoring unit shall actively cooperate in the work, and subject to the supervision of World Bank.

3.1.1 Environment management system in first phase of construction of project

The environment management in first phase of project construction is mainly implemented by Nanchang Rail Transit Group Co., Ltd. and coordinated by environment assessment unit and design unit and also supervised by Ministry of Environment Protection, Provincial Environment Protection Bureau, Nanchang Municipal Environment Protection Bureau and World Bank.

3.1.2 Environment management systems in construction period and operation period

The details of management systems in construction period and operation period see figures 3.1-1-a and 3.1-1-b. The responsibilities of all organs of management system refer to tables 3.1-1-a and 3.1-1-b

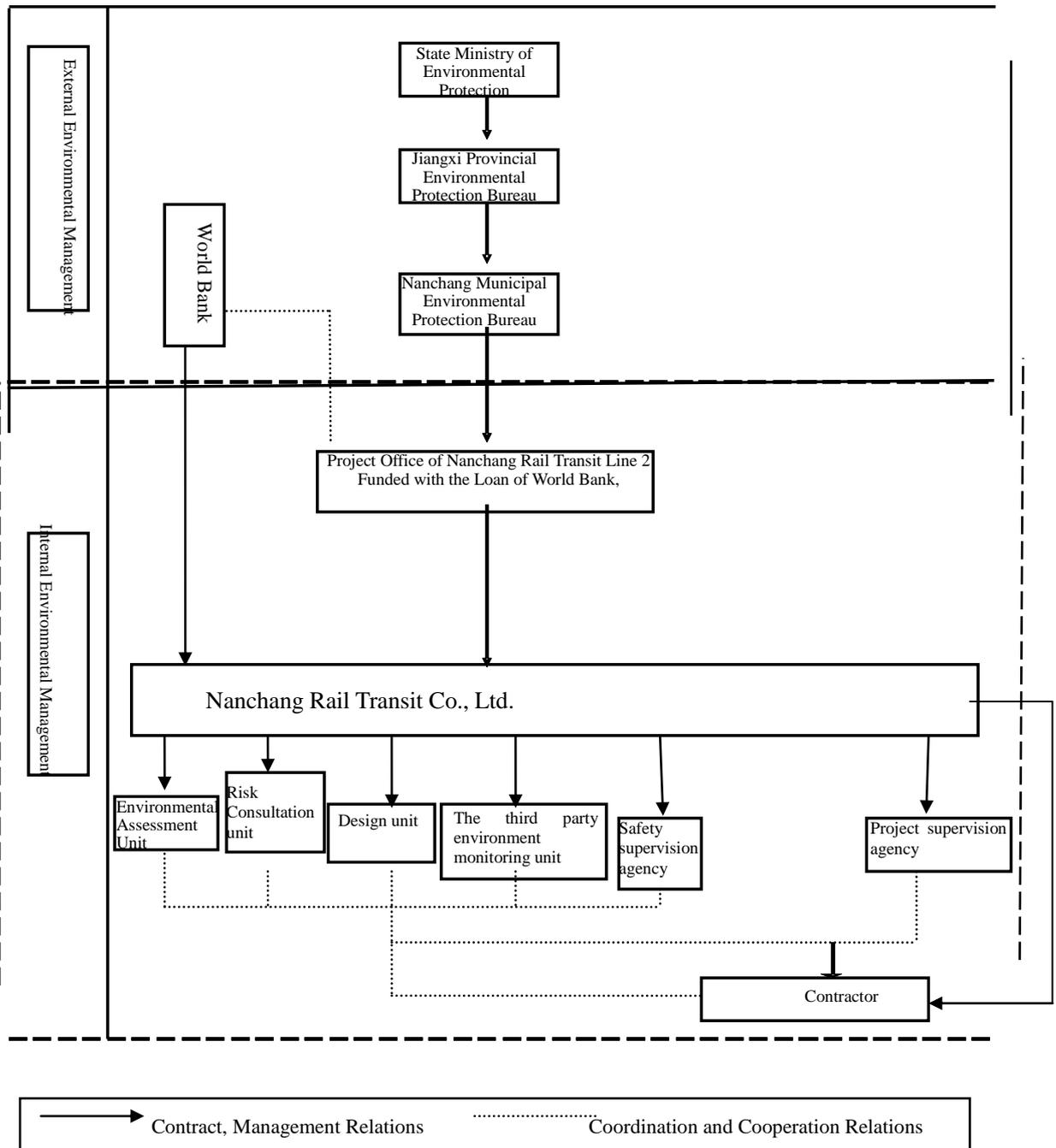


Figure 3.1-1-a Environmental Protection Management System of Phase I Project of Rail Transit Line 2 of Nanchang in Construction Period

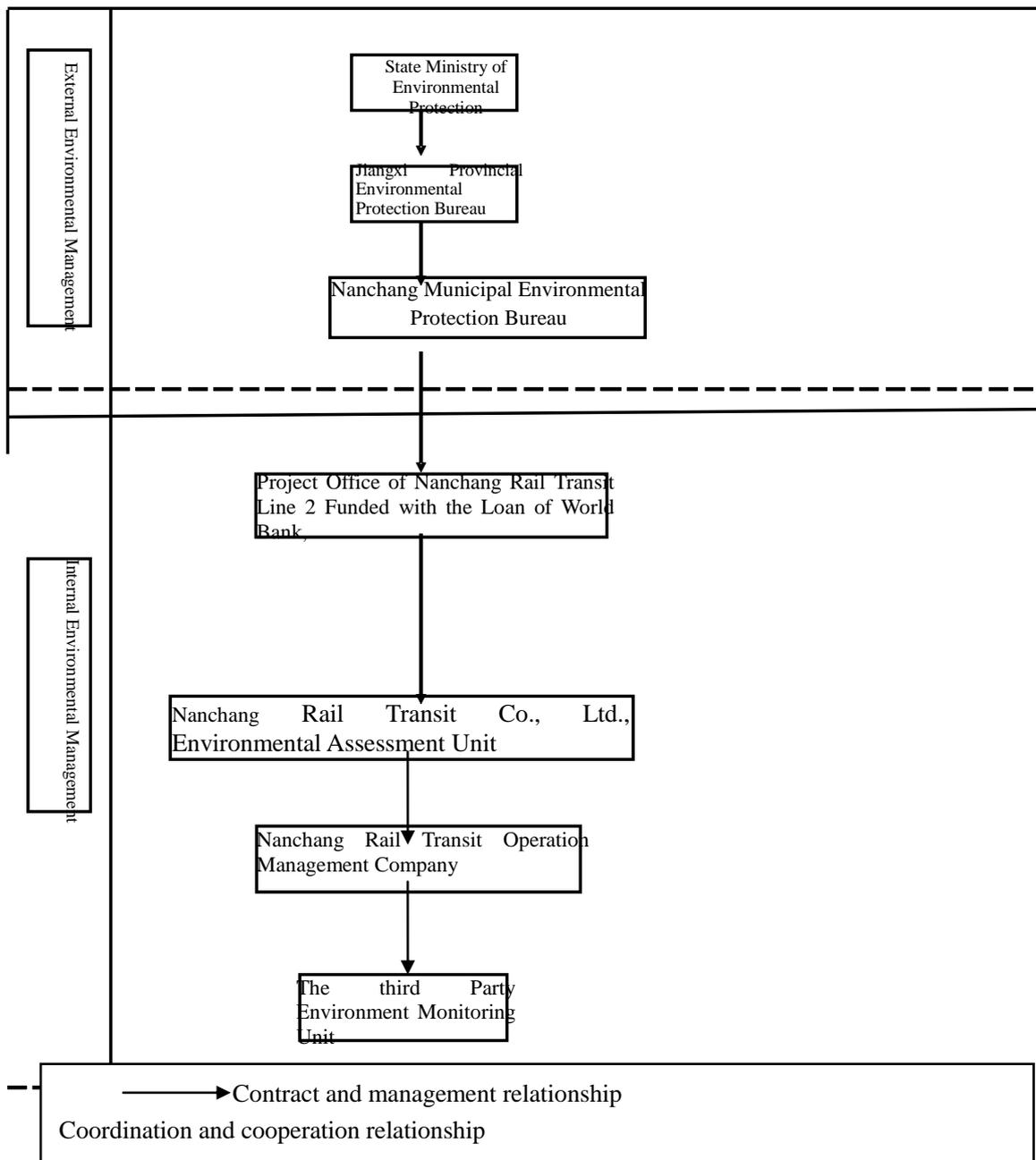


Figure 3.1-1-b Environment protection system of phase I project of No.2 rail of Nanchang in operation period

3.2 Environmental Management Organ, capability and Duties in construction period

The environment management in construction period consists of three parts of owner

unit environment management, project supervision unit and contractor environment management, and is also supervised and inspected by World Bank, Ministry of Environment Protection, Principal Environment Protection Bureau and Nanchang Municipal Environment Protection Bureau, in which the contractor is the implementation unit of various environment protection measures in this phase, and the design unit, environment assessment unit, risk consultation unit, safety monitoring and environment monitoring unit shall actively cooperate in the work and provide the services.

3.2.1 Environment management of owner unit

Organ staff: In project construction period, the owner unit shall assign 2 full-time environmental protection managerial persons to take charge of environmental management and environmental supervision in construction period, and also of disposing complaints toward environmental problems.

Capacity requirements: the environment management staff shall graduate from major related to civil engineering and have received environment management training, have environment management qualification and participate in No.1 line project environment management, and have related experiences of subway project environment management.

Duties: urge the contractor to establish and improve the construction management institutions and system, encourage the contractor to fulfill the construction environment management according to ISO14001 environment management system (EMS) and safety and health management according to 18000 occupational safety and health management system; from global view, timely master the construction environment protection tendencies of entire line; regularly check and summarize the implementation conditions of environment protection measures and fund utilization conditions; actively organize and solve in case of major environment protection issue or dispute and assist the contractors to deal with the relationships with the environment protection department, the public and the interested parties.

3.2.2 Environment management of project supervision unit

The project supervision unit mainly takes charge of project supervision works and the supervision and implementation of project risk prevention measures in construction period. The supervision unit shall consider various environment protection works and measures specified in EA, ESMP, environment protection works design documents and construction contract as the main contents of supervision works, strictly control the environment protection works quality and supervise the implementation of various environment protection measures by the contractor. The project supervision agency of this project designates a full-time environment supervision engineer which is directly led by general supervision engineer.

(1) Purpose of Environmental Supervision

Carry out environmental supervision during construction period according to requirements for design of environmental protection during project construction, and comprehensively supervise and inspect implementation and effect of the environmental protection measures by the contractors, dispose of and solve environmental pollution accidents in time; Meanwhile, the supervisory achievements during the construction will be taken as the basis of acceptance inspection for development project, and the necessary special report in the acceptance inspection report.

(2) Duties

Environmental supervision is an important part of project supervision during project construction, and the main duties are as follows: carry out environmental supervision over implementation of the environmental protection measures during the project construction period and operational period, and supervise, inspect and manage the environmental protection by the project contractor and professional parts of the environmental protection project; supervise, review and assess the implementation of various environment protection measures by the contractor according to the contract provisions and national laws, regulations and policies of environment protection as well as the environment monitoring data and inspection results; timely find out and correct the construction actions against the environment protection provisions in the contract and national environment protection requirements.

In this project, the main contents of supervision works are as follows: carry out supervision and inspection of environmental protection of all contractors on the construction site and residential camps, for example the implementation of noise reduction measures on construction site, handling measures of construction spoil and construction wastes, treatment measures for production wastewater, sprinkling and dedusting measures, waterproof and water stop measures for construction in station and section, environment control device noise reduction measures, underground section vibration reduction measures, ground traffic dispersion measures, land requisition and relocation measures, compensation measures, construction risk and geologic risk preventive measures in construction period, EHS protection measures in construction period and material culture resource protection measures in construction period; The main duties should include supervision of geologic risks in construction period and risks due to construction accident, and the management and implementation of risk prevention when passing through major municipal works and Ganjiang River. at same time, the effectiveness of measures can be the ground to bring forward correction requirements to the contractor under the coordination of the third party environment monitoring agency and safety monitoring agency and in reference to the monitoring data provided by them (such as construction period noise, raise dust, vibration, production sewage drainage, underground water level and ground settlement) (see table 11.6-1 – 11.6.3 for details).

The working methods are as follows:

① Dispatch supervisors to carry out site inspection and monitoring of the construction area and residential area of the contractors, and comprehensively supervise and inspect implementation of environmental protection measures, and put forth rectification requirements within a prescribed time limit to the unqualified items below the standard, and compile environmental supervision diary for project construction.

② Assist environment management organs and relevant departments in disposing of environmental pollution and environmental disputes caused by the project according to the environmental protection laws, rules, engineering design documents and project contracts.

③ Compile weekly, monthly and annual report on environmental supervision, and put forth significant environmental problems and proposals on solution to the problems. Delivery the environment supervision report after construction completed.

④ Participate in acceptance inspection during project construction and completion acceptance;

(3) Management Organ and Working Methods

Environmental supervision is an important part of environmental management, and is relatively independent. Thus independent environmental supervisory organ shall be established. Such function shall be undertaken by unit with supervisory qualification, which will supervise, examine and assess implementation of various environmental protection measures of construction unit according to the contract provisions, the requirements of state environmental protection laws, rules and policies, and the environmental monitoring data and results of circuit inspection. Discover and rectify construction in violation of environmental protection provisions under the contract, and the requirements of state environmental protection provisions.

1 full-time/part-time environmental protection supervisor under the leading of general supervision engineer will be assigned for each bid section according to the particularity and complexity of special environment supervision of this project and the specialty requirements. The environment supervisor shall have received environment protection training, have participated in No.2 environment management training and have the capacity of environment management.

Establish level I linear supervisory organizational organ according to the characteristics of the project: See Figure 11.4-1 for the supervisory organizational organ:

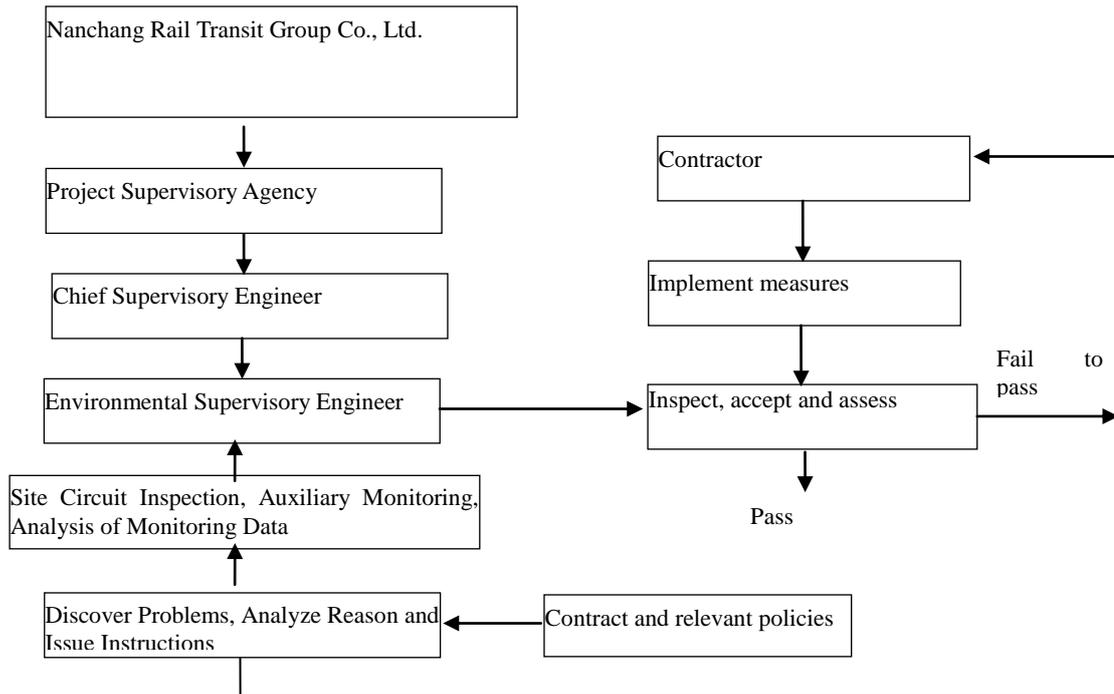


Figure 3.2-1 Environmental Supervisory Organ and Working Process in Construction Period

3.2.3 Contractor environment management in construction period

Staff: The contractor shall assign 2 full-time/part-time personnel for each bid section to take charge of the environment protection works in construction period.

Capability requirements: engineering technical personnel received environment protection training and that with training plan and having certain capability and qualification.

Duties: assume related duties and rights and make full use of frontline environment protection supervision duties; implement environment management responsibility system and environment protection assessment system; ensure the construction progress with the environment protection measures taken according to related state environment protection laws, EA and ESMP; strictly comply with the environment protection contents specified in contract provisions and bid/bidding documents; implement the environment protection tasks assumed by the contractor.

Detailed working tasks: for example the implementation of noise reduction measures on construction site, handling measures of construction spoil and construction wastes, treatment measures for production wastewater, sprinkling and dedusting measures, waterproof and water stop measures for construction in station and section, environment control device noise reduction measures, underground section vibration reduction measures, ground traffic dispersion measures, land requisition and relocation measures, compensation measures, construction risk and geologic risk preventive measures in construction period, EHS protection measures in construction period and material culture resource protection measures in construction period;

The working methods are as follows:

A. Formulate annual work plan on environmental protection

B. Inspect construction progress, quality, operation and testing of environmental protection facilities and dispose of problems during implementation:

C. The contractor shall communicate and consult with the masses in the project area, and establish bulletin in each construction unit to inform the public of the specific construction activities and construction time during construction; Meanwhile, the contractor shall provide information on the contact person and telephone number so that the public may complain or put forth proposal for the construction activities.

D. Account use of annual environmental protection expenses

E. Report information on implementation of environmental protection provisions under the contract; require the contractor to monitor its environmental activities, and provide 1 record report on environmental achievements every day or every week; The project office and construction supervision team will supervise and examine such records.

3.2.4 Environment management of environment consultation agencies in construction period

The environment consultation agencies in construction period include design unit, environment assessment unit, risk evaluation and consultation unit, environment monitoring unit and safety monitoring unit; their mainly duties are as follows: assigned by the owner, provide related consultation services and conduct site monitoring; provide data support and technical support for environment management of construction unit and supervision unit. The detailed working contents refer to table 11.3.1-a.

3.2.2.4 Environment management agencies, capabilities and duties in operation period

The environment management in operation period is responsible by Nanchang Rail Operation Management Company which is the subordinate unit of Nanchang Rail Transit Company. At same time, Nanchang Rail Operation Management Company entrusts environment monitoring unit to conduct long term monitoring for noise, vibration and waster water generated from No.2 line operation.

Staff and capability requirements: in project operation period, Nanchang Rail Operation Management Company shall assign a full-time environment protection management staff to take charge of environment protection works during project operation period of line 2, of which the works are directed and supervised by Ministry of Environment Protection, Jiangxi Provincial and Nanchang Municipal Bureau of Environment Protection. The full-time environment management staff shall have received environment management training with related environment management qualification, and have been engaged in line 1 project environment management and have related experiences in subway project environment management.

Duties: take charge of environmental management of the whole company and external environmental management; do well in education and publicity to improve the awareness of environmental protection and technical levels of managerial personnel and staffs at various levels; formulate environmental management methods and operational regulations for pollution prevention and control facilities during operational period of the rail transit, regularly maintain, inspect and repair sewage treatment equipment, and noise control measures for air kiosks etc. to guarantee normal operation thereof. Cooperate with the environmental protection authority in environmental management, supervision and inspection; cooperate with the environmental protection authority in disposal of various environmental pollution accidents etc.

According to the characteristics of environmental impacts of the project and the assessment results of the report, the key points in environmental management during operational period of the project are as follows: noise monitoring and management for the environmental control equipment of the underground stations and noise in other sections; monitoring and management of the impacts on the environmental quality by the vibration of the train in underground sections along the project line; management of the depots and comprehensive drainage facilities on the base, and monitoring of the disposal effect.

3.2.3 Environment supervision and management of World Bank and environment protection government agencies

The World Bank, Ministry of Environment Protection, Provincial Environment Protection Bureau, Nanchang municipal environmental protection bureau and the environmental protection bureaus in various districts shall carry out external management, regular and irregular inspection of implementation of environmental protection facilities of Rail Transit Line 2 to guarantee implementation of various environmental protection measures of Rail Transit Line 2; Meanwhile, pay attention to the environmental protection problems reflected by the public toward Rail Transit Line 2, and mainly supervise and inspect such problems reflected by the public.

The project environment management systems and duties in construction period and operation period refer to table 3.2-1-a and table 3.2.1-b.

Table 3.2.1-a Agencies and duties of environment management system in construction period

Agency nature		Agency name	Agency duties
External environment management	Supervision agency	State Environmental Protection Administration, Provincial and municipal environment protection	Governmental administrative supervision and management agency; take charge of the environment protection works at each phase of entire project

		bureau	
Internal environment management	Management agency	World Bank Load Project office for Nanchang Rail Transit No.2 line phase 1 project	Take charge of the environment protection works at each phase of entire project
		Nanchang Rail Transit Group Co., Ltd.	Owner unit, take charge of the environment protection works of each phase, including the environment protection management works from start of construction to completion acceptance; take charge of the environment protection management responsibilities of entire project area
	Supervision agency	World Bank	Supervise and check the implementation of environment management plan
	Implementation agency	Contractor	Implementation agency; implement various environment protection measures in EA and ESMP. Include: implementation of noise reduction measures, vibration reduction measures, water pollution prevention measures, atmosphere pollution prevention measures, traffic dispersion measures, construction soil and construction waste disposal, construction staff health and safety protection measures.
	Consultation service agency	Supervision agency	Entrusted by the owner unit, take charge of supervision and management of contract environment protection measures, including implementation of noise reduction measures, vibration reduction measures, water pollution prevention measures, atmosphere pollution prevention measures, traffic dispersion measures, construction soil and construction waste disposal, construction staff health and safety protection measures; at same time supervise the implementation of environment monitoring such as underground water level, waste water quality, construction noise, vibration, raise dust and ground settlement, and prepare environment monitoring report; take charge of supervision and management of geologic risk and safety management, construction accident risk and safety management and environment risk of contractor in construction period, and prepare the safety

			supervision report.
		Design unit	Through design in construction phase, implement various environment protection measures in EA and EMSP into the design documents, and instruct the construction activity of contractor.
		Environment assessment unit	Entrusted by the owner unit, provide explanation and related technical support for various environment protection measures put forward in EA and ESMP.
		Environment monitoring unit	Entrusted by the owner unit, complete various environment monitoring such as noise, vibration, production waste water and raise dust brought forward in construction period, and prepare the safety monitoring report.
		Safety monitoring unit	Entrusted by the owner unit, complete the monitoring including underground water level, ground settlement and building settlement provided in EA and ESMP in construction period, and prepare the safety monitoring report
		Risk evaluation and consultation unit	Entrusted by the owner unit, prepare project risk evaluation report; provide technical support for various risk management measures mentioned in project risk evaluation report, EA and ESMP.

Table 3.2-1-b Composition agency of environment management systems in operation period

Agency nature		Agency name	Agency duties
External environment management	Supervision agency	State Environmental Protection Administration, Provincial and municipal environment protection bureau	Governmental administrative supervision and management agency; take charge of the environment protection works in project operation period
Internal environment management	Management agency	World Bank Loan Project office for Nanchang Rail Transit No.2 line phase 1 project	Take charge of the environment protection works in project operation period

		Nanchang Rail Transit Group Co., Ltd.	Owner unit, take charge of the environment protection works in project operation period; take charge of the environment protection management responsibilities of entire project area
	Supervision agency	World Bank	Supervise and check the implementation of environment management plan
	Implementation agency	Nanchang Rail Operation Management Company	A subordinate unit of Nanchang Rail Transit Group Co., Ltd.; noise monitoring and management for the environmental control equipment of the underground stations and noise in other sections; monitoring and management of the impacts on the environmental quality by the vibration of the train in underground sections along the project line; management of the depots and comprehensive drainage facilities on the base, and monitoring of the disposal effect
	Consultation service agency	Environment monitoring unit	Entrusted by the owner unit, complete the environment monitoring such as noise and vibration put forward in EA and ESMP in construction period; prepare environment monitoring report.

3.3 Environmental Management Training

3.3.1 Purpose of Training

It is necessary to carry out training on environmental protection and skills and training of environment management measures in EA and ESMP for the employees engaged in environment management and supervision of owner unit, supervision unit and contractor for smooth and effective implementation of the project so as to enable them fully understand and learn the environment protection of project, and cultivate the capability for environment management and supervision of line 2 and provide personnel and technical guarantee for the implementation of various environment protection measures in EA and ESMP.

3.3.2 Objects of Training

Personnel engaged in line 2 environment management and supervision of owner unit, supervision unit and contractor.

3.3.3 Contents of Training

The major contents of training involve environmental protection laws, environment protection technologies, EA and ESMP environment management measures, environment monitoring technologies and etc.

3.3.4 Training Plan

In first phase of construction, the owner unit shall organize the environment awareness training for all staff of related departments; in construction period, organize the employees on important posts including construction site management staff in owner unit, engineering supervision unit, contractor project manager and site environment protection responsible personnel to participate in environment management knowledge training; organize related personnel of rail company and contractor directly participating in management to attend the environment management skill training; in operation period, organize rail company environment protection management personnel for special training on environment management in operation period.

