E4437 V3 REV

Zhengzhou Rail Transit Line3 Project

Environmental and Social Management Plan

Environmental Protection Center of Ministry of Transportation Assessment

Certificate of National Environment Assessment: Jia Zi No. 1038

April, 2014 Beijing

1 Introduction

1.1 Project Origin

As the provincial capital of Henan Province, Zhengzhou City is located in the hinterland of the Central Plain, with "an important hub controlling advantageous positions." Zhengzhou is always one of China's important transportation and communication hubs, an important city of the new Eurasian Continental Bridge, and a national open and historical and cultural city. Zhengzhou is an important center city of the central region, the first city in Henan province and the urban agglomeration in the Central Plain, has unique and important geographic conditions, and is Henan Province's political, economic and cultural center.

Zhengzhou City has a long history. The Shang Dynasty had its capital here. It is the birthplace of the Chinese Civilization and one of China's oldest cities. Its north is near the Yellow River, its southwest is hilly land, and its southeast is a vast plain. In the pattern of China's economic development, it has an important role in linking the east and west, north and south.

Zhengzhou now has under its jurisdiction six districts, five county-level cities, one county and two state-level development zones. The city's total area is 7446.2 square kilometers. In recent years, Zhengzhou's economic construction and development is rapid. Throughout 2011, Zhengzhou completed 491.27 billion yuan of GDP, ranking 20th among Chinese large and medium-sized cities, and the annual general budget revenue of its local fiancé was 50.23 billion yuan, ranking 17th among Chinese large and medium-sized cities.

With the rapid development of the city, Zhengzhou presents such problems as population growth, the rapid growth of its motor vehicles, traffic jams and so on. Although, in recent years, Zhengzhou has been increasing investment in the construction of its urban traffic, the increase of its traffic supply is still far less than the growth of its traffic demand and its traffic supply and demand contradiction has an intensifying momentum.

To solve the problem of metropolitan traffic congestion, the general experience of domestic and international cities is to build rapid rail transit systems and construct integrated transport systems so as to solve traffic pressure and promote cities' healthy development. To this end, in September 2000, Zhengzhou began the preparation of the planning of its urban rail transit lines and networks. In 2004, according to Zhengzhou's overall urban planning-related local adjustment program and to experts' review comments, the planning of Zhengzhou's rail lines and networks experienced a local adjustment.

In August 2005, the Henan Development and Reform Commission organized and convened an experts' review meeting on Zhengzhou City's urban rail transit construction planning. The meeting proposed an opinion of further optimizing the forward line and network solutions. In January 2006, Zhengzhou's rail transit construction plan was completed. In January 2008, in Zhengzhou, the China International Engineering Consulting Corporation (CIECC) organized and convened an evaluation meeting for "Zhengzhou City's Rapid Rail Transit Construction Plan"; in March, the CIECC completed an assessment report and submitted it to the National Development and Reform Commission.

In April 2008, in Zhengzhou, the Ministry of Environmental Protection organized and convened an experts' review meeting, comprehensively reviewing and passing in principle the "Environmental Impact Report for Zhengzhou City's Rail Transit Lines and Networks Construction Planning." In February 2009, the National Development and Reform Commission printed and issued the "Circular of the National Development and Reform Commission Regarding the Request for the Examination and Approval of the Recent Construction Plan (2008 ~ 2015) for Zhengzhou's Urban Rapid Rail Transit" (NDRC Basic Document No. [2009] 369.).

According to the construction plan, the Phase-1 project of Line 1 for rail transit started in June 2009, and the Phase-1 project of Line 3 started in December 2010.

Meanwhile, in order to coordinate the construction of Lines 1 and 2, do a good job

of the reserved projects and provide technical support, the Zhengzhou Rail Transit Office organized and carried out the preliminary study of Lines 3, 4, 5 and 6, so as to provide a technical resource guarantee for along-the-line land use control planning, urban construction and the interim construction plan.

In July 2009, the Zhengzhou Rail Transit Office entrusted relevant units to formulate and complete the pre-feasibility study report (draft for review) for Line 3 project of Zhengzhou's rail transit, which passed experts' review. According to the experts' review comments and related units' opinions, the report underwent corresponding modification. In November 2009, the pre-feasibility study report (final draft) of Line 3 project of Zhengzhou's Rail Transit was completed.

In 2010, in order to maintain the sustainability, feasibility and rationality of Zhengzhou's rail transit construction, give play to the overall efficiency of Zhengzhou's rail transit lines and networks as soon as possible, accelerate the process of building rail transit, and provide the construction basis for the follow-up projects of its rail transit, Zhengzhou started the preparation of "Zhengzhou City's Rail Transit Construction Plan" (2013 - 2020). Currently, this planning report has been basically completed, initially having the conditions for being reported to a higher body. .

Combining with the progress of the original construction plan and with Zhengzhou's recent years' development, this plan proposes that after the phase-1 projects of Line 1 and 2, the Phase-2 project of Line 1, the Phase-2 project of Line 3, the Phase-1 project of Line 3, the Phase-1 project of Line 4 and Line 5 be constructed. Among them, the project of Line 3 will be constructed in 2014 and will be completed and opened to traffic in 2016.

In October 2010, in order to coordinate the formulation of its rail transit construction plan and to carry out in advance the research work for the relevant lines, the Zhengzhou Rail Transit Office entrusted the Beijing Urban Construction Survey and Design Institute to carry out the feasibility study work for Line 3 project for Zhengzhou's rail transit. In 2012, the institute completed a first draft feasibility study report. This EIA

report is based on this first draft.

The Line 3 project of Zhengzhou City's rail transit was included in the projects using the World Bank's loans in 2011, which needed preparing an EA report, environmental assessment summary and environmental management plan (EMP) and other documents in line with the World Bank's requirements. After accepting the entrustment, our unit organized experienced EIA staff members to undergo field research and collect the information and data related to the project, and completed the preparation of this report in December 2012.

1.2 The brief introduction of the project

Line 3 will be an oblique radial rail backbone line from northwest to southeast in the city's center. The north end of the Phase-1 project of Line 3 will start from Xinliu Road Station at the provincial sports center in Huiji District, and the south section will end at East Hanghai Road Station at the Economic Development Seventeenth Street in the Economic Development Zone. The length of the line will be about 25.2km, all underground, with 21 stations, one car depot and one parking lot. The line will be constructed along Changxing Road, Nanyang Road, Minggong Road, Jiefang Road, West Street, East Street, Zhengbian Road, Nandu Road and Economic Development Seventeenth Street, and will connect the Feb 7 Square's Commercial Center, Economic Development Zone's center and other urban functional centers. The line's average station spacing will be 1.29km, and its length will be about 25.2km, with 21 stations, one car depot and one parking lot.

1.3 Project summary

See Figure 3.3-1 "Sketch of Zhengzhou Urban Rail Transit Line 3" for the line details.

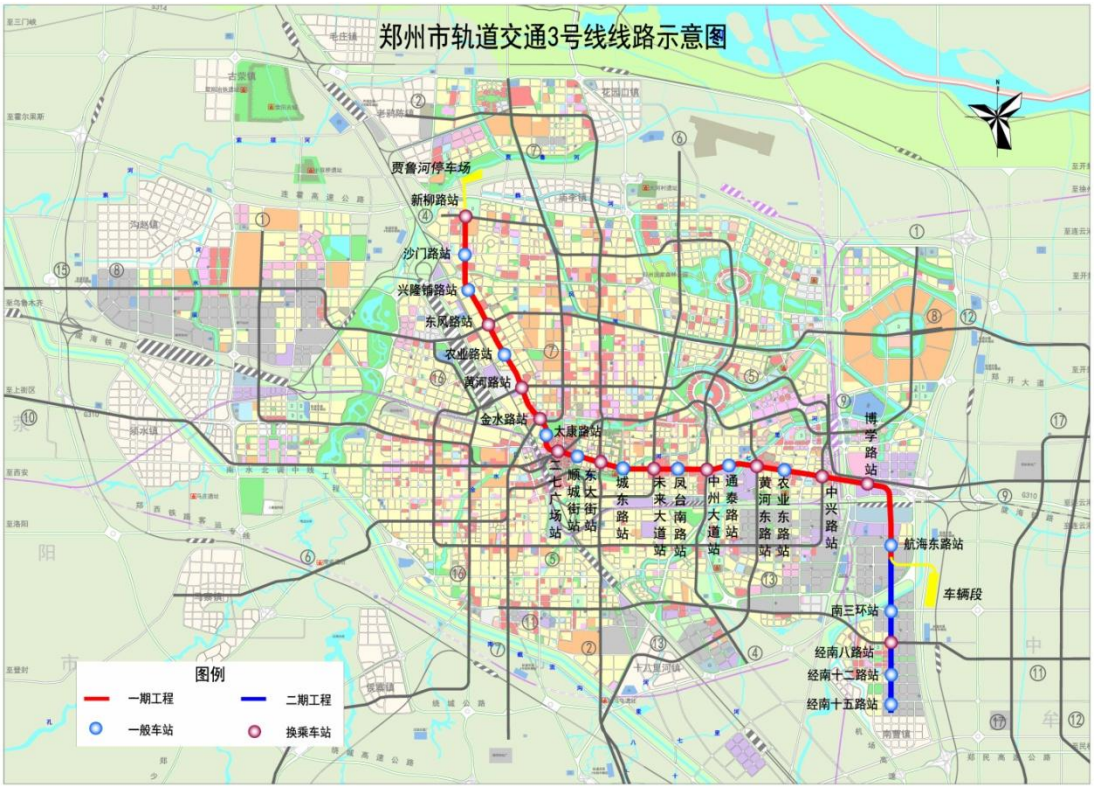


Figure 3.3-1 Sketch of Zhengzhou Urban Rail Transit Line 3

1.3.3 Station

Twenty one stations are laid in the first-stage project of Line 3 totally, all of which are underground stations. See Table 3.3-1 for the station distribution.

The table 1.3-1 The station distribution table Phase I Project of Zhengzhou Rail Transit Line 3

SN	Station	mileage	Length (m)	Form of station	Notes
	starting point.	K0+0			The starting point of the Phase I Project.
1	Xinliu road station	K0+130	130	Second floor underground island station	Set single crossover and out of line
2	Samen road station	K1+560	1430	Second floor underground island station	
3	Xinglongpu road station	K2+870	1310	Second floor underground island station	Set single crossover before the Station
			1630		

SN	Station	mileage	Length (m)	Form of station	Notes
4	Dongfeng road station	K4+500		Second floor underground island station	And the 8th line transfer
			1220		
5	Agriculture road station	K5+720		Second floor underground island station	
			1480		
6	Huanghe road station	K7+200		Second floor underground island station	And the 5th line transfer Set double stop line
			1135		
7	Jinshui road station	K8+335		Detached island station	
			910		
8	Taikang road station	K9+245		Second floor underground island station	
			890		
9	Erqi square station	K10+135		Third floor underground island station	And the first and 7th line transfer
			780		
10	Shuncheng Sreet station	K10+915		Second floor underground island station	
			990		
11	Dongdajie Str eet station	K11+905		Third floor underground island station	And the second line transfer Set single crossover
			795		
12	Chengdong road station	K12+700		Third floor underground island station	
			1145		
13	Future road station	K13+845		Second floor underground island station	And the 6th line transfer
			930		
14	Fengtai south road station	K14+775		Second floor underground island station	
			1010		
15	Zhongzhou avenue station	K15+785		Third floor underground island station	And the 4th line transfer
			940		
16	Tongtai road	K16+725		Second floor underground	Set double stop

SN	Station	mileage	Length (m)	Form of station	Notes
	station		1080	island station	line
17	Huanghe east road station	K17+805		Second floor underground island station	And the 13th line transfer
			1020		
18	Agriculture east road station	K18+825		Second floor underground island station	
			1465		
19	Zhongxing road station	K20+290		Second floor underground island station	And the 5th line transfer Set single crossover and connecting line
			1850		
20	Boxue road station	K22+140		Second floor underground island station	And the 5th line transfer Set connecting line
			2840		
21	Hanghai east road station	K24+980		Second floor underground island station	Behind the terminal station, there will be incoming and outgoing lines.
			2500		

Line 3 is proposed to choose Type-A cars , A main technical specifications for Type-A cars, see Table 1.3-2.

Table1.3-2 the main technical specifications for Type-A cars

SN	name		A type vehicle
1	Body length of the basic /mm		22000
2	Body width of the basic /mm		3000
3	The maximum height of vehicle	The inverter vehicle	3800
		Motor Car with pantograph	3810
		Pantograph working height	3900~5600
4	interior height /mm		≥2100
5	High floor /mm		1130
6	axle weight /t		≤16
7	length between truck centers /mm		15700
8	rigid wheel base /mm		2200~2500
9	Each side door number		5

10	Passenger capacity	Fixed number of staff members or passengers（6 peoples/m2）	310
		overman（9 peoples /m2）	432

The total length of line 3 is 31.3km, including one car and one parking lot in the whole line. The car depot is located in the area south of Jingnan 3rd Road, east of Beijing-Hongkong Expressway, west of Circle-city Railway and north of Xin'an Road, covering a surface of about 33.9ha; the parking lot is located in the plot which is south of Jialu River, east of Changxing Road, north of Lianyungang-Huoerguosi Expressway and west of Jinbei Road, covering an area of about 8.9ha.

The overall layout of Xinliu Road parking lot is designed on the basis of stub-end depot type. According to technologic needs, the scheme plans such production rooms like application depot and project garage, and production support constructions like complex building, canteen and bathroom, drivers' apartment, combined substation, signal cabin and sewage treatment station etc.

There are two accesses connecting to outside in Xinliu Road parking lot. The main access is located at the west part of the plot, opening to the planned Changxing Road and being close to the life and office area in front of plant; the secondary access is located at the east part of the plot, opening to the planned Guhe Road.

The overall layout of Xinliu Road parking lot is shown in Figure 1.3-2.

Main overhauling tasks assumed by Xinliu Road parking lot are shown in Table 1.3-3.

Table 1.3-3 Main overhauling tasks assumed by Xinliu Road parking lot

	Intermediate repair	Temporary repair	month examination	Parking lot		
				initial stage	Short-term	Long-term
Hanghai east road car depot	3+3	2	2	32	32	32
Xinliu road parking lot	0	0	2	16	16	32
total	3+3	2	4	48	48	64

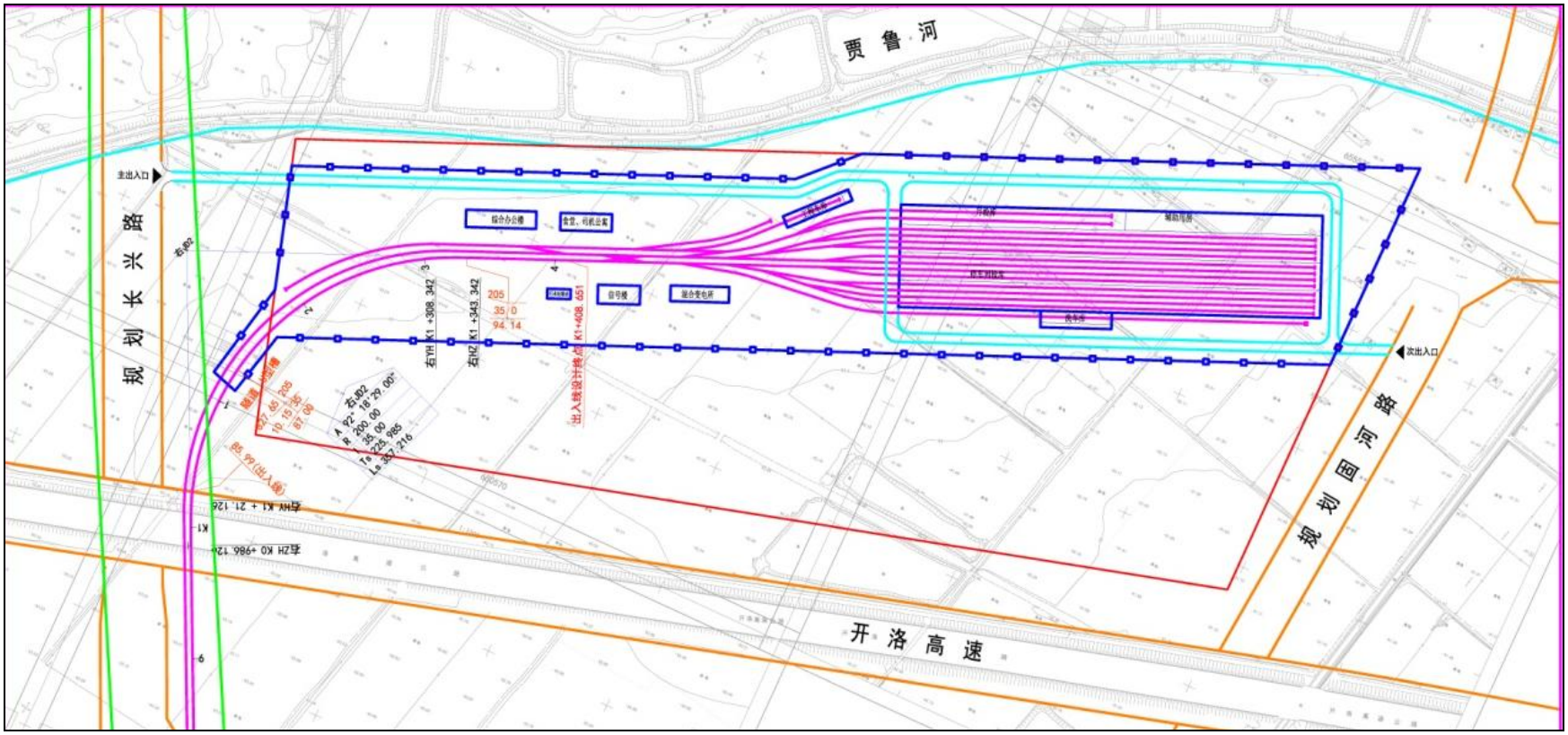


Figure 1.3-2 Layout Plan of Xinliu Road Parking Lot

East Hanghai Road car depot

The overall layout of the scheme is designed with paralleled stub-end depot type. According technological needs, the scheme plans production rooms like application depot, unite overhauling house, track garage, scheduling machine house and service shop etc. and such production supporting houses as complex buildings, drivers' apartments, canteens and bath rooms, material depots, combined substations and signal cabins and so on.