See Table 3.3-1 for the specific training plan

Table 3.3-1 Training Plan

Project phase and training organization agency	Training organization agency	Training teacher		Contents of Training	Training objective	Training Time	Training Expenses
Construction period	Nanchang Rail Transit Group Co., Ltd.	Famous experts engaged in environment protection specialty for long time, and familiar with World Bank environment protection policy, especially for subway construction technology	3 persons of owner unit, 5 persons of project supervision unit per bid section; 5-10 persons of contractors per bid section	Related environmental protection laws in construction period; related construction spoil, noise, vibration, underground water, construction waste water, raise dust pollution control measures, impact on traffic, resident livings, resident income and vulnerable groups in construction period and relief measures, construction risk management measures in construction period, project geologic risk control measures in construction period, EHS, public participation, noise in construction period, construction waste water, vibration, TSP, underground water and ground settlement and other environment monitoring technical contents.	Fully understand the environment protection of subway project in construction period; learn the capability for environment management and supervision for line 2, and provide personnel and technical guarantee for implementation of various environment protection measures of EA and EMSP.	2~3 Day	150,000 yuan

Operation period	Nanchang Rail Transit Group Co., Ltd.	Famous experts engaged in environment protection specialty for long time, and familiar with World Bank environment protection policy, especially for subway operation period environment impact features.	2 persons for Nanchang Rail Transit Group Co., Ltd., 3 persons for Nanchang Rail Operation Co., Ltd.	Related environment protection laws, standards and technical systems such as wastewater drainage, operation noise and vibration in operation period; odor and waste water monitoring and control technology in operation period, noise, vibration and electromagnetic monitoring and control technology.	Full understand the environment impact after subway operation and the adopted environment protection measures; get familiar with related environment monitoring technology and ensure normal operation of various environment protection facilities.	3 ~ 4 Day	50,000 yuan
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4 Environment impact measures of Prevention and mitigation

According to the environmental impact characteristic of the subway engineering and Line 2 actual situations, during the designing period, construction period and operational period, this project will implement a series of aiming environmental mitigation measures to alleviate the impact on the environment, the details See Table 4-1 and Table 4-2:

Table 4-1 List of Common Mitigation Measures for Environmental Impacts by Phase I Project of Rail Transit Line 2 of Nanchang Funded with the Loan of the World Bank

Phase	Environmental Factors		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
Feasibility Study and Design	Natural Environment	Ecological Environment	(1) Comprehensively consider the means of paving of the line, and the principle of occupying less arable fields and green land during selection of the route to reduce impact on urban ecological environment; (2) Carry out landscape design for the air kiosks, entrance and exit to make it compatible with the style of the surrounding buildings; (3) For the landscape design around car depot & integrated base and main substation, the greening shall give priority to local native plants and also the fruit trees, but favorable for evergreen and flower species, and dynamically combine the arbors, shrub, flowers and grassland with proper colors and pattern combination so as to form a beautiful seasonal landscape.	Design Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee Calculated into design expenses
		Environmental Vibration	(1) In case the underground routes must run through the ground buildings and residential areas, the depth thereof shall be duly increased if conditions permitting to reduce vibration and noise, and interference with the ground buildings;	Design Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee
		Sound Environment	(1) Carry out noise control from the sonic source, and select low-noise equipment and structural type (2) Rationally plan the functional division of the land along the project line according to urban upgrading and planning, optimize layout of buildings, and avoid new environmental problems (3) Scientifically plan the layout of the buildings, and the first row of the buildings near the noise source shall be planned to be non-noise sensitive buildings such as commercial venues and offices etc.; (4) Dismantle residential houses near the sonic source first according to upgrading of the old urban areas; reserve noise prevention distance for the newly-developed houses or make use of the shielding and sound-isolation function of the non-sensitive buildings according to greening design and relocation of the buildings to put the impact on the sensitive buildings within the permitted scope under the standard;	Design Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee
		Electromagnetic	(1) It is requested to carry out rational layout of the major transformer substation, and rational planning of the surrounding land of the major transformer substation to keep the enclosure walls	Design Unit	Project Owner			calculated into design fee

Phase	Environmental Factors	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)	
	Environment	thereof far away from the residential area(at least 15 meters to the residential area)		Local Environmental Protection Bureau				
	Solid waste	(1) Explicitly prohibits the procurement of equipment containing polychlorinated biphenyls material in transformers and other equipment in the design and tender documents.	Design Unit	Project Owner Local Environmental Protection Bureau				
	Social Environment	Resident's Life	(1) The principle of route selection is to reduce resettlement and impact on residents' life as much as possible; (2) Do well in various preparatory work before construction, and carry out detailed survey of the roads, various underground pipelines such as power supply, telecommunication, water supply and drainage pipelines etc. along the subway line; Determine the resettlement and relocation program with relevant departments in advance; Do well in various emergency preparatory work to reduce impacts on residents' life.	Design Unit	Project Owner			calculated into design fee
		Traffic	(1) The routes plane shall be constructed along the urban arteries and deployed within the planned red lines of the roads. The station routes shall be parallel to the planned red lines. Reduce interference with ground traffic in addition to considering the station positions and construction methods. (2) Distribution of stations is determined after considering the major concentration points of passenger flow, and coordination with the urban comprehensive planned traffic network to attract passenger flow as much as possible, provide convenience for travel by passengers and really embody the principle of human paramount.	Design Unit	Project Owner			calculated into design fee
		Protection of Disadvantaged Group	(1) Non-barrier passage for the disabled shall be established at various stations; (2) The toilet cesspit for females shall be increased according to due proportion at various stations.	Design Unit	Project Owner			calculated into design fee
Human Health	(1) It shall be definitely prohibited that the relevant materials such that contains Polychlorinated Biphenyls during purchase of the equipment of transformer substation; (2) Non-poisonous pesticide and herbicide with low residue shall be used during greening of the							

Phase	Environmental Factors		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
			depots and transformer substation.					
	Material Cultural Resources	Cultural Relics	(1) As for landscape design for the sections adjacent to historical and cultural areas and protected cultural relics, the dimension, height and color design shall be compatible with the surrounding environment, especially the features and customs of the scenic area. (2) Entrust qualified unit to carry out detailed prospecting of cultural relics along the rail transit line before project construction, and avoid and protect the ancient ruins and underground buried substances discovered during prospecting and unlisted in the list of protected cultural relics at present; (3) Do well in protection of protected cultural relics and underground burial site of cultural relics before project construction, formulate specific protection program, and report to local cultural relics authority and planning department for approval.	Design Unit	Project Owner Local Environmental Protection Bureau Cultural Relics Bureau			calculated into design fee
Construction Period	Natural Environment	Sound Environment	(1) It is forbidden to carry out construction operation that produces environmental noise pollution at night in the concentrated area of buildings sensitive to noise in the urban areas; In case continuous operation is to be carried out due to special needs, "Nighttime Construction License" shall be handled for nighttime construction, and the approved nighttime operation shall be publically notified to the adjacent residents. (2) It is forbidden to drive pile at night. In case it is really necessary to do so, it shall be reported to Nanchang Municipal Environmental Protection Bureau for approval, and restrict operational time within the scope of 7:00-12:00 and 14:00-22:00. (3) The machinery with high noise such as power generator and air compressor etc. in the secluded place or inside the tunnel if possible, and keep them far away from sensitive points in sound environment such as residential area, school and hospital etc.. (4) The transport vehicles shall be enter into and get out of the construction site on the side far away from the residential area (5) Use commodity concrete, and no concrete mixer shall be placed on the construction site; (6) Incorporate measures to reduce environmental noise pollution as the contents of construction organization and design during tender invitation for the construction project, and make definite in the contract signed. (7) In addition to strict control of various sources of environment noises according to the relevant state environmental noise standards during the college entrance examination and half a month before the college entrance examination, it is forbidden to carry out construction operation that produce noise beyond standards and interfere with people's life.	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee
		Environmental Vibration	(1) The operational routes of the construction vehicles, especially heavy transport vehicles shall avoid areas sensitive to vibration if possible. (2) High vibration operations will be carried out in periods with a high environmental vibration	Construction Unit	Project Owner Local			calculated into engineering fee

Phase	Environmental Factors	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
	n	<p>background value(7:00~12:00, 14:00~22:00), and construction operations with strong vibration and serious pollution will be restricted during night.</p> <p>(3)As for sections where shield tunneling construction is adopted, detailed survey shall be carried out toward the sensitive points near the tunnel, and keep records well and take preventive measures such as consolidation toward influences such as cracking of houses and ground settlement etc..</p> <p>(4) During construction period, prepare complete monitoring program for culture relics and ancient architectures affected, focus on the monitoring of their settlement, tilting and crack development, define the pre-alarm value, alarm value and control value and prepare the construction emergency plan;</p> <p>(5) Renovate the key buildings in advance; conduct the retaining protection for the building with poor stability;</p> <p>(6) Except reasonable adjustment of parameters such as soil chamber pressure, jack pushing force and grouting pressure during shield propelling, reduction of disturbance for surrounding soil mass as possible and control of surrounding stratum deformation, conduct grouting reinforcement for stratum around the ancient building foundation if necessary so as to enhance the bearing capacity and further control the ancient building deformation.</p>		Environmental Protection Bureau			

Phase	Environmental Factors	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
	Atmospheric Environment	<p>(1)Hard enclosure shall be established on the construction site, and the major roads shall be hardened and kept clean.</p> <p>(2)Special personnel shall be established for the environmental protection on the construction site. Corresponding sprinkling equipment shall be equipped to sprinkle water in time and reduce dust pollution.</p> <p>(3)Duly spray water when dismantling and digging dry earth ground to keep certain humidity of the operational surface.</p> <p>(4)The rubbish and residual earth produced during house dismantlement shall be cleaned away and transported within 3 days after dismantlement of the house, and the residual earth piles and exposed ground left over for over 2 days shall be covered with dust-proof cloth or solidified to prevent dust.</p> <p>(5)The vehicles transporting rubbish, residual earth and sands shall obtain “permit for transport vehicles of residual earth and sands”. The transport trucks shall be well sealed without leakage, and shall not be excessively full during loading to guarantee no littering during transport. In case of littering during transport, cleaning shall be carried out in time to reduce pollution.</p> <p>(6)Explosion, dismantlement, earth and stone operation and manual dry sweeping shall be not carried out in case of dry weather with air pollution index above 100, or strong wind above level 4. In case of air pollution index between 80-100, cleaning shall be carried out every 4 hours with alternative of sprinkling and cleaning. And denser cleaning shall be carried out in case the air pollution index is larger than 100.</p> <p>(7)Establish washing platform inside the gate of the construction site. The washing operational ground and the roads connecting the entrance and exit must be hardened. Frequently wash the earth on the transport vehicles and chassis. The operational vehicles shall clean the earth on the wheels when running out of the boundary to reduce earth carried by the wheels.</p>	Construction Unit	Project Owner Local Environmental Protection Bureau	The owner entrusts qualified organ to undertake the work by means of contract.	TSP	calculated into engineering fee
	Water Environment Ground Water	<p>(1) Do well in design of drainage system on the construction site during the construction period. The excretion sewage of the construction personnel shall be collected and disposed of by the environmental health personnel regularly.</p> <p>(2) Establish sediment tank at the drainage outlet on the construction site, and the construction sewage shall be recycled for washing or greening the site through sediment disposal. The construction slurry in shield tunneling shall be totally recycled through disposal by the mud-water separation system.</p>	Construction Unit	Project Owner Local Environmental Protection Bureau	The owner entrusts qualified organ to undertake by means of contract	pH, SS, Oil, COD	calculated into engineering fee

Phase	Environmental Factors		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
		Underground Water	<p>(1)Establish septic tank in the construction camp, and equip with anti-leakage measures to prevent pollutionon the underground water;</p> <p>(2)The domestic rubbish produced during construction period shall be collectively managed, and handed over to the municipal environmental health department for collective disposal to prevent pollution on the underground water source.</p> <p>(3)The digging construction scale of the base pit of underground station is large, and the adverse factors that influence the stability of base pit shall be comprehensively considered, and suitable protective measures shall be adopted to ensure the safety of the base pit construction, surrounding road, underground pipelines and buildings.</p> <p>(4) Strengthen construction monitoring, and carry out close monitoring over the enclosure structure of the base pit, horizontal and vertical movement of the sourrounding buildings, the changes of stress on the enclosure structure and underground water level, and earth pressure;</p>	Constructi on Unit	Project Owner Local Environmen tal Protection Bureau	The owner entrusts qualifie d organ to underta ke by means of contract	Under ground water level, ground settle ment extent, water quality	monitoring expenses(600,000 yuan); The other expenses are calculated into engineering fee
	Ecologi cal environ ment	Vegetati on greening	<p>(1) Carry out necessary restoration and compensation for the green land occupied, and restore its ecological functions as soon as possible.</p> <p>(2) Protect the vegetation in the land requisitioned and areas along the line during project construction, and reduce damage to the woods, grass land and bushes in the land temporarily used, and around the operational zone.</p>	Constructi on Unit	Project Owner Local Environmen tal Protection Bureau			calculated into engineering fee
		Water and soil erosion	<p>(1)The construction unit shall formulate construction organizational plan for the earth and stone project according to the climatic features and characteristics of rainfall in the area. The construction unit will avoid the rainy season to carry out large-scaled earth and stone project; And it will make out water and soil conservation measures during construction of earth and soil project;</p> <p>(2) The construction deserted dregs will be cleaned and transported in time, and the road base surface built will be stamped solid; Properly carry out protective measures;</p>	Constructi on Unit	Project Owner Local Environmen tal Protection Bureau			calculated into engineering fee
		Solid wastes	<p>(1)The construction unit will sign construction rubbish transport contract with the company engaged in transport of construction rubbish, and apply for approval certification for disposal of construction rubbish.</p> <p>(2)The construction unit shall be equipped with managerial personnel to carry out site management of the disposal of dregs and rubbish. The vehicles transporting dregs shall be equipped with sealed cover, and shall run according to the prescribed time, site and routes.</p> <p>(3)The residual earth site shall be leveled in time, and be equipped with drainage pitches etc. to prevent water and soil erosion.</p>	Constructi on Unit	Project Owner Local Environmen tal Protection Bureau			calculated into engineering fee

Phase	Environmental Factors	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)	
	Social environment	Traffic evacuation	(1)Strengthen tariffic management during construction period and rationally arrange construction program to carry out construction with less road occupied and speed up construction progress through making out detailed traffic evacuation program during open digging of stations that influences traiffc.	Project owner	Project Owner Municipal Government			calculated into engineering fee
		Resident income	(1)Compensation and reward measures will be taken for the impacts on resident income due to occupation of agricultural fields, and income of the businesses and relevant employees respectively.	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee
		Resident Living	(1) Carry out survey of the roads, various underground pipelines along the subway line; Determine the resettlement and relocation program with relevant departments in advance; (2) Establish enclosure on the construction site to lower impacts on residents' life due to construction noise; sprinkle water to reduce dust on the construction site, and the odd construction materials shall be covered to reduce impacts due to dust.	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee
		Human Health	(1)Carry out immunity injection for the construction personnel to improve health and prevent infection; carry out regular physical check for the construction personnel. (2)Strictly carry out working and rest system for the construction personnel operating equipment with high noise and vibration, guarantee sufficient rest, and shall not alternate shifts and work overtime except on special occasions. (3)The workers shall wear masks during tunnel construction. The ventilation system in the tunnel shall be kept in normal working state to guarantee sufficient amount of ventilation. Construction inside the tunnel shall be stopped in case the ventilation system is damaged. (4)Environmental protection materials shall be used during decoration of the tunnel and subway station, and the content of formalin therein shall meet the requirements of relevant standards. (5)The constructors shall wear corresponding gas masks and gloves during installation of the equipment of transformer substation to prevent physical damage due to poisonous substances in the equipment.					
		Resettle	(1) Make out compensation and reward program for the personal households with resettled houses and	Project	Municipal			Calculated into

Phase	Environmental Factors	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
		ment requisitioned land, and the enterprises, units and shops influenced by resettlement, and the employees of the shops influenced during resettlement. (2)Make out feedback mechanism for public opinion to collect the opinions of the public influenced.	owner	Government			resettlement expenses
	Materials Cultural Resources	rotection of Cultural Relics (1)In case of discovering cultural relics and ruins during construction, construction shall be stopped at once, and protective measures such as blockading the site, reporting to cultural relics management department of Nanchang City, which will organize rational measures to dig the cultural relics and ruins. Construction shall be proceed until such work is completed. (2)Formulate perfect monitoring program for the influenced cultural relics and ancient buildings; mainly monitor settlement, leaning and development of cracks etc. thereof, and set early warning value, alarming value and control value; make out emergency construction plan;	Construction Unit	Project Owner Local Environmental Protection Bureau Cultural Relics Bureau			calculated into engineering fee
Operational Period	Natural Environment	Sound Environment (1) Regularly rectify the wheel tread; (2)Regularly grind the steel rail to keep smooth surface; (3)Strengthen operational management of the comprehensive base, and improve the awareness of environmental protection of the driver and passengers; control honking; It is forbidden to carry out commissioning and workshop production with high noise. (4)It is requested to give priority to the low and medium-rise buildings within 15 meters to the air kiosks and cooling tower when considering resettlement measures. (5)Adjust the location of the air kiosks and cooling tower to keep the distance between them and the sensitive points larger than 15 meters. (6)Install silencer on the wind pipes and ventilators for the ventilation and air kiosks to reduce impacts due to noise by the air kiosks.	Project owner	Project Owner Local Environmental Protection Bureau			/
		Environmental Vibration (1) Give priority to vehicles with low noise and vibration value, and excellent structure during choice of vehicles; (2)Strengthen maintenance of the wheel rails, and regularly rotate wheels and grind steel rails; apply oil to the curves with small radius to guarantee desirable operational conditions thereof and reduce additional vibration.	Project Owner	Project Owner Local Environmental Protection Bureau			/
		Atmospheric Environment (1)The underground stations shall adopt decoration materials that comply with state environmental standard, which is good for protecting human health, and reducing the impacts on the surrounding environment due to the strange smell from the exhaust of the air kiosk during the preliminary operational period.	Project owner and government	Project Owner Local Environmental			calculated into engineering fee

Phase	Environmental Factors	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)	
		(2) Buildings with a high concentration of populations such as schools, hospitals and concentrated residential areas etc. shall not be built within 15 meters to the air kiosks.	planning department	tal Protection Bureau				
		Water Environment	Strengthen monitoring of the domestic sewage and production sewage during operational period of the stations and depots along the project line to discharge such sewage after reaching the standard.	Project owner entrusts qualified unit	Project Owner Local Environmental Protection Bureau	The owner entrusts qualified organ to undertake by means of contract	pH, SS, COD	15
	Ecological Environment	Vegetation / Greening		Project Owner	Local Environmental Protection Bureau			calculated into engineering fee
		Solid Wastes	(1)Establish dustbin for the domestic rubbish at the stations along the line, and arrange managerial staffs to clean the ground and wagon in time, and classify the rubbish and collectively transport to environmental health department for collective disposal.	Project Owner	Local Environmental Protection Bureau			calculated into engineering fee
	Social Environment	Protection of Disadvantaged Populations	(1)Establish non-barrier passage for the disabled at stations; (2)The toilet cesspit for females shall be increased according to due proportion at various stations. (3)Formulate rational ticket price mechanism for the low-income populations;	Construction Unit	Project Owner			calculated into engineering fee

Phase	Environmental Factors		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
		Human Health	(1)The staffs exposed to high-noise operation in the depot repair workshops shall wear ear plug etc.. (2)The driver and passengers of the subway train shall shorten the working time as much as possible, and regularly receive physical check to guarantee physical and mental health. (3) Guarantee normal operation of the ventilation system and carry out regular air quality test to lower air pollution in the underground sections. (4)The staffs exposed to dangerous wastes such as waste oil and dregs produced by the treatment system of oil-bearing waste water, the oily cleaning cloth of various processes, waste transformer and waste storage battery etc. shall wear protective gloves and masks.	Project Owner	Local Environmental Protection Bureau			Calculated into daily operational expenses
	Material cultural ruins	Cultural relics	Strengthen own protective measures of the cultural relics and ancient buildings, properly take engineering measures, establish vibration monitoring mechanism, strengthen long-term tracing and monitoring to guarantee no adverse impact will be caused on the protected cultural relics due to operation of the train.	The project owner entrusts qualified unit	Project Owner Local Environmental Protection Bureau Cultural relics bureau			90

Table4-2 List of General Characteristic Mitigation Measures of the Environmental Impacts by Nanchang Rail Transit Line2 Funded with the Loan of World Bank

Phase	Environmental Elements	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(100,000 Yuan)
Feasibility Study and Design Stage	Natural Environment	Environmental Vibration	(1) Adopt 60kg/m seamless routes adopted in engineering design will positively prevent vibration pollution. (2) The the protective distance for buildings on both sides of the underground routes in areas such as “mixed district, CBD”, “industrial concentrated district”, and “both sides on the traffic artery” shall be 25 meters. The protective distance for	Design unit	Project Owner Local Environmental Protection Bureau		/
		Sound Environment	(1) It is requested that buildings sensitive to noise such as residential area, school and hospital not be built within the noise prevention distance, for example 15 metter to the air kiosk and cooling tower(category 4 area), 26 meters(category 2 area) and 50 meters(category 1 area).	Design unit	Project Owner Local Environmental Protection Bureau		Calculated into design fee
		Surface Water	(1) Construction site and spoil ground shall not be established within the level I and level II reserve areas for the drinking water source of Ganjiang River.	Design Unit	Project Owner Local Environmental Protection Bureau		calculated into design fee
		Underground Water	(1) Underground continuous wall is adopted in construction to stop water for Qianhu Avenue station, Xuefu Avenue station, Cuiyuan Road station, Subway Building station, Yayuan Road station, Hongguzhong Avenue station, Tengwangge station, Yangming Park Station, Qingshan Road station, Fuzhou Road station, Bayi Square station, Yongshu Road station, Yongshu Road station, Dinggong South Road station, Nanchang Railway Station and Hongdu Avenue station. (2) Drilling pouring stake enclosure and spray stake are adopted to stop water for Frong South Avenue station, west express passenger transport station, Longgang Station, International Sports Center station, Wolongshan Station, No. 3 Lingbei Road station, Xinjia'an Station. (2) Water stopping measures are taken for section that runs across F2 fracture zone under Ganjiang River to cut off penetration channels of the river water.	Design Unit	Project Owner Local Environmental Protection Bureau		calculated into design fee
	ecological environment	(1) For the design of station entrance/exits and ventilation pavilions for 12 stations including Zhanqiannan Avenue Station, Nanchang west railway station, Longgang Station, International Sports Center Station, Wolongshan Station, Lingbei 3rd Road Station, Qianhu					

Phase	Environmental Elements	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(100,000 Yuan)
		<p>Road Station, Xuefu Road Station, Cuiyuan Road Station, Metro Building Station, Yayuan Road Station, Honggu Middle Road Station, it shall consider in principle their location of Changbei Honggutan New Area, which is a integrated modern new downtown and CBD of commercial, office, information and business functions, so their structures and appearances shall be uniform as possible.</p> <p>(2) For 7 stations in Changnan old town central area and Chengdong district of Yangming Park Station, Qingshan Crossing Station, Yongshu Road Station, Ding Road South Station, Nanchang Railway Station, Hongdu Middle Road Station and Xinjia'an Station, the design of the stations and ventilation pavilions in this section shall be arranged in combination with surrounding buildings as possible, and it can consider the joint construction with existing ground buildings if conditions allow so as to ensure the coordination of station buildings with surrounding urban building landscape, reduce the impact of newly built facilities on ground landscape visual effect and make them open space presenting the urban style.</p> <p>(3) For Fuzhou Road station and Bayi Avenue station, the design of entrance/exit and ventilation pavilion of station shall fully consider the actual conditions and adopt the combination design concept of blending method and hidden method to both reduce the impact of station entrance/exit and ventilation pavilion on ground landscape visual effect, and not lose the eye-catching state of station building so that it can maintain the open landscape space of Nanchang city and surrounding grandeur feeling, but also blend into the modern atmosphere.</p>					
	Social Environment	Resident's life	(1) Compare and select route program for sections from International Sports Center Station to Qianhu Avenue Station, Fenghe Station(former World Trade Center Station) to Yangming Park, select the program that involves less quantity of resettlement to reduce impacts on the residents.	Design Unit	Project Owner Local Environmental Protection Bureau		calculated into design fee
		Traffic	(1) Select covered digging for construction of Yangming Park station, Fuzhou Road station, Yongshu Road station and Hongdu Avenue station with narrow roads and large traffic flow at present to reduce impacts on the ground traffic. (2) Formulate detailed traffic evacuation program before construction of Yangming Park station, South Dinggong Road station and Xinjiaan station etc. to reduce impacts on ground traffic. Specific traffic grooming scheme is as shown in the following table 11.6-2-a	Design unit	Project Owner Local Environmental Protection Bureau		calculated into design fee

Phase	Environmental Elements	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(100,000 Yuan)
	Planning	<p>Implement the major opinions in construction planning and planning environmental assessment,</p> <p>(1) The direction of the route is as follows: South Avenue in front of the station, west express passenger transport station, west passenger transport station, north avenue in front of the station, Fenghe Avenue, Chunhui Road, Ganjiang River, Yangming Road, Bayi Avenue, Luoyang Road, Shunwai Road and Shanghai Road. The length and direction of the route are basically identical with the planning.</p> <p>(2)The whole route is totally underground line.</p> <p>(3)Totally 22 stations are established, which are all underground stations, including South Avenue in front of the station, west express passenger transport station, Longgang station, international sports center station, Wolongshan station, No. 2 Lingbei road station, Qianhu Avenue station, Xuefu Avenue station, Cuiyuan road station, Subway building station, Yayuan road station, Hongguzhong avenue station, Yangming park station, Qingshan road station, Fuzhou road station, Bayi square station, Yongshu road station, South Dinggong Road station, Nanchang Railway Station, Hongdu Avenue Station and Xinjia'an Station. 3 stations have been added to the original planning program.</p> <p>(4) Comprehensive vehicle base for west express passenger transport station is established on the south of the west express passenger transport station, which is identical with the original planning program.</p>	Design unit	Project Owner Local Environmental Protection Bureau			calculated into design fee
	Material Cultural Resources	<p>(1) Transfer the entrance and exit, and air kiosks of No. 10 station of Bayi Square Station out of the controlled construction zone of Bayi revolution memorial tower, and it is requested to transfer to the west near the pedestrian lane of Bayi Avenue.</p> <p>(2)Meanwhile, strengthen landscape design of the entrance and exit of No.4, 7, 9 and 10 stations, and avoid adverse impacts on "Memorial Hall for Maozedong's Thoughts" and "Bayi Revolution Memorial Tower".</p>	Design unit	Project Owner, Local Environmental Protection Bureau, Cultural Relics Bureau			calculated into engineering fee

Phase	Environmental Elements		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(100,000 Yuan)
Construction Period	Natural Environment	Sound Environment	(1) Establish temporary 3-4 meter high sound insulation walls or sound absorption screen for the sensitive points with serious impacts by construction noise of the station. (2) Specific sensitive points are as shown in the following table 11.6-2b:	Construction Unit	Project Owner Local Environmental Protection Bureau	The owner entrusts qualified organ to undertake by means of contract	Equivalent sound level A	Monitoring expenses: 400,000 yuan; Other expenses: 3 Million yuan
		Environmental Vibration	(1) Strengthen vibration monitoring and settlement monitoring during the construction period for the station construction site, and surrounding sensitive points, and the vibration sensitive points that runs under or are close to the project. Specific sensitive points are as shown in the following table 11.6-2-c:	Construction Unit	Project Owner Local Environmental Protection Bureau	The owner entrusts qualified organ to undertake by means of contract	Vibration level Z	Monitoring expenses is 300,000 yuan; The other expenses is calculated into engineering fee
	Water Environment	Surface Water	(1) It is forbidden to directly or indirectly discharge the sewage and domestic sewage on the construction site into Ganjiang River. And construction site and residual dregs site shall not be established within the level I and level II reserve areas of the drinking water sources. (2) It is strictly forbidden to dig earth and fill the ground in case of heavy rain. Cover cloth etc. on the temporary spoil and materials in case of rain to prevent entry into the Ganjiang River and water pollution due to the spoil flushed down by the heavy rain. (3) Certain anti-penetration and leakage measures will be taken on the Hongguzhong avenue station construction site to prevent penetration of the construction sewage into underground areas, and into Ganjiang River through underground water.	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee

Phase	Environmental Elements		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(100,000 Yuan)
		Underground Water	(1) Due to the large quantity of daily underground water extracted to reduce water in the base pit, it is requested to discharge the waterfall and drainage into the urban rainwater system through removing SS in temporary sediment tank. (2) Water stoppage measures shall be taken to cut off penetration channels of river water for the section that runs across fracture zone F2 under Ganjiang River. Meanwhile, management of mud grouting shall be strengthened during construction to strictly control quantity of grouting and quality of slurry and reduce soil deformation during construction. Monitoring ships shall be established to patrol on the river at any time to monitor the changes at the bottom of the river, and the measurement results will be fed back to construction personnel in time for timely adjustment of various construction parameters.	Construction Unit	Project Owner Local Environmental Protection Bureau			Monitoring expenses: 100,000 yuan; Expenses for temporary sediment tank: 500,000 yuan
	Ecological Environment	Vegetation Greening	(1) Duly plant vegetation such as lawn etc. in addition to cleaning away engineering spoils and leveling construction site after completion of construction for the construction site from west express passenger transport station to Longgang station. (2) Clean and restore the roads and municipal land occupied during construction period after completion of construction for the construction site from International Sports Center Station to Xinjiaan Station.	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee
		Solid Wastes	(1) The spoil will be transported to spoil ground of Yaohua repair section project department, and spoil ground of Jiaoqiao depot for landfill and disposal.	Construction Unit	Project Owner Local Environmental Protection Bureau			/
	Materials Cultural Resources	Cultural Relics	(1) Strengthen vibration monitoring and settlement observation during construction period for the cultural relics involved along the project line.	Construction Unit	Project Owner Local Environmental Protection Bureau Cultural Relics Bureau	The owner entrusts qualified organ to undertake by means of contract	Vibration speed	calculated into engineering fee
		Ancient and renowned trees	(1) Control the digging surface of the underground projects, strengthen protection of tree roots and environmental protection during construction period etc. for the ancient and renowned trees of No. 10 Nanchang Middle School.	Construction Unit	Project Owner, Landscape Bureau			/
	Social	Traffic	(1) It is requested to adopt cover digging for construction of Yangming Road, Fuzhou Road,	Project Owner	Municipal			calculated

Phase	Environmental Elements	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(100,000 Yuan)
	environment	evacuation	South Dinggong Road and Hongdu Avenue Station with the most serious impacts on traffic during construction period. (2) Make out detailed construction organization and traffic evacuation program for stations constructed with open digging to minimize impacts on traffic, and travelling by disadvantaged populations such as pedestrians, motorized vehicle and the disabled etc..		Government		into engineering fee
		Resident income	(1) Resettle the private houses by means of compensation in cash and exchange of property right ; (2) Compensate the requisitioned land according to the highest annual output value in the area, and the times of compensation is 28.6 times; In addition, green seedling compensation will be granted, and the aforesaid compensation expenses will be directly granted to each person of the influenced families. (3) In addition to the resettlement compensation for the aforesaid shops to be resettled, the decoration expenses will be compensated, and 6-month compensation for suspension of production or business will be granted as reward. One lump-sum 6-month minimum monthly wage will be granted to the employees of the shops	Project Owner	Municipal Government		Calculated into resettlement expenses
	Construction risk	Construction risk of the station	Specific measures are as shown in the following table 11.6-2-d:	Construction Unit	Project owner and local environmental protection bureau		Calculated into engineering supervision expenses
Risk of interval construction		Specific measures are as shown in the following table 11.6-2-e:					

Phase	Environmental Elements	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(100,000 Yuan)
	floodproofing measures	set emergency drainage measures for foundation pits of excavated stations during construction period; set rain water pump station nearby; the discharging capacity of pump station shall be designed according to 50-year return period standard in Nanchang city. The flood protection materials shall be also reserved on construction site.	Construction Unit	Project owner and local environmental protection bureau			Calculated into engineering supervision expenses
	Earthquake measures	the left bank of rail transmit after passed through Ganjiang River section is of riverside embankment and the right bank is of riverside flood protection wall. The design flood protection standard for both embankment and wall is of 100 years; the design flood protection standard for both banks when passing through Yudai River Master Channel is of 100 years;	Construction Unit	Project owner and local environmental protection bureau			Calculated into engineering supervision expenses
	Environmental Supervision during Construction Period	(1)Carry out monitoring and supervision over the environmental problems caused by construction	Construction Unit	Project Owner Local Environmental Protection Bureau			Calculated into engineering supervision expenses
	Environmental Protection Organ and Personnel Training	(1) Training on establishment of environmental protection organs of the construction unit and building unit, environmental protection laws, construction planning, and environmental monitoring guidelines and regulations etc..	Construction Unit	Project Owner Local Environmental Protection Bureau			5

Phase	Environmental Elements	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(100,000 Yuan)	
Operational Period	Natural Environment	Sound Environment	(1)Establish 2-meter high sound screen(1110 meter long) by the commissioning lien of the depots and comprehensive base, and the investment amount will be 820,000 yuan. Install 100m ² sound isolation windows in the vehicle washing shed, control room and workshop. The investment amount will be 45,000 yuan. (2) The air kiosk silencers in 19 air kiosks are prolonged from 2m to 3m or 4m. The 10 cooling tower are super-low noise crossflow cooling tower. One cooling tower is surrounded with sound isolation hood. The 5 air kiosk near to the sensitive points are adjusted to area beyond 15 meters to the sensitive points. One residential buildings less than 15 meters(controlled distance) to the air kiosk on the south at the west end of Hongdu Avenue Station. The specific arrangement is as follows:see table 11.6-2-f	Construction Unit	Project Owner Local Environmental Protection Bureau		Equivalent sound level A	Monitoring expenses: 300,000 yuan; Other expenses: 30.45 Million yuan
		Environmental Vibration	Establish steel spring float plate integrated roadbed for 16 sensitive points such as school, hospital and residential areas that the project lines runs through(from over the rail to 5 meters to the central line of the external rail), including Changbei Post Office(dormitory of Changbei Post Office), Tangzihe reconstruction community, No. 8 Railway Village and Shajing Community etc., totally 2390 meters for the double lines. Moreover, give priority to two sensitive points such as Fuxiang Wang's and Fuxiang Zhu's family the project runs under in resettlement. In case the resettlement measures have not be implemented, establish steel spring float plate integrated roadbed, totally 760 meters for the double lines. (2) As for the 36 sensitive points that exceed standard within 5 to 10 meters, mainly including Jiangxi Provincial Publication Building, Yuzhang backstreet food city, and teachers' dormitory of Chengbei school etc., adopt elastic support block integrated roadbed. 3)As for other 7 environmental sensitive points with environmental vibration VLZ10 exceeding the standards, or qualified VLz10 but unqualified VLzmax, including Xiao' in Yuantou, Li's in Wangshigang, teachers' dormitory of No. 28 Middle School of Nanchang, and employee dormitory of transport bureau, and office building of provincial party committee school, adopt GJ-III vibration reduction fastenings, totally 1200 meters for double lines. See the following table for the specific measures: see table 11.6-2-g	Construction Unit	Project owner and local environmental protection bureau	The project owner entrusts qualified organ by contract	Vibration Level	Monitoring expenses: 300,000 yuan; Other expenses: 83.88 Million yuan
		Atmospheric Environment	(1) It is requested to adjust the positions of 4 air kiosks at Cuiyuan Road station, Yangming Park station and Fuzhou Road station that have not met the requirement for the controlled distance for noise prevention(15 meters), and resettle the 4 residential buildings at Yongshu	Construction unit	Project Owner, Local Environmental			Calculated into expenses for noise

Phase	Environmental Elements	Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(100,000 Yuan)
	ent	Road station and Hongdu Avenue Station. Arbors shall be planted around the air kiosks to effectively reduce the impacts by the strange smell, and the ventilation outlets shall turn back onto the sensitive points such as residences etc..		Protection Bureau			measures
	Water Environment	(1)The sewage produced by the depots shall be disposed by the oil separation and sediment tank. (2)The domestic sewage at the stations along the subway line. (3)Anti-penetration measures shall be taken on the domestic sewage at the stations such as Hongguzhong Avenue station and Tengwangge station connected with the water of Ganjiang River to avoid penetration of the domestic sewage into underground, and discharge into Ganjiang River through underground water.	Construction unit	Project Owner, Local Environmental Protection Bureau			calculated into engineering fee
	Electromagnetic Environment	(1) Reserve compensation expenses for cable closed circuit TV for 28 residents with no access to cable TV at Xiaojia in Yuantou and Lijia in Wangshigang within 50 meters to the commissioning line.	Project Owner	Project Owner, Local Environmental Protection Bureau	The project owner entrusts qualified organ to undertake the work by contract	Power frequency electromagnetic field, strong radio interference field	Monitoring expenses 150,000 yuan; other expenses 1.4
	Solid Wastes	(1)The rubbish at various stations will be collected by the environmental health staffs, and collectively handed over to the urban rubbish site for disposal. (2)The dangerous substances such as waste oil and dregs, oily cleaning cloth of various processes, and waste transformer oil in the depots and comprehensive base shall be entrusted to the relevant qualified unit for harmless disposal. (3) The storage cells regularly replaced shall be recycled by the factory regularly, and anti-penetration treatment shall be carried out for the storage room of the storage cells to prevent leakage of the infiltration fluid.	Project Owner	Project Owner, Local Environmental Protection Bureau			calculated into engineering fee
	Environment	Vegetation Greening	(1) Comprehensive greening shall be carried out for the depots, comprehensive base and transformer station etc. during operational period, and the species of the trees shall be mainly local plants.	Construction Unit	Project Owner, Local Environmental Protection Bureau		

Phase	Environmental Elements		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(100,000 Yuan)
	Material cultural resources	Cultural relics	Establish steel spring float plate roadbed for 3 protected cultural relics such as Jiangxi Hotel, Jiangxi Provincial Literary Association(Sino-Russia Friendship Venue) and Jiangxi Provincial Exhibition Center(former site of Memorial Hall of Mao Zedong Thoughts) on both sides of the project line, totally 570 meters for the double lines. See the following table for specific information; see table 11.6-2-h	Construction Unit	Project Owner, Local Environmental Protection Bureau	The project owner entrusts qualified organ to undertake the work by contract	Vibration speed	Monitoring expenses: 200,000; Other expenses 1140
	Environmental protection organ and personnel training	Environmental Protection Organ and Training during operational period	Establish environmental protection organ of the operational unit, and training on environmental noise, vibration, air, and waste water monitoring and control techniques for relevant environmental protection managerial personnel	Project Owner	Project Owner, Local Environmental Protection Bureau			5
Total Environmental Protection Investment		Total: 132444,000 yuan						

11.6-2-a

No.	Station name	Station location	Construction method	Present status	Measures
1	Zhanqiannan Avenue Station	Juncture of Longxing Street and Planned F4 and F5 Road	Open cut method	No impact of existing traffic during construction of line 2	/
2	Nanchang west railway station	Planned road	Open cut method	No impact of existing traffic during construction of line 2	/

3	Longgang Station	Crossing of West Station Street and Longgang Road	Open cut method	Bi-direction total 6 lanes and 2Non-motor vehicle lanes, Longgang Road Bi-direction 6 lanes and 2 non-motor vehicle lanes	The station is constructed in two phases: Phase 1: construct the main structures and north side accessory structures, the enclosure occupies West Station Street north side road and open spaces; the West Station Street road traffic can be dispersed with south side half road surface; bi-direction total 6 lanes and 2 non-motor vehicle lanes, temporarily closed of Longgang Road north side road. Total 18 months. Phase II: Construct the station south side accessory structure; the West Station Street road traffic can be dispersed with north side half road surface; bi-direction total 6 lanes and 2 non-motor vehicle lanes; no impact on Longgang Road traffic; construction period of 4 months.
4	International Sports Center Station	Crossing of National Gym Avenue and Haibao Street	Open cut method	Bi-direction total 6 lanes and 2 non-motor vehicle lanes, Haibao Street bi-direction 4 lanes and 2 non-motor vehicle lanes	The station is constructed in 3 phases: Phase 1: Construct station main body structure; the enclosure occupies National Gym Avenue north side road; the National Gym Avenue road traffic can be dispersed with south side half ground and north side open spaces; bi-direction total 6 lanes and 2 non-motor vehicle lanes; no impact on Haibao Street traffic; total 11 months. Phase 2: Construct the enclosed station north side accessory structure, occupy the road north side space; the traffic is not affected; construction period for 4 months. Phase 3: Construct station south side accessory structure; the enclosure occupies National Gym Avenue south side road; the National Gym Avenue road traffic can be dispersed with north side half road and ensure National Gym Avenue bi-direction 6 lanes + 2Non-motor vehicle lanes no impact on Haibao Street road; construction period for 4 months.
5	Wolongshan Station	Crossing of Fenghenan Avenue and Wolong Avenue	Open cut method	Present as farmland at east side and south side and green land for west side, north side. Present Yangming Road status: bi-direction 6 lanes and 2 non-motor vehicle lanes.	The station is constructed in 3 phases: Phase 1: Construct north side main structures; make use of roads at Fenghenan Avenue west side and east side in station enclosure range to arrange bi-direction total 6 lanes and 2 non-motor vehicle lane ; total 15 months. Phase 2: Construct station west side accessory structures; make use of the road above main structures completed on Fenghenan Avenue and Fenghenan Avenue east side road to provide bi-direction total 6 lanes and 2 non-motor vehicle lane; total 7 months. Phase 3: Construct station east side accessory structure; make use of the road above main structures completed on Fenghenan Avenue and Fenghenan Avenue west side road to provide bi-direction total 6 lanes and 2 non-motor vehicle lane; total 7 months.
6	Lingbei 3rd Road Station	Crossing of Fenghenan Avenue and Lingbei 3rd Road	Open cut method	Present status of Fenghenan Avenue: Bi-direction total 6 lanes and 2 non-motor vehicle lane	The station is constructed in 2 phases: Phase 1: complete the station main structures, including main part enclosure construction, foundation pit excavation and main structure backfill; make use of both sides of enclosed range of station for traffic to ensure bi-direction 4 lanes and 2 non-motor vehicle lanes; total 22 months. Phase 2: conduct accessory structure and track laying construction (reserve entrance/exit not constructed); part of traffic makes use of the ground above completed construction main structures to provide bi-direction 4 lanes and 2 Non-motor vehicle lanes; total 5 months.
7	Qianhu Road Station	Fenghenan Avenue near Qianhu Avenue	Open cut method	Bi-direction 6 lanes + 2 sidewalks	Phase1: relocate the road to above the station accessory structure, and ensure Fenghenan Avenue bi-direction 6 lanes + 2 sidewalks Phase 2 (1# and 2# entrance/exit)”: the road is relocated to above of 3# and 4# entrance/exit of station to ensure Fenghenan Avenue bi-direction 4 lanes + 1 sidewalk Phase 3 (3# and 4# entrance/exit), the road is relocated to the above of 1# and 2# entrance/exit of station to provide Fenghenan Avenue bi-direction 4 lanes + 1 sidewalk
8	Xuefu Road	Crossing of Fenghenan	Open cut method	Present traffic at south-north	Phase 1: the road is relocated to above of entrance/exit to ensure Fenghenan Avenue at south-north

	Station	Avenue and Xuefu Road	method	direction: Fenghenan Avenue: Bi-direction 4 lanes + 2 non-motor vehicle lane; east-west direction Xuefu Road: single direction 3 lanes	direction as bi-direction 6 lanes + 2 non-motor vehicle lanes. Phase 2: the road is relocated to above the entrance/exit to ensure Fenghenan Avenue at south-north direction of bi-direction 4 lanes.
9	Cuiyuan Road Station	Crossing of Fenghenan Avenue and Cuiyuan Road	Open cut method	Present status of Fenghe Middle Avenue: Bi-direction total 6 lanes and 2 Non-motor vehicle lane .	The station is constructed in 2 phases: Phase 1: construct north side main structure enclosure structure, internal structures; make use of both sides in enclosure range of station to provide bi-direction total 6 lanes and 2 Non-motor vehicle lanes; total 16 months. Phase 2: construct accessory structure; make use of the road above station main structures for traffic of total bi-direction 6 lanes; total 6 months.
10	Metro Building Station		Open cut method	Present status of Fenghe Middle Avenue: Bi-direction total 6 lanes and 2 non-motor vehicle lanes; present status of World Trade Road: 4 lanes and 2 non-motor vehicle lanes.	Phase 1: construct station main structures and east side accessory structures, and set up temporary lane boards in the middle of station main structures to provide Fenghe Middle Avenue bi-direction 4 lanes + 2 non-motor vehicle lanes; prohibit straight traveling on Lvyin Road; construct the station main structures with bottom-up method and EMUs accessory structure; total 23 months. Phase 2: construct station west side accessory structures and ensure Fenghe Middle Avenue bi-direction 4 motor vehicle lanes + 2 non-motor vehicle lanes; Lvyin Road fully restores the traffic.
11	Yayuan Road Station		Open cut method	Present status of Fenghe Middle Avenue: Bi-direction total 6 lanes and 2 non-motor vehicle lanes; present status of Lvyin Road: 4 lanes and 2 non-motor vehicle lanes.	The traffic dispersions of Yayuan Road Station consists of two phases Phase 1: construct station main structures and east side accessory structures, and set up temporary lane boards in the middle of station main structures to provide Fenghe Middle Avenue bi-direction 4 lanes + 2 non-motor vehicle lanes; prohibit straight traveling on Lvyin Road; construct the station main structures with bottom-up method and EMUs accessory structure; total 23 months. Phase 2: construct station west side accessory structures and ensure Fenghe Middle Avenue bi-direction 4 motor vehicle lanes + 2 non-motor vehicle lanes; Lvyin Road fully restores the traffic. total construction enclosure of 3520m ² and construction period of 10 months; track-laying base total enclosure area of 4425m ² .
12	Honggu Middle Road Station	Crossing of Honggu Middle Avenue and Chunhui Road	Open cut method	Present status of Honggu Middle Avenue: Bi-direction total 4 lanes and 2 non-motor vehicle lanes	The station is constructed in 5 phases: Phase 1: Temporarily lay the covering system at construction intervals; make use of both sides of station enclosure to provide bi-direction total 4 lanes and 2 non-motor vehicle lanes; total 2 months. Phase 2: Construct main structure diaphragm wall; make use of temporary covering system to organize Honggu Middle Avenue traffic as bi-direction 6 lanes and 2 non-motor vehicle lanes; Chunhuilu traffic closed; construct the station main structures (local covered excavation) with bottom-up method; total 13 months. Phase 3: construct rest accessory structures and restore the east-west traffic of Honggu Middle Road Station; total 7 months.
13	Yangming Park Station	Lay in east-west direction at middle to south side of Yangming Road	semi-covered excavation method	Present status of Yangming Road: Bi-direction total 8 lanes and 2 non-motor vehicle lanes	The station is constructed in 5 phases: Phase 1: Construct north side main structure diaphragm wall, B-pillar and cross beam and lay the temporary covering system; make use of both sides of station enclosure to provide bi-direction total 6 lanes and 2 non-motor vehicle lanes; total 5 months. Phase 2: Construct south side main structure diaphragm wall; make use of north side temporary covering system to organize the traffic to provide bi-direction 6 lanes and 2 non-motor vehicle lanes; construct the station main structures with bottom-up method; total 14 months. Phase 3: Demolish north side temporary ground system and backfill north side top plate surface

					soil; restore north side road surface; make use of both sides of station enclosure to provide bi-direction total 6 lanes and 2 non-motor vehicle lanes; total 2 months. Phase 4: Construct south side accessory structure; make use of north side to organize the traffic for total bi-direction 6 lanes and 2 non-motor vehicle lanes; total 4 months. Phase 5: Construct north side accessory structure; make use of the road above station main structure to organize the traffic for bi-direction 6 lanes and 2 hybrid roads of pedestrian and non-motor vehicles; total 4 months.
14	Qingshan Crossing Station	Locate in the block of Bayi Avenue and Qingshannan Road, Yangming Road, Yangming East crossing southwest side	Open cut method	Present status of Yangming Road: bi-direction 8 lanes; present status of Yangming East Road: bi-direction 7 lanes; Present status of Qingshannan Road: Bi-direction 6 lanes; present status of Bayi Avenue: Bi-direction 8 lanes.	The station is constructed in 5 phases: Phase 1: enclose part of east end of line 2 station with the enclosure area of 870m ² ; construction period for 1 month; make use of the west side of station enclosure range to provide 2 motor vehicle lanes, the others do not affect present traffic. Phase 2: 1: Enclose line 2 station and part of line 3 station with the enclosure area of 21,880m ² ; construction period of 17 months; 2: Enclose the open cut station of line 2 in first sub-phase; construction period of 15 months; construct station open cut end of line 3 in 2 nd sub-phase; construct part of line 3 and construct the top plates in 3 rd sub-phase; construction period of 2 months. Make use of the east side of line 2 station east end enclosure to provide 2 motor vehicle lanes. Others do not impact the present traffic. Phase 3: 1: Enclose line 3 station north section semi-covered excavation range with the enclosure area of 2900m ² ; construction period of 3 months; 2: Make use of line 3 station semi-covered enclosure to provide Qingshannan Road 6 motor vehicle lanes + 2 non-motor vehicle lanes; others do not impact the present traffic. Phase 4: 1: Enclose the open cut range of line3 station with the enclosure area of 12870m ² ; construction period is 14 months; 2: Make use of line 3 station open cut enclosure to provide Qingshannan Road 6 motor vehicle lanes + 2 non-motor vehicle lanes; organize Yangming Road 8 motor vehicle lanes + 2 non-motor vehicle lanes. Phase 5: 1: Enclose residual accessory structure range with the enclosure area of 6520m ² and the construction period is 6 months; 2: Maintain present traffic flow.
15	Fuzhou Road Station	Bayi Avenue	semi-covered excavation method	Present status of Bayi Avenue: Bi-direction total 8 lanes and 2 non-motor vehicle lanes.	Phase 1: Construct station west side diaphragm wall and covering system; make use of both sides of enclosure range to provide bi-direction 8 lanes, 2 non-motor vehicle lanes and 2 sidewalks; total 6 months. Phase 2: Enclose and construct east side diaphragm wall and main structures); make use of covering and enclosure west side to provide bi-direction 8 lanes, 2 non-motor vehicle lane and 2 sidewalks; total 16 months. Phase 3: Enclose and construct east side accessory structure. Make use of enclosure west side to provide bi-direction 8 lanes, 2 non-motor vehicle lanes and 2 sidewalks; total 5 months. Phase 4: Remove covering system; make use of both sides of enclosure to provide bi-direction 8 lanes, 2 non-motor vehicle lanes and 2 sidewalks; total 2 months.. Phase 5: Enclose and construct west side accessory structure. Make use of enclosure east side to provide bi-direction 8 lanes, 2 non-motor vehicle lanes and 2 sidewalks; total 5 months.
16	Bayi Square	Bayi Avenue	Open cut method	Present status of Bayi Avenue: bi-direction total 8 lanes and 2 non-motor vehicle lanes.	
17	Yongshu Road Station	Lay out along south-north direction at middle to east	semi-covered excavation	Present status of Bayi Avenue: Bi-direction total 8 lanes and 2	The station is constructed in 5 phases: Phase 1: construct north side main structure diaphragm wall, B-pillar, cross beam; lay temporary