The overall layout of East Hanghai Road car depot is shown in Figure 1.3-3.

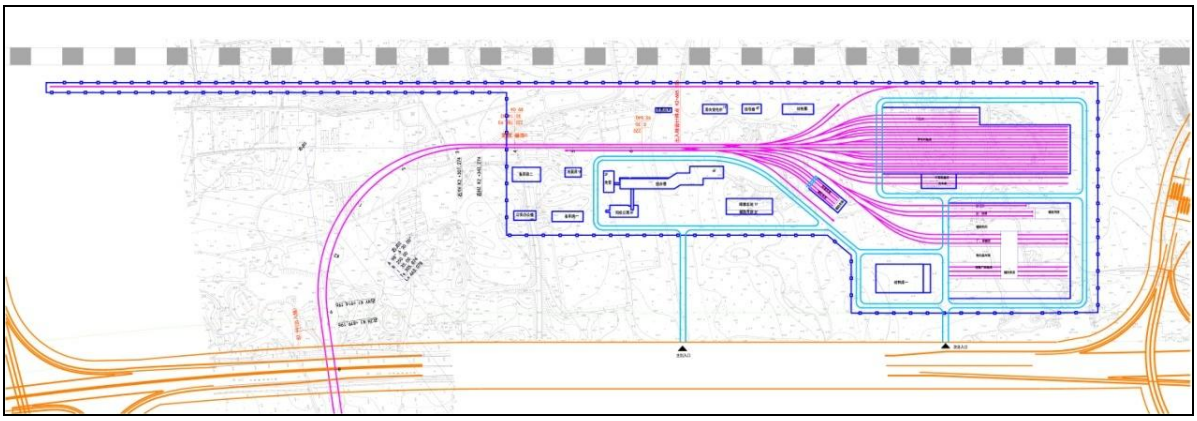


Figure 1.3-3 Layout Plan of Hanghai east Road Parking Lot

1）Designed year

Initial stage: 2022; short-term: 2029; long-term: 2044

2）Passenger flow volume

Table 1.3-4 Predicted Passenger Flow of Zhengzhou Subway Line 3

design period	Total passenger traffic volume of all day (10,000 person-time/day	Passenger transport intensity (10,000 person-time/km)	Maximum section of passenger flow of all day(10,000 person-time)	Average riding distance (km)
Initial stage（2022）	42.38	1.35	2.23	7.94
short-term（2029）	86.92	2.77	2.90	6.79
long-term（2044）	117.47	3.75	4.05	6.96

3）Traffic organization

① Marshalling:Marshalling form of six-car metro train including four motor

cars and two trailers in initial stage,short-term and long-term.The maximum driving speed is 80km/h, and operation speed is 35 km/h.

② Operating time：Operating time in the whole day is 18 hours from 5 o'clock to 23 o'clock.

③ Number of trains：In initial stage: 129/day; in short-term: 181/day; in long-term: 247/day.

④ Operating plan

Table 1.3-5 Driving Plan of Whole Day (number of trains/day)

Time period	Initial stage	short-term	long-term
5:00-6:00	4	6	8
6:00-7:00	8	10	15
7:00-8:00	15	15+3	20+5
8:00-9:00	8	15+3	20+5
9:00-10:00	6	10	15
10:00-11:00	6	8	10
11:00-12:00	6	8	10
12:00-13:00	6	8	10
13:00-14:00	6	8	10
14:00-15:00	6	8	10
15:00-16:00	6	8	10
16:00-17:00	8	8	15
17:00-18:00	12	15+3	20+5
18:00-19:00	8	12+3	15+5
19:00-20:00	8	10	15
20:00-21:00	6	8	10
21:00-22:00	6	6	8
22:00-23:00	4	6	6
Total	129	169+12	227+20

4) Construction methods

Phase I Project of Zhengzhou Metro Line 3 runs through current city zones of Zhengzhou and passes through prosperous commercial trade center of Zhengzhou. All adopt open-cut method except Jinshui Road Station. See Table 3.3-6.

Underground interval tunnel of this project adopts open-cut and shield methods for construction, see Table 1.3-7.

Table 1.3-6 Summary of Construction Method and Structural Shape of Line 3 Stations

SN	Name of station	Form of station	Construction method	Structural shape of station	Depth of foundation pit (m)	Containment form	Remarks
1	Xinliu Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	Transfer with Line 4
2	Shamen Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	
3	Xinglongpu Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	
4	Dongfeng Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	Transfer with Line 8
5	Agricultural Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	
6	Huanghe Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	Transfer with Line 5

7	Jinshui Road Station	Second floor underground separted island station	Cover dig method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	
8	Taikang Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	
9	Erqi square Station	Third floor underground island station	Open-cut method	Three-layer three-span box frame	23	The underground continuous wall	Transfer with Line 1 and 7
10	Shunchengjie Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	
11	Dongdajie Station	Third floor underground island station	Open-cut method	Three-layer three-span box frame	23	The underground continuous wall	Transfer with Line 3
12	Chengdong Road Station	Third floor underground island station	Open-cut method	Three-layer three-span box frame	23	The underground continuous wall	
13	Weilaidadao Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	Transfer with Line 6
14	Fengtai south Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	
15	Zhongzhoudadao Station	Third floor underground island station	Open-cut method	Three-layer three-span box frame	23	The underground continuous wall	Transfer with Line 4

16	Tongtai Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	
17	Huanghe east Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	Transfer with Line 13
18	Agricultural east Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	
19	Zhongxing Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	Transfer with Line 5
20	Boxue Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	Transfer with Line 9
21	Huanghai east Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	The terminal station of first phase of line 3
22	Nansanhuan Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	
23	Jingba south Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	Transfer with Line 11

24	Jingnan 12 Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	
25	Jingnan 15 Road Station	Second floor underground island station	Open-cut method	Double-layer three-span box frame	17	Cast-in-situ bored pile & waterproof curtain	

Table1.3-7 Construction Method of Interval Tunnel

SN	Name of interval	Construction method	Structural shape of interval	Length of interval (m)	Buried depth (m)	Remarks
1	Xinliu Road-Shamen Road Station Interval	Shield & open-cut methods	Circular section and rectangular section	1090	10-16	Distributing area of Xinliu Road Station adopts open-cut method.
2	Shamen Road-Xinglongpu Road Station Interval	Shield methods	Circular section	1130	10~18	
3	Xinglongpu Road -Dongfeng Road Station Interval	Shield & open-cut methods	Circular section and rectangular section	1300	10~16	Distributing area of Xinglongpu Road Station adopts open-cut method.
4	Xinglongpu Road- Agricultural Road Station Interval	Shield methods	Circular section	980	10~16	
5	Agricultural Road- Huanhhe Road Station Interval	Shield & open-cut methods	Circular section and rectangular section	900	10~11	Distributing area of Hunaghe Road Station adopts open-cut method.
6	Huanghe Road-Jinshui Road Station Interval	Shield methods	Circular section	900	10~16	
7	Jinshui Road-Taikang Road Station Interval	Shield methods	Circular section	740	10~16	

8	Taikang Road-Erqi square Station Interval	Shield & open-cut methods	Circular section and rectangular section	605	10~16	Distributing area of Taikang Road Station adopts open-cut method.
9	Erqi square-Shunchengjie Station Interval	Shield methods	Circular section	630	10~19	
10	Shunchengjie-Dongdajie Station Interval	Shield methods	Circular section	760	10~11	
11	Dongdajie-Chengdong Road Station Interval	Shield & open-cut methods	Circular section and rectangular section	480	10~16	Distributing area of Dongdajie Station adopts open-cut method.
12	Chengdong Road-Weilaidadao Station Interval	Shield methods	Circular section	950	10~16	
13	Weilaidadao-Fengtai south Road Station Interval	Shield methods	Circular section	670	10~15	
14	Fengtai south Road-Zhongzhoudadao Station Interval	Shield methods	Circular section	785	10~18	
15	Zhongzhoudadao – Tongtai Road Station Interval	Shield & open-cut methods	Circular section and rectangular section	470	10~16	Distributing area of Tongtai Road Station adopts open-cut method.
16	Tongtai Road – Huanghe east Road Station Interval	Shield methods	Circular section	890	10~19	
17	Huanghe east Road –Agricultural east Road Station Interval	Shield methods	Circular section	785	10~16	
18	Agricultural east Road ~Zhongxing Road Station Interva	Shield methods	Circular section	1250	10~15	

19	Zhongxing road – Boxue Road Station Interval	Shield & open-cut methods	Circular section and rectangular section	1520	10~20	Distributing area of Zhongxing Road Station adopts open-cut method.
20	Boxue Road – Hanghai east Road Station Interval	Shield methods	Circular section	2590	10~16	

1.3.14. Quantity of Major Works

1.3.14.1. Construction Site

(1) The layout of a construction site should make full use of a station's building land, and as far as possible, combine development plots, green belts, squares, etc, which will be used as temporary construction sites, but should be subject to consent of the municipal environmental protection and planning departments. For a location whose site layout is difficult and whose traffic volume is smaller, after a traffic police department's approval, its roads may be temporarily closed or part of its roads may be occupied as a construction site.

(2) The construction site for an underground station normally will take about 25 thousand square meters. Each station's geographical location is different, with a different environment and a different construction method, and some construction sites are relatively concentrated, and some are more dispersed, which requires that a construction team's comprehensive ability be stronger and its construction management level be higher.

(3) A shield shaft should be used as the assembly shaft and construction-related earth-going shaft of a shield.

(4) In order to ensure the smooth progress of the work of laying tracks, the track laying for the Phase-1 project of Line 3 should have two track panel bases at the car depot and parking lot to facilitate the track-laying operation.

1.3.14.2. Earthwork

The total amount of earthwork of Zhengzhou's Metro Line 3 will be approximately 4,974,000 cubic meters, of which the station excavation will be approximately 2,661,000 m3, and filling will be 293,000 m3; the interval shield soil

excavation will be approximately 531,000 cubic meters, and the filling will be approximately 58,000 cubic meters; the Xinliu Road station's car park's dredging excavation will be a total of 120,000 cubic meters, and the filling will be 279,000 cubic meters; Hanghai East Road's car depot's excavation will be about 393,000 cubic meters, and the filling will be about 638,000 cubic meters. For the earthwork quantity of the project of Line 3, see Table1.3-8.

Table 1.3-8.Earthwork Quantity of Phase-1 Project of Zhengzhou's Metro Line 3

Item	Excavation (ten thousand cubic meters)	Filling (ten thousand cubic meters)	Total (ten thousand cubic meters)
Station	266.1	29.3	295.3
Interval	53.1	5.8	58.9
Parking lot	12.0	27.9	39.9
Car depot	39.3	63.8	103.2
Total (ten thousand cubic meters)	370.5	126.9	497.4

1.3.14.3 Project Land

For the land covering situation of the Phase-1 project of Zhengzhou's Metro Line 3, see Table 1.3-9.

Table 1.3-9 Along-the-Line of Quantity of Land for the Project: Unit: hm 2

	Vegetable plot	Arable land	Orchard	Woodland	Other land	Total
Parking lot	5.5	6.4	0	0	2.3	14.2
Car depot	0	7.7	7.5	19.1	3.9	38.2
Station					2.9	2.9
Interval	0	0	0	0	0	0
Total						55.3

1.3.14.4 Quantity of Major Works

For the quantity of major works of the Phase-1 project of Zhengzhou's Metro Line 3, see Table 1.3-10.

Table 1.3-10. Quantities of Major Works

Item	Unit	Quantity	Remark
Length of line	km	25.2	All underground lines
Station	set	21	All underground stations
Car depot and parking lot	Set	2	Hanghai East Road's parking lot and Xinliu Road Station and car depot

Main substation	Set	1	Boxue Road Station's main substation
Demolition of buildings	m 2	101660	
Permanent site	Chinese acre	829.68	
Project investment	Ten thousand yuan	1820853	

1.3.15 Management organization and seating capacity

This project will be managed by zhengzhou 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 3 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 3 is 3011 in initial stage, 3175 in short-term and 3666 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 3 of Zhengzhou 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 3 of Zhengzhou 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 Zhengzhou rail transit Line 3 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 (revised on December 25, 2010, implemented on march1, 2011)

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

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

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

(19) 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)

(20)Implementation approaches of the Water Law of the People's Republic of China in Henan Province (come into effect since August 1st, 2006);

(21)Henan Province's Implementation approaches of the Cultural Relics Protection Law (Amendment) (come into effect since February 23rd, 1984);

(22)Circular of Henan Provincial People's Government on Intensifying Land Control and Strict Land Management (No.33 [2007] of the People's Government of Henan Province)

(23)Circular of Henan Provincial People's Government on Issuing the Five-Year Energy Development Plan (No.36 [2012] of the People's Government of Henan Province)

(24)Opinions of the People's Government of Henan Province on Implementing the Decision of the State Council on Implementing the Scientific Development View and Strengthening the Environmental Protection (No.36 [2006] of the People's

Government of Henan Province)

(25)Circular of the People's Government of Henan Province on Issuing the Implementation Scheme for Energy Conservation and Emission Reduction (No.46 [2007] of the People's Government of Henan Province)

(26)Notice of Designating Water Source Protection Areas on the Two Sides of Main Channel of North-South Water Transfer First-Stage Project Middle Route (No.134 [2006] of State Council North-South Water Transfer Office for Environmental Protection and Resettlement)

(27)Circular of the People's Government of Henan Province on Issuing the Implementation Opinion for the Water Source Protection Areas Designation on the Two Sides of Main Channel of North-South Water Transfer First-Stage Project Middle Route (No.32 [2007] of the People's Government of Henan Province);

(28)Circular of Zhengzhou Municipal People's Government on Issuing the Implementation Opinion for the Water Source Protection Areas Designation on the Two Sides of Main Channel of North-South Water Transfer First-Stage Project Middle Route (No.74 [2007] of Zhengzhou Municipal Government);

(29)Zhengzhou Municipal Government's Opinion on Implementing the Water Source Protection Areas Designation on the Two Sides of Main Channel of North-South Water Transfer First-Stage Project Middle Route & Implementation Scheme;

(30)Notification of Zhengzhou Municipal People's Government on Urban Groundwater Resources Protection and Self-supply Wells Closing (No.227 [2002] of Zhengzhou Municipal Government);

(31)Notification of Zhengzhou Municipal People's Government on Issuing the Zhengzhou National Economic and Social Development Plan of 2007 (No.13 [2007] of Zhengzhou Municipal Government);

(32)Zhengzhou Control Measures of Environmental Noise Pollution (No. 154 of Zhengzhou Municipal Government Notice);

(33) Zhengzhou Municipal Regulation on Air Pollution Control (come into effect since November 1st, 2005);

(34) Zhengzhou Water Resources Management Ordinance (come into effect since August 1st, 2003);

(35)Zhengzhou Urban Drinking Water Sources Protection and Pollution Control Ordinance (come into effect since January 1st, 2000).

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 Zhengzhou rail transit line 3 project and World Bank security policy/procedures, and list the results in table 2.3-1.