		side of Bayi Avenue	method	non-motor vehicle lanes. Present status of Yongshu Road Station: Bi-direction total 10 lanes and 2 non-motor vehicle lanes.	covering system; make use of both sides of station enclosure to provide bi-direction total 10 lanes and 2 non-motor vehicle lanes; total 5 months. Phase 2: Construct east side main structure diaphragm wall and main part internal structures; make use of west side temporary covering system to organize the traffic for total bi-direction 10 lanes and 2 non-motor vehicle lanes; construct the station main structures with bottom-up method; total 12 months. Phase 3: Construct 1# entrance/exit and air duct; remove the temporary ground system on main structure foundation pit; backfill the top plate soil and restore the road traffic of Bayi Avenue for bi-direction total 10 lanes and 2 non-motor vehicle lanes; total 6 months. Phase 4: Construct enclosure structure near 3# entrance/exit and 2# air duct east side and the temporary ground system; make use of both sides of enclosure to provide bi-direction 10 lanes and 2 non-motor vehicle lanes; total 3 months. Phase 5: Construct 2#, 3# entrance/exit and 2# air duct; make use of road above station main structures to provide total bi-direction 10 lanes and 2 non-motor vehicle lanes; total 3 months.
18	Ding Road South Station	Crossing east side of Luoyang Road and Square South Road	Open cut method	One-way 2 lanes and 2 non-motor vehicle lanes.	The station is constructed in 2 phases: Phase 1: construct station main structures. During main structure construction, prohibit all traffic of motor vehicles in station location range and all vehicles shall bypass through Zhanqian Road. Two non-motor vehicle lanes are set at north side of station enclosure. A 2.5m wide road is reserved out of station south side enclosure for pedestrian traffic. The construction period of phase 1 is 13 months. Phase 2: Construct the station entrance/exit and suspension part. During construction of station entrance/exit and suspension part, restore the traffic for 2 motor vehicle lanes and 2 non-motor vehicle lanes between enclosures above station main structures. The construction time of phase 2 lasts 6 months.
19	Nanchang Railway Station	At east square of Nanchang Railway Station; separately built with national railway station buildings	Open cut method	Present status of station location is of Pengzi Lane mainly of low-rise temporary buildings; station north side is Luoyang Road and the under tunnel of Luoyang Road under construction; the station area is planned for commercial, public traffic and residential land; the line direction in this area is basically of east-west.	No existing road occupation during construction period
20	Hongdu Middle Road Station	Crossing of Luoyang Road and Hongdu Middle Avenue	Open cut method	Present status of Luoyang Road: Bi-direction 2 lanes and 2 non-motor vehicle lanes; Present status of Shunwai Road: Bi-direction 4 lanes and 2 non-motor vehicle lanes; present status of Hongdu Middle Avenue: bi-direction 6 lanes and 2 non-motor vehicle lanes	Phase 1: Construct the enclosure structure and internal structures of station nodal region; Luoyang Road bi-direction 2 lanes + 2 non-motor vehicle lanes and Shunwai Road bi-direction 4 lanes + 2 non-motor vehicle lane; vehicles bypass through south side of nodal region; Hongdu Avenue bi-direction 6 lanes + 2 non-motor vehicle lanes; vehicles bypass from east and west sides of nodal region. Construct the main structures of station with bottom-up construction method; construction period for 9 months. Phase 2: Construct east and west sides of station, 1# entrance/exit 1# ventilation pavilion, 2# entrance/exit, 2# ventilation pavilion, Luoyang Road bi-direction 2 lanes + 2 non-motor vehicle lanes and Shunwai Road bi-direction 4 lanes + 2 non-motor vehicle lanes, and Hongdu Avenue bi-direction 6 lanes + 2 non-motor vehicle lanes; vehicles travel in original route. Construct the

					station main structures with bottom-up method; construction period for 11 months. Phase 3: Construct the station 3# and 4# entrance/exit; Luoyang Road and Shunwai Road make use of road above station main structures to organize the traffic; the Hongdu Avenue direction keep same traffic mode for total bi-direction 2 lanes and 2 hybrid road of pedestrian and non-motor vehicles; total 6 months.
21	Xinjia'an Station	Lay up along north-south direction of Shanghai Road	Open cut method	Present status of Shanghai Road: Bi-direction total 4 lanes and 2 non-motor vehicle lane	<p>The station is constructed in 3 phases:</p> <p>Set enclosure walls at Nanchang Institute of Aeronautical Technology and Jiangxi Armed Police Corps 3rd Detachment and divided Xinjia'an Station into south part and north part.</p> <p>Phase 1: construct Xinjia'an Station north enclosure, underground diaphragm wall, blocking wall, foundation pit excavation and structures; adopt open cut construction method.</p> <p>During construction period, the vehicle flow at south-north direction is dispersed to the urban main roads of Hongdu Middle Avenue and Qingshanhunan Avenue which are in 1km range; part of Shanghai Road section where the Xinjia'an Station is located is changed into one-way driving; the station north section reserves a non-motor vehicle lane; the station south section reserves bi-direction total 4 lanes and 2 non-motor vehicle lanes; total 13 months.</p> <p>Phase 2: construct Xinjia'an Station south enclosure, underground diaphragm wall, foundation pit excavation and structure construction; adopt open cut construction method.</p> <p>During construction period, part of Shanghai Road section where the Xinjia'an Station is located is changed into one-way driving; the station south section reserves a non-motor vehicle lane; the station north section reserves bi-direction total 4 lanes and 2 non-motor vehicle lanes; total 11 month.</p> <p>Phase 3: Remove Xinjia'an Station south construction enclosure; construct the accessory structures of residual entrance/exit and air ducts with open cut method.</p> <p>Restore the south-north traffic of Shanghai Road and reserve bi-direction 4 lanes; total 6 months.</p>

11.6-2-b

No.	Administrative zone	Name of sensitive spot	Section	Position relative to the station	Scale	Least distance from construction boundary (m)	Environment function area
1	Honggutan New zone	Wanda Xincheng	Cuiyuan Road Station	South end east side	3 buildings 524 households	30	Category 4a zone
2	Honggutan New Area	Lixiang Jiayuan	Cuiyuan Road Station	South end west side	3 buildings 176 households	30	Category 4a zone

3	Honggutan New Area	Fenghe Xincun	Cuiyuan Road Station	North end west side	20 households	28	Category 2 zone
4	Honggutan New Area	Jiangxin International Garden	Metro Building Station	South end east side	2 buildings 230 households	50	Category 4a zone
5	Honggutan New Area	Fenghe Duhui community	Yayuan Road	Northwest side	2 buildings 152 households	30	Category 4a zone
6	Honggutan New Area	International Financial Center	Honggu Middle Road Station	South end west side	2 buildings 120 households	30	Category 4a zone
7	Donghu District	Tangzihe Community	sectional ventilation pavilion	West side	3 buildings 150 households	16	Category 4a zone
8	Donghu District	Jiangxi Daily Press staff dormitory Zone A	Yangming Park Station	West end north side	3 buildings 70 households	10	Category 4a zone, Category 1 zone
9	Donghu District	Jiangxi Daily Press staff dormitory Zone B	Yangming Park Station	East end south side	3 buildings 200 households	13	Category 2 zone
10	Donghu District	Dongwanyixiang community	Yangming Park Station	West end south side	150 households	10	Category 4a zone, Category 2 zone
11	Donghu District	Nanchang Public Transport Company dormitory	Qingshan Crossing Station	North end west side	1 building 56 households	20	Category 2 zone
12	Donghu District	28th high school teacher dormitory	Qingshan Crossing Station	South end west side	2 buildings 78 households	10	Category 2 zone
13	Donghu District	Nanchang Center for Disease Control and Prevention staff dormitory	Fuzhou Road Station	North end east side	1 building 60 households	24	Category 2 zone
14	Donghu District	Nanchang University the Second Affiliated Hospital	Fuzhou Road Station	North end west side	1 building 1200 hospital beds	48	Category 2 zone
15	Donghu District	Bayi Avenue No.399	Fuzhou Road Station	South end east side	1 building 48 households	11	Category 2 zone
16	Donghu District	Yongshu Road residential area	Yongshu Road Station	North end west side	4 building 200 households	8	Category 2 zone
17	Xihu District	Jiangxi Province Bureau of Geology and Mineral Resources dormitory	Ding Road South Station	South side	9 building 352 households	7	Category 4a zone, Category 2 zone
18	Xihu District	No.1 Railway High School	Ding Road South Station	West end north side	2000 students	50	Category 2 zone

19	Xihu District	Railway No.8 Town 1	railway station	East end south side	5 building 200 households	16	Category 2 zone
20	Qingshanhu District	Railway No.8 Town 3	Hongdu Middle Road Station	West end south side	3 building 144 households	6	Category 2 zone
21	Qingshanhu District	Jiangxi Inspection and Quarantine Bureau Family Area	Hongdu Middle Road Station	East end north side	2 building 250 households	20	Category 4a zone
22	Qingshanhu District	Hufang Chucun	Xinjia'an Station	North end east side ventilation pavilion	50 households	26	Category 2 zone
23	Qingshanhu District	Nanchang Hangkong University School of Science& Technology	Xinjia'an Station	Middle part east side	500 students and teachers	10	Category 2 zone
24	Qingshanhu District	Shanghai Road residential community	Xinjia'an Station	South end west side	12 building 432 households	5	Category 4a zone

11.6-2-c

Name of building	Mileage	Foundation type	Pile length (m)	Pile diameter (m)	Relationship between pile and tunnel	Treatment program
Changbei Shajing Post Branch Office complex building	YAK33+100	Vibration driven cast-in-place pile foundation	15	0.425	Minimum clear distance of pile foundation and tunnel 5.15m	Strengthen shield construction control and the monitoring

Name of building	Mileage	Foundation type	Pile length (m)	Pile diameter (m)	Relationship between pile and tunnel	Treatment program
Changbei Shajing Post Branch Office residence	YAK33+140	Vibration driven cast-in-place pile foundation	15	0.425	Tunnel passing under building; the distance of pile foundation bottom from tunnel roof of 3.1m	Grouting reinforcement when removal
Jiangxi Publishing Group Building (Bank of China Building)	YAK35+569 .333	Large diameter cast-in-place foundation	About 18 - 22m	1.0 - 1.8m	Minimum clear distance of pile foundation and tunnel 4.2m	Strengthen shield construction control and the monitoring
China Bank Entrust Company Yangming Road Development Road Modification (Yintai Move-back building)	YAK35+648 .047	Vibrating type pipe driving cast-in-place foundation	About 20m	1.0 - 1.8m	Minimum clear distance of pile foundation and tunnel 3.4m	Strengthen shield construction control and the monitoring
Dongwanyi Street No. 45 residential building	YAK35+740 .021	strip foundation			Minimum clear distance of foundation and tunnel 5.7m	Strengthen shield construction control and the monitoring
Dongwanyi Street No. 9-15 residential building	YAK35+801 .451	strip foundation			Minimum clear distance of foundation and tunnel 9.4m	Strengthen shield construction control and the monitoring
Jiangxi Province People's Hospital	YAK35+861 .421	Bored rock socketed pile foundation	About 14 - 17.5m	1.2 - 1.8m	Minimum clear distance of pile foundation and tunnel 10m	Strengthen shield construction control and the monitoring
Nanchang municipal Procuratorate (former municipal intermediate people's court) residential building	YAK36+342 .675	strip foundation			Minimum clear distance of foundation and tunnel 3.2m	Strengthen shield construction control and the monitoring

Name of building	Mileage	Foundation type	Pile length (m)	Pile diameter (m)	Relationship between pile and tunnel	Treatment program
Nanchang municipal Procuratorate (former municipal intermediate people's court) residential building and bank	YAK36+353 .679	strip foundation			Minimum clear distance of foundation and tunnel 4.2m	Strengthen shield construction control and the monitoring
Jiangxi Provincial Public Security Department residential building	YAK36+438 .023	strip foundation			Minimum clear distance of foundation and tunnel 3m	Strengthen shield construction control and the monitoring
CCB Yangming Road branch	YAK36+510 .241	Pile foundation	about 10m		Minimum clear distance of pile foundation and tunnel 5.6m	Strengthen shield construction control and the monitoring
Public Security Department dormitory	YAK36+590 .448	Pile foundation	About 9m		Minimum clear distance of pile foundation and tunnel 8.4m	Strengthen shield construction control and the monitoring
Yangming Road commercial and residential building (Nanchang Disabled Rehabilitation Center and move-back building)	YAK36+610 .228	Anchor rod static pressure precast reinforced concrete square pile	About 5m	0.2*0.2m	Minimum clear distance of pile foundation and tunnel 1.4m	Strengthen shield construction control and the monitoring
Yangming Road Bank of Communications	YAK36+640 .328	raft foundation			Minimum clear distance of foundation and tunnel 1.7m	Strengthen shield construction control and the monitoring
Yangming Road No. 85 residential building	YAK36+670 .268	raft foundation			Minimum clear distance of foundation and tunnel 2.1m	Strengthen shield construction control and the monitoring

Name of building	Mileage	Foundation type	Pile length (m)	Pile diameter (m)	Relationship between pile and tunnel	Treatment program
Yangming Road No. 81 residential building	YAK36+685.564	raft foundation			Minimum clear distance of foundation and tunnel 2.2m	Strengthen shield construction control and the monitoring
Nanchang municipal legal service building	YAK36+705.524	raft foundation			Minimum clear distance of foundation and tunnel 2.5m	Strengthen shield construction control and the monitoring
Yangming Road No. 51 – 69 residential building	YAK36+739 .619	strip foundation			Minimum clear distance of foundation and tunnel 1.7m	Strengthen shield construction control and the monitoring
Nanchang municipal legal service building	YAK36+805.619	raft foundation			Minimum clear distance of foundation and tunnel 2.5m	Strengthen shield construction control and the monitoring
Traffic system Yangming Road renovation project of dilapidated buildings 2# building	YAK36+945.192	Man-excavated shaft pile foundation	About 15m	1 - 1.7m	Tunnel passing under building; the clear distance of pile foundation bottom from tunnel roof of 6.77m	Strengthen shield construction control and the monitoring, grouting protection
Material Trading Center north side building	YAK37+174 .078	Driven type cast-in-place pile foundation	About 8m	0.377 m	Tunnel passing under building; the clear distance of pile foundation bottom from tunnel roof of 7.25m	Strengthen shield construction control and the monitoring, grouting protection
Material Trading Center main building	YAK37+224 .078	box foundation			Minimum clear distance of pile foundation and tunnel 1.26m	Strengthen shield construction control and the monitoring, grouting protection
Material Trading Center south side building	YAK37+238 .028	Driven type cast-in-place pile foundation	About 8m	0.377 m	Tunnel passing under building; the clear distance of pile foundation bottom from tunnel roof of 6.48m	Strengthen shield construction control and the monitoring, grouting protection

Name of building	Mileage	Foundation type	Pile length (m)	Pile diameter (m)	Relationship between pile and tunnel	Treatment program
Nanjing West Road - Bayi Avenue commercial and residential building	YAK37+300 .000	Man-excavated shaft pile	About 15m		Minimum clear distance of foundation and tunnel 12m	Strengthen shield construction control and the monitoring
Jiangxi Medical College Medical Research Building	YAK37+380 .000	Preset square pile foundation	about 10m	0.35*0.35m	Minimum clear distance of pile foundation and tunnel 5.1m	Strengthen shield construction control and the monitoring
Jiangxi Medical College Teaching and Research Building	YAK37+400 .000	Cast-in-place foundation	19.5/ 18.9	0.8 - 1.6m	Minimum clear distance of pile foundation and tunnel 3.5m	Strengthen shield construction control and the monitoring
Jiangxi Province Hospital Of Traditional Chinese Medicine outpatient department	YAK37+515.640	Man-excavated shaft pile foundation	About 8m	0.9/1 .0/1. 2/1.4 m	Minimum clear distance of pile foundation and tunnel 5.3m	Strengthen shield construction control and the monitoring
Skirt building – No.236 and 237 at both sides of Galactic Peace International Hotel	ZAK39+740 .382 ~ZAK39+84 1.780	Independent foundation	—	—	Left line tunnel passes under the skirt building foundation; minimum clear distance of about 2.78m.	Reinforce with dual-pipe jet grouting pile
railway station building – No. 372	YAK40+785.777 ~YAK40+823.117	Cast-in-place bored pile (station building)	15.1m	1.0~1.2m (expanded head diameter of 1.5~1.9m)	Right line tunnel passes under the railway station building pile foundation; the right line clear distance to the pile foundation is about 2.38 - 6.69m.	Reinforce the station building protection measures with dual-pipe jet grouting pile; strengthen the monitoring of drainage culvert and Luoyang Road tunnel.
Railway No.8 Town No. 7	YAK41+210	rubble foundation	None	None	tunnel passing under the building, vertical clear distance of 4.51m	tilting dual-pipe jet grouting pile stabilization

Name of building	Mileage	Foundation type	Pile length (m)	Pile diameter (m)	Relationship between pile and tunnel	Treatment program
Railway No.8 Town No. 12	YAK41+280	strip foundation	None	None	Relation of pile and tunnel, vertical clear distance of 5.377m	tilting dual-pipe jet grouting pile stabilization
Railway No.8 Town No. 18	YAK41+350	rubble foundation	None	None	tunnel passing under the building, vertical clear distance of 4.565m	tilting dual-pipe jet grouting pile stabilization
Railway No.8 Town No. 16	YAK41+350	independent column foundation	None	None	tunnel passing under the building, vertical clear distance of 3.891m	tilting dual-pipe jet grouting pile stabilization
Railway No.8 Town No. 24	YAK41+400	rubble foundation	None	None	tunnel passing under the building, vertical clear distance of 5.867m	tilting dual-pipe jet grouting pile stabilization
Railway No.8 Town No. 22	YAK41+420	rubble foundation	None	None	Tunnel passing the side of the building, minimum clear clearance of side line of tunnel to the building of about 2.022m.	tilting dual-pipe jet grouting pile stabilization
Railway No.8 Town No. 72	YAK41+480	rubble foundation	None	None	tunnel passing under the building, vertical clear distance:5.284m.	tilting dual-pipe jet grouting pile stabilization
Railway No.8 Town No. 26	YAK41+530	rubble foundation	None	None	Tunnel passing under the building, vertical clear distance: 5.565m.	tilting dual-pipe jet grouting pile stabilization
Hybrid No. 6 building (Railway 8 th Village No. 32 south side)	YAK41+550	to be investigated	to be investigated	to be investigated	to be investigated	Incomplete data, to be investigated

Name of building	Mileage	Foundation type	Pile length (m)	Pile diameter (m)	Relationship between pile and tunnel	Treatment program
foreign transport fleet commercial and residential building	YAK41+890	Man-excavated shaft pile	About 10m	to be investigated	tunnel passing under the building, vertical clear distance:0.934m.	Demolish the building
Laodong community No. 13 building	YAK42+60	Man-excavated shaft pile	12~13 m	0.8~1 .2m	tunnel passing the side of the building, minimum clear clearance of side line of tunnel to the building of about 3.973m.	Reinforce with dual-pipe jet grouting pile at present stage

11.6-2-d

No.	Station	Engineering proposal	Construction method	Risk engineering category	Description of basic risk conditions	Risk classifications	Solution
1	Longgang station	underground 2-floor island station	open cut normal method	Geologic risk	1. The main soil layers in station foundation pit range are mainly of medium weathering argillaceous siltstone which is of soft rock. The softening characteristics may lead to rock strength variation and strength reduction. At same time, its own steadiness is poor and it will soften and disintegrate if exposed to the water for long term, and therefore lead to adverse impact on foundation evenness and foundation pit	Class II	1. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing measures. 2. Properly carry out anti-seepage for station buildings to avoid the rise of underground water level and pollution of station interior; conduct foundation pit monitoring and phreatic water level observation and treatment; reinforce the waterproof design and treatment at bottom of

2	International Sports Center Station	underground 2-floor island station	open cut normal method	Construction method risk	stability. The station adopts open cut construction method with the standard section width of 19.7m, enlarged end width of 24.1m and standard section maximum foundation pit depth of 16.21m.	Class II	foundation pit. 1. The first support is of concrete support to enhance the support stiffness; adopt large diameter boring bored cast-in-place pile to increase retaining structure stiffness. 2. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing measures. 3. Use waterstop curtain for station; properly carry out anti-seepage for station buildings to avoid the rise of underground water level and pollution of station interior; conduct foundation pit monitoring and phreatic water level observation and treatment; reinforce the waterproof design and treatment at bottom of foundation pit.
				Passing under municipal pipeline	There are a DN500 sewage pipe, a DN300 sewage pipe, a DN800 rain pipe, an electric cable and a DN300 gas pipe.	Class II	Adopt measures such as permanent relocation, temporary relocation and temporary hanging; the specific method shall be determined according to pipeline features, station construction method, station buried depth and other factors. The valves of gas pipe newly set outside two ends of station shall be properly protected.
3	Wolongshan station	underground 2-floor island station	open cut normal method	Construction method and geologic risk	1. The terrain is of west-high and east-low tendency; main structure foundation pit depth: about 16m - 19m; accessory structure foundation pit depth: about 10m. 2. The soil layers from top to bottom in foundation pit excavation range are in following sequence: 1-2 Artificial earth fill, 2-1 silty clay, 2-2 muddy clay, 2-4 medium sand mixing with few 2-3 fine sand; the foundation pit bottom is located at the interface of 5-1-2 argillaceous siltstone and medium sandy rock; 3. The elevation of station underground water level is 17.88-18.29m, and about 3m underground; the phreatic aquifer thickness is of 2.0m-3.7m with certain water richness.	Class II	1. Main body foundation pit retaining structure adopts 800-thick underground diaphragm wall for bracing; carry out dewatering in pit till the underground water level decreases 1.5-2.0m under foundation pit excavation face. 2. To ensure the waterproof performance of underground wall joints, adopt I-beam joint and prepare emergency plan for seepage to ensure the construction safety of foundation pit and reduce the impact of dewatering construction in pit on the ground settlement outside the pit. 3. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing measures. 4. Properly carry out anti-seepage for station buildings to avoid the rise of underground water level and pollution of station interior; conduct foundation pit monitoring and phreatic water

							level observation and treatment; reinforce the waterproof design and treatment at bottom of foundation pit.
				Neighboring existing structures and buildings	The upper part of station strides overhead and the piers are at both sides of station.	Class II	1. The construction monitoring shall be intensified for foundation pit retaining structure, traffic dispersion road face and bridge piers at both sides of station. Strictly control the ground settlement and horizontal displacement of bracing structures. 2. Monitor the deformation of piers beside the foundation pit and retaining structures, and prepare the protection plan for the piers beside the foundation pit; recommend the grouting reinforcement in case of too large deformation.
4	Lingbeisan Road station	Underground floor island station	open cut normal method	construction method and geologic risk	<p>1. The foundation pit cutting depth at center mileage of standard section of this station is 16.21m; end well foundation pit cutting depth is 17.25m; the main structure foundation pit adopts 800-thick underground diaphragm wall and I-beam joint; accessory structure foundation pit depth: about 9m. 2. The phreatic water level buried depth of underground on site is 2.7-3.4m; the pore water and surface waters communicates with Ganjiang River for mutual supplement and drainage</p> <p>3. The soil courses in station excavation range and foundation pit bottom are distributed as follows: <1-2> artificial earth fill, <2-1> silty clay, <2-2> muddy clay, <2-5> coarse sand, <5-1-1> argillaceous siltstone, <5-1-2> argillaceous siltstone; the foundation pit bottom is located at the interface of coarse sand and argillaceous siltstone; the soil layer in excavation range features rich water content and superior permeability.</p>	Class II	1. Adopt 3-axle mixing pile for reinforcement for accessory structure foundation pit bottom soils with the reinforcement area of 3m range under foundation pit bottom. 2. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing measures. 3. Properly carry out anti-seepage for station buildings to avoid the rise of underground water level and pollution of station interior; conduct foundation pit monitoring and phreatic water level observation and treatment; reinforce the waterproof design and treatment at bottom of foundation pit. 4. The retaining structure adopts the underground diaphragm wall with large stiffness and good waterstop performance; the underground diaphragm wall joint adopts I-beam rigid joint.
				neighboring existing structures and buildings	There is an existing open channel at west of this station. The channel depth is about 6m and about 20m from station main structure.	Class II	The impact of open channel on foundation pit and the protection of surrounding buildings shall be specially considered. The design adopts 800-thick underground diaphragm wall and I-beam steel joint method to prevent the water infiltration from

												open channel into the foundation pit. The first pass support adopts reinforced concrete support to reduce foundation pit deformation and prevent underwater level decrease outside of foundation pit so as to reduce the settlement of surrounding buildings and pipelines; it shall be closely monitored during construction and the grouting shall be done if necessary. Strictly control the ground settlement and horizontal displacement of bracing structures.
5	Qianhu Avenue station	underground station	2-floor island	open cut normal method	Construction method risk	1. The end well foundation pit depth is about 17.31m and others are same to the main body foundation pit.	Class II	The end well sets 4-pass supports; the first pass is of concrete support, and the 2 nd , 3 rd and 4 th pass supports are of $\phi 609t=16$ steel pipe support. The support spacing is less than that of main body standard section and the others are same to those of main body standard section.				
6	Xuefu Avenue East Station	underground station	2-floor island	open cut normal method	Construction method and geologic risk	1. The platform center foundation pit buried depth is about 17.71m. 2. The soils in station foundation pit excavation range include fill, silty clay, sandy soil, highly weathering pelite, medium weathering pelite. The bottom board is mainly located in medium weathering terrane. 3. The underwater are mainly of loosen rock pore water and base rock crack water, and the soil layers are of weak permeable stratum.	Class II	1. The first pass of support is of concrete support to improve the supporting stiffness with the spacing of 9m; adopt underground diaphragm wall and set crown beam (also as capping beam) at top to enhance the retaining structure stiffness. 2. The retaining structure adopts three passes of horizontal supports: the first pass of support aligns to pile top crown beam and adopts 800x1000 reinforced concrete support with the horizontal supporting distance of 9m; the 2 nd and 3 rd passes adopt $\phi 609t=16$ steel pipe support with the vertical spacing separately of 6.5 and 5.5 m and the horizontal support distance of about 3.0m. 3. The foundation bottom is located in medium weathering stratum with favorable foundation conditions and no need of any reinforcement measures for foundation bottom.				
7	Cuiyuan Road station	underground station	2-floor island	open cut normal method	Construction method and geologic risk	1. The terrain is of south-low and north-high tendency; the main structure foundation pit depth is about 17m-18m; accessory structure foundation pit depth: about 10m. 2. There is 3m- thick muddy and silty clay at south end of station, which may lead to collapse.	Class II	1. The station retaining structure adopts 800mm underground diaphragm wall. The underground diaphragm wall concrete strength adopts underwater C35 and two wall lengths of 23.5m and 25.0m. The wall bottom enters 5-1-2 medium weathering argillaceous siltstone for about 3.5m. 2. The				