Table 2.3-1 Schedule of relationship between Zhengzhou Rail Transit Line 3 project and World Bank security policy/procedures

Policy/procedure	Zhengzhou Rail Transit Line 3 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 2.4.2 Assessment standard

2.4.2.1 Noise standard

The noise standard consulted in this assessment is shown in table 2.4-1, according to the Acoustic Environmental Function Zoning Plan of Zhengzhou City (2011) and the Confirmation of Environmental Impact Assessment Standard for Zhengzhou Metro Line 3 First-stage Project issued by the Environmental Protection Bureau of Henan Province.

Table 2.4-1 Summary table of acoustic environmental impact assessment

Name and No. of standard	Standard value and grade (type)	Scope of application
Environmental Quality Standard for Noise GB3096-2008	Type 4a: Daytime 70dB Nighttime 55dB	(1) Areas of 20-50m away from the motor lane border on the road sides; (2) Areas of 50m away from the railway outer track; (3) Areas within 35m from the two sides of car depot access line.

	Type 3: Daytime 65dB Nighttime 55dB	Certain distances away from the two sides of Boxue Road Station to East Hanghai Road Station (included).
	Type 2： Daytime 60dB Nighttime 50dB	Certain distances away from the two sides of Jinshui Road Station to Bocue road station (included).
	Type 1： Daytime 55dB Nighttime 45dB	Certain distances away from the two sides of Xinliu Road Station (included) to Jinshui road station (included)
Emission Standard for Industrial Enterprises Noise at Boundary GB12348-2008	Type 1： Daytime 55dB Nighttime 45dB	1m outside the parking lots
	Type 3: Daytime 65dB Nighttime 55dB	1m outside the car depot
Noise Limits for Construction Site GB12523-2011	Type 4a: Daytime 70dB Nighttime 55dB	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).

Containue 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.

2.4.2.2 Vibration standard

(I) 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

Scope of application	Daytime	Nighttime	Remarks
Residence and cultural and educational area standard	70dB	67dB	VL_{z10}
Mixing area and central business district	75dB	72dB	
industrial concentration district	75dB	72dB	
Both sides of arterial traffic standard	75dB	72dB	

(II) Reference standard

The assessment of Metro running vibration impact is carried out according to the allowable vibration velocity limits of historic brick masonry structures defined in *Technical Specifications for Protection of Historic Buildings against Man-made Vibration* (GB/T50452-2008), see table 2.4-3.

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	Brick masonry V_P(m/s)		
				<1600	1600～2100	>2100
Ancient brick structure	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
	Level of protection	Control point position	Control the direction	Stone masonry V_P(m/s)		
				<2300	2300～2900	>2900
Ancient stone structure	National key cultural relic protection unit	Highest position of bearing structure	Horizontal	0.20	0.20～0.25	0.25
	Provincial level cultural relic protection unit	Highest position of bearing structure	Horizontal	0.36	0.36～0.45	0.45
	Level of protection	Control point position	Control the direction	Wood masonry V_P(m/s)		
				<4600	4600～5600	>5600
Ancient wood structure	National key cultural relic protection unit	Top of pillars	Horizontal	0.18	0.18～0.22	0.22
	Provincial level cultural relic protection unit	Top of pillars	Horizontal	0.25	0.25～0.30	0.30

(III) 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).

"Limits and Measurement Method Standards for Urban Rail Transit Causing Secondary Radiation Noise and Building Vibration " JGJ / T 170-2009;

"Metro Noise and Vibration Control Specification" DB11/T838-2011.

2.4.2.3 Water environment

The metro line passes Jialu River, Jinshui River, Xiong'er River, Weihe River, Qili River and Chaohe River, and Level IV standards of the *Environmental Quality Standards for Surface Water* (GB3838-2002) shall be executed here;

For the underground water environment along the Metro line, *Environmental Quality Standards for Ground Water* (GB/T14848-93) Level III standard shall be executed.

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 , table 2.4-5 and table 2.4-6 for the details.

Table 2.4-4 Executive standard of ground water environmental impact assessment (mg /L) (Except the pH)

SN	items	standard value
1	pH value	6～9
2	Do	≥3
3	permanganate index	≤10
4	COD	≤30
5	BOD5	≤6

SN	items	standard value
6	NH3-N	≤1.5
7	TP	≤0.3
8	As	≤0.1
9	Hg	≤0.001
10	Cr	≤0.05
11	cyanide	≤0.2
12	Ar-OH	≤0.01
13	Oil Type	≤0.5
14	sulfide	≤0.5

Table 2.4-5Standard of ground water Quality Standard (mg /L)(Except the pH)

items	standard value	items	standard value
pH	6.5～8.5	Mn	≤0.1
Total hardness	≤450	Cu	≤1.0
Total soluble solids	≤1000	Pb	≤0.05
CODMN	≤3.0	Zn	≤1.0
fluoride	≤1.0	Cd	≤0.01
Nitrates	≤20	Cr^{+6}	≤0.05
Nitrites	≤0.02	Hg	≤0.001
sulfate	≤250	As	≤0.05
ammonia nitrogen	≤0.2	Total Plate Count (个/mL)	≤100
Ar-OH	≤0.002	The total coliforms (个/L)	≤3.0
Fe	≤0.3		

Table 2.4-6 *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	/

2.4.2.4 Ambient air

(I)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 2.4-7for standard values.

Table 2.4-7 Level 2 Standard of Ambient Air Quality Standard (GB3095-2012)

SN	Pollutants	secondary standard mg/Nm3			The standard source
		annual mean	daily mean	hourly mean	
1	SO_2	0.06	0.15	0.5	standard of Ambient Air Quality Standard （GB3095-2012）
2	NO_2	0.04	0.08	0.2	
3	Nitrogen oxides	0.05	0.1	0.25	
4	TSP	0.2	0.3		
5	PM_{10}	0.07	0.15		
6	$PM_{2.5}$	0.035	0.075		
7	CO		4.0	10.0	

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

(III) For construction dust, execute the Fugitive Emission Limit Values in " Integrated Standards of Air Pollutant Emission " (GB16297-1996) that is, particulate matter 1.0mg / m^3.

2.4.2.5 Electromagnetic radiation

(I) 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.

(II) 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 3 of Zhengzhou 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.

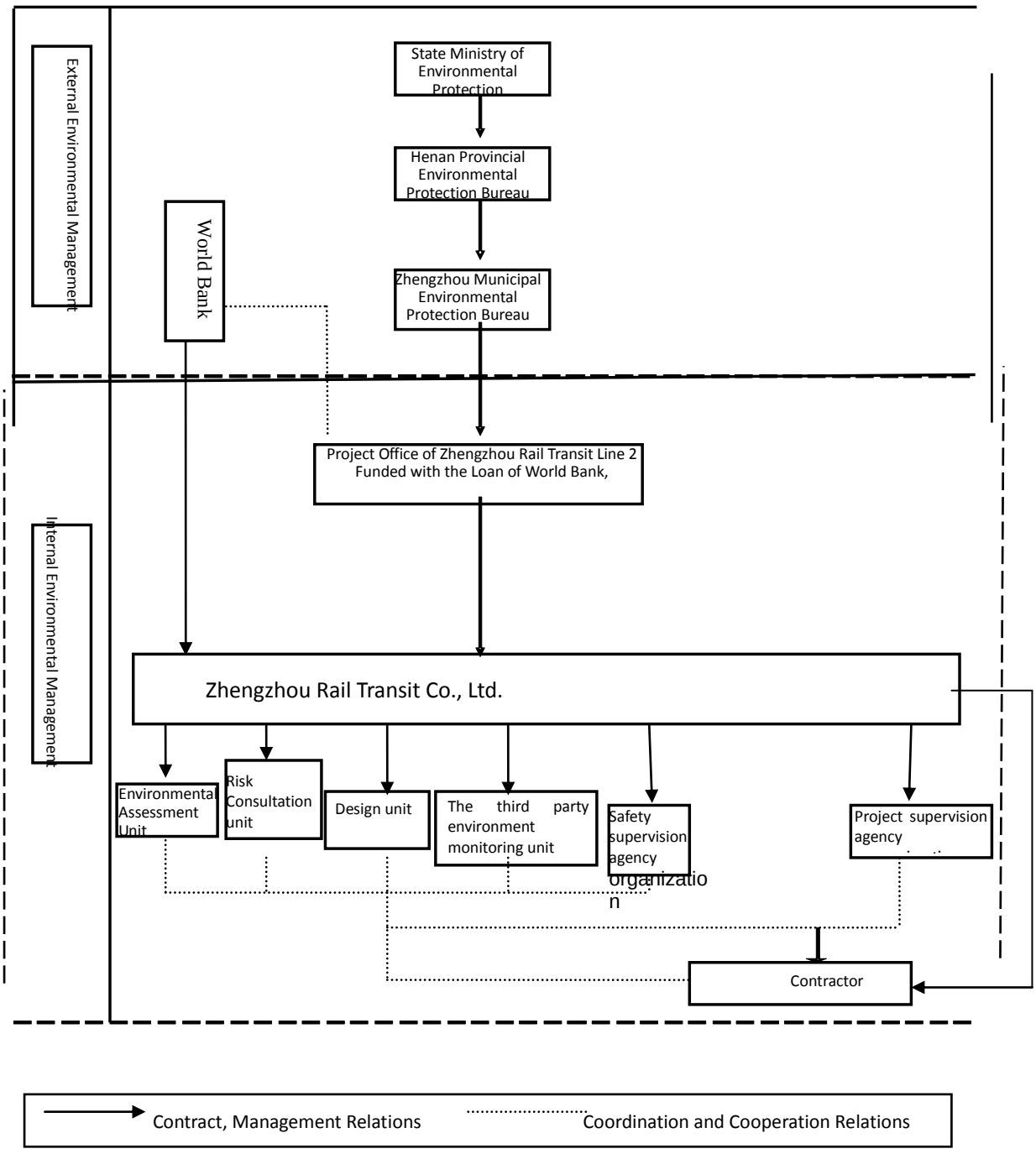
3.1.1 Environment management system in first phase of construction of project

The environment management in first phase of project construction is mainly implemented by Zhengzhou 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, Zhengzhou

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-a and 3.1-b. The responsibilities of all organs of management system Refer to tables 3.1-a and 3.2-b.



Risk consultation unit The third party environment monitoring unit Safety supervision agency Engineering management agency Safety supervision agency

Figure 3.1-a Environmental Protection Management System of Phase I Project of Rail Transit Line 3 of Zhengzhou in Construction Period

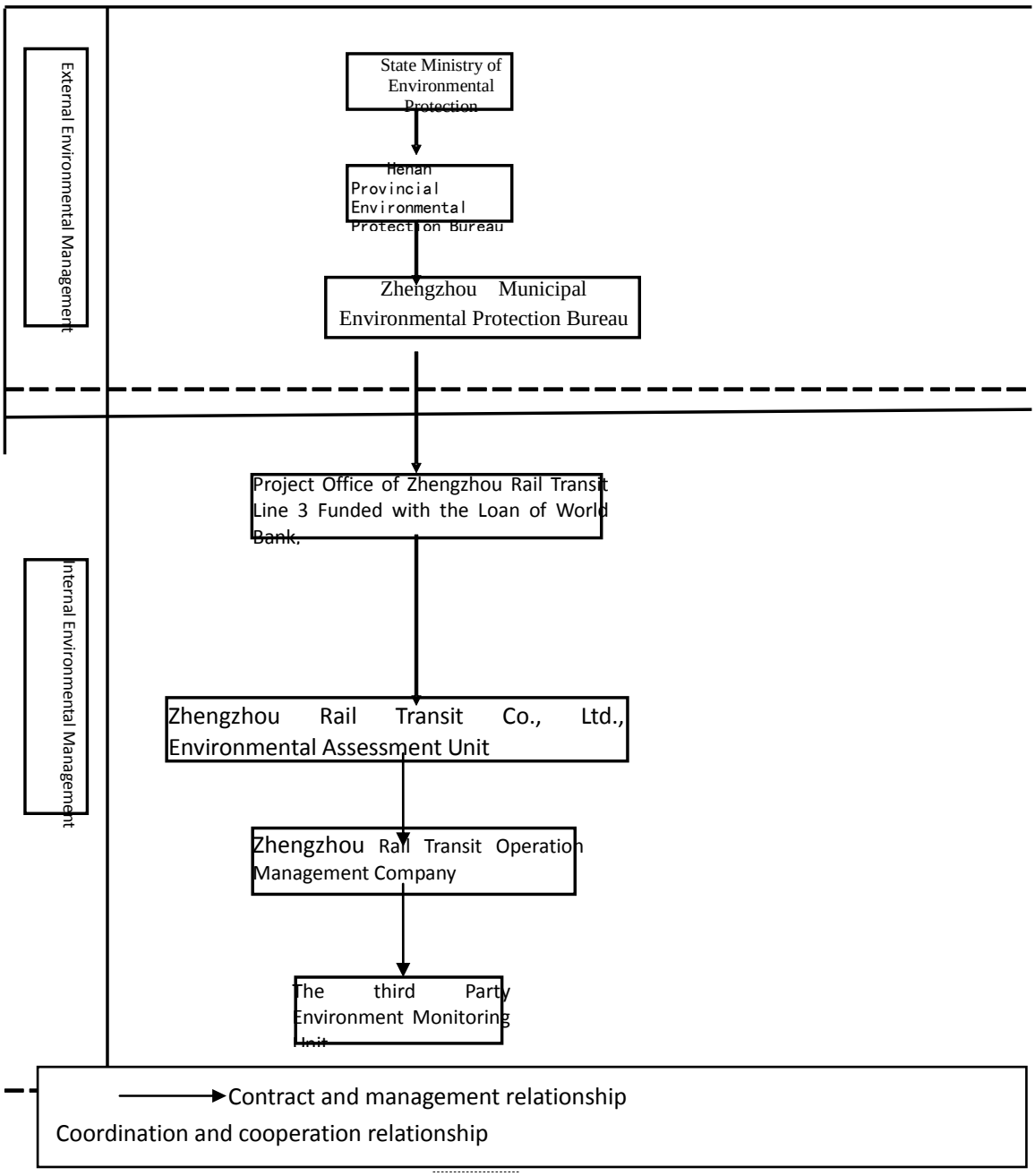


Figure 3-1-b Environment protection system of phase I project of No.3 rail of Zhengzhou in operation period

3.2 Environmental Management Organ, capability and Duties

3.2.1 Environmental Management Organ, Capability and Duties in First Phase of Project Construction

Organ and personnel: in first phase of construction, the owner unit is the main body of environment management. In first phase of construction, the owner unit assigns a full-time or part-time environment protection management staff to take charge of coordinating environmental protection in the first phase of project construction.

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: ① Protect the benefits of the units subject to land requisition and resettlement and the residents during land requisition and relocation. The owner unit shall strictly comply with state and Zhengzhou city resettlement regulations and determine reasonable compensation and setting modes for the units and residents subject to the relocation.

② Entrust the environment assessment unit to prepare the environment assessment report to conduct environment impact prediction and evaluation in project construction period and operation period and put forward various environment assessment measures; the preparation of report shall meet the requirements of World Bank, state and local environment protection laws and regulations and related technical policies. Through the implementation of measures in report in the design documents by the design unit and including the environment protection project investment into the project estimate (budget), it can realize the requirements for "simultaneous design" in "three simultaneously" in environmental protection project.

③ The construction unit shall attach equal attention to environmental protection project and the major project during project contracting, and make it definite in the

tender of the engineering construction. In addition, it shall put forth requirement for environmental protection to the construction organizational program of the construction unit, and give priority to the construction unit and team with strong sense of environmental protection, better achievements in environmental protection and stronger capacity to lay foundation for civilized construction, and "simultaneous construction" with high quality in environment protection.

3.2.2 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 Zhengzhou 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.

3.2.2.1 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.