							retaining structure adopts three passes of horizontal supports: the first pass of support aligns to pile top crown beam and adopts 800x1000 reinforced concrete support with the horizontal supporting distance of 9m; the 2 nd and 3 rd passes adopt $\phi 609$ t=16 steel pipe support with the horizontal support distance of about 3.0m and vertical spacing of 4.5m from top to bottom.
				Passing through under the municipal pipelines	The longitudinal pipelines along the top of station include 2 $\Phi 1000$ concrete rain pipes 2 $\Phi 400$ sewage pipes, 1200X200 electronic pipeline and 800X350 power supply pipeline; $\Phi 250$ gas pipeline crosses the auxiliary structures of station.	Class II	Adopt measures such as permanent relocation, temporary relocation and temporary hanging for existing pipelines; the specific method shall be determined according to pipeline features, station construction method, station buried depth and other factors.
8	Yayuan Road station	underground 2-floor island station	open cut normal method	Construction method risk	1. The station is of south-north trend; main structure foundation pit depth at standard section: about 16.326m; at south end well: about 17.165m at north shaft: about 18.09m; accessory foundation pit depth: about 10m.	Class II	1. The station retaining structure adopts 800mm underground diaphragm wall. The underground diaphragm wall concrete strength adopts underwater C35 and two wall lengths of 23.5m and 25.0m. The wall bottom enters 5-2-2 medium weathering <u>glutenite</u> for about 3.5m. 2. The retaining structure adopts three passes of horizontal supports: the first pass of support aligns to pile top crown beam and adopts 800x1000 reinforced concrete support with the horizontal supporting distance of 9m; the 2 nd and 3 rd passes adopt $\phi 609$ t=16 steel pipe support with the horizontal support distance of about 3.0m and vertical spacing of 4.5m from top to bottom.
				Neighboring existing structures and buildings	1. The station is under Fenghe Middle Avenue. 2. The west side is Gan'an Printing Automobile Service Building of Jiangxi Provincial Public Security Department (4-floor concrete structure) which is about 29m from main body foundation pit of station; the Vehicle Administration Office of Jiangxi Provincial Public Security Department (4-floor concrete structure) is about 30m from main body foundation pit of station; 3. The north side is of Fenghe Residential Zone (8-floor concrete structure)	Class II	During construction of station, it is necessary to monitor the deformation, settlement, cracks and inclination of all buildings in construction impact range. The minimum monitoring frequency shall be once every day; it shall be at least once every two days during construction of internal structures; the monitoring frequency shall be properly enhanced for major or specially protected buildings such as control buildings near the north side of station. Strictly control the ground settlement and horizontal

					which is about 13m from the foundation pit of 5# entrance/exit and about 40m from station main body; 4. The east side is Longteng Building (7-floor concrete structure) which is about 40m from station main foundation pit.		displacement of bracing structures.
				Passing through under the municipal pipelines	1. A 1200X300 copper power supply pipe is above the soil mass of station with the buried depth of 1.79m; 2. The 200PE diameter gas pipe crosses 1#-5# entrances/exits with the buried depth of 0.92m; 3. The 1000 diameter concrete rain pipe is above the main body with the buried depth of 2.55m; 4. The 600 diameter concrete sewage pipe is above the main body with the buried depth of 4.68m; 5. The 500 diameter cast iron water supply pipe crosses 1# and 2# air shaft with the buried depth of 0.89m; 6. 1200x200 optical fiber copper electronic pipeline crosses the station main structure and accessory structures with the buried depth of 0.58m.	Class II	Adopt measures such as permanent relocation, temporary relocation and temporary hanging for existing pipelines; the specific method shall be determined according to pipeline features, station construction method, station buried depth and other factors. The pipeline amount of this project is less, so the water supply pipeline and gas pipeline can be permanently relocated to above the station main body after earthing up of main body roof plate of station.
9	Honggu Middle Avenue station	Underground 3 rd floor island station	open cut normal method	Construction method risk	1. Standard foundation pit cutting depth of this station is 22.96m and the end well foundation pit cutting depth is 24.19m; accessory structure foundation pit depth: about 9 m.	Class II	1. The first support is of concrete support to enhance the support stiffness; adopt large diameter boring bored cast-in-place pile to increase retaining structure stiffness. 2. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing measures. 3. Properly carry out anti-seepage for station buildings to avoid the rise of underground water level and pollution of station interior; conduct foundation pit monitoring and phreatic water level observation and treatment; reinforce the waterproof design and treatment at bottom of foundation pit.
				Neighboring existing structures and buildings	1. The Nanchang Daily Press Building (International Finance Center) is about 20m at south of station main structure. 2. The Sheraton Hotel is about 23m from the west side of station main structure. 3. The Hongkekong 1 st block is about 23m from the east side of station main structure. 4. The World Trade Center property is about 17m from the north of station main structure.	Class II	1. Strengthen the construction monitoring of foundation pit retaining structure, traffic dispersion road surface and neighboring houses. Strictly control the ground settlement and horizontal displacement of bracing structures. 2. Monitor the deformation of piers beside the foundation pit and retaining structures, and prepare the protection plan for the piers beside the

							foundation pit; reserve grouting holes for the buildings besides the foundation pit, and conduct grouting reinforcement if detected too large deformation of foundation.
				Pass through under municipal pipelines	The longitudinal pipelines along the top of station include DN1200 water supply pipe, DN600-800 rain pipes, DN400 sewage pipes, 300X150 electric cable and DN250 gas pipeline.	Class II	Adopt measures such as permanent relocation, temporary relocation and temporary hanging for handling of existing pipelines; the specific method shall be determined according to pipeline features, station construction method, station buried depth and other factors. The valves of gas pipe newly set outside two ends of station shall be properly protected.
11	Yangming Park station	underground 2-floor island station	open cut normal method	Construction method and geologic risk	1. The platform center foundation pit depth is about 16.26m; west end well foundation pit depth: about 17.766m; east end well foundation pit depth: about 18.243m; accessory structure foundation pit depth: about 10m. 2. The underground water in foundation pit range of this station mainly includes pore confined water in quaternary gravel stratum, and the perched water in fill layer. The station is near the Ganjiang River, so the detailed investigation report recommends "special investigation and study for detailed relations of underground water and Ganjiang River water"; the station is located in old town with dense surrounding buildings. Yangming Road is the arterial road of city with large traffic volume; the foundation pit excavation range has miscellaneous fill, silty clay, muddy-silty clay and thick sandy layer. The bottom plate is mainly on pebble layer and part is located at high weathering argillaceous siltstone layer; part of accessory structure bottom plate bearing layer is of muddy silty clay.	1. Class II	1. The first pass of support is of concrete support to improve the support stiffness; adopt underground diaphragm wall with high stiffness and good waterstop effect with rigid joint for wall connection. 2. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing measures. 3. Properly carry out anti-seepage for station buildings to avoid the rise of underground water level and pollution of station interior; conduct foundation pit monitoring and phreatic water level observation and treatment; reinforce the waterproof design and treatment at bottom of foundation pit. 4. When accessory structure bottom plate bearing layer is of muddy silty clay, carry out skirting reinforcement and stripping reinforcement for foundation bottom stratum. 5. Adopt large stiffness bored pile for the accessory structure and retaining structures very close to surrounding buildings.
				neighboring existing structures and buildings	1. Jiangxi Daily Press concrete 16-floor; Jiangxi Daily Press concrete 9-layer; Yangming Road No. 178 concrete 5; west end underpass. 2. Yangming Road south concrete 7, Yangming Road No. 190 brick 3. Xinhua News Agency Jiangxi Branch concrete 5, Hongdu Hotel brick 3, Jiangxi	1. Class II 2. Class I	1. Strengthen the construction monitoring of foundation pit retaining structure, traffic dispersion road surface and neighboring houses. Strictly control the ground settlement and horizontal displacement of bracing structures. 2. Monitor the deformation of buildings besides foundation

					Straits Economic Technology Cooperation Center brick 4.		pit and retaining structure. Take measures such as foundation bottom grouting reinforcement if detected excess deformation of foundation. 3. For class I risk source, it shall carry out reinforcement treatment with 3-axle mixing pile for soil layer at outside of retaining wall. Insert H-type steel locally.
				Near municipal pipeline	1. DN500-DN600 concrete sewage pipe; DN900 concrete rain pipe; DN1000 concrete drinkable water pipe; 300×200 10KV electric cable.	1. Class II	1. Adopt measures such as permanent relocation, temporary relocation and temporary hanging for existing pipelines; the specific method shall be determined according to pipeline features, station construction method, station buried depth and other factors. If the relocation method is used, it shall be kept away from the station foundation pit as possible. 2. Temporarily relocate main pipelines affecting the station, and monitor the stratum deformation at locations after relocation. Once exceeded alarm range, take measures such as grouting reinforcement.
12	Qingshanlu kou station	Underground 3-floor island station for line 2; underground 2-floor island station for line 2	Line 2 station: open cut normal method; line 3 station: open cut normal method + semi-cover cut normal method + full-cover cut reverse method	Construction method and geologic risk	1. Station length of line 2: 202.9m; standard section main structure width: 24.5m; end well main structure width: 28.65m; bottom plate buried depth at center mileage of effective platform: about 23.22m; bottom plate buried depth at end well: about 24.25m. 2. Station length of line 3: 336.018m; standard section main structure width: 23.7m; end well main structure width: 25.75m; bottom plate buried depth at center mileage of effective platform: about 16.26m; bottom plate buried depth at end well: about 17.29m. 3. The stratum of line 2 station are mainly of plain fill, silty clay, fine sand, pebble, medium weathering muddy siltite with poor geologic conditions. 4. The stratum of line 3 station are mainly of plain fill, silty clay, fine sand and pebble with poor geologic conditions. 5. The station main body bracing of line 2 adopts 1000-thick underground diaphragm wall H-type steel joint. 6. The station main body bracing of line 3 adopts 800-thick underground diaphragm wall H-type steel	Class I	1. To ensure waterproof effect between diaphragm wall joints, adopt H-type steel joint and eliminate the joint seepage of diaphragm wall joints to ensure construction safety of foundation pit and relieve the impact of pit internal dewatering construction on external ground settlement. 2. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing and prestress reinforcement measures. 3. The irregular section of foundation pit has large risk, so it adopts covered cut reverse construction method with high safety. 4. Properly fulfill the monitor of foundation pit and observation and handling of phreatic level; strength the waterproof design and treatment for foundation pit bottom.

					joint. 7. The underground water phreatic water level buried depth of site is about 4-6m.		
				neighboring existing structures and buildings	1. Communication system Yangming Road dilapidated house transformation project 2# building (brick-concrete 8, friction pile): about 10m from foundation pit at west end of line 2 station; 2. north building of Material Trading Center (brick-concrete 4. friction pile): about 3.4m from the foundation pit at east end of line 2 station; Dieshan Road overpass (end support pile foundation): about 1.7m from the foundation pit at east end of line 2 station.	Class I	1. The design mainly takes measures from two aspects of foundation pit retaining type and underground water. The foundation pit retaining adopts large stiffness 1000/800-thick underground diaphragm wall and H-type steel joint; the first pass of support adopts reinforced concrete support to effectively reduce the foundation pit deformation and avoid decrease of underground water level out of the foundation pit so as to minimize the settlement of surrounding buildings and pipelines; strictly monitor during construction and carry out backfill and grouting if necessary. 2. Monitor the deformation of buildings besides foundation pit, ground surface and retaining structure and reserve grouting holes at buildings near the foundation pit; conduct grouting reinforcement if excess deformation of foundation is detected.
				Passing through under the municipal pipelines	1. Rain and sewage combined pipeline, concrete, DN300, buried depth of 1.59m; 2. Drinkable water pipeline, concrete, cast iron, DN800, DN250, DN300, buried depth of about 1m 3. Gas pipe, cast iron, medium pressure, buried depth of 0,94m.	Class II	Adopt measures such as permanent relocation, temporary relocation and temporary hanging for existing pipelines; the specific method shall be determined according to pipeline features, station construction method, station buried depth and other factors. The main pipelines affecting the station shall be temporarily relocated, and monitor the terrain deformation of locations after relocated. Once it exceeds the alarm value, conduct grouting reinforcement.
13	Fuzhou Road station	underground station	2-floor island	semi-cover cut normal method	Construction method risk	Class II	1. Main structure foundation pit depth: about 17m. 1. Adopt underground diaphragm wall structure and the first pass of support is of reinforced concrete support. 2. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing measures. 3. Properly carry out anti-seepage for station buildings to avoid the rise of underground

							water level and pollution of station interior; conduct foundation pit monitoring and phreatic water level observation and treatment; reinforce the waterproof design and treatment at bottom of foundation pit.
				Pass through/near municipal pipeline	1. Pipeline distributed along station west side: DN800 concrete rain and sewage combined pipe , 10KV electric, DN400 drinkable water pipe, 800X300 military/communication cable. 2. Pipelines distributed along east side of station: DN1000 concrete rain and sewage combined pipe	Class II	Adopt measures such as permanent relocation, temporary relocation and temporary hanging for existing pipelines; the specific method shall be determined according to pipeline features, station construction method, station buried depth and other factors. The valves of water supply pipe and gas pipe newly set outside two ends of station shall be properly protected.
14	Nanchang Railway Station	underground 2-floor island station	open cut normal method	Construction method and geologic risk	1. Foundation pit cutting depth at standard section center mileage: about 15.5m; end well foundation pit cutting depth: about 15.1m; main body foundation pit retaining structure adopts sloping + 800 underground diaphragm wall. 2. The stratum in foundation pit excavation range and foundation pit bottom of this station are basically of <3-1>, <3-2> fine sand, <3-3> medium sand and <3-4> coarse sand. It may lead to piping and sand drift during excavation construction.	Class II	1. The retaining structure adopts the underground diaphragm wall with large stiffness and good waterstop performance; the underground diaphragm wall joint adopts I-beam rigid joint. The retaining structure adopts the underground diaphragm wall with large stiffness and good waterstop performance; the underground diaphragm wall joint adopts I-beam rigid joint. The first pass of support adopts reinforced concrete support to effectively reduce the foundation pit deformation and avoid decrease of underground water level out of the foundation pit so as to minimize the settlement of surrounding buildings and pipelines; strictly monitor during construction and carry out backfill and grouting if necessary. 2. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing and prestress reinforcement measures. 3. Properly carry out anti-seepage for station buildings to avoid the rise of underground water level and pollution of station interior; conduct foundation pit monitoring and phreatic water level observation and treatment; reinforce the waterproof design and treatment at bottom of foundation pit.
				neighboring existing	Luoyang Road under-pass tunnel at north of	Class II	1. Strengthen the construction monitoring for

				structures and buildings	station is about 10m from the nearest position of main structures with large risk.		foundation pit bracing structure and traffic dispersion road surface. Strictly control the ground settlement and horizontal displacement of bracing structures. 2. Monitor the deformation of buildings besides foundation pit, ground surface and retaining structure and reserve grouting holes at buildings near the foundation pit; conduct grouting reinforcement if excess deformation of foundation is detected.
15	Yongshu Road station	Underground 2-floor island station	semi-cover cut normal method	Construction method risk	Foundation pin depth at station center and end well: about 17.34m; accessory structure foundation pit depth: about 10m.	Class II	1. The first support is of concrete support to enhance the support stiffness. 2. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing measures. 3. Properly carry out anti-seepage for station buildings to avoid the rise of underground water level and pollution of station interior; conduct foundation pit monitoring and phreatic water level observation and treatment; reinforce the waterproof design and treatment at bottom of foundation pit. 4. The retaining structure adopts the underground diaphragm wall with large stiffness and good waterstop performance; the underground diaphragm wall joint adopts I-beam rigid joint.
				neighboring existing structures and buildings	About 5m from the main body of station: Jiangxi Changyun Co., Ltd. (Shopping Mall building A) concrete 12; about 6m from the west of 4# entrance/exit of station: 7-days Inn (brick-concrete 9); about 12m from the west of 4# entrance/exit of station: China Life Insurance; about 12m from north side of main body of station: underpass of Yongshu Road (underground 1 st floor).	Class I	1. Strengthen the construction monitoring of foundation pit retaining structure, traffic dispersion road surface and neighboring houses. Strictly control the ground settlement and horizontal displacement of bracing structures. 2. Monitor the deformation of buildings besides foundation pit and retaining structure and reserve grouting holes at buildings near the foundation pit; conduct grouting reinforcement if excess deformation of foundation is detected.
				Passing through under the municipal pipelines	There are large diameter rain and sewage combined pipes (DN1800, DN1000, and DN800), drinkable water pipe (DN800), gas pipe (DN200), military copper/optical fiber (900x600) longitudinal along the station.	Class II	1. Carry out permanent or temporary relocation of pipelines affecting station main body and accessory structure construction to make them away from the station foundation pit (out of 6m range) and prepare protection

							plan for the pipeline still close to the foundation pit after relocation due to field restraints. 2. Monitor the terrain deformation of location of main station pipelines after relocated, and conduct grouting reinforcement once exceeded the alarm range. 3. For the critical pipelines with special requirements by supervised department, related measures shall be taken according the requirements.
16	Dinggong Road South station	Underground 2-floor island station	open cut normal method	Construction method risk	Foundation pit depth of foundation pit at platform center: about 16.21m; west end well foundation pit depth: about 17.195m; east end well foundation pit depth: about 17.579m.	Class II	1. The first support is of concrete support to enhance the support stiffness. 2. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing measures. 3. Properly carry out anti-seepage for station buildings to avoid the rise of underground water level and pollution of station interior; conduct foundation pit monitoring and phreatic water level observation and treatment; reinforce the waterproof design and treatment at bottom of foundation pit. 4. The retaining structure adopts the underground diaphragm wall with large stiffness and good waterstop performance; the underground diaphragm wall joint adopts I-beam rigid joint.
				neighboring existing structures and buildings	Station south side: No. 336 Jiangxi Provincial Economic and Trade Commission authority dormitory (brick-concrete 6); Zhanqian Road No.34-38 (brick-concrete 7); No. 339 Bureau of Geology and Mineral dormitory 3# building (brick-concrete 6); No.338 Bureau of Geology and Mineral dormitory 5# building (brick-concrete 8); No.340 Bureau of Geology and Mineral dormitory 2# building (brick-concrete 8). The location nearest to the main structure is only 5.82m away, so they are in intensive impact area. The net clearance from rain and sewage pipes after permanent relocation is 1.3m.	Class I	1. Strengthen the construction monitoring of foundation pit retaining structure, traffic dispersion road surface and neighboring houses. Strictly control the ground settlement and horizontal displacement of bracing structures. The alarm shall be provided when the accumulative building integral inclination is up to 0.002H or the inclination speed is higher than 0.0001H/d in continuous 3 days (H indicates the height of bearing structure of building). The alarm shall also be provided when the crack width of building is larger than 1.5mm 2. Prepare protection plan for the building near the foundation pit and reserve grouting holes at buildings near the foundation pit; conduct grouting reinforcement if excess deformation of foundation is detected. 3. The

						permanently relocated rain and sewage combined pipe (reinforced concrete) is close to foundation of existing buildings; set 6m-long hot-rolled U-shape steel plate pile (500x200mm) at both sides of reinforced concrete combined pipe to minimize the excavation for permanent relocation of rain and sewage combined pipe (reinforced concrete) on existing building foundations. It is possible to set up timber support of profile steel for temporary support during excavation construction of combined pipe.	
				Pass through under municipal pipelines	Along the longitudinal direction of station, there are large diameter water supply pipe (DN500, DN300, DN150), rain pipe (DN3000X2500), gas pipe (DN200). The net clearance of permanently relocated DN3000x2500 rain and sewage combined pipe at south side from diaphragm wall is 0.82m-2.33m, and that from outer wall of south existing building is 1.3m.	Class I	1. Carry out permanent or temporary relocation of pipelines affecting station main body and accessory structure construction to make them away from the station foundation pit (out of 6m range) and prepare protection plan for the pipeline still close to the foundation pit after relocation due to field restraints. 2. There is a DN3000x2500 rain and sewage combined pipe after permanent relocation at south side of foundation pit; it is necessary to closely monitor the settlement and deformation of pipelines in foundation pit excavation impact range and ensure their safety. The measurement point shall be set each for every 15m longitudinal along channel box and the monitoring control values shall be approved by the pipeline supervision unit. 3. The net clearance of permanently relocated DN3000x2500 rain and sewage combined pipe at south side from diaphragm wall is 0.82m-2.33m, and that from outer wall of south existing building is 1.3m.. Set 6m-long hot-rolled U-shape steel plate pile (500x200mm) at both sides of reinforced concrete combined pipe before construction to minimize the excavation for permanent relocation of rain and sewage combined pipe (reinforced concrete) on existing building foundations. It is possible to set up timber support of profile steel for temporary support during excavation construction of combined pipe.

17	Hongdu Middle Avenue station	Underground 2-floor island station (transfer station, transfer node of 3-floor)	open cut normal method	Construction method and geologic risk	1. Foundation pit cutting depth of line 2 station platform center mileage: about 16.97m; end well foundation pit cutting depth: about 17.84m; node area foundation pit cutting depth: 24.94m; main body foundation pit retaining structure adopts 800-thick underground diaphragm wall. 2. The field underground phreatic water level buried depth is about 0.3~8.7m. 3. The terrains of this station are basically of plain fill, silty clay, fine sand, medium sand, coarse sand, grit, round gravel and pebble, high weathering argillaceous siltstone, medium weathering silty and muddy rock with favorable geologic conditions.	Class II	1. To ensure waterproof effect and stiffness, adopt I-beam profile steel joint to ensure construction safety of foundation pit and relieve the impact of pit internal dewatering construction on external ground settlement. 2. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing and prestress reinforcement measures. 3. Properly fulfill the monitor of foundation pit and observation and handling of phreatic level during construction; strengthen the waterproof design and treatment for foundation pit bottom. 4. The first support is of concrete support to enhance the support stiffness. 5. For 3-floor node area, set a pass of concrete support and three passes of steel supports according to cutting depth, and the displacement and deformation shall be considered for special class foundation pit.
				Pass through under/neighbor existing structures and buildings, urban road	At north side, 13-floor Jiangxin Province Quality Supervision and Test Center Building and 4-floor Jiangxi International Travel Healthcare Center of frame structure, and 7-floor railway 8th village residential buildings shall be protected. The minimum distance of buildings to the foundation pit is about 6-8m, and they are major protection objects in design of this foundation pit.	Class I	1. Strengthen the construction monitoring for foundation pit bracing structure and traffic dispersion road surface. The design mainly takes measures from two aspects of foundation pit retaining type and underground water. Adopt large stiffness underground diaphragm wall as retaining structure; the first pass of support adopts reinforced concrete support to reduce the foundation pit deformation and avoid decrease of underground water level out of the foundation pit so as to minimize the settlement of surrounding buildings and pipelines; 2. Monitor the deformation of buildings and ground surface around foundation pit and the retaining structure; reserve grouting hole at building beside the foundation pit; if detected excess deformation of foundation, immediately stop construction and carry out grouting reinforcement. For the buildings requiring focused protection, request competent and experienced professional agency for assessment before construction.
				Pass through under/near	The main pipelines affect station	Class II	1. Carry out permanent or temporary

				municipal pipelines	construction mainly include DN1200 and DN300 concrete water supply pipe, DN200 and DN400 cast iron gas pipe and 110KV high voltage line on Hongdu Middle Avenue;, 2mX4m brick rain and sewage combined pipe, DN300 plastic water supply pipe, 1400x300 copper power supply line, 1400x300 copper electric communication pipeline, DN50 cast iron gas pipe, 110KV high-voltage pipeline along Shunwai Road and Luoyang Road.		relocation or temporary hanging measure for the pipelines affecting station main body and accessory structure construction to make them away from the station foundation pit (out of 6m range) and prepare protection plan for the pipeline still close to the foundation pit after relocation due to field restraints. 2. Monitor the terrain deformation of location of main station pipelines after relocated, and conduct grouting reinforcement once exceeded the alarm range. 3. For the critical pipelines with special requirements by supervised department, related measures shall be taken according the requirements.
18	Xinjiaan station	Underground 2-floor island station	open cut normal method	Construction method and geologic risk	1. The standard section foundation pit cutting depth of this station is 16.09 - 17.90m; small shield end well foundation pit cutting depth: about 17.20 m; large shield end well foundation pit cutting depth: about 18.98m; accessory structure foundation pit depth: about 10.5m. 2. The stratum in foundation pit cutting depth range are mainly of 1-2 plain fill, 3-1 silty clay, 3-2 fine sand, 3-4 coarse sand, 3-6 round gravel. The field to be constructed features abundant underground water with high water level; the underground water level buried depth during investigation is 3.0 – 4.5m.	Class II	1. The retaining structure adopts the underground diaphragm wall with large stiffness and good waterstop performance; the underground diaphragm wall joint adopts I-beam rigid joint. Set three passes of support at standard section and 4 passes of support at end well. 2. The first support is designed as concrete support to increase the support stiffness and the others are of steel support. 3. Stratified excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing measures. 4. Properly carry out anti-seepage for station buildings to avoid the rise of underground water level and pollution of station interior; conduct foundation pit monitoring and phreatic water level observation and treatment; reinforce the waterproof design and treatment at bottom of foundation pit.
				neighboring existing structures and buildings	West side: Nanchang Knitting Factory dormitory (brick-concrete 5-6 floors), shallow foundation and only 5.3m from the main structure foundation pit; Shanghai Road residential zone dormitory (brick-concrete 6-7 floors), shallow foundation and only 7.2m from main structure foundation pit. East side: Shanghai Road G8 public houses (brick-concrete 5-floor) about 8.5m from main structure	Class I	1. Strengthen the construction monitoring of foundation pit retaining structure, traffic dispersion road surface and neighboring houses. Strictly control the ground settlement and horizontal displacement of bracing structures. The alarm shall be provided when the accumulative building integral inclination is up to 0.002H or the inclination speed is higher than 0.0001H/d in continuous 3 days (H indicates the height of

				foundation pit; College of Continuing Education of NUAA only 2.4m from the entrance/exit foundation pit.		bearing structure of building). The alarm shall also be provided when the crack width of building is larger than 1.5mm. 2. Prepare protection plan for the building near the foundation pit and reserve grouting holes at buildings near the foundation pit; conduct grouting reinforcement if excess deformation of foundation is detected.
			Pass through under municipal pipelines	Due to narrow road, after pipeline relocation, there still have rain and sewage pipe (1000x1500), gas pipe (DN600), drinkable water pipe (DN500, DN300) and electronic pipeline in 0.5m foundation pit depth range. The sewage at west of road requires connecting the rain and sewage pipe at east of road through temporary suspended steel pipe over-crossing the station.	Class I	1. Carry out permanent or temporary relocation of pipelines affecting station main body and accessory structure construction to make them away from the station foundation pit (out of 6m range) and prepare protection plan for the pipeline still close to the foundation pit after relocation due to field restraints. 2. At east side of foundation pit, there is a 1000x1500 permanently relocated rain and sewage combined pipe and temporarily relocated DN500 gas pipe, DN300 and 500 drinkable water pipe; closely monitor to ensure their safety. The measurement points shall be set each for every 15m and the monitoring control values shall be approved by the pipeline supervision unit.