3.2.2.2 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. 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 3.4-1 – 3.4-3 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 3.2-1 for the supervisory organizational organ:

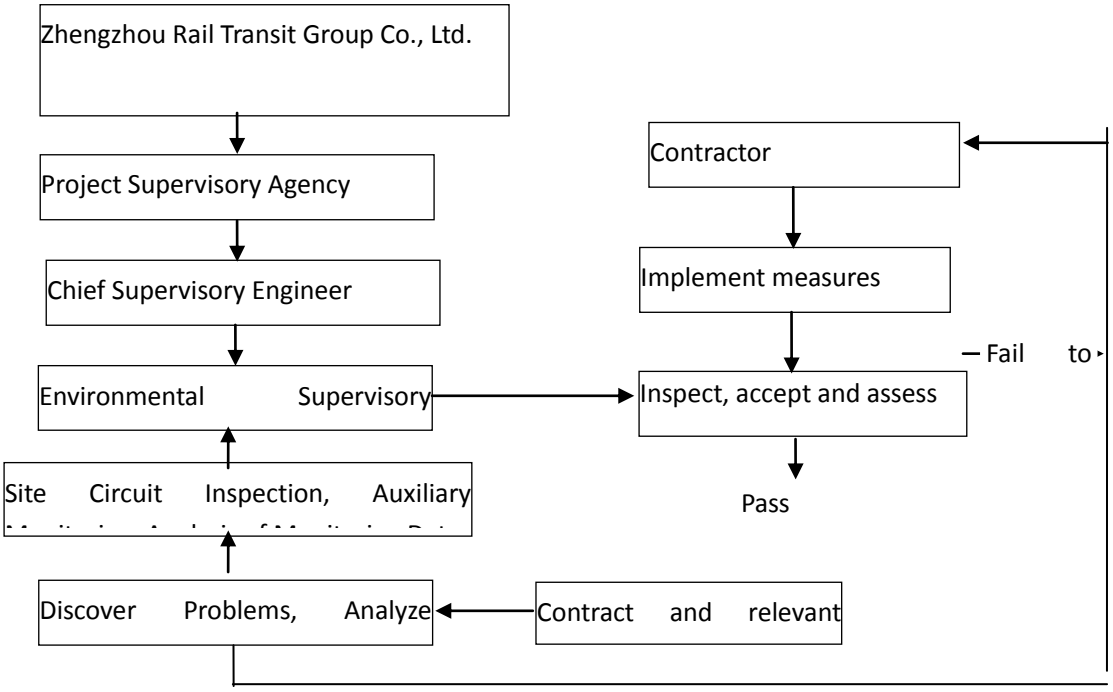


Figure 3.2-1 Environmental Supervisory Organ and Working Process in Construction Period

3.2.2.3 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.

3.2.2.4 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 3.1-a.

3.2.3 Environment management agencies, capabilities and duties in operation period

The environment management in operation period is responsible by Zhengzhou Rail Operation Management Company which is the subordinate unit of Zhengzhou Rail Transit Company. At same time, Zhengzhou Rail Operation Management Company entrusts environment monitoring unit to conduct long term monitoring for noise, vibration and waster water generated from No.3 line operation.

Staff and capability requirements: in project operation period, Zhengzhou 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 3, of which the works are directed and supervised by Ministry of Environment Protection, Henan Provincial and Zhengzhou 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.

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

The World Bank, Ministry of Environment Protection, Provincial Environment Protection Bureau, Zhengzhou 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 3 to guarantee implementation of various environmental protection measures of Rail Transit Line 3; Meanwhile, pay attention to the environmental protection problems reflected by the public toward Rail Transit Line 3, 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 bureau	Governmental administrative supervision and management agency; take charge of the environment protection works at each phase of entire project
Internal	Management	World Bank Load	Take charge of the environment

environment management	agency	Project office for Zhengzhou Rail Transit No.3 line phase 1 project	protection works at each phase of entire project
		Zhengzhou 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	Governmental administrative supervision and management agency; take charge of the environment protection works in project operation period

		environment protection bureau	
Internal environment management	Management agency	World Bank Loan Project office for Zhengzhou Rail Transit No.3 line phase 1 project	Take charge of the environment protection works in project operation period
		Zhengzhou 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	Zhengzhou Rail Operation Management Company	A subordinate unit of Zhengzhou 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 3 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 3 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	Zhengzhou 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 waster 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 3, 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	Zhengzhou 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 Zhengzhou Rail Transit Group Co., Ltd., 3 persons for Zhengzhou 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

3.4 Abstract of Environmental Protection Measures

See Table 3.4-1 and Table 3.4-2 for summary of the environmental protection measures:

Table 3.4-1 List of Common Mitigation Measures for Environmental Impacts by Phase I Project of Rail Transit Line 3 of Zhengzhou 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
		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 nose, 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 Environment	(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 thereof far away from the residential area(at least 15 meters to the residential area)	Design Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee
		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	Design Unit	Project Owner			calculated into design fee

Phase	Environmental Factors		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
			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.					
		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 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 Zhengzhou 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	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee

Phase	Environmental Factors		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
			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.					
		Environmental Vibration	(1)The operational rotues of the construction vehicles, especially heavey 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 background value(7:00～12:00，14:00～22:00), and construction operations with strong vibration and serious pollution will be restricted during night.(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..(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;(5) Renovate the key buildings in advance; conduct the retaining protection for the building with poor stability;(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.	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee
		Atmospheric Environment	(1)Hard enclosure shall be established on the construction site, and the major roads shall be hardened and kept clean. (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. (3)Duly spray water when dismantling and digging dry earth ground to keep certain humidity of the operational surface. (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. (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 withtout 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. (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	Construction Unit	Project Owner Local Environmental Protection Bureau	The owner entrusts qualified organ to undertake the work by means of contract.	TSP	monitoring expenses(200,000 yuan); The other expenses are calculated into engineering fee

Phase	Environmental Factors			Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
				sprinkling and cleaning. And denser cleaning shall be carried out in case the air pollution index is larger than 100. (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.					
		Water Environment	Ground Water	(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. (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.	Construction Unit	Project Owner Local Environmental Protection Bureau	The owner entrusts qualified organ to undertake by means of contract	pH, SS, Oil, , COD	monitoring expenses(150,000 yuan); The other expenses are calculated into engineering fee
			Underground Water	(1)Establish septic tank in the construction camp, and equip with anti-leakage measures to prevent pollutionon the underground water; (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. (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. (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；	Construction Unit	Project Owner Local Environmental Protection Bureau	The owner entrusts qualified organ to undertake by means of contract	Underground water level, ground settlement extent, water quality	monitoring expenses(600,000 yuan); The other expenses are calculated into engineering fee
	Ecological environment		Vegetation greening	(1) Carry out necessary restoration and compensation for the green land occupied, and restore its ecological functions as soon as possible. (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 temporaily used, and around the operational zone.	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee
			Water and soil erosion	(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; (2) The construction deserted	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee

Phase	Environmental Factors		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
			dregs will be cleaned and transported in time, and the road base surface built will be stamped solid; Properly carry out protective measures;					
		Solid wastes	(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.(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.(3)The residual earth site shall be leveled in time, and be equipped with drainage pitches etc. to prevent water and soil erosion.	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee
	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
		traffic accessibility	Each station are set straight ladder, provide convenient for people with more bags	Design Unit	Project Owner			calculated into design 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.					
		Resettlement	(1) Make out compensation and reward program for the personal	Project owner	Municipal			Calculated into

Phase	Environmental Factors		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
			households with resettled houses and 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.		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 onec,e and protective measures such as blockading the site, reporting to cultural relics management department of Zhengzhou 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 Envrionment	(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 horning; 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 ari 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.(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.	Project owner and government planning department	Project Owner Local Environmental Protection Bureau			calculated into engineering fee
		Water Envrionment	Strengthen monitoring of the dometic 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)Estalbish dustbin for the domestic rubbish at the stations along the line, and arrange managerial staffs to clean the ground and wagon in	Project Owner	Local Environmental Protection Bureau			calculated into engineering fee

Phase	Environmental Factors		Measures	Implementation Organ	Supervisory Organ	Monitoring Organ	Monitoring Items	Expenses(10,000 Yuan)
			time, and classify the rubbish and collectively transport to environmental health department for collective disposal.					
	Social Environment	Protection of Disadvantagted 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 ratinal ticket price mechanism for the low-income populations;	Construction Unit	Project Owner			calculated into engineering fee
		complaint channels	In every station location visible complaints and other complaints	Project Owner	Local Environmental Protection Bureau			Calculated into daily operational expenses
		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

Table 3.4-2 List of General Characteristic Mitigation Measures of the Environmental Impacts by Zhengzhou Rail Transit Line 3 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 waste residue site are not set in the scope of 200m from both sides of river channels of Jialu River, Jinshui River, Xiong’er River, Qili River and Chaohe River.	Design unit	Project Owner Local Environmental Protection Bureau			Calculated into design fee
		groundwater	(1) Xinliu Road Station, Shamen Road Station, Xinglongpu Road Station, Dongfeng Road Station, Nongye Road Station, Huanghe Road Station, Jinshui Road Station, Taikang Road Station, Shuncheng Street Station, Weilai Avenue Station, South Fengtai Road Station, Tongtai Road Station, East Huanghe Road Station, East Nongye Road Station, Zhongxing Road Station, Boxue Road Station and East Hanghai Road Station adopt cast-in-situ bored pile & waterproof curtain for enclosure. (2) Erqi Square Station, Dongdajie Street Station, Chengdong Road Station and Zhongzhou Avenue Station adopt underground diaphragm wall.(2) All intervals adopt shield method for construction	Design Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee
		ecological environment	(1)For the design of entrances and ventilation pavilion of 10 stations including Weilai Avenue Station, Fengtainan Road Station, Zhongzhou Avenue Station, Tongtai Road Station, Huanghedong Road Station, Nongyedong Road Station, Zhongxing Road Station, Boxue Road Station, Hanghai East Road Station, it shall consider in principle their location of new district and economic development zone, which is an integrated modern new downtown and CBD of commercial, office, information and business functions, so their structures and appearances shall be uniform as possible; adopt blending landscape design handling principle to uniformly plan and construct with surrounding buildings and construct the ventilation pavilion station, pavilion and other ground buildings together to meet the design requirements of local urban regions.(2)For 5 stations in Zhengzhou old town area including Xinglongpu Road Station, Dongfeng Road Station, Nongye Road Station, Huanghe Road Station and Jinshui Road Station, there are dense buildings around the stations and the ground buildings appears crowded. The rail transit construction shall be considered together with Zhengzhou old town reconstruction planning and Nanyang Road expansion project; The along-line regions integrates the functions of resident, commercial, traffic connection, special mending and lacing, so 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.(3)For Erqi Square Station and Chengdong Road Station, since they are near national and provincial historic sites to be protected such as Memorial Tower for February 7th Strike, Zhengzhou Confucius Temple and Zhengzhou Shang Dynasty Relics and there are many modern buildings such as Hualian Shopping Center, Wanda Plaza and Zhengzhou Department Store, and also near 3 historic and cultural blocks of Shuyuan Street, Confucius Temple- Chenghuang Temple, Dehua Street-Datong Road, the design of entrance/exit and ventilation pavilion of these stations 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 Zhengzhou city and surrounding grandeur feeling, but also blend into the modern atmosphere.					
	Social Environment	Resident's life	(1)Comparison of recommended scheme and alternative scheme is made for routes of lines including section at north of North Ring Road and section between Jinshui Road Station and Erqi Square Station, and select the scheme with the least amount of demolition so as to reduce its influence on residents.	Design Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee
		Traffic	(1) Dashiqiao area has large traffic volume and severe congestion, so Jinshui Road Station selects cover-excavation method for construction to reduce its influence on ground traffic. (2) Nanyang Road is relatively narrow but with large traffic volume, for Dongfeng Road Station, Huanghe Road Station and Nongye Road Station which are located along the Line and adopt open-cut method for construction, since they have large traffic volume now, rationally arrange construction site, do not occupy road or occupy road as least as possible, and shorten construction time to the greatest extent; (3)For Taikang Road Station, Shuncheng Street Station, Dongdajie Station and Chengdong Road Station in prosperous area , since they have large ground traffic volume and occupy large areas of roads, main measures are to formulate traffic dispersion scheme, and vehicles can pass round in advance; elaborately arrange construction site and occupy roads as least as possible; set accommodation lane at both sides of construction site to the greatest extent to relieve traffic obstruction; accelerate construction progress, reduce time of road occupying; take priority in guaranteeing unobstructed bus route etc.	Design Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee
		The traffic channel	（1） The section of Nanyang road : Cover construction at sections crossing the intersection and fully fencing open-cut construction for stations at both sides, necessary demolition at the same time, traffic limitation, keep one driveway and one non-motor vehicle lane at either direction, and regional traffic organization.. （2） The section of Minggong road : fully fencing open-cut construction for stations at both sides, necessary demolition at the same time, traffic limitation, keep one driveway and one non-motor vehicle	Design Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee

			lane at either direction, and regional traffic organization.. （3） The section pf Jiefang road : During the peak period, regional organization will be used to ease the traffic on the premise of station traffic organization in Er qi square stadion. （4） The section of east street and west street : During the peak period, regional organization will be used to ease the traffic on the premise of station traffic organization in Shunche jie sdation and in dodajie sation.					
		Planning	Main opinions in Construction Planning and Planning Environmental Impact Assessment are implemented: (1) The line starts from Xinliu Road Station, passes Nanyang Road→Minggong Road→Jiefang Road→Xidajie Street→Dongdajie Street→Zhengbian Road→Shangdu Road→Crossing Lianyungang-Lanzhou Railway→Jingkai 17th Avenue. Length and direction of the line is in basic consistency with those of the planned line.(2)The whole route is totally underground line. (3)Totally 21 stations are established, which are all underground stations, including Xiuliu road station、Shamen road station、Xinglongpu road station、Dongfeng road sttion、Agricultural road station、Huanghe road station、Jinshui road station、Taikang road station、Erqi square station、Shunchenjie station、Dongdajie station、Chengdong road station、Weilaidadao station、Fengtai south station、Zhongzhoudadao station、Tongtai road station、Huanghe east station、Agricultural east station、Zhongxing road station、Boxue road station、Hanghai east station。Station setting is in conformity with the original planning.(4)Parking lot is set at southern bank of Jialu River, and car depot is set at east of East Hanghai Road Station, which are in conformity with the original planning	Design Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee
	Material Cultural Resources	Cultural relics	（1）Rail Transit Line 3 passes round the axis of the Memorial Tower and passes the outside of tower footing, and the depth of the line shall meet the requirement of 15m made by cultural relics protection department(2) When designing Erqi Square Station, Chengdong Road Station and Taikang Road Station near historical and cultural sites under government protection, the design of its entrance & exit, ventilation kiosk and cooling tower shall be coordinated with Shang Dynasty Culture Display Area in People’s Park and landscape belt of park at riverside of Jinshui River, Erqi Memorial Tower in honor of the Great Strike and Dehua Street Commercial Center as well as Shang Dynasty Site respectively(3) Depth of underground city wall of Shang Dynasty Site in Zhengzhou is about 8-13m, so buried depth of the metro is suggested to be 15-20m.(4)Design of rail near Erqi Memorial Tower in honor of the Great Strike, Shang Dynasty Site in Zhengzhou and Zhengzhou Confucious’ Temple adopts steel spring floating slabs to reduce the influence of metro vibration on historical and cultural sites under government protection.	Design Unit	Project Owner Local Environmental Protection Bureau			calculated into design fee

Construction Period	Natural Environment	Atmospheric Environm		(1)Construction site shall set hard enclosures with height of not less than 2.5m, and main roads must be hardened and keep cleaning; construction site shall appoint specially-assigned personnel to be in charge of cleaning-keeping work, and conduct sprinkling and cleaning in time to reduce dust（2）Regularly monitor sensitive points near each station construction	Construction Unit	Project Owner Local Environmental Protection Bureau		Tsp	Monitoring expenses: 600,000 yuan; Expenses for temporary sediment tank: 500,000 yuan
		Sound Environment		(1)Set temporary sound insulation enclosing wall or absorbent lined barrier with height of 3-4m at sensitive points which are greatly affected by construction noise of stations. See the following table for the specific measures: see table 11.6-2a	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: 600,000 yuan; Other expenses: 2.25 Million yuan
		Environmental Vibration		During construction period, strengthen vibration monitoring and settlement observation for station construction site and surrounding sensitive points as well as underneath and adjacent vibration sensitive points, and reinforcement measures shall be taken if necessary.。See the following table for the specific measures: see table 11.6-2b	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 200,000 yuan; The other expenses is calculated into engineering fee
		Water Environmen	surfacewater	(1) Construction site and waste residue site shall not be set in the scope of 200m from surface water body. Construction waste residue and dried sludge after treatment by shield mud and water separation system shall be stacked in the designated place, and enclosure measures must be taken, and they shall be sent to local residue management department for treatment.(2) Excavation and earth filling are strictly prohibited on rainstorm days. Temporary spoil and windrow must be covered with tarpaulin or other coverings on rainy days to prevent spoil from flowing into and polluting surface water body due to scour of rainstorm.(3) Waste water produced in car depot shall be treated in adjustment oil removal sedimentation basin, and waste water produced at 21 stations along the Line shall be treated in septic tanks.	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee
			groundwater	(1) Daily pumping drainage of groundwater amount is large during foundation pit dewatering process, to protect groundwater quality, it is suggested that dewatering and drainage shall be discharged into urban rainwater system after removing SS in temporary sedimentation basin. (2) It is suggested to strengthen monitoring and supervision over water level, flow direction and flow rate of groundwater along the Line (especially section of Zhongxing Road-East Hanghai Road).	Construction Unit	Project Owner Local Environmental Protection Bureau			Monitoring expenses: 100,000 yuan; Expenses for temporary sediment tank: 500,000 yuan
	Environment	Vegetation Greening		(1) Protect vegetation within land acquisition and along the Line to the greatest extent during project construction, and minimize deterioration of vegetation such as forest, grass and bushwood around temporary ground and operating zone.	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee
		Solid Wastes		(1) Spoil will be transported to southwestern hilly area for ravine filling, there are four construction waste disposal sites determined at present which are located in Houzhai Village, Honghuasi Village, Xiaoliu Village and Shawoli Village.	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee
	Materials	Cultural Relics		(1) It shall be reinforced before construction of Erqi Memorial Tower in	Construction Unit	Project Owner	The owner	Vibration speed	Monitoring