11.6-2-e

No.	Section	Construction method	Risk engineering classification	Mileage	Description of basic risk conditions	Risk class	Solution
4	International Sports Center Station - Wolongshan station section	shield method	Geologic risk	tunneling in section YCK24+679.000 - YCK24+689.000	Wolongshan station south end tunneling in section is located in <2-2> muddy clay, <2-4> medium sand and <5-1-2> medium weathering muddy siltite; the soil-rock interface is located in shield tunneling range. The <2-4> medium sand stratum is of main aquifer with water-riching property as medium aquifer. It shall be reinforced before shield tunneling in. the own risk level: class 2	Class II	Adjust the shield tunneling parameters according to dynamic monitoring data; carry out reinforcement of mixing pile and rotary churning pile at shield tunneling in and out section;
			Geologic risk	tunneling out section YCK23+721.300 - YCK23+731.300	International Sports Center Station north end shield tunneling out section is located in <2-1> silty clay, <2-3> fine sand, <2-4> medium sand stratum, <2-3> fine sand; The <2-4> medium sand stratum is of main aquifer with water-riching property as medium aquifer. It shall be reinforced before shield tunneling in. the own risk level: class 2		
			Shengmi overpass pile	YCK24+170 - YCK24+210	The shield laterally passes with the minimum clearance with bridge pile of 2.56m. Adopt D=1m cast-in-situ bored pile; intensive impact area for neighboring zone.		
5	Wolongshan station -	shield method	Geologic risk	tunneling out section YCK24+917.000 - YCK24+927.	Wolongshan station north end tunneling out section is located in <2-2> muddy clay, <2-3> fine sand, <2-4> medium sand and <5-1-2> medium weathering muddy siltite; the soil-rock interface is located in shield tunneling range. The <2-3> fine sand and <2-4>	Class II	Adjust the shield tunneling parameters according to dynamic monitoring data; carry out reinforcement of mixing pile and rotary churning pile at shield tunneling in and out section;

	Lingbeisan Road station section			000	medium sand stratum is of main aquifer with water-riching property as medium aquifer. It shall be reinforced before shield tunneling in. the own risk level: class 2		
			4# bridge pile	YCK25+390 - YCK25+430	The shield laterally passes with the minimum clearance with bridge pile of 2.24m. Adopt D=1m rotary churning pile; intensive impact area for neighboring zone.	Class II	Carry out two-shot grouting reinforcement in advance for the soil passed by the shield before the shield arriving; strength the bridge pile monitoring during shield passing through the bridge pile; adjust the advancing speed and secondary grouting volume according to monitoring data and carry out tracing and grouting for the pile foundation
8	Xuefu Avenue East Station - Cuiyuan Road station	shield method	Pass through under existing building	YCK28+500	Pass through under Fenghe South Avenue 1# bridge, about 5.4m from the tunnel top	Class II	1) Arrange monitoring points on structures, pipelines and surrounding ground surfaces in advance; set shield construction simulation section and immediately submit the monitored data to technician; the technician, through back analysis, timely notifies the shield construction staff to adjust the construction parameters such as shield advancing speed, cutter speed, front soil compartment pressure, excavated soil volume and synchronous grouting volume. 2) Before the shield arrives at the building/structure and pipelines, reduce the advancing speed and strictly control the shield direction; timely adjust the shield advancing parameters according to monitored data and feedback information from design back analysis to ensure stable passing of shield machine and the stratum loss rate in construction impact area of no more than 5%. 3) Adjust shield construction parameters at any time to minimize the over-excavation and under-excavation and therefore eliminate the slump or squeezing of soils before the shield. 4) Adopt synchronous grouting, reduce the construction gap formed outside the tunnel after shield tail passed and reduce the horizontal displacement of soils around the tunnel. 5) After shield passed, open the embedded grouting pipe in duct according to deformation of ground surface and building/structures, and timely carry out two-shot grouting reinforcement behind the wall for surrounding soils. 6) Control the uneven settlement difference of buildings of no more than $\leq 3\%$
				YCK31+160	Pass through under Fenghe Overpass with the clearance of 1#, 2# and 3# from pile foundation of about 0.75m	Class II	
11	Yayuan Road station - Honggu zhong	shield method	Geologic risk	Shield tunneling in and out YCK32+698.654 YCK33+425.	The position of shield tunneling in and out is mainly located in gravel stratum with high water level and high water permeability.	Class II	1. Adopt earth pressure balance shield and select optimal construction parameters to ensure stable cutting face; strength the synchronous grouting and necessary supplement measures to control the settlement of structures. 2. Adjust shield construction parameters at any time to minimize the over-excavation and under-excavation, eliminate the slump or squeezing of soils before

	Avenue station		150				the shield and reduce the lateral force applied on pile foundation from lateral deformation of foundation soil. 3. Adopt synchronous grouting, reduce the gap formed outside the tunnel after shield tail passed and reduce the horizontal displacement of soils around the tunnel and the resulted negative friction resistance. 4. Strengthen the monitoring and take related measures including monitoring of deformation and settlement of structures; the large deformation detected shall be timely feed back to design and construction unit so as to adjust the construction parameters or take necessary ground reinforcement measures. 5. During side channel construction: ① The design temperature and thickness of frozen soil curtain of side channel shall meet the requirement. ② Prepare preventive emergency plans such as freezing hole construction plan, freezing construction plan, excavation and pouring construction plan, frost heave and melting settlement prevention plan.
		Pass through under building	YCK33+136	Tunnel passing through under Changbei Shajing Branch Post Office residential building	Class II		
		Transverse the building	YCK33+126	Pass laterally through Changbei Shajing Branch Post Office Complex Building; minimum clearance of pile foundation and tunnel: 5.15m	Class II		
12	hongguzhong Avenue station - Yangming Park station	shield method	Tunnel passes through under Ganjiang River, Ganjiang River revetment food protection wall	YCK33+800 - YCK35+200	Pass through under Ganjiang River; minimum vertical clearance of the top face of structure and existing stratum at bottom of river is about 6m.	Class II	1. Adopt earth pressure balance shield and select optimal construction parameters to ensure stable cutting face; strength the synchronous grouting and necessary supplement measures to control the settlement of ground. 2. Adjust shield construction parameters at any time to minimize the over-excavation. 3. Adopt synchronous grouting, reduce the gap formed outside the tunnel after shield tail passed and reduce the horizontal displacement of soils around the tunnel. 4. Strengthen the monitoring and take related measures. 5. Notice when passing through under the river: ① Earth pressure balance shield machine shall favorably select auger conveyor with “soil plugging effect”; timely shut down the auger conveyor if detected abnormal variation of soil pressure to avoid injecting; ② The soil pressure for advancing process shall be set according to design value and adjusted according to water level variation when advancing. If the soil pressure is lower than the design value for the equipment reason, immediately stop normal tunneling and then continue normal tunneling only after the soil pressure recovers to design value; ③ Pay attention to the maintenance of shield tail brush, control the tunneling posture during tunneling and minimize the retraction/release times of articulation; the shield tail greasing shall be uniform and effective to ensure the tightness of shield mechanism; ④ Improve the synchronous grouting quality; require short initial setting time of

							grout and no cracking when contacting with mud water; require certain flowability of grout and the grout after synchronous grouting shall be evenly distributed around the tunnel. ⑤ Prepare the tunnel supplement grouting works; once detected large upward floating of tunnel and wide affecting range, immediately carry out supplement grouting measures for built tunnel to cut off the flowing path of muddy water.
			Geologic risk	shield tunneling in and out YCK35+392.500 YCK35+923.900	The shield tunneling in and out positions are mainly in gravel stratum and rock stratum with high water level and permeability.	Class II	1. Adopt earth pressure balance shield and select optimal construction parameters to ensure stable cutting face; strength the synchronous grouting and necessary supplement measures to control the settlement of structures. 2. Adjust shield construction parameters at any time to minimize the over-excavation and under-excavation, eliminate the slump or squeezing of soils before the shield and reduce the lateral force applied on pile foundation from lateral deformation of foundation soil.3. Adopt synchronous grouting, reduce the gap formed outside the tunnel after shield tail passed and reduce the horizontal displacement of soils around the tunnel and the resulted negative friction resistance. 4. Strengthen the monitoring and take related measures including monitoring of deformation and settlement of structures; the large deformation detected shall be timely feed back to design and construction unit so as to adjust the construction parameters or take necessary ground reinforcement measures.
			Pass through under structures	YCK35+450 - YCK35+650	Pass through under Bayi Bridge south approach bridge; 1 0 pile foundations invades into the tunnel; many pile foundations are close to the tunnel; the tunnel passes through under Yangming Road pedestrian underpass project; minimum clearance of bottom plate and tunnel top: 3.8m	Class II	
			Transverse the building	YCK35+392.500 - YCK35+923.900	Minimum clearance of Jiangxi Publishing Group Building (brick-concrete 5) pile foundation and tunnel: 4.2m; minimum clearance of China Bank Trust and Loan Company Yangming Road development building (brick-concrete 9) pile foundation with tunnel: 3.4m; minimum clearance of Dongwanyi Street No.45 residential building (brick-concrete 6) pile foundation and tunnel: 5.7m; minimum clearance of Dongwanyi Street No.9-15 residential building (brick-concrete 6) pile foundation and tunnel: 9.4m; minimum clearance of Jiangxi Provincial People's Hospital (concrete 20) pile foundation and tunnel: 10m.	Class II	
14	Yangming Park station - Qingshanlukou station	shield method	Pass through under the building/structure	YCK36+191.690 - YCK36+986.664	Pass through under Yangming Road pedestrian underpass project 1#-2# Jing Crossing, Yangming Road pedestrian underpass project 1#-3# Jing Crossing, Yangming Road pedestrian underpass project 1#-4# Jing Crossing; pass through under communication Yangming Road dilapidated house transformation project 2# building pile foundation with the clearance from tunnel top of 6.77m.	Class II	1. Adopt earth pressure balance shield and select optimal construction parameters to ensure stable cutting face; strength the synchronous grouting and necessary supplement measures to control the settlement of structures. 2. Adjust shield construction parameters at any time to minimize the over-excavation and under-excavation, eliminate the slump or squeezing of soils before the shield and reduce the lateral force applied on pile foundation from lateral deformation of foundation soil. 3. Adopt synchronous grouting, reduce the gap formed outside the tunnel after shield tail passed and reduce the horizontal displacement of soils around the
			Transverse the building	YCK36+191.690 - YCK36+986.664	Minimum clearance of Nanchang Municipal Procuratorate residential building (brick-concrete 7) and tunnel: 3.2m; minimum clearance of Nanchang Municipal Procuratorate residential building and bank (brick-concrete 6) foundation and tunnel: 4.2m;	Class II	

					minimum clearance of Jiangxi Provincial Public Security Department residential building (brick-concrete 6) foundation and tunnel: 3m; minimum clearance of China Construction Bank Yangming Road branch (brick-concrete 4) pile foundation and tunnel: 5.6m; minimum clearance of Jiangxi Provincial Public Security Department dormitory (brick-concrete 5) pile foundation and tunnel: 8.4m; minimum clearance of Yangming Road Business-living building (concrete 11) pile foundation and tunnel: 1.4m; minimum clearance of Yangming Road Bank of Communication (concrete 11) foundation and tunnel: 1.7m; minimum clearance of Yangming Road No.85 residence (concrete 8) foundation and tunnel: 2.1m; minimum clearance of Nanchang Legal Service Building (concrete 11) foundation and tunnel: 2.5m; minimum clearance of Yangming Road No.51 - 69 residence (brick-concrete 5) foundation and tunnel: 1.7m; minimum clearance of Nanchang Legal Service Building (brick-concrete 7) foundation and tunnel: 2.5m;		tunnel and the resulted negative friction resistance. 4. Strengthen the monitoring and take related measures including monitoring of deformation and settlement of structures; the large deformation detected shall be timely feed back to design and construction unit so as to adjust the construction parameters or take necessary ground reinforcement measures. 5. During side channel construction: ① The design temperature and thickness of frozen soil curtain of side channel shall meet the requirement. ② Prepare preventive emergency plans such as freezing hole construction plan, freezing construction plan, excavation and pouring construction plan, frost heave and melting settlement prevention plan.
15	Qingsha nlukou station - Fuzhou Road station	shield method	Pass through under the building/structure	YCK37+141.164 - YCK37+686.900	Pass through under Dieshan Road overpass; 6 pile foundations invade into the tunnel and many pile foundations are close to the tunnel; the tunnel passes through under Material Trading Center north building (brick-concrete 4) with the clearance from pile foundation bottom to tunnel top of 7.25m; pass through under Bayi Avenue – Minde crossing underpass with the minimum clearance of bottom plate and tunnel of 5.1m.	Class II	1. Adopt earth pressure balance shield and select optimal construction parameters to ensure stable cutting face; strength the synchronous grouting and necessary supplement measures to control the settlement of structures. 2. Adjust shield construction parameters at any time to minimize the over-excavation and under-excavation, eliminate the slump or squeezing of soils before the shield and reduce the lateral force applied on pile foundation from lateral deformation of foundation soil. 3. Adopt synchronous grouting, reduce the gap formed outside the tunnel after shield tail passed and reduce the horizontal displacement of soils around the tunnel and the resulted negative friction resistance. 4. Strengthen the monitoring and take related measures including monitoring of deformation and settlement of structures; the large deformation detected shall be timely feed back to design and construction unit so as to adjust the construction parameters or take necessary ground reinforcement measures.
			Transverse the building	YCK37+141.164 - YCK37+686.900	Minimum clearance of Material Trading Center main building (concrete 15) pile foundation and tunnel: 1.26m; minimum clearance of Material Trading Center south building (brick-concrete 4) pile foundation and tunnel top: 6.48m; minimum clearance of Nanjing West Road -Bayi Avenue business-living building (concrete 10) foundation and tunnel: 12m; minimum clearance of Jiangxi Medical College Medical Scientific Research Building (brick-concrete 8) pile foundation and tunnel: 5.1m; minimum clearance of Jiangxi Medical College Medical Scientific Research Building (brick-concrete 8) pile foundation and tunnel: 3.5m; minimum clearance of Jiangxi Hospital of traditional Chinese Medicine out-patient department (brick-concrete 6) pile foundation and tunnel: 5.3m;	Class II	
16	Fuzhou Road	Underground	Semi-cover cut normal method		Main structure foundation pit depth: about 17m.	Class II	1. Adopt underground diaphragm wall structure and the first pass of support is of reinforced concrete support. 2. Stratified

	station ~ Bayi Square	2-floor open cut section					excavation, timely supporting and prohibition from over-excavation; the steel support shall have anti-releasing measures. 3. Properly carry out anti-seepage for station buildings to avoid the rise of underground water level and pollution of station interior; conduct foundation pit monitoring and phreatic water level observation and treatment; reinforce the waterproof design and treatment at bottom of foundation pit.
			neighboring existing structures and buildings			Class II	1. Strengthen the construction monitoring of foundation pit retaining structure, traffic dispersion road surface and neighboring houses. Strictly control the ground settlement and horizontal displacement of bracing structures. 2. Monitor the deformation of buildings besides foundation pit and retaining structure.
			neighboring existing structures and buildings			Class II	1. Strengthen the construction monitoring of foundation pit retaining structure, traffic dispersion road surface and neighboring houses. Strictly control the ground settlement and horizontal displacement of bracing structures. 2. Monitor the deformation of buildings besides foundation pit and retaining structure.
			Pass through under/near the municipal pipeline			Class II	Adopt measures such as permanent relocation, temporary relocation and temporary hanging for existing pipelines; the specific method shall be determined according to pipeline features, station construction method, station buried depth and other factors. The valves of water supply pipe and gas pipe newly set outside two ends of station shall be properly protected.
17	Bayi Avenue station - Yongshu Road station	shield method	Geologic risk	shield method section YCK38+696.971 - YCK39+252.788	The main stratums passed by the shield include round gravel, grit and medium sand with abundant underground water.	Class II	Adopt composite earth pressure balance shield, notice the adjustment of shield posture and construction parameters during shield advancing, timely conduct grouting behind the wall and secondary grouting, strengthen the deformation monitoring of surrounding stratums and buildings and prepare related handing plan.
			.Geologic risk	shield tunneling in and out (Bayi Square south end well) YCK39+252.788	The stratums mainly include fine sand, round gravel and grit with abundant underground water.	Class II	1)Strictly control the main tunneling parameters, reduce pressure surge, adopt constant low-speed advancing, avoid large disturbance of soils, strengthen muddy management and excavated soil amount monitoring and avoid over-excavation and under-excavation (2) Strengthen the management of grout quality, shield posture, synchronous grouting behind wall, monitoring and measurement. (3) Adopt 3-axle mixing pile for reinforcement in the range of 3m laterally and vertically out of the tunnel. The clearances between reinforcement area by 3-axle mixing pile and station retaining structure will be filled with double rotary churning
			Geologic risk	shield tunneling in and out	The stratums mainly include round gravel and medium weathering argillaceous siltstone with abundant underground water.	Class II	

			(Yongshu Road station north end well) YCK38+696.971				pile. Strictly control the reinforcement quality of end stratum at start and end points.
			Geologic risk	Bayi Avenue – Ruzi Crossing south underpass. YCK38+800.000.	The section tunnel passes through under the underpass with the minimum clearance of underpass bottom plate and section tunnel top of about 6.5m; the stratum passed by the shield mainly include silty clay and round gravel with abundant underground water.	Class II	Notice the shield posture during shield advancing process, timely conduct grouting behind the wall and secondary grouting, strengthen the deformation monitoring of surrounding stratum and buildings and prepare related handling plan.
			Geologic risk	Bayi Avenue – Yongshu Crossing underpass. YCK39+208.340 - YCK39+248.500.	The section tunnel passes through under the underpass with the minimum clearance of underpass bottom plate and section tunnel top of about 4.7m; the stratum passed by the shield mainly include silty clay, fine sand, round gravel and grit with abundant underground water.	Class II	
18	Yongshu Road - Dinggong Road South station	shield method	Geologic risk	shield method section YCK40+128.686 - YCK40+969.000	The stratum passed by the section shield mainly include grit, coarse sand and medium sand with abundant underground water.	Class II	Adopt composite earth pressure balance shield, notice the adjustment of shield posture and construction parameters during shield advancing, timely conduct grouting behind the wall and secondary grouting, strengthen the deformation monitoring of surrounding stratum and buildings and prepare related handling plan. (1) Strictly control the main tunneling parameters, reduce pressure surge, adopt constant low-speed advancing, avoid large disturbance of soils, strengthen muddy management and excavated soil amount monitoring and avoid over-excavation and under-excavation (2) Strengthen the management of grout quality, shield posture, synchronous grouting behind wall, monitoring and measurement. (3) Adopt 3-axle mixing pile for reinforcement in the range of 3m laterally and vertically out of the tunnel. The clearances between reinforcement area by 3-axle mixing pile and station retaining structure will be filled with double rotary churning pile. Strictly control the reinforcement quality of end stratum at start and end points.
			Geologic risk	Shield tunneling out (Yongshu Road station south end well) YCK40+128.686	The stratum mainly include medium sand, coarse sand, round gravel and high weathering argillaceous siltstone with abundant underground water.	Class II	
			Geologic risk	Shield tunneling in (Dinggong Road South station west	The stratum mainly include fine sand, medium sand, coarse sand, round gravel, grit and medium weathering argillaceous siltstone with abundant underground water.	Class II	

				end well) YCK40+969. 000			
			Section tunnel right track transverses former Fushan overpass Bayi Avenue approach bridge abutment pile foundation	YCK39+614.605	Section tunnel right track transverses former Fushan overpass Bayi Avenue approach bridge abutment pile foundation; the minimum clearance of pile foundation and section tunnel top is about 2.26 m; the stratums passed by the shield mainly include highly permeable round gravel, medium sand and grit with abundant underground water.	Class II	(1) Reinforce the approach bridge pile foundation and soils around the tunnel before shield advancing to this location. (2) Add the grouting holes in the design for the shield segment in the range of transverse approach bridge pile foundation to improve the effect of synchronous grouting and secondary grouting, and timely fill the gap outside the segment. (3) According to the stratum features of tunnel locations of this project, to improve the soils, protect the cutter and ensure normal excavated soil volume of shield auger conveyor, the foaming agent or bentonite can be injected at front of shield during advancing process according to auger conveyor excavated soil conditions and cutter oil pressure variation.
			Section tunnel both lines transverse former Fushan overpass square south road approach bridge pile foundation	YCK39+875.974 - YCK39+880.518	Section tunnel both lines transverse former Fushan overpass square south road approach bridge pile foundation; the minimum clearance of pile foundation and section tunnel top is about 2.04 m; the stratums passed by the shield mainly include round gravel and grit with abundant underground water.	Class I	(4) Strengthen the monitoring for deformation of surrounding stratums and bridge foundation during shield advancing process, and prepare related handling plan.
			Section tunnel left track transverses the skirt building foundation of Galactic Peace International Hotel	ZCK39+840.382 - ZCK39+841.780	Section tunnel left track transverses the skirt building foundation of Galactic Peace International Hotel; the minimum clearances from left and right skirt buildings foundations to section tunnel top are separately of about 2.78m; the stratums from top to bottom are of medium sand, round gravel and grit; the stratums passed by the shield include grit and round gravel as upper soft and lower hard with abundant underground water.	Class I	(1) Reinforce the soils in range of Galactic Hotel skirt building and around the tunnel before the shield passes; the reinforced soil range is of 3m at left side and right side, and 4m at front and rear under tunnel profile till skirt building foundation bottom plate. (2) Add the grouting holes in the design for the shield segment in under-passing range to improve the effect of synchronous grouting and secondary grouting, and timely fill the gap outside the segment. (3) Strengthen the monitoring for deformation of surrounding stratums and building during shield advancing process, and prepare related handling plan.
19	Dinggon g Road South station -	shield method	shield method section	YCK40+128.686 - YCK40+969.000	The main stratums passed by the shield include round gravel, grit and coarse sand with abundant underground water.	Class II	Adopt composite earth pressure balance shield, notice the adjustment of shield posture and construction parameters during shield advancing, timely conduct grouting behind the wall and secondary grouting, strengthen the deformation monitoring of surrounding stratums and buildings and prepare related handling

Nanchang Railway Station					plan.
	Shield tunneling out	YCK40+128.686	The stratums mainly include grit, round gravel, medium weathering argillaceous siltstone with abundant underground water.	Class II	(1) Strictly control the main tunneling parameters, reduce pressure surge, adopt constant low-speed advancing, avoid large disturbance of soils, strengthen muddy management and excavated soil amount monitoring and avoid over-excavation and under-excavation (2) Strengthen the management of grout quality, shield posture, synchronous grouting behind wall, monitoring and measurement. (3) Adopt 3-axle mixing pile for reinforcement in the range of 3m laterally and vertically out of the tunnel. The clearances between reinforcement area by 3-axle mixing pile and station retaining structure will be filled with double rotary churning pile. Strictly control the reinforcement quality of end stratums at start and end points.
	Shield tunneling in	YCK40+969.000	The stratums mainly include fine sand, round gravel, grit, and medium weathering argillaceous siltstone with abundant underground water.	Class II	
	Connecting passage and pump room	YCK40+478.100	The stratums mainly include fine sand, round gravel, grit and medium weathering argillaceous siltstone with abundant underground water.	Class II	Adopt freezing construction method: (1) The design temperature and thickness of frozen earth curtain of connecting passage shall meet the requirements. (2) Prepare preventive emergency plans such as freezing hole construction plan, freezing construction plan, excavation and pouring construction plan, frost heave and melting settlement prevention plan.
	Section tunnel left line crosses Luoyang Road tunnel and drainage culvert and right line crosses railway station yard pile foundation	YCK40+785.777~YCK40+823.117	Section tunnel left line crosses Luoyang Road tunnel and drainage culvert and right line crosses railway station yard pile foundation; the minimum clearances from tunnel left line to Luoyang Road tunnel bottom plate and drainage culvert are separately of 5.46 m and 6.55 m; the clearance from right line to pile foundation is about 2.38 - 6.69m; the shield pass-through soil layer is mainly of round gravel with abundant underground water.	Class I	1) Carry out foundation reinforcement for building pile foundation and the soils around the tunnel before shield advancing. (2) Add the grouting holes in the design for the shield segment in the range of crossing building pile foundation to improve the effect of synchronous grouting and secondary grouting, and timely fill the gap outside the segment. (3) According to the stratum features of tunnel locations of this project, to improve the soils, protect the cutter and ensure normal excavated soil volume of shield auger conveyor, the foaming agent or bentonite can be injected at front of shield during advancing process according to auger conveyor excavated soil conditions and cutter oil pressure variation. (4) Strengthen the deformation monitoring of surrounding stratum and building foundation during shield advancing and prepare related handling plan.
	Section tunnel passes under railway station yard, in which the left track	YCK40+833.210~YCK40+939.439	Section tunnel double lines pass through under the railway station yard, in which the left track passes under Luoyang Road drainage culvert; the minimum clearances from tunnel to station yard rail structure and drainage culvert are separately of 10.32 m and 4.92 m; the pass-through length is about 106.23 m and the shield pass-through soil layer is mainly of round gravel with abundant	Class I	(1) Set steel detour beams to protect the railway before shield advancing; set the pile foundation for steel detour beams between both sides of tunnel and two tunnels. In this proposal, the pile foundation end shall go under the bottom of subway tunnel and so it shall pass through the round gravel stratum and enter argillaceous siltstone, so the construction is difficult; on the other hand, the

			passes under Luoyang Road drainage culvert.		underground water.		construction time is limited and shall be discussed with railway department. (2) Reinforce with rotary churning pile for the soils in tunnel passing range before shield advancing. The reinforcement range is of 3m around the tunnel. For this proposal, it shall discuss with the railway department due to limited construction time. (3) Conduct prior grouting during shield advancing process and take the supplement measures of grouting reinforcement for the soils in tunnel before excavation face, i.e. pre-design several grouting reinforcement holes in shield machine (design according to full section grouting requirement), and equip with special grouting device in shield machine. Once the construction requires, immediately install the grouting device and fulfill prior grouting reinforcement for the soil before excavation soil. This construction program features more convenient, low construction cost, but slow advancing speed. Further analysis shall be done in combination with the deformation control requirements of railway. (4) Fulfill the design of increased grouting holes for shield segments in under-passing range to enhance the synchronous grouting and secondary grouting effect and timely fill the gap out of the segment. (5) Analyze the impact of train load on tunnel structure according to the operation conditions after tunnel construction completed; consider the effect of additional load on tunnel structure and purposely strengthen the tunnel segment reinforcing bars.
			Section tunnel passes through under a rain and sewage pipe		Section tunnel passes through under a rain and sewage pipe; brick structure, dimension of about 3mX2.5m~3mX4m, clearance of water pipe bottom plate to tunnel of about 5.8m.	Class II	Notice the shield posture during shield advancing process and construction parameters; strictly control the main tunneling parameters, reduce pressure surge, adopt constant low-speed advancing, avoid large disturbance of soils, strengthen muddy management and excavated soil amount monitoring, avoid over-excavation and under-excavation, timely conduct grouting behind the wall and secondary grouting, strengthen the deformation monitoring of surrounding stratum and buildings and prepare related handing plan.
20	Nanchang Railway Station - Hongdu Middle	shield method	Geologic risk	Tunneling out: YCK41+132.200~YCK41+143.700; Tunneling in: YCK41+628.	The section tunneling out/in range is of 3-6 round gravel and 3-2 fine sand stratum with abundant water and high permeability, and with tendency of sand boil.	Class II	1. Strictly control the main tunneling parameters, reduce pressure surge, adopt constant low-speed advancing, avoid large disturbance of soils, strengthen muddy management and excavated soil amount monitoring and avoid over-excavation and under-excavation. 2. Strengthen the management of grout quality, shield posture, synchronous grouting behind wall, monitoring and measurement. 3. Adopt 3-axle mixing pile for reinforcement in the range of 3m