	Cultural Resources		honor of the Great Strike, and isolation pile measure shall be taken for shield construction of Line 3. (2) (2) Strengthen vibration monitoring and settlement observation for cultural relics involved along the Line during construction period. (3) Within 50 meters from Erqi Tower, the shield tunneling, especially the operation, will be under strict control to ensure equipment in good condition. The earth-pressing balance mode will be applied, the shield tunneling excavation position, earth cut from each cycle and the volume of synchronous grouting shall be under control, and secondary grouting will done to achieve tunneling in balance. The tunneling parameters of the shield tunneling machine will be studied in detail and parameters such as grouting ratio, pressure, thrust force and speed of the machine will be optimized based on specific geologies in Zhengzhou to ensure the shield tunneling machine passes below Erqi Tower in continuous and steady way in order to achieve minimal ground settlement and meet the requirement on protection of historical relics.		Local Environmental Protection Bureau Cultural Relics Bureau	entrusts qualified organ to undertake by means of contract		expenses is 200,000 yuan; The other expenses is calculated into engineering fee
		Ancient and renowned trees	(1) There is no old and famous tree along the Line.	Project Owner	Municipal Government			Calculated into resettlement expenses
	Social environment	Traffic evacuation	(1) For construction of Jinshui Road Station and Taikang Road Station which most severely affect traffic during construction period, it is suggested to adopt cover-excavation method for construction. (2) Detailed construction organization and traffic dispersion scheme is required to be formulated for other stations adopting open-cut method for construction to minimize its influence on traffic, pedestrians, motor vehicles and traveling of disadvantaged groups such as the disabled.	Project Owner	Municipal Government			Calculated into resettlement expenses
		Resident income	(1) Conduct two placement means including monetary indemnity and property right in exchange for material object for demolition of private reidence;(2) For land acquisition, it shall be compensated as the maximum uniform annual output value of local district with 28.6 times of compensation, and young crops shall be compensated as well, the above compensation fees shall be directly sent to each family. (3) Shops shall be compensated as the market price when demolished, decoration fees shall be given, and six-month business suspension compensation fees shall also be given, and the minimum salary compensation of six months at one time will be given to employees in shops.	Project Owner	Government			Calculated into immigrant relocation costs
	Construction risk	Construction risk of the station	See the following table for the specific measures: see table 11.6-2c	Construction Unit	Project owner and local environmental protection bureau			Calculated into engineering supervision expenses
		Risk of interval	See the following table for the specific measures: see table 11.6-2d					

		construtionn						
	Environmental Supevision during Construction Period		(1)Carry out monitoring and supervision over the environmental problems caused by construction	Construction Unit	Project owner and local environmental protection bureau			Calculated into engineering supervision expenses
	Environmental Protection Organ and Personnel Training	Environmental Protection Organ and 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 and local environmental protection bureau			20
Operational Period	Natural Environment	Sound Environment	(1) Jialu River Parking Lot is surrounded by green belt with width of 10m and enclosing walls all around, western enclosing wall is increased to 3.5m in height, which requires investment increment of 609,000 yuan; one testing line of car depot on East Hanghai Road is set with acoustic barrier with height of 2m, which requires investment increment of 1.35 million yuan.(2) Ventilation kiosk silencers at 17 ventilation kiosk areas are extended from 2m to 3m or 4m in length. Three cooling towers adopt ultra-low noise cross-flow type, and one of them is surrounded by acoustic enclosure; 7 ventilation kiosk areas and 5 cooling towers which are near to sensitive points change site selection and become over 15m from the points,Details are as follows:Table 11.6-2e	Construction Unit	Project Owner Local Environmental Protection Bureau		Equivalent sound level A	Monitoring expenses: 200,000 yuan; Other expenses: 62.59Million yuan
		Environmental Vibration	(1)For three cultural relics protection units of Shanhaimomuduha Tomb ,Zhengzhou Memorial Tower for February 7th Strike, Zhengzhou Confucius Temple and Zhengzhou Shang Dynasty Relics 4 along both sides of the line in this project, set the steel spring floating slab ballast beds or equivalent moderate shock-absorbing measures., totaling 780m at both sides and requiring 1.95million yuan investment. (2)For 38 over-limit sensitive spots where the line passes just through (in 5m range from the outer rail center line just above track) such as school, hospital and residence areas, including RCC family member courtyard (Gadameilin district) so on, arrange the steel spring floating slab integral ballast beds, totaling 7052m at both sides and requiring investment of 105.78 million yuan. (3)For 45 over-limit sensitive spots within 10--15m range mainly including City bus company, family member courtyard, and Tianxiu courtyard so on, use the flexible support block type integral ballast bed or equivalent moderate shock-absorbing measures, totaling 8753m for double line and the investment of 87.53 million yuan. (4)For the environment sensitive spot with over-limit environment vibration VLz10, or VLz10 is qualified, but VLzmax exceeds the standard environment requirements, including 28 locations of Peaceful residential homes, Building 8 and so on,, use type III vibration reduction fasteners or equivalent moderate shock-absorbing	Construction Unit	Project owner and local environmental protection bureau	The project owner entrusts qualified organ by contract	Vibration Level	Monitoring expenses: 200,000 yuan; Other expenses: 229.3 Million yuan

			measures, totaling for 5239mm and investment of 17.45 million yuan. See the following table for the specific measures: see table 11.6-2f					
		Atmospheric Environm	(1) the distance from ventilation pavilions at Shuncheng Street Station and Taikang Road Station to the sensitive spot is less than 15m, and the odors emitted from ventilation pavilion will impact the resident livings to some extent; in combination with the control measures listed in noise topic, the environment assessment suggests to adjust the locations of 8 ventilation pavilions with the distance of less than 15m from sensitive spots. (2)To effectively relieve the odor impact, it is necessary to plant arbors around ventilation pavilion and make the outlet opposite to the sensitive spots such as residential building.	Constructin unit	Project Owner, Local Environmental Protection Bureau			Calculated into expenses for noise measures
		Water Environment	(1) The design adopts adjustment, oil separation and settlement tank to treat the inspection & repair oily sewage.(2)In the design, the domestic sewage is discharged after treatment with septic tank. the sewage of each station during project construction period is able to be included in existing or planned municipal sewage pipeline network and then into related urban sewage treatment plant for centralized treatment	Construction Unit	Project Owner Local Environmental Protection Bureau			calculated into engineering fee
		Electromagnetic Environment	(1)there are no environmental sensitive points around the depots and parking lots, thus no measures need be taken on such influence in the project。 (2)keep the fencing wall of main substation away from residential area as possible, and the least distance from residential area shall be more than 50m.	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	/
		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.	Construction Unit	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			calculated into engineering fee
	Material cultural resources	Cultural relics	（1）For three cultural relics protection units of Shanhaimomuduha Tomb ,Zhengzhou Memorial Tower for February 7th Strike, Zhengzhou Confucius Temple and Zhengzhou Shang Dynasty Relics 4 along both sides of the line in this project, set the steel spring floating slab ballast beds or equivalent moderate shock-absorbing measures., totaling 780m at both sides and requiring 1.95million yuan investment.	Construction Unit	Project Owner, Local Environmental Protection Bureau	The project owner entrusts qualified organ to undertake the work by contract	Vibration speed	Calculated into Vibration costs

			See the following table for the specific measures: see table 11.6-2g					
	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 investment: 238309000yuan(excluding investment for monitoring during operational period)					

Table 11.6-2a Summary sheet of main sensitive spots affected by construction noise

No.	Station	Sensitive point	Position relative to stations	Size	Closest distance from the constructional boundary (m)	Predicted noise before measures (dB(A))	Measures to reduce noise	Investment (RMB ¥:×10^4)	Predicted noise after measures (dB(A))
1	Shamen Road Station	Chengshi Bei'an Community 1# building	North end west side	5 units - 2 households, 6 floors, 1 building, about 60 households	18	54.4	Erect a 3m-high fence; build simple acoustic-proof shelters to house air compressors and generators; Use static-pressed piles instead of drilled and grouted piles; locate the vehicle access at the west side.	25	47.4
2		Changxing Building	South end west side	5 units, 12 households each unit, about 60 households	13	57.3			50.3
3		Huiji District Changxing Road Subdistrict Office	North end east side	Subdistrict Office	9	60.5			53.5
4		Changxing Road 2# Yard 13#, 10# building	North end east side	5 units, 2 households, 7 floor, 2 buildings, about 140 households	24	51.9			44.9
5		Baiwen Garden 1#, 2#, 6#, 7# building	South end east side	3 units, 2 households for each stairs, 1 building; 4 units, 2 households for each stairs, 2 buildings; 8 nits, 2 households for each stair, 1 building, 6 floors (in which the first floor is for store); total about 190 households	Immediately Close to	70.0			63.0
6	Xinglongpu Road Station	Zhengzhou Public Transportation Company Family Area	North end west side	3 units, 2 households for each stair, 7 floors, 3 buildings; 1 units, 4 households for each stair, 7 floors, 1 building; total about 154 households	Immediately Close to	70.0	Erect a 3m-high fence; build simple acoustic-proof shelters to house air compressors and generators; Use static-pressed piles instead of drilled and grouted piles; locate the vehicle access at the east side.	25	63.0
7		Huarun Chengshi Zhiyin (Xinyu Yayuan) Community 1#, 5# building	North end east side	2 units, 2 households, 5 floors, total about 40 households	15	56.0			49.0
8		Changjian Yufeng (in construction)	South end west side	8 households per floor, 17 floors, total about 136 households	22	52.7			45.7
9	Dongfeng Road Station	Sunshine Holiday Community 3# Building Sunshine Holiday Community 2# Building	North end west side	3 units, 2 households for each stair, 7 floors, 4 buildings, total about 84 households	6	64.0	Erect a 3m-high fence; build simple acoustic-proof shelters to house air compressors and generators; Use static-pressed piles instead of drilled and grouted piles;	25	57.0
10		Tongle Community 46# Building Tongle Community 61# Building Food Machinery Plant Family Area 2# Building	South end east side	4 units, 2 households for each stair, 6 floors, 1 building; 1 units, 3 households for each stair, 4 floors, 1 building; 1 units, 3 households for each stair, 7 floors, 1 building; total about 81 households	Immediately Close to	70.0			63.0
11		Tongle Community North Area 1#, 2#, 3#, 4#, 5# building	North end east side	1 unit, 2 households for each stair, 7 floors, 2 buildings; 1 unit, 2 households for each stair, 5 floor, 1 building; 5 units, 2 households for each stair, 6 floors, 1 building; 3 units, 2 households for each stair, 7 floors, 1 building; total about 140 households	3	70.0			63.0
12		Futian Lijing Garden Community 39#, 40# building	South end west side	7 floors, 2buildings, about 40 households each floor; total about 560 households	Immediately Close to	70.0			63.0
13	Nongye Road Station	Ronghua Family Area 3#, 4#	North end west side	3 units, 2 households, 5 floors, 1 building; 7 floors, 1 building; total about 72 households	12	58.0	Erect a 3m-high fence; build simple acoustic-proof shelters to house air compressors and generators; Use static-pressed piles instead of drilled and grouted piles; locate the vehicle access at the north side.	25	51.0
14		Zhengzhou Ceramics Factory Family Area 1#, 3# building, Nanyang Road No. 62	South end east side	3 units, 2 households for each stair, 5 floors, 2 buildings, total about 60 households	6	64.0			57.0
15		Nanyang Road 68# Yard	North end east side	4 units, 2 households, 7 floors, 1 building;	11	58.7			51.7

		Zhengtie Nanyang New Town Community 1#, 2#, 3#, 10#, 41# building		1 unit, 4 households, 7 floors, 3 building; 5 units, 2 households, 7 floors, 1 building; total about 210 households.					
16		Xiaoyuzhai (Nanyang Road 266# Yard) 3#, 5# building	South end west side	5 units, 3 households, 6 floors, 1 building; 2 units, 3 households; 6 floors, 1 building; total about 114 households	6	64.0			57.0
17	Huanghe Road Station	Zhengzhou Textile Machinery Staff Apartment 18# - 20# building	North end east side	3 units, 2 households, 7 floors, 3 buildings; total about 126 households	7	62.6	Erect a 3m-high fence; build simple acoustic-proof shelters to house air compressors and generators; Use static-pressed piles instead of drilled and grouted piles; locate the vehicle access at the east side.	25	55.6
18		Nanyang Road 296# Yard (Nanyang Renjia) 1#, 2#, 3#	North end west side	2 units, 3 households, 12 floors, 1 building; 3 units, 2 households, 6 floors, 1 building; 1 unit, 2 households, 6 floors, 12 households; 9 units, 2 households, 6 floors, 1 building; total about 312 households	Immediately Close to	70.0			63.0
19		Zhengzhou Textile Machinery Co., Ltd. Family Area 6#, 5#, 4#, south 3#, south 2# building	South end east side	10 households per floor, 4 floors, 5 buildings, total about 150 households	Immediately Close to	70.0			63.0
20		Huayuan Community (Nanyang Road No.300) 5# building	South end west side	3 units, 2 households, 7 floors, 1 building, total about 42 households	Immediately Close to	70.0			63.0
21	Jinshui Road Station	Film Bureau Family Area 6#, 7# building (Nanyang Road No. 7)	North end east side	3 units, 2 households, 5 floors, 1 building; 1 unit, 2 households, 5 floors, 1 building; total about 32 households	Immediately Close to	70.0	Erect a 3m-high fence; build simple acoustic-proof shelters to house air compressors and generators; Use static-pressed piles instead of drilled and grouted piles; locate the vehicle access at the south side.	25	63.0
22		Zhengzhou City Library	North end east side	In library	Immediately Close to	70.0			63.0
23		Zhengzhou National Oil Reserve Base Family Area 1# building	South end west side	5 units, 2 households, 7 floors, 1 building, total about 70 households	24	51.9			44.9
24		Downtown Community Phase II 1# building	South end east side	3 units, 2 households, 18 floors, 1 building, total about 108 households	31	49.7			42.7
25	Taikang Road Station Jinshui Road Station	Xicai Community (Minggong Road 240# Yard)2#, 3# building	South end west side	7 floors, 10 households 2 buildings; total about 140 households	Immediately Close to	70.0			63.0
26		Minggong Road N0.245 (Xiqian Street 85# Yard 1#, 2# building)	South end west side	about 20 households for low rise; 3 units, 3 households, 7 floors, 1 building, about 63 households; total about 83 households	Immediately Close to	70.0			63.0
27		Huarun Yuefu (in construction)	South end east side	10 households per floor, 58 floors, 1 building; about 580 households	20	53.5			46.5
28	Erqi Square Station	Huigang New Town 1#, 2#, 3# building	Northwest end west side	15 households per floor, 1 building; 10 households per floor, 1 building; 20 households per floor, 1 building; total about 1260 households	10	59.5	/		59.5
29		Xiaolou Mosque, Female Mosque	West end north side	Religion	12	58.0			51.0
30	Shuncheng Street Station	Hongxin Garden 1# building	East end north side	3 units, 4 households, 7 floors, 1 building; about 约 84 households	6	64.0	Erect a 3m-high fence; build simple acoustic-proof shelters to house air compressors and generators; Use static-pressed piles instead of drilled and grouted piles; locate the vehicle access at the west side.	25	57.0
31		Xidan Apartment 2# Building	East end north side	7 households per floor, 7 floors, 1 building; 4 units, 4 households; 7 floors, 1 building; about 138 households	26	51.2			44.2
32		Xiandai Xingyuan 1#	West end south side	About 120 households	9	60.5			53.5
33		Yinzuo International	East end south side	15 floors, 5 units, 2 households per stair; about 150 households	Immediately Close to	70.0			63.0

34	East Street Station	Changjiang Chengzhongcheng	West end south side	4 units, 2 households, 7 floors, 1 building, about 42 households	Immediately Close to	70.0	Erect a 3m-high fence; build simple acoustic-proof shelters to house air compressors and generators; Use static-pressed piles instead of drilled and grouted piles; locate the vehicle access at the east side.	25	63.0
35		Hongyu Garden 1#, 2#, 3# building	West end south side	About 500 households	20	53.5			46.5
36		East Street 220# Yard	East end south side	6 units, 2 households 6 floors, 1 building; about 72 households	7	62.6			55.6
37		Ziyan Huating 1#, 2# building	West end north side	6 households per floor, 24 floors, 2 buildings, about 288 households	14	56.6			49.6
38		Zhengzhou Guancheng District State Administration of Taxation Office Service Hall (to be relocated)	West end north side	Government office, 8 floors	Immediately Close to	70.0			63.0
39		The First People's Hospital of Zhengzhou	East end north side	1200 beds	19	54.0			47.0
40	Chengdong Road Station	Dongguandongli 96# Yard 1# building	East end north side	3 units, 2 households, 5 floors, 1 building, about 30 households	16	55.5	/	/	55.5
41		Shangcheng Garden 1# building	West end north side	2 units, 3 households, 7 floors, about 42 households	43	46.9			39.9
42	Fengtainan Road Station	Zhengzhou Huimin Middle School	West end north side	About 72 classrooms, 2900 teachers and students	25	51.6	/	/	51.6
43		Zhengzhou City Public Security Bureau SWAT Detachment	East end north side	Government office, 8 floors	27	50.9			43.9
	TOTAL							225	

Table 11.6-2b Summary list of main sensitive spots of station contruction vibration impact

SN	station	Target Name	Mileage	section	The recent distance（m）	Buried depth（m）	Using function	Scale	Buildings Category	Sensitive point overview	Contruction year	construction way
1	Xinliu road station	Yuhua ninth city, Building 1 #~ 3 #	K0+100～ K0+280	Xinliu Road-Shamen Road Station Section	46	14.5	House	25 floors， Frame	I	about 1475 househlds	2010	Open cut methed

SN	station	Target Name	Mileage	section	The recent distance（m）	Buried depth（m）	Using function	Scale	Buildings Category	Sensitive point overview	Contruction year	construction way
								structure				
2	Shamen road station	Huiji District, Changxing Road, Street office	K1+454～K1+537	Xinliu Road-Shamen Road Station Section	30	14.3	institution	4~5 floors，mixed structure	II	Street agency	In the 1990 s	Open cut methed
3		Changxing Road, No. 2 Courtyard	K1+476～K1+539	Xinliu Road-Shamen Road Station Section	38	14.3	House	7 floors，mixed structure	II	about 140 househlds	2000	Open cut methed
4		Cityorth Shore District, 1 # building	K1+450～K1+540	Xinliu Road-Shamen Road Station Section	18	14.5	House	6 floors，mixed structure	II	about 60 househlds	2000	Open cut methed
5		Baiwen Garden, Buildings 1 #, 2 #, 6 #, 7 #	K1+587～K1+700	Shamen Road-Xinglongpu Road Station Section	17	14.7	House	6 floors，mixed structure	II	about 190 househlds	2010	Open cut methed
6	Xinglongpu road station	CR City Concert (Xinyu Garden) district ,1 #, 5 # Buildings	K2+800～K2+900	Shamen Road-Xinglongpu Road Station Section	9	16.0	House	6 floors，mixed structure	II	about 40 househlds	In the 1980 s	Open cut methed
7		City bus company, family member courtyard	K2+800～K2+910	Shamen Road-Xinglongpu Road Station Section	15	14.5	House	7 floors，mixed structure	II	about 154 househlds	In the 1990 s	Open cut methed
8		Projects under construction (Chang Jian.Yufeng)	K2+940～K3+170	Xinglongpu Road-Dongfeng Road Station Section	50	14.0	House	17 floors，Frame structure	I	about 136 househlds	Under contruction	Open cut methed
9	Dongfeng road station	Fun district, Northern District, fun district building 1#、2#、3#、4#、5#	K4+291～K4+463	Xinglongpu Road-Dongfeng Road Station Section	11	14.9	House	6～7 floors，mixed structure	II	about 140 househlds	In the 1990 s	Open cut methed
10		Sunshine Holiday district, 1 #, 2 # Building	K4+286～K4+500	Xinglongpu Road-Dongfeng Road Station Section	10	14.9	House	7 floors，mixed structure	II	About 80 househlds	In the 1980 s	Open cut methed
11		Fun district, Southern District, fun district building 46, 61	K4+560～K4+600	Dongfeng Road-Agricultural Road Station Section	36	14.5	House	6 floors，mixed structure	II	about 81 househlds	In the 1980 s	Open cut methed
12		Fu Tian Lijing Garden District, 39 #, 40 # Building	K4+585～K4+774	Dongfeng Road-Agricultural Road Station Section	17	15.0	House	7 floors，mixed structure	II	about 560 househlds	2000	Open cut methed
13	Agricultural road station	Nanyang Road 68 homes, 1 #, 2 #, 3 #, 10 #, 41 # Building	K5+480～K5+679	Dongfeng Road-Agricultural Road Station Section	12	14.5	House	7 floors，mixed structure	II	about 210 househlds	In the 1980 s	Open cut methed
14		Residential Community of Meat Product Branch of Food Company	K5+570～K5+700	Dongfeng Road-Agricultural Road Station Section	40	14.1	House	5～7 floors，mixed structure	II	about 72 househlds	In the 1980 s	Open cut methed
15		Zhengzhou ceramics factory family member courtyard, 1 #, 3 # Building, Nanyang Road 62	K5+790～K5+890	Agricultural Road-Huanghe Road Station Section	10	14.6	House	5 floors，mixed structure	II	about 60 househlds	In the 1980 s	Open cut methed
16		Small Yuzhai	K5+753～	Agricultural Road-Huanghe	20	14.4	House	6 floors，mixed	II	about 114	In the 1980 s	Open cut methed

SN	station	Target Name	Mileage	section	The recent distance（m）	Buried depth（m）	Using function	Scale	Buildings Category	Sensitive point overview	Contruction year	construction way
		(Nanyang Road courtyard 266--275) Building	K5+832	Road Station Section				structure		households		
17	Huanghe road station	Zhengzhou Textile staff apartments, 18 # to 20 # buildings	K7+000～K7+100	Agricultural Road-Huanghe Road Station Section	37	14.5	House	7 floors，mixed structure	Ⅱ	about 126 househlds	2000	Open cut methed
18		Nanyang Road, No. 296 Courtyard, 1 #, 2 #, 3 #	K7+032～K7+168	Agricultural Road-Huanghe Road Station Section	15	13.9	House	6～12 floors，mixed structure	Ⅱ	about 312 househlds	In the 1990 s	Open cut methed
19		Buildings 6#, 5#, 4#, and Buildings 3# and 2# in the south of Community of Zhengzhou Textile Machinery Co., Ltd.	K7+214～K7+696	Huanghe Road-Jinshui Road Station Section	15	13.9	House	4（floors，mixed structure	Ⅱ	about 150 househlds	In the 1970 s	Open cut methed
20		Garden community, (Nanyang Road 300) 5 # building	K7+220～K7+320	Huanghe Road-Jinshui Road Station Section	14	13.3	House	7 floors，mixed structure	Ⅱ	about 42 househlds	In the 1980 s	Open cut methed
21		Zhengzhou Jianguo Medicine Institute	K07+280～K07+400	Huanghe Road-Jinshui Road Station Section	15	13.9	Hospital	4 floors，mixed structure	Ⅱ		In the 1980 s	Open cut methed
22	Jinshui road station	Film Bureau, family member courtyard, 6 #, 7 # F (Nanyang Road 7)	K8+174～K8+190	Huanghe Road-Jinshui Road Station Section	6#(12m)，7#(0m)	14.8	House	5 floors，mixed structure	Ⅱ	about 32 househlds	In the 1980 s	covered excavation methed
23		Zhengzhou City Library	K8+250～K8+300	Huanghe Road-Jinshui Road Station Section	5	14.4	Library	2～6 floors，mixed structure	Ⅱ	—	In the 1980 s	covered excavation methed
24		Jinfeng jinan	K09+158～K09+183	Jinshui Road-Taikang Road Station Section	33	14.6	House	28 floors Frame	Ⅰ	about 324 househlds	Nearly 10 years	Open cut methed
25		Zhengzhou National Oil Reserve Depot, family member courtyard 1 # building	K8+290～K8+360	Huanghe Road-Jinshui Road Station Section	20	14.4	House	7 floors，mixed structure	Ⅱ	about 70 househlds	In the 1980 s	covered excavation methed
26	Taikang road station	Huarun Yue House (under construction)	K9+245～K9+610	Taikang Road-Erqi square Station Section	45	19	House	58 floors	Ⅰ	about 580 househlds	Under contruction	Open cut methed
27		West Cai district, (Ming Gong Road No. 240 Courtyard) 1 #	K9+275～K9+315	Taikang Road-Erqi square Station Section	0	14.2	House	4～7 floors，mixed structure	Ⅱ	about 82 househlds	In the 1980 s	Open cut methed
28		West Cai district, (Ming Gong Road, No. 240 Courtyard), 2 #, 3 # Building	K9+275～K9+315	Taikang Road-Erqi square Station Section	16	14.2	House	7 floors，mixed structure	Ⅱ	about 84 househlds	In the 1980 s	Open cut methed
29		Courtyard No. 85 West Front Street, 1 # Building (Ming Gong Road, No. 245 Courtyard)	K9+325～K9+410	Taikang Road-Erqi square Station Section	9	14.2	House	2、3，7 floors，mixed structure	Ⅱ	About 83househlds	In the 1980 s	Open cut methed

SN	station	Target Name	Mileage	section	The recent distance（m）	Buried depth（m）	Using function	Scale	Buildings Category	Sensitive point overview	Contruction year	construction way
30	Erqi square station	Huigang New Town 1 #, 2 #, 3 # Building	K9+700～K9+860	Taikang Road-Erqi square Station Section	0	19.9	House	28 floors，Frame structure	Ⅰ	about 1260 househlds	Under contruction	Open cut methed
31		Small building mosques	K10+000～K10+059	Taikang Road-Erqi square Station Section	6	23.5	Religion	4～6 floors，mixed structure	Ⅱ	—	In the 1960 s	Open cut methed
32	Shunchengjie station	Modern XingYuan 1 #	K10+800～K10+873	Erqi square-Shunchengjie Station Section	23	14.4	House	14～17 floors，Frame structure	Ⅰ	about 120 househlds	2000	Open cut methed
33		Hongxin Jia Yuan 1 # building	K10+915～K10+990	Shunchengjie-Dongdajie Station Section	14	14.4	居住	7 floors，mixed structure	Ⅱ	about 84 househlds	2000	Open cut methed
34		Xidan apartments, two buildings	K11+070～K11+151	Shunchengjie-Dongdajie Station Section	8	14.9	House	7 floors，mixed structure	Ⅱ	about 138 househlds	2000	Open cut methed
35		Ginza International	K10+956～K11+025	Shunchengjie-Dongdajie Station Section	14	14.2	House	15 floors，Frame structure	Ⅰ	about 150 househlds	2010	Open cut methed
36	Dongdajie station	Zi Yan Huating 1 #, 2 # Building	K11+821～K11+917	Shunchengjie-Dongdajie Station Section	23	14.4	House	24 floors，Frame structure	Ⅰ	about 288 househlds	2010	Open cut methed
37		Yangtze River City in City	K11+580～K11+666	Shunchengjie-Dongdajie Station Section	13	16.0	House	7 floors，mixed structure	Ⅱ	about 42 househlds	In the 1990 s	Open cut methed
38		Yuhong Garden, 1 #, 2 #, 3 # Buildings	K11+675～K11+800	Shunchengjie-Dongdajie Station Section	25	14.8	House、Office	26 floors，Frame structure	Ⅰ	about 500 househlds	2010	Open cut methed
39		Municipal Guancheng State Taxation office services hall	K11+929～K11+978	Dongdajie-Chengdong Road Station Section	33	14.3	institution	8 floors，mixed structure	Ⅱ	—	In the 1990 s	Open cut methed
40		First People's Courtyard of Zhengzhou	K11+990～K12+055	Dongdajie-Chengdong Road Station Section	22	14.3	Hospital	5 floors，mixed structure	Ⅱ	--	In the 1990 s	Open cut methed
41		220 East Main Street	K11+978～K12+105	Dongdajie-Chengdong Road Station Section	10	14.3	House	6 floors，mixed structure	Ⅱ	about 72 househlds	In the 1990 s	Open cut methed
42	Chengdong road station	East Main Street, No. 1 Court, Building 1	K12+716～K12+830	Chengdong Road-Weilaidadao Station Section	11	20.5	House	4～7 floors，mixed structure	Ⅱ	about 30 househlds	In the 1980 s	Open cut methed
43		East Main Street, No. 1 Court, Building 2	K12+716～K12+830	Chengdong Road-Weilaidadao Station Section	32	20.5	House	4～7 floors，mixed structure	Ⅱ	about 66 househlds	In the 1980 s	Open cut methed
44		East Main Street, No. 1 Court,	K12+550～K12+600	Dong dajie station- Chengdong Road Station Section	38	21.2	House	7 floors，mixed structure	Ⅱ	about 42househlds	In the 1980 s	Open cut methed
45		Zhengbian road 23	K12+820～K12+857	Chengdong Road-Weilaidadao Station Section	7	20.5	House	5 floors，mixed structure	Ⅱ	about 72 househlds	In the 1980 s	Open cut methed
46	Fengtai south road station	Zhengzhou Huimin High School	K14+686～K14+769	Weilaidadao –Fengtai south Road Station Section	47	14.3	School	5 floors，mixed structure	Ⅱ	about2900 peple	In the 1990 s	Open cut methed
47		Zhengzhou City Public Security	K14+793～K14+942	Fengtai south Road ~ Zhongzhoudadao Station Section	27	14.3	institution	7～8floors，Frame	Ⅰ	-	2010	Open cut methed

SN	station	Target Name	Mileage	section	The recent distance（m）	Buried depth（m）	Using function	Scale	Buildings Category	Sensitive point overview	Contruction year	construction way
		Bureau Police Detachment						structure				
48	traction line	Dongyinggang Village	K24+300～K24+800	Boxue Road - Hanghai east Road Station Section	0	13.0	House	Below the second floor are peasant houses	Ⅲ	about 70 househlds	In the 1990 s	Open cut methed

Table 11.6-2c　Construction risks and measures of stations

No.	Station	Engineering proposal	Construction method	Risk engineering category	Description of basic risk conditions	Risk classifications	Solution

1	Xinliu Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	There are a DN219 gas pipe along Xinliu road with underground 2 meters depth.	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.
2	Shamen Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	There are a DN219 gas pipe along Changxin road with underground 3 meters depth.	Class 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.

3	Xinlongpu Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	There are a DN250 gas pipe along Nanyang road with underground 2 -4 meters depth. a DN400 drinkable water pipe along Xinglongpu road with underground 2 meters depth.	Class IIclass 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.
4	Dongfeng Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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	No. 111 in Nanyang Road (TongLe Xiao Qu Nan Qu),The distance from the line is 6m.	Class IIclass II	The impact on foundation pit and the protection of surrounding buildings shall be specially considered. The design adopts drilling piles to prevent the water infiltration from surrounding soiles into the foundation pit and reinforce 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.
				Passing under municipal pipeline	There are a DN250 gas pipe along Nanyang road with underground 2-4 meters depth. a DN600 concrete drinkable water pipe along Nanyang road with underground 2 meters depth.	Class IIclass 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.
5	Agriculture Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	There are a DN250 gas pipe along Nanyang road and a gas pipe at Agriculture Road station with underground 2-4 meters depth, a DN600 concrete drinkable water pipe along Nanyang road with	Class IIclass 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.

					underground 2 meters depth.		
6	Huanghe Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	There are a electric cable at Agriculture Road station with a depth of 2 metres, a DN250 gas pipe along Nanyang road with underground 2-4 meters depth, a DN600 concrete drinkable water pipe along Nanyang road with underground 2 meters depth.	Class IIclass 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.
7	Jinshui Road station	underground 2-floor separating island station	Cover cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of cover digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	underneath the jinshui river and jinshui overpass	Class CLASS IICLASS II	1.Generally optimal construction parameters may be adopted while strengthening the management of excavation parameters and status control, and carrying out simultaneous pressure grouting and necessary supplementary pressure grouting measure to guarantee its safety. In case

							of excessively large ground load, or close distance, compensatory filling may be adopted to duly reinforce the earth surrounding tunnel, or strengthen the pipe segment structure. 2.As for intrusion of bridge pile foundation into the tunnel structure, it is necessary to dismantle such pile foundations before arrival of the shield tunnel machine. It is possible to take pile foundation underpinning, or pile dismantlement for bridge reconstruction. 3. Grouting pipes shall be reserved in the tunnel to reinforce the surrounding soil. Meanwhile, high-pressure jet sprouting piles shall be established between the bridge pile foundation and the structure of the inter-zone tunnel for isolation.
8	Taikang Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	double gas pipeline in the north side of taikang road d250, Distance from The north side of the midline is 10、12.5，Distance from The East side of the midline is 8.5 m.From west to east along taikang road D600, 8 meters depth.Minggong road ,D600,from south to north,about 4 meters depth.	Class IIclass 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.