	Avenue station		388~YCK41+640.888				laterally and vertically out of the tunnel. The clearances between reinforcement area by 3-axle mixing pile and station retaining structure will be filled with double rotary churning pile. Strictly control the reinforcement quality of end stratum at start and end points.
			In the range of this tunnel	Shield excavation stratum are of round gravel 3-6, fine sand 3-2 and grit 3-5; 1. Seepage of country rock and water bursting of excavation face; 2. Tunnel collapse and structure damage	Class II		1. Select optimal shield construction parameters and ensure stable excavation surface; strengthen synchronous grouting and necessary supplement grouting measures to control the settlement of structures; 2. Adjust shield construction parameters at any time to minimize the over-excavation and under-excavation, eliminate the slump or squeezing of soils before the shield and reduce the lateral force applied on underground wall from lateral deformation of foundation soil; 3. Adopt synchronous grouting, reinforce the possible loose soils around the tunnel after shield tail passed and reduce the displacement of soils around the tunnel and the impact of tunnel on underground foundation. 4. Strengthen the monitoring and take related measures including monitoring of deformation and settlement of section tunnel, bridge foundation and building foundation; the large deformation detected shall be timely feed back to design and construction unit so as to adjust the construction parameters or implement auxiliary construction technologies and measures. 5. Investigate the building current status before construction; strengthen dynamic monitoring and measurement during construction period, including monitoring of tunnel and building, and carry out informationization construction according to monitoring results and take properly emergency measures; 6. Carry out reinforcement treatment to the pipeline in advance if necessary.
		Passing through under the municipal pipelines	YCK41+400~YCK41+640.888	Rain and sewage combined pipeline, brick structure, varying section dimensions of maximum 4000×2000mm, buried depth of 2.71m, about 6.5m from tunnel structure top	Class II		
		Pass through under railway 8 th village building	In the range of this tunnel	The railway 8 th village is of building planned to be removed; the building foundation is of shallow foundation.	Class II		
		Cross Shunwai Village business-living buildings	YCK41+545.000~YCK41+590.000	Shunwai Village business-living building foundation is of artificial bored pile with the pile length of about 10m; lack of data for pile foundation. The Shunwai Village business-living building foundation is of artificial bored pile with the pile length of about 10m; lack of data for pile foundation. According to existing data, the pile foundation is 4.8m from tunnel top.	Class II		
21	Hongdu Middle Avenue station - Xinjiaan station	shield method	Geologic risk	Tunneling out: YCK43+008.888~YCK43+020.388; Tunneling in: YCK41+837.889~YCK41+850.389	The section tunneling out/in range is of 3-6 round gravel and 3-4 coarse sand stratum with abundant water and high permeability, and with tendency of sand boil.	Class II	

				points.	
	Connecting passage YCK42+424.275 YCK42+423.275	Connecting passage with freezing method construction method	Class II	During construction of connecting passage: ① The design temperature and thickness of frozen earth curtain of connecting passage shall meet the requirements. ②Prepare preventive emergency plans such as freezing hole construction plan, freezing construction plan, excavation and pouring construction plan, frost heave and melting settlement prevention plan.	
	In range of this tunnel	Shield tunneling stratum are of round gravel 3-6, high weathering argillaceous siltstone 5-1-1 and coarse sand 3-4. 1 with water seepage of country rock and water burst at excavation face; 2. Tunnel collapse and structural damage.	Class II	1. Adopt composite earth pressure balance shield and select optimal construction parameters to ensure stable cutting face; strength the synchronous grouting and necessary supplement measures to control the settlement of structures. 2. Adjust shield construction parameters at any time to minimize the over-excavation and under-excavation, eliminate the slump or squeezing of soils before the shield and reduce the lateral force applied on pile foundation from lateral deformation of foundation soil; 3. Adopt synchronous grouting, reduce the gap formed outside the tunnel after shield tail passed and reduce the horizontal displacement of soils around the tunnel and the resulted negative friction resistance. 4. Strengthen the monitoring and take related measures including monitoring of deformation and settlement of structures; the large deformation detected shall be timely feed back to design and construction unit so as to adjust the construction parameters or take necessary ground reinforcement measures. 5. The tunnel shield advancing in Foreign Transport Fleet business-living building area adopts 800@600 double pipe rotary churning pile for reinforcement. 6. Add the grouting holes in the design for the shield segment in the range of crossing building pile foundation to improve the effect of synchronous grouting and secondary grouting, and timely fill the gap outside the segment. 7. When the tunnel passes through under the building, it is possible to purposely strengthen the tunnel segment reinforcing bars.	
Passing through under the municipal pipelines	YCK41+837.889~YCK41+700.000, YCK41+900.000~YCK43+020.388	Rain and sewage combined pipeline, brick structure, uneven dimensions of sections with maximum 9000×2300mm; buried depth of 4.64m; 6m from tunnel structure top.	Class II		
Pass through under Yudai River	YCK42+345.000~YCK42+387.000	Shunwai bridge is of independent foundation with the pile bottom foundation of about 13.13m and about 11m from tunnel structure top.	Class II		
Cross foreign transport fleet business-living building	YCK41+880.000~YCK41+910.000	foreign transport fleet business-living building foundation is of artificial bored pile with the pile length of about 10m; lack of data for pile foundation. According to existing data, the minimum clearance of pile foundation and tunnel external profile is 2.793m; plan to adopt reinforcement program.	Class II		
Pass through under Hongli business-living building	YCK42+630.00~YCK42+660.000	Hongli Business-living building foundation is of artificial bored pile with the pile length of about 9m; lack of data for pile foundation. The Hongli Business-living building foundation is of artificial bored pile with the pile length of about 9m; lack of data for pile foundation. According to existing data, the pile foundation is 6.3m from tunnel top.	Class II		
Intrude /laterally pass three citizen houses	YCK42+920.000~YCK42+970.000	The tunnel invades the foundations of Liu Aiguo house and Chu Weibiao house; the minimum clearance of Chu Jianyong house foundation to the profile of tunnel is 2.110m.	Class II		The stratum of three residential buildings passed by the shield are of coarse sand, grit and round gravel with rich water content and the stratum reinforcement effect is not remarkable. Recommend the proposal to demolish three buildings in preliminary design phase.

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Station Section Name	Sensitive Point		Prediction Point		Noise Control Program and Proposal
	No.	Name	No.	Horizontal Distance to Sound Source(m)	
Qianhu Avenue Station	1	Liantai Hanlin Town	N1-1	Piston air kiosk 25; ventilation kiosk 26; fresh air kiosk 33; cooling tower 25	Super-low noise crossflow cooling tower
Xuefu Avenue Station	2	Xinwei Hanwangjia	N2-1	Piston air kiosk 31; ventilation kiosk 35; fresh air kiosk 37; cooling tower 31	1. The silencer of the ventilation kiosk is prolonged to 4 meters, and , and turn away from the sensitive point. 2. Adopt super-low noise crossflow cooling tower.
Cuiyuan Road Station	3	Wanda Xingcheng	N3-1	Piston air kiosk 13; ventilation kiosk 14; fresh air kiosk 20; cooling tower 21	1. adjust the air kiosk and cooling tower to the greening belt opposite to the avenue. 2. Adopt super-low noise crossflow cooling tower
	4	Fenghe Village	N4-1	Piston air kiosk 20; ventilation kiosk 14; fresh air kiosk 19;	The silencer of the piston and new fresh air kiosk is prlonged to sensitive point at the back of the ventilation outlet
Yayuan Road Station	5	Shajing Community	N5-1	Piston air kiosk 31	The silencer of the piston and air kiosk is prolonged to 3 meters at the back side of the sensitive points.
Chunhui Road Station	6	Nanchang International Financial Center	N6-1	Piston air kiosk 33; ventilation kiosk 31; fresh air kiosk 30;	The silenter of the ventilation kiolsk is prolonged to 3 meters at the back side of the sensitive point.

Station Section Name	Sensitive Point		Prediction Point		Noise Control Program and Proposal
	No.	Name	No.	Horizontal Distance to Sound Source(m)	
Yangming Road Station	7	Employee Dormitory(Section A) of Jiangxi Daily Press	N7-1	Piston air kiosk 9; ventilation kiosk 13; fresh air kiosk 25; cooling tower 9	1. The air kiosk and cooling tower are moved to the east by 24 meters, and are 30 meters to the piston air kiosk, 35 meters to the ventilation kiosk, and 38 meters to the fresh air kiosk after adjustment. 2. The silencers of the ventilation, piston and fresh air kiosk are prolonged to 4 meters, and the ventilation outlet turns away from the sensitive points. 3 Adopt super-low noise crossflow cooling tower. 4. install sound isolation hood for the cooling tower.
	8	Yishuge cultural art school, Meiya foreign language training school	N8-1	Piston air kiosk 33; ventilation kiosk 32; fresh air kiosk 31; cooling tower 31	The position of the air kiosk in employee dormitory(section A) of Jiangxi Daily Press is adjusted, and measures have been taken on the air kiosk and cooling tower. The distance to piston air kiosk is 31 meters, with 32 meters to ventilation kiosk, 33 meters to fresh air kiosk and 31 meters to the cooling tower through adjustment.
	9	Employee dormitory(section A) of Jiangxi Daily Press	N9-1	18 Piston air kiosk 15; ventilation kiosk 14; fresh air kiosk 18;	1. The air kiosk section is placed near the east end in compact layout to ensure distance to the sensitive point is over 15 meters. See Figure 4-7. The distance to the piston kiosk is 15 meters, 15 meters to ventilation kiosk, and 15 meters to the fresh air kiosk through adjustment. 2. The silencer of the ventilation, piston and fresh air kiosk is prolonged to 4 meters. The ventilation outlet turns away from the sensitive points.

Station Section Name	Sensitive Point		Prediction Point		Noise Control Program and Proposal
	No.	Name	No.	Horizontal Distance to Sound Source(m)	
Medical College Station	10	Municipal bus company dormitory	N10-1	Piston air kiosk 25; ventilation kiosk 30; fresh air kiosk 35; cooling tower 25	1. The silencer of the ventilation, piston and fresh air kiosk is prolonged to 4 meters. The ventilation outlet turns away from the sensitive points. 2. Adopt super-low noise crossflow cooling tower
	11	Teachers' Domitory of No. 28 Middle School of Nanchang	N11-1	26 Piston air kiosk 31; ventilation kiosk 28; fresh air kiosk 25; cooling tower 26	1. The silencer of the ventilation, piston and fresh air kiosk is prolonged to 4 meters. The ventilation outlet turns away from the sensitive points. 2. Adopt super-low noise crossflow cooling tower
Fuzhou Road Station	12	Employee dormitory of municipal disease prevention and control center	N12-1	31 Piston air kiosk 31; ventilation kiosk 36; fresh air kiosk 40; cooling tower 31	1. The silencer of the ventilation, piston and fresh air kiosk is prolonged to 4 meters. The ventilation outlet turns away from the sensitive points. 2. Adopt super-low noise crossflow cooling tower
	13	Inpatient Building of Jiangxi Provincial TCM Hospital	N13-1	48 Piston air kiosk 48; ventilation kiosk 49; fresh air kiosk 50; cooling tower 48	The employee dormitory of municipal disease prevention and control center has taken measures on ventilation kiosk and cooling tower.
	14	No. 399 Bayi Avenue	N14-1	Piston air kiosk 14; ventilation kiosk 11; fresh air kiosk 9;	① The distance between the air kiosk and sensitive points cannot meet the requirement for minimum distance(15 meters). It is requested to move the air kiosk to the southwest side. See Figure 4-9. The distance to the piston kiosk is 25 meters, 22 meters to ventilation kiosk, and 20 meters to the fresh air kiosk. 2. The silencer of the ventilation, piston and fresh air kiosk is prolonged to 4 meters.

Station Section Name	Sensitive Point		Prediction Point		Noise Control Program and Proposal
	No.	Name	No.	Horizontal Distance to Sound Source(m)	
	15	Jiangxi Provincial Revolutionary Martyr Memorial Hall	N15-1	Piston air kiosk 48; ventilation kiosk 50; fresh air kiosk 53;	
Yongshu Road Station	16	No.1, No. 13, NO. 3-7 of Yongshu Road	N16-1	Piston air kiosk 8; ventilation kiosk 8; fresh air kiosk 8;	1. The distance between the air kiosk and sensitive points cannot meet the requirement for minimum distance(15 meters). It is requested to move the air kiosk to the north. See Figure 4-10. The distance to the piston kiosk is 22 meters, 20 meters to ventilation kiosk, and 18 meters to the fresh air kiosk. 2. The silencer of the ventilation, piston and fresh air kiosk is prolonged to 3 meters, and the ventilation outlet turns away from the sensitive point.
			N16-2	Piston air kiosk 30; ventilation kiosk 29; fresh air kiosk 29;	
Sourth Dinggong Road Station	17	No. 12 Dinggong Road	N17-1	Piston air kiosk 27; ventilation kiosk 23; fresh air kiosk 20;	The silencer of the ventilation, piston and fresh air kiosk is prolonged to 3 meters, and the ventilation outlet turns away from the sensitive point.
Nanchang Railway Station	18	No. 8 Railway Village 1	N18-1	Piston air kiosk 18; ventilation kiosk 18; fresh air kiosk 18; cooling tower 18	1. The silencer of the ventilation, piston and fresh air kiosk is prolonged to 4 meters, and the ventilation outlet turns away from the sensitive points. 2. Adopt super-low noise crossflow cooling tower.
Hongdu Avenue Station	19	Nanchang Special Police Detachment	N19-1	Piston air kiosk 35; ventilation kiosk 37; fresh air kiosk 42; cooling tower 35	1.The silencer of the ventilation and piston is prolonged to 4 meters, and the silencer of fresh air kiosk is prolonged to 3 meters. The ventilation outlet turns away from the sensitive points. 2. Adopt super-low noise crossflow cooling tower.

Station Section Name	Sensitive Point		Prediction Point		Noise Control Program and Proposal
	No.	Name	No.	Horizontal Distance to Sound Source(m)	
	20	No. 8 Railway Village 3	N20-1	Piston air kiosk 6; ventilation kiosk 7; fresh air kiosk 9;	<p>1. The distance between the air kiosk and sensitive point can not meet the requirement for minimum distance(15 meters), and it is requested to move the air kiosk to the east, and dismantle and resettle Building 1 of No. 44 residential building. The distance between No. 10 residential building to the piston air kiosk is 24 meters, 33 meters to ventilation kiosk and 39 meters to the fresh air kiosk. See Figure 4-13. 2. The silencer of the ventilation and piston air kiosk is prolonged to 4 meters, and the silencer of the fresh air kiosk is prolonged to 3 meters. The ventilation outlet turns away from the sensitive points.</p>
			N20-2	Piston air kiosk 7; ventilation kiosk 15; fresh air kiosk 19;	
	21	Residential zone of Provincial Exit and Entry Inspection and Quarantine Bureau	N21-1	Piston air kiosk 21; ventilation kiosk 20; fresh air kiosk 21;	
Yudai	22	Hufangchu Village	N22-1	Piston air kiosk 38; ventilation kiosk 34; fresh air kiosk 31;	The silencer of the ventilation kiosk is prolonged to 4 meters, and the silencer of the fresh air kiosk and piston air kiosk is prolonged to 3 meters. The ventilation outlet turns away from the sensitive points.
	23	Nanchang Hangkong University Further Studies College	N23-1	ventilation kiosk 63; fresh air kiosk 76; cooling tower 45	1. The silencer of the ventilation kiosk and fresh air kiosk is prolonged to 3 meters. The ventilation outlet turns away from the sensitive points. 2. Adopt super-low noise crossflow cooling tower.
	24	North Community of Shanghai Road Residential Area	N24-1	piston air kiosk 45	The environmental noise after project construction is maintained at the current level, and measures may not be taken.

Station Section Name	Sensitive Point		Prediction Point		Noise Control Program and Proposal
	No.	Name	No.	Horizontal Distance to Sound Source(m)	
Honguzhong Avenue station to Yangming Park Station To Y	25	Tangzihe Community	N25-1	piston air kiosk 18	The silencer of the piston air kiosk is prolonged to 3 meters.

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No. of Sensitive Point	Name of Sensitive Point	Relative Route Position (m)		Vibration Reduction Measures	Corresponding Mileage of Vibration Reduction Measures	Length of Vibration Reduction Measures	Investment(10,000 Yuan)
		Horizontal Distance L	Height Difference H				
1	Xiao's Family in Yuantou	34	0	Adopt GJ-III Rail vibration reducing fastenings	Commisioning line	double line 350linear meter	91
2	Li's Family in Wangshigang	22	0				
3	Zhu's Family in Fuxiang	0	14.5	Steel Spring Float Plate Roadbed	CAK0+780~CAK1+070	double line 290linear meter	580
				reseltte 7 households first			420
4	Wang's Family in Fuxiang	0	9.9	Steel Spring Float Plate Roadbed	CAK0+100~CAK0+570	double line 470linear meter	940
				Resettle 21 households first			1260

16	Sha ing Community	6.4	14.7	Steel Spring Float Plate Roadbed	YAK32+660~YAK32+920	double line 260linear meter	520
17	Employee dormitory of pronicial communication technical school	11.7	15.3	Adopt elastic support block integrated roadbed	YAK32+920~YAK33+020	double line 100linear meter	40
18	No. 1558 Fenghe Avenue, Longteng Xiaozhu Community	17.9	17.3				
19	Changbei Post Office	4.5	15.6	Steel Spring Float Plate Roadbed	YAK33+020~YAK33+190	double line 170linear meter	340
	Domitory of Changbei Post Office	0	15.6				
20	Honggu Kaixuan	16.3	17.6	Adopt elastic support block integrated roadbed	YAK33+190~YAK33+310	double line 120linear meter	48
		48	17.6				
21	Honggu Kaixuan Kindergarten	15.5	17.6				
25	Nanchang Aviation Bureau, Nanchang hydrological Bureau, Nanchang Water Environment Monitoring Center	0	25.8	Steel Spring Float Plate Roadbed	YAK35+110~YAK35+440	double line 330linear meter	660
26	Tangzihe Reconstruction Community	0	24.8	Steel Spring Float Plate Roadbed	YAK35+110~YAK35+440	double line 330linear meter	660
27	Datuyuan No. 2 Community	17.3	22.6	Adopt elastic support block integrated roadbed	YAK35+440~YAK35+900	double line 460linear meter	184
28	Jiangxi Publication Building	7.2	20.1				
31	Yuzhang ba kstreet food town(No. 236-302 Yangming Road)	5	16.2				
35	Employee dormitory(section B) OF Jiangxi Daily	15.1	14.5	Adopt elastic support block integrated roadbed	YAK35+900~YAK36+400	double line 500linear meter	200
36	Residential quarter of municipa party committee	10.7	16.3				
40	Jiangxi Provincial Public Security Department	11.3	20.6				
		47.5	20.6				
41	Employee domintory of provincial public security department	8.3	20.3	Adopt elastic support block integrated roadbed	YAK36+400~YAK36+780	double line 380linear meter	152
		23	20.3				
42	Domitory of municipal prosecutor's	11	20.6				

	office						
45	Teacher's dormitory of Chengbei School	8.3	17.7	Adopt elastic support block integrated roadbed	YAK36+780~YAK36+950	double line 170linear meter	68
		46.7	17.7				
46	Graduate student dormitory of TCM college	16	17.7				
47	Nanchang Highway Management Office, dormitory of municipal bus company, dormitory of Nanchang Educational College	3.3	15.6	Steel Spring Float Plate Roadbed	YAK36+950~YAK37+070	double line 120linear meter	240
48	Teachers' dormitory of Nanchang No. 28 Middle School	9.7	14.9	Adopt GJ-III rail vibration reduction fastenings	YAK37+130~YAK37+300	Double Line 170, Lenear meter	44.2
50	Clinic department of provincial TCM hospital, medical cosmetics clinic department of Nanda Medical College, Nanda Medical Science Research Institute	19.5	13.8	Adopt GJ-III rail vibration reduction fastenings	YAK37+300~YAK37+580	double line 280linear meter	72.8
54	Employee dormitory of provincial revolutionary martyr memorial hall, domitory of provincial women's association	21.8	14.1	Steel Spring Float Plate Roadbed	YAK37+880~YAK38+060	double line 180linear meter	含在第 110 个敏感点的措施中
59	Ji ngxi Telecommunication Bureau	16	17	Adopt GJ-III rail vibration reduction fastenings	YAK38+680~YAK39+080	double line 400linear meter	104
60	Employee dormitory of traffic and transport bureau	14.8	14.6				

61	Teaching office building of provincial party committee school	8.2	16				
65	Nanchang Bairui Legend Hotel	6.1	15.3	Adopt elastic support block integrated roadbed	YAK39+330~YAK39+600	double line 270linear meter	108
66	Guilin Business Hotel	6	16.2				
68	Jiangxi Long-Distance Transport Company	7.1	17.2				
69	Jiangxi Provincial Xinhua Bookstore(Xinhua Hotel)	8.5	17.6				
70	Hualong International Building	18.7	19.1	Adopt elastic support block integrated roadbed	YAK39+600~YAK39+750	double line 150linear meter	60
74	Galactic Peace International Hotel	18.6	19.3				
75	Nanchang Non-Ferrous Metallurgical Design Research Institute	4.6	18.9	Steel Spring Float Plate Roadbed	YAK39+750~YAK40+040	double line 290 linear meter	580

76	Employee dormitory of provincial foreign trade company	2.8	16.2				
79	Dormitory of Nanchang Tea Plant	5.3	15	Adopt elastic support block integrated roadbed	YAK40+040~YAK40+330	double line 290linear meter	116
80	Employee dormitory of Bayi Guesthouse	20	15.2				
81	Dormitory of Nanchang Commercial Storage and Transport Company	7.2	19.4	Steel Spring Float Plate Roadbed	YAK40+330~YAK40+530	double line 200linear meter	400
82	Dormitory of Nanchang Foreign Trade Bureau	2.9	19.4				
83	Nanchang Post Office	9.6	19.7	Adopt elastic support block integrated roadbed	YAK40+530~YAK40+730	double line 200linear meter	80
84	Motai 168 Chain Hotel	9.3	19.2				
87	No. 8 Railway Village 1	0	14.7	Steel Spring Float Plate Roadbed	YAK41+100~YAK41+650	double line 550linear meter	1100

89	Domitory of provincial light industrial product import and export company, Donglou garden	3.5	13.6				
90	No. 8 Railway village 2	0	13.5				
91	No. 8 Railway village 3	7.6	14.5	Adopt elastic support block integrated roadbed	YAK41+650~YAK42+050	double line 400 linear meter	160
92	Nanchang Special Police Detachment	8	14.3				
93	Provincia exit and entry inspection and quarantine bureau	10	15.4				
94	Domitory of transport vehicle detachment of provincial economic and trade department	5.5	15.4				
95	NO. 40-98 Shunwai Road	8.2	17.4				
96	Zuolingyoushe Community, Shunwai Sunjiating Village	13	19.2	Adopt elastic support block integrated roadbed	YAK42+050~YAK42+090	double line 40linear meter	16
97	Yujingcheng Residential Community	8.6	21.3	Adopt elastic support block integrated roadbed	YAK42+090~YAK42+320	double line 300linear meter	92

98	No. 100-232 Shunwai Road	10.5	20.9	Adopt elastic support block integrated roadbed	YAK42+320~YAK42+560	double line 240linear meter	96
99	Oriental Saina Residential Community	12.7	21.3				
100	No. 318-364 Shunwai Road	0	21.2	Steel Spring Float Plate Roadbed	YAK42+560~YAK42+770	double line 210linear meter	420
101	Shanghai Central Road Residential Community	35	18.2	Steel Spring Float Plate Roadbed	YAK42+770~YAK42+820	double line 50linear meter	100
102	Hufangwan Village	0	17.1	Steel Spring Float Plate Roadbed	YAK42+820~YAK43+030	double line 210linear meter	420
103	Hufangchu Village	15	17.2	Adopt elastic support block integrated roadbed	YAK43+030~YAK43+230	double line 200linear meter	80
106	Shanghai Road New Village Residential Community	6.9	16.8	Adopt elastic support block integrated roadbed	YAK43+230~YAK43+540	double line 210linear meter	84
107	Nanchang Medicine Company, Provincial Handicraft Industry Association	5.6	15	Adopt elastic support block integrated roadbed	Liaison lien	single line 160 linear meter	32

11.6-2-h

Name of Sensitive Point	Relative Route Position (m)		Vibration Reduction Measure	Corresponding Mileage of the Vibration Reduction Measures	Length of Corresponding Route	投资 (万元)
	Horizontal	Height Difference				

Jiangxi Hotel	Distance 52	13.8	Steel Spring Float Plate Roadbed	YAK37+620~YAK37+780	double line 160 linear meter	320
Jiangxi Hotel, Jiangxi Provincial Literary Association(Sino-Russia Friendship Venue)	37	14.8	Steel Spring Float Plate Roadbed	YAK37+920~YAK38+060	double line 140 linear meter	280
Jiangxi Provincial Exhibition Center(former site of Memorial Hall of Mao Zedong Thoughts)	30.3	15.1	Steel Spring Float Plate Roadbed	YAK38+400~YAK38+670	double line 270 linear meter	540

5 Environmental Monitoring Plan

5.1 Purpose of Monitoring

Environmental monitoring under the project mainly include monitoring of impacts on environment (water, air, noise, vibration environment, electromagnetic) along the line during construction period and operational period, and is intended to take all the necessary measures to learn about the scope and extent and period of impacts caused by various engineering behaviors during the project construction period and operational period on the objects under environmental protection so as to take corresponding mitigation measures on the engineering behaviors that cause environmental impacts, and verify the preventional and control effect of the environmental protection measures taken thereby and control the environmental impacts due to project construction within the permitted scope to the greatest extent.