9	Erqi Square station	underground 3-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a three-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 23 meters, and it is proposed to adopt continuous waterproof concrete walls for the bracing structure. 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	distance from xiaolou qingzhen temple and qingzhen woman temple is about 6 meters.	Class IIclass II	1. Strength the construction monitoring for 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.
10	Shunchengjie station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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	distance from honhxinjiayuan number 1 building （7 floor，brick-concrete structure）	Class I	1. Strength the construction monitoring for 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.
				Passing under municipal pipeline	1、Gas pipeline from west to east along xiadajie D250,about 2-3 meters depth.from north to south along shuncheng street,about 2-3 meters depth. 2、tap water pipe from east to west along xidajie D600,4-6 meters depth.	Class IIclass 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.
11	Dongdajie station	underground 3-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a three-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 23 meters, and it is proposed to adopt continuous waterproof concrete walls for the bracing structure. 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.

				Passing under municipal pipeline	1gas pipeline from west to east along dongdajie d250,about 2-3 meters depth,distance from the north side of the midline is about 12 meters.esat side of zijin mountain,from north to south ,2-5 meters depth.	Class IIclass 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	Chengdong Road station	underground 3-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a three-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 22 meters, and it is proposed to adopt continuous waterproof concrete walls for the bracing structure. 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.
					Distance between Number 96 building of dongguangdongli (4-7floors, brick-concrete structure)and the line is sbout 11meters	Class I	1. Strength the construction monitoring for 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.
				Passing under municipal pipeline	1gas pipeline from west to east along dongdajie d250,about 2-3 meters depth,distance from the north side of the midline is about 12 meters. from north to south along chengdong road ,2-3 meters depth.distance from east side of the middle line is about 13 meters,distance from west side is about 11.5 meters	Class IIclass 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.
13	Weilaidadao station	underground 3-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure.

					composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.		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.
					gas pipeline from east to west along the zhengbian road d250,2-3meters depth ,distance from south side of middle line is about 25meters,distance from the north side ofweilaidadao is21 meters ,south side about 24 meters.	Class IIclass 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	Fengtai South station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	1、gas pipeline from north to south along the fengtai road,2-3meters depth ,distance from east side of middle line is about 15meters,located on the south side of zhengbian road,d250,from north to south ,2-3 meters depth,north side of the middleline.2、water pipe from west to east ,d600,about 6 meters depth	Class IIclass 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.

15	Zhongzhoudadao station	underground 3-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a three-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 23 meters, and it is proposed to adopt continuous waterproof concrete walls for the bracing structure. 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	zhongzhou dadao viaduct	Class I-CLASS II	1.Generally optimal construction parameters may be adopted while strengthening the management of excavation parameters and status control, and carrying out simultaneous pressure grouting and necessary supplementary pressure grouting measure to guarantee its safety. In case of excessively large ground load, or close distance, compensatory filling may be adopted to duly reinforce the earth surrounding tunnel, or strengthen the pipe segment structure. 2.As for intrusion of bridge pile foundation into the tunnel structure, it is necessary to dismantle such pile foundations before arrival of the shield tunnel machine. It is possible to take pile foundation underpinning, or pile dismantlement for bridge reconstruction. 3. Grouting pipes shall be reserved in the tunnel to reinforce the surrounding soil. Meanwhile, high-pressure jet sprouting piles shall be established between the bridge pile foundation and the structure of the inter-zone tunnel for isolation.
				Passing under municipal pipeline	east side of zhongzhoudadao,d250,from north to south ,about 2-5 meters depth,distance from the north sideof the junction is about 30 meters	Class CLASS IICLASS 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.

16	Tongtai Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	1、Gas pipeline located on the east side of tongtai road d250,from south to north ,2-3meters depth.the north side gas pipeline,west to east ,2-5 meters depth2、From west to east along shangdu road,D600,3meters depth,located on the south side of the middleline.	Class IIclass 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	Huanghe East Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	1、Gas pipeline located on the east side of huanghe river road d250,from south to north , 3meters depth.the north side of shangdu roadd250,west to east ,2-5 meters depth 2、bothway tap water pipe from east to west along shangdu road D600,3 meters depth 3、The south side of the Power cable from west to east along shangdu road,2	Class IIclass 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.

					meters depth		
18	Agriculture East Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	1、Gas pipeline located on the east side of nongye road,from south to north ,2-3meters depth.distance from the east side of midline is 20.5 meters.the north side of shangdu road d250,west to east ,2-3 meters depth, 2、bothway tap water pipe from east to west along shangdu road D600,3 meters depth 3、The south side of the Power cable from west to east along shangdu road,2 meters depth	Class IIclass 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.
19	Zhongxing Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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

					and poor stability.		treatment; reinforce the waterproof design and treatment at bottom of foundation pit.
				Passing under municipal pipeline	1、Natural gas pipeline is located on the north of shangdu road D250,from west to east ,2-5 meters depth.2、 bothway tap water pipe from east to west along shangdu road D600,3 meters depth.3、south of power cable from east to west along shangdu road,2 meters depth.	Class IIclass 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.
20	Boxue Road station	underground 2-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	1、bothway tap water pipe from east to west along shangdu road D600,3 meters depth.2、south of power cable from east to west along haihang road D600,2 meters depth.	Class IIclass 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.

21	Hanghai East Road station	underground 3-floor island station	open cut normal method	Construction method risk and Geologic risk	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	Class IIclass II	1. The main body of the station is constructed by means of open digging method with a bi-level three-span steel reinforcement rod and concrete rectangular framework structure. The depth of the base pit of the station is about 17 meters, and it is proposed to adopt drilling filling pile plus waterproof curtain for the bracing structure. 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.
				Passing under municipal pipeline	single tap water pipe from east to west along haihang road D600,3 meters depth.	Class IIclass 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.

Table 11.6-2d Construction risks and measures of Interval

No.	Station	Engineering proposal	Construction method	Risk engineering category	Description of basic risk conditions	Risk classifications	Solution
1	xinliu road station –hanghai road station	shield method	geology risk	K0+000-K25+200	The aforesaid stratums belong to category I wall rock with uneven distribution of rock properties and ordinary engineering geological conditions. The stratums are composed of powdery earth, powdery clay, powdery sand and fine sand. The rock and soil layers are mainly earth with medium and high compressibility, low strength and poor stability.	class IIclass 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;
2	shanmen road station –xinglongpu road station	shield method	Adjacent / Crossing Underneath Existing Buildings	K2+444～K2+495	Huiji District's office building of Land and Resources,7floor,5meters from the linefloor distance from the line is	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. 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. 6. 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. 7. Control the uneven settlement difference of buildings of no more than ≤3‰
				K2+600～K2+619	Peaceful residential homes, Building 8,，17floor floor，distance from the line is 9meters 。Frame structure	class II	
				K2+623～K2+663	RCC family member courtyard (Gadameilin district),distance from the line is o meters 。17 floors，Frame structurefloor	class II	
				K2+800～K2+900	CR City Concert (Xinyu Garden) district ,1 #, 5 # Buildingsfloor distance from the line is ,9meters	class II	
				K2+800～K2+910	City bus company, family member courtyard，7floor floor，distance from the line is 15meters from the line	class II	
	xinglongpu road station –dongfeng road station			K3+280～K3+339	National Food Authority's Zhengzhou Institute of Science，3~6floor floor，distance from the line is 15m from the line。	class class II	
				K3+410～K3+546	Tractor plant family member building，5floor floor， distance from the line is 12meters。	class II	
				K3+573～K3+600	Nanyang Road 137，6floor floor ， distance from the line is 15meters from the line	class II	
				K3+610 ～ K3+723	Tianxiu home district, 1 # ~ 4 # Building, distance from the line is 16meters from the line，7 floors，mixed structurefloor mixed structure	class II	
				K3+730 ～ K3+784	Zhengzhou Oriental Tumor Courtyard，5floor ，distance from the line is 15m，mixed structure 。	class II	
				K3+957～K3+990	ICBC family member building，5floor ，distance from the line is 11m，mixed structure	class II	
				K4+000～K4+213	张砦村，2~7floor ，distance from the line is 17m，mixed structure	class II	
				K4+291～K4+463	Fun district, 1 #, 2 #, 3 #, 4 #, 5 # Buildingfloor ，11meters from the line distance from the line is ，6--7 floors，mixed structuremixed structure	class II	
				K3+200～K3+328	Grain transport community, Building 9, Building 10，6floor floor，distance from the line is 11m from the line，mixed structuremixed structure	class II	
				K3+611～K3+621	Huiji District's Board of Education family member building，7floor floor，mixed structuremixed structure ， distance from the line is 13meters from the line。	class II	
				K3+635～K3+773	Yuhua Wen Hui Garden District, Building 1 to 5，7floor floor，mixed structuremixed structure ， distance from the line is 16meters from the line。	class II	
				K3+917～K4+049	Yuhua Wen Qing Garden District Building 1 to 4，7floor ，mixed structure ，	class II	

No.	Station	Engineering proposal	Construction method	Risk engineering category	Description of basic risk conditions	Risk classifications	Solution
					distance from the line is 13m。		
				K4+129～K4+211	Yaxin good times area, 3 to 4 Building 7floor ， mixed structure ， distance from the line is 13m。	class II	
				K4+217～K4+277	Chuangye Homes，7floor ，mixed structure ，distance from the line is 9m。	class II	
				K4+286～K4+500	Sunshine Holiday district, 1 #, 2 # Building，7floor ， mixed structure ， distance from the line is 10m。	class II	
4	dongfeng road station-nonongye road station	shield method	Crossing Underneath Existing Buildings	K4+529～K4+558	Nanyang Road, No. 111 Courtyard，6floor ， distance from the line is 6m。	classII	
				K4+929～K5+010	China Railway Bridge Bureau family member courtyard 1 #，7floor ， distance from the line is 8m。	class II	
				K5+116～K5+247	Zhengzhou Boiler Factory family member courtyard 1 #, 2 #，7floor ， distance from the line is 11m。	class II	
				K5+268～K5+318	Zhengrong Group Limited family member courtyard, 3 #, 6 # building，5floor ， distance from the line is 8m	class II	
				K5+328～K5+390	Vision Garden 2 #, 3 # Building，7floor ， distance from the line is 11m。	class II	
				K5+392～K5+456	Old meat processing factory family member courtyard, 1 #, 3 #, 5 # Building，6floor ， distance from the line is 12m。	class II	
				K5+480～K5+679	Nanyang Road 68 homes, 1 #, 2 #, 3 #, 10 #, 41 # Building，6floor ，distance from the line is 12m。	class II	
				K4+785～K4+833	Mold factory family member courtyard 1 # building，6floor ，distance from the line is 12m。	class class II	
				K4+845～K4+900	Kaiyuan district, 1 #, 2 # Building，6floor ， distance from the line is 14m。	class II	
				K4+937～K5+025	Nanyang Road, No. 239 Courtyard，6floor ，distance from the line is 14m。	class II	
				K5+390～K5+441	Ronghua community, 1 # Building，5floor ，distance from the line is 12m。	class II	
				K5+477～K5+520	Nanyang Road 253 (food company meat branch family member building) 1 #, 3 #，6floor ，distance from the line is 11m。	class II	
5	nongyeroad station –huanghe road station	shield method	Adjacent / Crossing Underneath Existing Buildings	K5+790～K5+890	Zhengzhou ceramics factory family member courtyard, 1 #, 3 # Building, Nanyang Road 62	class II	
				K5+900～K5+965	Provincial Prospecting machinery factory family member courtyard 1 #, 5 #, 6 # building，6floor ，distance from the line is 12m。	class II	
				K6+043～K6+082	Nanyang Road, No. 52 (Yuhua Wen Jinyuan), three buildings，7floor ， distance from the line is 13m。	class II	
				K6+205～K6+234	Sipo Road 9，8floor ，distance from the line is 12m。	class II	
				K6+429～K6+500	Nanyang Road, No. 46，17floor ，distance from the line is 11m。	class II	
				K6+517～K6+548	Nanyang Road, No. 41 courtyard, 5 # Building，6floor ，distance from the line is 9m。	class II	
				K6+613～K6+679	Huafu Institute of Dermatology，5~7floor ，distance from the line is 10m。	class II	
				K6+690～K6+762	City No. 71 high school，5floor ，distance from the line is 11m。	class II	
				K6+900～K7+073	Zhengzhou Textile staff apartments, 29 #, 30 # Building，4floor ，distance from the line is 14m。	class II	

No.	Station	Engineering proposal	Construction method	Risk engineering category	Description of basic risk conditions	Risk classifications	Solution
				K7+100～K7+177	Nanyang Road, No.1 primary，3~6floor ，distance from the line is 9m。	class II	
				K5+843～K5+878	Transport company family member courtyard, (Nanyang Road No. 268 courtyard), 1 # Building，7floor ，distance from the line is 15m。	class II	
				K5+889～K6+021	Nanyang Road, No. 270 Courtyard, 2 #, 4 # Building，7floor ，distance from the line is 12m。	class II	
				K6+034～K6+085	Nanyang Road, No. 279 Courtyard, 1 #, 2 # Building，5~7floor ，distance from the line is 12m。	class II	
				K6+100～K6+180	Pearl Factory, family member courtyard, 1 #, 2 #, 3 # Building (Nanyang Road 275)，6floor ，distance from the line is 9m。	class II	
				K6+260～K6+305	Nanyang Road, No. 283 Courtyard，5floor ，distance from the line is 13m。	class II	
				K6+600～K6+975	Hengtian Heavy Industry Co., Ltd family area，3~6floor ，distance from the line is 14m。	class II	
				K7+032～K7+168	Nanyang Road, No. 296 Courtyard, 1 #, 2 #, 3 #，6~12floor ，distance from the line is 15m。	class II	
6	huanghe road station –jinshuiroad station	shield method	Adjacent / Crossing Underneath Existing Buildings	K7+214～K7+696	Zhengzhou Textile Machinery Co family member courtyard, 6 #, 5 #, 4 #, South 3 #, 2 # Building South，4floor ，distance from the line is 15m。	class II	
				K7+900～K8+150	Nanyang Road No. 12 courtyard, 1 #, 2 # Building，3~6floor ，distance from the line is 10m。	class II	
				K7+970～K8+010	Jinshui District Police Fire Brigade，7floor ，distance from the line is 14m。	class II	
				K8+174～K8+190	Film Bureau, family member courtyard, 6 #, 7 # F (Nanyang Road 7)，5floor ，crossing underneath number 7 building	CLASS II	
				K8+190～K8+220	Tingdao foreign language training，4floor ，crossing underneath。	CLASS II	
				K8+250～K8+300	Zhengzhou City Library，2~6floor ，distance from the line is 5m。	CLASS II	
				K7+220～K7+320	Garden community, (Nanyang Road 300) 5 # building，7floor ，distance from the line is 14m。	class II	
				K7+900～K8+020	Zhongheng Garden, 2nd Courtyard, 1 #, 2 #, 3 # Building，5~6floor ，distance from the line is 8m。	class II	
7	jinshui road station –taikang road station	shield method	Adjacent / Crossing Underneath Existing Buildings	K8+485～K8+495	Jinshui Road, 11th courtyard, 1 # building，4floor ，distance from the line is 11m。	class II	
				K8+640～K8+690	Minggong Road No. 67 courtyard, (Jinfeng Golden Coast International), 1 # Building，7floor ，distance from the line is 6m。	CLASS II	
				K8+920～K9+017	Minggong Road, No. 156 Courtyard, 1 #, 2 # Building，6floor ，distance from the line is 6m。	CLASS II	
				K9+030～K9+100	Jin Ming Yuan South, Building # 1，7floor ，distance from the line is 4m。	CLASS II	
8	taikang road station –erqi suquare station	shield method	Adjacent / Crossing Underneath Existing Buildings	K9+700～K9+860	Huigang New Town 1 #, 2 #, 3 # Building，28floor ，distance from the line is 0m。	CLASS II	
				K10+000 ～ K10+059	Small building mosques，4~6floor ，distance from the line is 6m。	CLASS II	
				K9+275～K9+315	West Cai district, (Ming Gong Road No. 240 Courtyard) 1 # ，4~7floor ，	CLASS II	