5.2 Monitoring Plan

Table 5.2-1 List of the Environmental Protection Monitoring Plan for Phase I Project of the Nanchang Rail Transit Line2 Funded with the World Bank Loan

Stage	Monitoring Objects	Monitoring Sites	Monitoring Items	Frequency	Total Expense (RMB10,000)	Monitoring Organ	Responsible Organization	Supervisory Organ	Executive Standards and Norms
Construction Period	Ambient air	Schools, hospitals and residential area outside the boundary of busy construction area at depots and various stations (represented by Fuxiangzhujia, employee dormitory of Jiangxi Daily Press, Tangzihe Community, Dongfang Yixiang residential community, dormitory of municipal bus company, No. 399 Bayi Avenue, No. 1 Railway Middle School, No. 8 Railway Village 1, Nanchang Hongkang University Technological College, and Shanghai Road residential community etc.)	TSP	Carry out monitoring once every quarter during the peak the construction period, and 3 continuous days each time. Monitor daily average value every day according to the specific requirements of "Quality Standards for Ambient Air" (GB3095-1996)	20	The project owner entrusts qualified organ to undertake the work by contract	Project Owner	Municipal and district environmental protection bureau	"Comprehensive Emission Standards for Atmospheric Pollutants" GB16297-1996
	Noise	Station construction site and surrounding sensitive points (represented by Tangzihe Community, employee dormitory of Jiangxi Daily Press, Dongfang Yixiang residential community, dormitory of municipal bus company, No. 399 Bayi Avenue, No. 1	Equivalent A sound level	Monitor once every month during the construction period, and 1 day each time; The daily monitoring periods are 8 : 00~10 : 00, 14 : 00~16 : 00, 20 : 00~22 : 00	40	The project owner entrusts qualified organ to undertake the work by contract	Project Owner	Municipal and district environmental protection bureau	"Limit for Noise on Architectural Construction Site" GB12523-90

Stage	Monitoring Objects	Monitoring Sites	Monitoring Items	Frequency	Total Expense (RMB10,000)	Monitoring Organ	Responsible Organization	Supervisory Organ	Executive Standards and Norms
		Railway Middle School, No. 8 Railway Village 1, Nanchang Hongkang University Technological College, and Shanghai Road residential community etc.) Dept site and surrounding sensitive points							
	Vibration	Dept construction site and surrounding sensitive points and sensitive points the project line runs under(represented by Changbei Post Office, Tangzihe reconstruction community and No. 8 Railway Village and Shajing Community etc.)	Vibration level	Monitor once every month during the construction period, and 1 day each time; The daily monitoring periods are 8 : 00~10 : 00, 14 : 00~16 : 00, 20 : 00~22 : 00	30	The project owner entrusts qualified organ to undertake the work by contract	Project Owner	Municipal and district environmental protection bureau	“Measurement Methods for Urban Environmental Vibration”(GB10071-88)
		Jiangxi Hotel, Jiangxi Provincial Literary Association(Sino-Russia Friendship Venue) and Jiangxi Provincial Exhibition Center(former site of Memorial Hall of Mao Zedong Thoughts)	Vibration speed	Carry out continuous monitoring in case of shield tunneling, and 1 monitor every day;	20	The project owner entrusts qualified organ to undertake the work by contract	Project Owner	Municipal and district environmental protection bureau	“Technical Regulations for Prevention against Industrial Vibration for Ancient Buildings”(GB/T50452-2008)
	Surface Water	Discharge outlets of treatment facilities for vehicle cleaning water and slurry sewage	pH, SS, Oil, COD	Carry 1 monitor each month before 6 month, monitored once per quarter after then; 1 day each time	15	The project owner entrusts qualified organ to undertake the work by contract	Project Owner	Municipal and district environmental protection bureau	“Comprehensive Discharge Standards for Sewage”(GB8978-1996)
	Underground	Surrounding buildings of	Ground	Rainfall period during	60	Professional testing	Project	Municipal and	/

Stage	Monitoring Objects		Monitoring Sites	Monitoring Items	Frequency	Total Expense (RMB10,000)	Monitoring Organ	Responsible Organization	Supervisory Organ	Executive Standards and Norms	
	Water		the base pit at the station, sensitive points the project runs under	settlement	construction, 1 time every day		organ	Owner	district environmental protection bureau		
			Station and sections constructed with open digging	Underground water level	Rainfall period during construction, 1 time every day						/
			Station and sections constructed with open digging	Water quality	Rainfall period during construction, 1 time every day						“Quality Standard for Underground Water” Class III
Operational Period	Water Environment	Sewage at Depots	Discharge outlet of sewage treatment plant at depots	pH, SS, oil, COD	2 time in the first year, 1 day per time; irregular monitoring thereafter;	20	The project owner entrusts qualified organ to undertake the work by contract	Project Owner	Municipal and district environmental protection bureau	“Comprehensive Sewage Discharge Standards” (GB8978-1996)	
	Noise		Sensitive points around depots construction site, air kiosk of the stations and cooling tower((represented by Tangzihe Community, employee dormitory of Jiangxi Daily Press, Dongfang Yixiang residential community, dormitory of municipal bus company, No. 399 Bayi Avenue, No. 1 Railway Middle School, No. 8 Railway Village 1, Nanchang Hongkang University Technological College, and Shanghai Road residential community etc.)	Equivalent sound level A	2 time in the first year,; to be carried out in 2 periods(daytime and night); 1 day per time	30	The project owner entrusts qualified organ to undertake the work by contract	Project Owner	Municipal and district environmental protection bureau	“Quality Standards for Sound Environment” GB3096-2008 and “Discharge Standard for Environmental Noise in Factory Area of Industrial Enterprise” GB12348-2008	

Stage	Monitoring Objects	Monitoring Sites	Monitoring Items	Frequency	Total Expense (RMB10,000)	Monitoring Organ	Responsible Organization	Supervisory Organ	Executive Standards and Norms
	Vibration	Sensitive points such as Changbei Post Office(domintory of Changbei Post Office), Tangzihe reconstruction community and No. 8 Railway Village, and Shajing Community etc..	Vibration level	2 time in the first year.; to be carried out in 2 periods(daytimne and night); 1 day per time	30	The project owner entrusts qualified organ to undertake the work by contract	Project Owner	Municipal and district environmental protection bureau	“Measurement Methods for Urban Environmental Vibration”(GB10071-88)
		Jiangxi Hotel, Jiangxi Provincial Literary Association(Sino-Russia Friendship Venue) and Jiangxi Provincial Exhibition Center(former site of Memorial Hall of Mao Zedong Thoughts)	Vibration speed	1 time in the 3 year period during the operational period; to be carried out in 2 periods(daytimne and night); 1 day per time	20	The project owner entrusts qualified organ to undertake the work by contract	Project Owner	Municipal and district environmental protection bureau	“Technical Regulations on Prevention of Industrial Vibration for Ancient Buildings”(GB/T50452-2008)
	Electromagnetic Radiation	Residents that receive TV program through wireless acces in Xiaojia of Yuantou and Lijia of Wangshigang, and traction substation of Qingshan Road station	Power frequenxcy of electromagnetic field, strong radio interference field	1 time in the first 3 years, 1 hour per time	15				

6 Estimation of Environmental Protection Expenses and Analysis of Economic Profit and Losses

6.1 Estimation of Investment in Environmental Protection

6.1.1 Compilation Principle

The estimated costs include cost of environmental protection facilities, environmental protection measures fee, Environmental monitoring cost, reserve fund and special charges of Nanchang rail transit Line 2 project (section from the South Zhanqian Avenue Station to the Xinjianan Station), that is from project preparation until delivery operations including the all contents of static investment and dynamic investment. Immigrant relocation costs, design costs and construction costs associated with this project are not included in this investment.

6.1.2 Compilation basis

- 1) 《Summary budgeting measures of Urban rail transit engineering》.(Construction standards of the Ministry of Construction [2006] No. 279);
- 4) 《 Compilation method of investment and estimate in municipal engineering》.(Construction standards of the Ministry of Construction [2007] No. 164);
- 3) The related fixed and related documents and regulations of Jiangxi Province and Nanchang.
- 4) 《Urban rail transit project budget fixed》
- 5)technical and economic index of the similar engineering

6.1.3 costs

According to the relevant regulatory requirements, environmental protection investment in the project is composed of environmental protection measures fee, environmental monitoring measures fee, environmental protection equipment and installation fee, environmental protection interim measures fee, environmental protection independent fee, environmental protection reserve funds and financing interest during construction.

6.1.4 Basic Unit Price

The project is located in type-six wage region, artificial wage in accordance with the standard 190yuan / month, construction subsidy 3.5yuan / man-day, calculate manual budget unit price, manual budget unit price of engineering measures is 2.66yuan / hour, manual budget unit price of plant measures is 2.23yuan / hour.

(2) Material Budget Unit Price

The main materials price is consistent with material budget price of main project, other secondary materials, seedlings and so on refer to market price.

6.1.5 Independent costs

Mainly includes environmental construction and management fee, environmental supervision fee, research survey and design consulting fee and so on.

(1) construction and management fee

Including environmental management personnel recurrent costs, completion and acceptance fee of environmental protection facilities, environmental protection publicity and training fee. Among them:

environmental management personnel recurrent costs: accounts for 3% of the actual costs of the environmental protection measures.

completion and acceptance fee of environmental protection facilities: calculated taking actual workload into account.

environmental protection publicity and training fee: accounts for 2% of the actual costs of environmental protection measures.

(2) environmental supervision fee

Reference to the main project supervision personnel costs standard, calculate in terms of the number and time of environmental supervision.

(3) research survey and design consulting fee

Including environmental protection scientific research test fee, environmental impact assessment fee, environmental survey and design fees for environmental protection, technology consulting fees. Among them:

environmental protection scientific research test fee: calculated taking actual needs into account.

environmental impact assessment fee: calculated taking related charges into account.

environmental survey and design fees for environmental protection: calculated taking related charges into account.

technology consulting fees: calculated taking the relevant provisions of the State into account.

6.1.6 The estimated results

The total environmental protection investment listed for rail transit line 2 of Nanchang City is 132444000 yuan. See Table 6.1-1 for summary table of project environmental protection measures and investment:

Table 6.1-1 Summary Table for Estimated Environmental Protection Investment

Environmental Elements	Contents of Measures	Investment Estimation(10,000 Yuan)
Noise	The silencer at 19 air kiosks is prolonged from 2 meters to 3 meters or 4 meters.	478.5
	Super-low crossflow cooling tower is adopted for 10 cooling towers; establish sound insulation hood around 1 cooling tower;	560
	1 residential building has been resettled.	1920
	Establish sound screen by the depots and commissioning line in comprehensive base; Install sound insulation window in vehicle washing sheds, control room and workshop	86.5
	Temporary sound insulation facilities during construction period	300
	Subtotal	3345
Vibration	Establish steel spring float plate roadbed for 3 protected cultural relics such as Jiangxi Hotel, Jiangxi Provincial Literary Association(Sino-Russia Friendship Venue) and Jiangxi Provincial Exhibition Center(former site of Memorial Hall of Mao Zedong Thoughts), totally 570 meters for double lines;	1140
	Establish steel spring float plate integrated roadbed for 16 sensitive points such as school, hospital and residential areas that the project lines runs through(from over the rail to 5 meters to the central line of the external rail), including Changbei Post Office(dormitory of Changbei Post Office), Tangzihe reconstruction community, No. 8 Railway Village and Shajing Community etc., totally 2390 meters for the double lines. Moreover, give priority to two sensitive points such as Fuxiang Wang's and Fuxiang Zhu's family the project runs under in resettlement. In case the resettlement measures have not be implemented, establish steel spring float plate integrated roadbed, totally 760 meters for the double lines.	6460 (Resettlement Program)
	As for the 36 sensitive points that exceed standard within 5 to 10 meters, mainly including Jiangxi Provincial Publication Building, Yuzhang backstreet food city, and teachers' dormitory of Chengbei school etc., adopt elastic support block integrated roadbed.	1616
	As for other 7 environmental sensitive points with environmental vibration VLz10 exceeding the standards, or qualified VLz10 but unqualified VLzmax, including Xiao' in Yuantou, Li's in Wangshigang, teachers' dormitory of No. 28 Middle School of Nanchang, and employee dormitory of transport bureau, and office building of provincial party committee school, adopt GJ-III vibration reduction fastenings, totally 1200 meters for double lines.	312
	Subtotal	9528
Water Environment	Sewage treatment expenses during construction period .	50
Electromagnetic environment	Expenses for cable TV access It is requested to rationally lay out major transformer substation, and plan the land surrounding the major transformer substation to keep the enclosure walls of the major transformer substation far away from residential areas(at least 15 meters)	1.4
Environmental monitoring expenses during construction period	Monitoring noise, vibration, water, air, underground water level and settlement etc.	185
Environmental monitoring expenses during operational period	Monitoring of noise, vibration, water and electromagnetic factors	115
Environmental protection training	Environmental protection laws, construction planning, environmental monitoring guidelines and regulations, ambient air, sewage monitoring and control techniques, noise, vibration monitoring and control techniques;	20
Total Investment		13244.4

6.2 Analysis of Economic Gains and Losses due to Environmental Impacts

Analysis of economic gains and losses due to environmental impacts is mainly intended to measure the environmental protection effect that can be achieved through the environmental protection investment to be input for the construction project, and make general economic assessment of environmental impacts through comprehensive calculation of economic losses caused by factors of environmental impacts, benefits of environmental protection measures and engineering environmental benefits. Thus in addition to calculating investment and expenses for controlling pollution, the possible environmental and economic effects shall be accounted during analysis of economic gains and losses due to environmental impact.

6.2.1 Means of Assessment and Analysis

The economic gains and losses due to environmental impacts of the project are comprehensively assessed by means of static analysis method, and conclusion is drawn from environmental and economic perspectives.

(1) Net Benefits of Environmental Protection Investment

Calculation of net benefits of environmental protection investment is intended to assess the dominant environmental impacts of the project (beneficial or adverse impacts). The calculation formula is as follows:

$$B_{\text{总}} = (B_{\text{措}} - K) + B_{\text{工}} - L_{\text{前}}$$

As shown in the formula: $B_{\text{总}}$: Net benefits of environmental protection investment;

$B_{\text{措}}$: Environmental economic benefits produced by environmental protection investment;

K : Environmental protection investment and expenses;

$B_{\text{工}}$: Environmental and economic benefits due to environmental impacts of the project;

$L_{\text{前}}$: Environmental and economic losses in case of no environmental protection funds

(2) Investment Efficiency Ratio in Environmental Protection

The benefits and expenses ratio of investment on environmental protection must be calculated to assess the rationality of investment on environmental protection, and feasibility of environmental protection. The calculation formula is as follows:

$$E_{\text{总}} = (B_{\text{措}} + B_{\text{工}} - L_{\text{前}}) / K$$

In case $E_{\text{总}} \geq 1$, it shows that the environmental economic benefits of the project are larger than the environmental protection expenses, and the project is acceptable. In case $E_{\text{总}} < 1$, it shows the environmental protection expenses of the project is larger

than the benefits obtained, and the project shall be given up. The larger $E_{\text{总}}$ is, the better effect of environmental protection investment will be.

(3) Ratio between Environmental Protection Investment and Capital Construction Investment

Comparison of the index with that of similar domestic projects can confirm the rationality of the project.

6.2.2 Analysis of Economic Gains and Losses due to Environmental Impacts

The economic gains and losses due to environmental impacts of the project are comprehensively assessed by means of static analysis method, and conclusion is drawn from environmental and economic perspectives.

(I) Major Factors Influencing Environment

The major factors influencing environment entered into analysis of economic gains and losses due to environmental impacts are noise, ecological landscape and water pollution etc. according to characteristics of the project and specific local environmental conditions:

(II) Environmental economic losses produced before input of environmental protection funds $L_{\text{前}}$

(1) Environmental economic losses caused by noise: $L_{\text{前声}}$

According to the characteristics of the project, the populations around the air kiosk, cooling tower and depots as well as the ground lines of entrance/exit depot will be influenced by noise to various extents. Thus the project mainly assesses the environmental economic losses caused to surrounding populations due to subway noise. The report has selected the assessment coefficient for environmental and economic losses caused by noise of rail transit in Germany to passengers adopted by Planco in 1992 in a similar case, i.e. RMB 1.2 yuan per 100 persons km.

Suppose the average running speed of the train is 35km per hour(daily operational hour: 18 hours). As rail transit is a rapid means of transport, if the short interval between the trains is omitted, the trains running on the route can be seen as continuous, and the social populations around the noise source will receive constant impacts by the noise. And such people are influenced by the noise as if they travel by subway at 35km per hour for 18 years. It is estimated 9397 persons will be influenced by the noise of the project, and $L_{\text{前声}}$ is 22 million yuan per year.

(2) Environmental economic losses($L_{\text{前水}}$) caused by water pollution:

If the sewage discharged by the project is directly discharged without being disposed, the receiving water body will be polluted, and environmental economic losses will be caused due to deterioration of water quality. Such environmental economic losses is approximately replaced by the sewage discharge expenses payable for discharge of sewage of the same water quality and quantity. According to the current charging standards and provisions of relevant department, in case the sewage produced by the project is directly discharged without being disposed, the construction unit will pay 150,000 yuan per year as the sewage discharge expenses. Thus $L_{\text{前水}}$ is 150,000 yuan

per year.

(3) Total environmental and economic losses ($L_{前}$) caused before input of environmental protection funds:

Environmental and economic losses caused before input of environmental protection funds: $L_{前} = L_{前声} + L_{前水} = 22.15$ Million yuan per year

(III) Investment on Environmental Protection K

The investment on environmental protection of the project is 131644000 yuan, which will be amortized over 4.25 years. Thus K is 30,975,100 yuan.

(IV) Environmental economic benefits ($B_{措}$) caused by investment on environmental protection:

(1) Environmental economic benefits ($B_{措声}$) caused due to decrease in the number of people influenced by noise after noise control

According to the prediction results for impacts on sound environment, the noise level at the sensitive points along the project line is basically maintained at the level before project construction after noise and pollution prevention and control measures are taken, that is the project construction will not increase the noise level of various sensitive points. $B_{措声}$ is 22 million yuan per year.

(2) Environmental economic benefits ($B_{措水}$) caused by control of water pollution:

According to relevant provisions, the sewage of the project will be discharged after reaching standard through treatment. The sewage discharge fee in the amount of 30,000 yuan per year shall be paid after sewage treatment through calculation, and 150,000 yuan per year shall be paid before sewage treatment. Thus the environmental economic benefits produced through treatment of water pollution ($B_{措水}$) is 120,000 yuan per year.

(3) Total environmental economic losses produced by investment on environmental protection ($B_{措}$):

$$B_{措} = B_{措声} + B_{措房} + B_{措水} = 22.12 \text{ Million yuan per year}$$

(V) Environmental economic benefits caused by engineering environmental impacts ($B_{工}$):

The extent of environmental pollution will be different in case road traffic instead of rail transit is adopted to meet the ever increasing demands for traffic by economic and social development along the route of the project in Nanchang City.

(1) Comparison of Environmental Economic Losses due to Noise Pollution:

To compare the environmental economic losses caused by noise due to two means of transport, the function of road traffic shall be the same as that of the means of transport of the project, and the travelling speed per hour is 35km per hour, with the daily operational period being 18 hours and the same quantity of passengers. Moreover, as road traffic is totally on the ground, the number of people influenced by

noise on the two sides of the traffic route will be larger than that of subway, and is estimated to be 24,000. The populations along the road are influenced by noise as if they travel by road at the speed of 35km per hour for 18 hours.

According to relevant data of Germany, the estimation coefficient for environmental economic losses caused by road traffic noise on the passengers is RMB 1.7 yuan per 100 persons km.

The environmental economic losses caused by road traffic noise($L_{\text{路声}}$) is 80 million yuan per year through calculation.

The environmental economic benefits($B_{\text{工声}}$) caused by noise pollution in the two ways is $B_{\text{工声}} = L_{\text{路声}} - L_{\text{后声}} = 80$ Million yuan per year.

(2) Comparison of Environmental Economic Losses due to Atmospheric Pollution:

As rail transit utilizes power as energy, it produces less atmospheric pollution, thus the environmental economic losses caused by its atmospheric pollution is approximately 0.

According to the conclusion of atmospheric environmental impact assessment, the emission of automobile exhaust will be reduced due to project construction. The environmental economic losses due to road atmospheric pollution is estimated according to the environmental economic losses caused by the road traffic exhaust on passengers in Germany, that is RMB 0.2 yuan per 100 persons km. $B_{\text{工气}} = 9.8$ Million yuan per Year.

(3) Total environmental economic benefits($B_{\text{工}}$) due to engineering environmental impacts:

$$B_{\text{工}} = B_{\text{工声}} + B_{\text{工气}} = 89.8 \text{ Million yuan Per Year}$$

(VI) Analysis of Economic Gains and Losses due to Environmental Impacts:

(1) In case $B_{\text{总}}$ is larger than 0, it shows the environmental impacts of the project are mainly beneficial.

Net benefits from environmental protection investment $B_{\text{总}} = (B_{\text{措}} - K) + B_{\text{工}} - L_{\text{前}} = 58,294,900$ yuan per year.

(2) Environmental protection investment efficiency $E_{\text{总}} = (B_{\text{措}} + B_{\text{工}} - L_{\text{前}}) / K = 2.92$

$E_{\text{总}} > 1$, which shows that the environmental economic benefits of the project is larger than the environmental protection expenses, and the environmental protection investment effect is good.

(3) Environmental protection investment/capital construction investment ratio:

The environmental protection investment of the project is 132444000 yuan, and the estimated total investment of the project is 14846032400 yuan, thus the environmental protection investment/capital construction investment is 0.89%, which is similar to that of the environmental protection investment of similar domestic project. Thus the environmental protection investment is rational.

6.2.3 Conclusion:

The completion and operation of the project will positively promote social economy and urban environment in areas along the routes of the project. The environmental economic losses caused by project construction will be controlled within a small scope after several environmental protection measures are taken. Project construction will produce significant social benefits and environmental benefits, which complies with the principle of simultaneous growth of economic benefits, social benefits and environmental benefits.

6.3 Sources of funds

According to the current financial strength of Nanchang, the capital of Nanchang rail transit Line 2 project to be considered the mode of direct government investment, Adopted government financial sources of funding are: government budget funds for construction, special funds for urban construction(with civil air defense special funds) and Land transfer revenue and so on. Debt funds are mainly considered loans of domestic bank and World Bank.

7 Information management of the Environmental and Social Management Plan

7.1 Reorganize and save of monitoring data

The monitoring information involved in this project is reorganized by qualified units commissioned by Nanchang track Limited.

7.2 Information exchange

Environmental management requires the necessary exchange of information between different departments and different positions within the organization, at the same time, the organization also need communicate relevant information to the outside (stakeholders, public and so on).

Internal information exchange can be carried out in a variety of ways of meeting and internal briefings, but a formal meeting must be hold monthly, all exchange of information should be recorded and archived.

External information exchanges is held once every six months or one year, the exchange of information with collaboration unit should be formed the minutes and archived.

7.3 Record

For the effective operation of the environmental management system, the owners must be organized to establish a sound system of record, and retain the records of the following aspects:

- (1) Legal and regulatory requirements;
- (2) Related review and approval to the project;
- (3) Environmental factors and the related environmental impact;

- (4) Training;
- (5) Examination, checking and maintenance activities;
- (6) Monitoring data;
- (7) Problems in environmental management and environmental protection work;
- (8) Mitigation measures effectiveness;
- (9) Relevant project information.

Complementary, necessary control must to be done to the above types of recording, including: the identification, collection, cataloging, archiving, storage, management, maintenance, inquiry, shelf life, disposal and other links.

7.4 Report

Environmental Management Office, contractors, monitoring units of Nanchang rail transit Line 2 project should record the progress of the project, the implementation of the management plan (EMP), environmental quality monitoring results in the process of implementation of the project and report them to the authorities in a timely manner. These include:

- (1) Monitoring units and contractors should record the implementation of the EMP in detail, and promptly report it to the PMO;
- (2) The PMO must complete the project progress report (Such as the semi-annual report, etc.) timely according to the World Bank's requirements and submit it to the World Bank. The report mainly includes the followings:
 - 1) The implementation of environmental protection measures, environmental management, environmental monitoring, and training programs, etc, in the ESMP.
 - 2) The state of progress of the project, such as the progress;
 - 3) Whether there are complaints from the public, in case of a complaint, record the main content of complaints, solutions and public satisfaction;
 - 4) Execution plan of ESMP for the next year.