No.	Station	Engineering proposal	Construction method	Risk engineering category	Description of basic risk conditions	Risk classifications	Solution
					Crossing underneath		
				K9+325～K9+410	Courtyard No. 85 West Front Street, 1 # Building (Ming Gong Road, No. 245 Courtyard)，2~7floor ，distance from the line is 9m。	class II	
				K9+545～K9+608	Ming Gong Road No. 272, (Rural Credit Cooperative Union, family member building)，6floor ，crossing underneath。	CLASS II	
				K9+638～K9+674	Yalong district, 17 # Building，7floor ，正下穿。	CLASS II	
				K9+638～K9+674	Yalong districtl 16 # Building, 1 #, 2 # Building，7floor ，distance from the line is 16m。	class II	
				K9+687～K9+719	Catholic Church，2~5floor ，distance from the line is 2m。	CLASS II	
			Crossing Underneath bridge	K9+800 ～ K10+000	Jiefang Road overpass Pile foundationCrossing underneath	CLASS II	
9	erqi suquare station –shuncheng street station	shield method	Adjacent / Crossing Underneath Existing Buildings	K10+510 ～ K10+614	Shangfuxin Village House 1#，18floor ，distance from the line is 6m。	class II	
				K10+625 ～ K10+779	Fuchun Apartment 1 # building，7floor ，distance from the line is 15m。	class II	
				K10+317 ～ K10+348	Zhengzhou Feb 7 Strike Monument，14floor ，钢筋混凝土结构。distance from the line is 3m。	CLASS II	
				K10+528 ～ K10+614	Huating Apartments, Dehua Street community 1 #, 2 # Building，16floor ，distance from the line is 15m。	class II	
				K10+630 ～ K10+775	Jinding Huafu House, front 1 #，11floor ，distance from the line is 13m。	class II	
				K10+630 ～ K10+775	Jinding Huafu House, rear，5~7floor ，distance from the line is 8m。	class II	
10	shuncheng street station –dongdajie street station	shield method	Adjacent / Crossing Underneath Existing Buildings	K10+915 ～ K10+990	Hongxin Jia Yuan 1 # building，7floor ，distance from the line is 14m。	class II	
				K11+070 ～ K11+151	Xidan apartments, two buildings，7floor ，distance from the line is 8m。	class II	
				K11+250 ～ K11+286	West Street, No. 231，16floor ，distance from the line is 13m。	class II	
				K11+380 ～ K11+446	Zhongkai City Lights Clove Court, 1 #, 2 # Building，12floor ，distance from the line is 12m。	class II	
				K10+956 ～ K11+025	Ginza International，7floor ，distance from the line is 15m。15floor ，distance from the line is 14m。	class II	
				K11+038 ～ K11+100	233 West Main Street (the third secondary school, family member building)，18floor ，distance from the line is 11m。	class II	
				K11+230 ～ K11+300	Sun Moon Star City, 1 # building，20floor ，distance from the line is 15m。	class II	
				K11+328 ～	Zhongkai City Lights Clove Court, 1 #, 2 # Building，7floor ，distance from	class II	

No.	Station	Engineering proposal	Construction method	Risk engineering category	Description of basic risk conditions	Risk classifications	Solution
				K11+566	the line is 14m。		
				K11+580 ～ K11+666	Yangtze River City in City，7floor ，distance from the line is 13m。	class II	
11	dongdajie road station-chengdong road station	shield method	Adjacent / Crossing Underneath Existing Buildings	K11+978 ～ K12+105	number 220 community in dongdajie，6floor ，distance from the line is 10m。	class II	
				K12+133 ～ K12+366	Zhongkai City Lights Guangjingcui Court, 1 #, 2 # Building，7floor ，distance from the line is 8m。	class II	
12	chengdong road station-weilaidadao road station	shield method	Adjacent / Crossing Underneath Existing Buildings	K12+716 ～ K12+830	East Main Street, No. 1 Court, 1 # building，4~7floor ，distance from the line is 11m。	class II	
				K12+992 ～ K13+072	Knitting mill family member courtyard, 1 # building，5floor ，distance from the line is 12m。	class II	
				K13+076 ～ K13+226	Yutong Garden 1 # building ，6floor ，distance from the line is 12m。	class II	
				K13+230 ～ K13+408	Municipal underwear factory family member courtyard, 1 #, 2 #, 3 # Building，5~6floor ，distance from the line is 14m。	class II	
				K12+820 ～ K12+857	Zheng Bian Road, Building 23,，5floor ，distance from the line is 7m。	class II	
				K13+158 ～ K13+225	Cargo Terminal No. 23 North Street Courtyard, 1 #, (Phoenix Road Community)，5floor ，distance from the line is 18m。	class II	
				K13+332 ～ K13+390	Boai ENT Hospital of Zhengzhou，6floor ，distance from the line is 9m。	class II	
				K13+398 ～ K13+430	Zheng Bian Road, No. 49, family member courtyard, 1 # Building，5floor ，distance from the line is 13m。	class II	
				K13+512 ～ K13+650	Dongming Road 30 Courtyard, (electric power district), 1 #, 2 # Building，6floor ，distance from the line is 9m。	class II	
			Crossing Underneath water and rivers	K12+900 ～ K13+000	Crossing underneath xionger river	class II	
13	zhognzhoudadao road station-tongtai road station	shield method	Crossing Underneath bridge	K15+850 ～ K15+950	crossing underneath zhongzhoudadao overpass	CLASS II	
14	tongtai road station –huanghedong road station	shield method	Adjacent / Crossing Underneath Existing Buildings	K17+206 ～ K17+266	guancheng chinese hospital，8 floor,,10meters from the line	class II	
			Crossing	K17+200 ～	Underneathqili river,，The bottom to the top of tunnel is 10m	CLASS II	

No.	Station	Engineering proposal	Construction method	Risk engineering category	Description of basic risk conditions	Risk classifications	Solution
			Underneath water and rivers	K17+400			
15	zhongxing road station –boxue road station	shield method	Crossing Underneath bridgeCrossing Underneath bridge	K20+800 ～ K15+920	Crossing underneath the high-speed rail bridge pile foundation	CLASS II	
16	boxue road street station-hanghaidong road station	shield method	Adjacent / Crossing Underneath Existing Buildings	K24+300 ～ K24+8000	Dongyinggang cun,1-2floor,crossing undernath	CLASS II	
			Crossing Underneath railway	K23+250 ～ K23+360	underneath longhai railway,， ground line	class II	

Table 11.6-2e Noise control measures for ventilation pavilion and cooling tower

SN	Name of sensitive spot	The measuring points	Mileage	Distence(m)				Superscalar of predicated value during the air conditioning period		Increment of predicated value from the current value		Measures	Investment (10,000 yuan)	Contribution value in the air conditioning period after taking measures		Increment of predicated value after taking measures	
				Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Day	Night	Day	Night			Day	Night	Day	Night
1	Yuhua 9th City 1# building	Layer 1	K0+090 ～ K0+100	30	30	30	/	6.72	11.28	0.02	0.08	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB;	15	28.13	29.12	0.00	0.01
1	Yuhua 9th City 1# building	Layer 2	K0+090 ～ K0+100	30	30	30	/	7.12	11.77	0.02	0.07			28.07	29.07	0.00	0.01
1	Yuhua 9th City 1# building	Layer 5	K0+090 ～ K0+100	30	30	30	/	7.61	10.19	0.01	0.09			27.36	28.35	0.00	0.01
1	Yuhua 9th City 1# building	Layer 8	K0+090 ～ K0+100	30	30	30	/	6.31	10.17	0.01	0.07			26.13	27.12	0.00	0.01
2	Hualian Family Area 3# Building	Layer 1	K1+436 ～ K1+460	26	26	26	30	4.78	10.79	0.18	0.49	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB; （3）Use Ultra-low noise cooling tower （4）The cooling tower is provided with noise hood at the outside	45	32.51	33.01	0.01	0.03
2	Hualian Family Area 3# Building	Layer 3	K1+436 ～ K1+460	26	26	26	30	5.64	11.22	0.14	0.42			35.60	35.84	0.01	0.04
3	Hualian Family Area 4# building	Layer 1	K1+436 ～ K1+460	23	25	20	26	/	0.41	0.13	0.71			36.89	37.19	0.01	0.08
3	Hualian Family Area 4# building	Layer 3	K1+436 ～ K1+460	23	25	20	26	/	1.06	0.11	0.56			33.21	33.82	0.01	0.03
4	Hualian Family Area5# building	Layer 1	K1+436 ～ K1+460	20	19	23	16	/	0.02	0.29	1.82			40.26	40.37	0.03	0.22
4	Hualian Family Area5# building	Layer 3	K1+436 ～ K1+460	20	19	23	16	/	/	0.45	1.84			39.60	39.72	0.05	0.22
5	Chengshi Bei'an Residence Community 1# building	Layer 1	K1+615 ～ K1+650	33	33	33	/	/	/	0.03	0.15	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB; （3）The wind pavilion is moved 10m to the north	15	27.38	28.38	0.00	0.02
5	Chengshi Bei'an Residence Community 1# building	Layer 2	K1+615 ～ K1+650	33	33	33	/	/	/	0.03	0.18			27.34	28.33	0.00	0.02
5	Chengshi Bei'an Residence Community 1# building	Layer 5	K1+615 ～ K1+650	33	33	33	/	/	/	0.02	0.16			26.74	27.73	0.00	0.02
6	Chengshi Bei'an Residence Community 4# building	Layer 1	K1+615 ～ K1+650	16	19	13	/	7.55	8.55	0.05	0.55			30.75	32.48	0.00	0.04
6	Chengshi Bei'an Residence Community 4# building	Layer 2	K1+615 ～ K1+650	16	19	13	/	6.26	9.06	0.06	0.46			30.65	32.34	0.00	0.03
6	Chengshi Bei'an Residence Community 4# building	Layer 5	K1+615 ～ K1+650	16	19	13	/	6.44	8.60	0.04	0.30			29.35	30.76	0.00	0.02

SN	Name of sensitive spot	The measuring points	Mileage	Distence(m)				Superscalar of predicated value during the air conditioning period		Increment of predicated value from the current value		Measures	Investment (10,000 yuan)	Contribution value in the air conditioning period after taking measures		Increment of predicated value after taking measures	
				Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Day	Night	Day	Night			Day	Night	Day	Night
7	Zhengzhou Public Transportation Company Family Area 2# building	Layer 1	K2+787 ～ K2+803	26	23	31	/	/	/	0.01	0.25	（1）Main exhaust port backing to the sensitive spot.		29.39	30.12	0.00	0.03
7	Zhengzhou Public Transportation Company Family Area 2# building	Layer 2	K2+787 ～ K2+803	26	23	31	/	/	/	0.01	0.23			29.32	30.05	0.00	0.02
7	Zhengzhou Public Transportation Company Family Area 2# building	Layer 5	K2+787 ～ K2+803	26	23	31	/	/	/	0.01	0.17			28.36	29.13	0.00	0.02
8	Changjian Yufeng (in construction)	Layer 1	K3+070 ～ K3+090	48	48	48	40	12.52	15.19	0.02	0.09	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB; （3）Use low noise cooling tower	35	33.13	33.28	0.00	0.01
9	Nanyang Road No.219 Yard 6# building	Layer2	K4+405 ～ K4+425	14	18	1	/	/	2.44	0.03	0.84	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB; （3）The location of wind pavilion is adjusted, and moved 6m to the center of the road	15	33.63	39.89	0.00	0.09
9	Nanyang Road No.219 Yard 6# building	Layer 4	K4+405 ～ K4+425	14	18	1	/	/	1.38	0.03	0.28			32.17	34.39	0.00	0.03
10	Nanyang Road No.219 Yard 4# building	Layer 1	K4+405 ～ K4+425	26	30	15	/	4.54	10.57	0.04	0.17			29.11	31.45	0.00	0.02
10	Nanyang Road No.219 Yard 4# building	Layer 3	K4+405 ～ K4+425	26	30	15	/	3.74	9.02	0.04	0.22			28.84	30.98	0.00	0.02
11	Sunshine Holiday Community 3# Building	Layer 1	K4+405 ～ K4+425	6	6	6	/	7.87	12.67	0.27	1.27			35.29	36.28	0.01	0.04
11	Sunshine Holiday Community 3# Building	Layer 3	K4+405 ～ K4+425	6	6	6	/	7.44	12.38	0.14	0.58			34.15	35.14	0.01	0.03
12	Sunshine Holiday Community 2# Building	Layer 1	K4+405 ～ K4+425	17	14	21	/	/	1.81	0.07	0.21			31.42	32.14	0.01	0.02
12	Sunshine Holiday Community 2# Building	Layer 3	K4+405 ～ K4+425	17	14	21	/	/	1.11	0.08	0.21			30.95	31.70	0.01	0.02
13	Tongle Community 46th building	Layer 1	K4+600 ～ K4+637	30	25	39	16	4.07	8.66	0.57	2.46	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to	45	34.36	34.50	0.02	0.09
13	Tongle Community 46th building	Layer 3	K4+600 ～	30	25	39	16	4.62	7.65	0.42	2.75			33.93	34.08	0.01	0.11

SN	Name of sensitive spot	The measuring points	Mileage	Distence(m)				Superscalar of predicated value during the air conditioning period		Increment of predicated value from the current value		Measures	Investment (10,000 yuan)	Contribution value in the air conditioning period after taking measures		Increment of predicated value after taking measures	
				Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Day	Night	Day	Night			Day	Night	Day	Night
			K4+637									more than 3m to reduce the noise of ventilation pavilion for 10dB;; （3）Use Ultra-low noise cooling tower （4）The location of wind pavilion is adjusted, and moved 3m to the center of the road					
14	Tongle Community 61th building	Layer 1	K4+600 ～ K4+637	28	23	31	23	5.43	7.84	0.23	1.54			32.73	33.02	0.01	0.06
14	Tongle Community 61th building	Layer 3	K4+600 ～ K4+637	28	23	31	23	5.98	7.12	0.18	1.72			32.47	32.78	0.01	0.07
15	Food Machinery Plant Family Area 2# Building	Layer 1	K4+600 ～ K4+637	28	28	28	35	8.46	8.56	0.06	0.66			34.76	35.03	0.01	0.07
15	Food Machinery Plant Family Area 2# Building	Layer 3	K4+600 ～ K4+637	28	28	28	35	8.16	8.45	0.06	0.65			34.59	34.85	0.01	0.07
16	Xincun Community 3# Building	Layer 1	K5+640 ～ K5+660	31	35	20	/	9.11	8.78	0.01	0.18	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB;	15	27.75	29.74	0.00	0.02
16	Xincun Community 3# Building	Layer 3	K5+640 ～ K5+660	31	35	20	/	8.41	8.09	0.01	0.19			27.56	29.46	0.00	0.02
17	Ronghua Community 2#	Layer 1	K5+640 ～ K5+660	12	12	12	/	3.89	6.90	0.19	1.40			33.55	34.54	0.01	0.11
17	Ronghua Community 2#	Layer 3	K5+640 ～ K5+660	12	12	12	/	4.72	6.77	0.12	1.07			32.78	33.77	0.01	0.09
18	Ronghua Community 3#	Layer 1	K5+640 ～ K5+660	25	21	29	/	6.53	7.86	0.03	0.26			29.77	30.52	0.00	0.03
18	Ronghua Community 3#	Layer 3	K5+640 ～ K5+660	25	21	29	/	5.24	8.03	0.04	0.23			29.45	30.21	0.00	0.02
19	Xiaoyuzhai (Nanyang Road 266# Yard) 3# building	Layer 2	K5+816 ～ K5+836	21	15	26	16	/	/	0.74	3.20	（1）Main exhaust port backing to the sensitive spot. （2）moved 10m to the center of the road （3）Use Ultra-low noise cooling tower	30	34.66	34.90	0.02	0.14
19	Xiaoyuzhai (Nanyang Road 266# Yard) 3# building	Layer 5	K5+816 ～ K5+836	21	15	26	16	/	/	0.63	2.26			33.29	33.56	0.02	0.10
20	Transport Company Family Area (Nanyang Road No. 268) 1# building	Layer 1	K5+843 ～ K5+878	21	26	10	19	/	/	0.46	2.69			35.22	36.56	0.02	0.18
20	Transport Company Family Area (Nanyang Road No. 268) 1# building	Layer 3	K5+843 ～ K5+878	21	26	10	19	/	/	0.34	2.68			34.76	35.84	0.01	0.17
21	Zhengzhou Textile Machinery Apartment 29#	Layer 1	K7+000 ～ K7+030	4	1	9	1	2.09	16.59	9.19	18.79	（1）Main exhaust port backing to the sensitive spot.	45	61.53	61.53	2.38	9.28

SN	Name of sensitive spot	The measuring points	Mileage	Distence(m)				Superscalar of predicated value during the air conditioning period		Increment of predicated value from the current value		Measures	Investment (10,000 yuan)	Contribution value in the air conditioning period after taking measures		Increment of predicated value after taking measures	
				Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Day	Night	Day	Night			Day	Night	Day	Night
21	Zhengzhou Textile Machinery Apartment 29#	Layer 3	K7+000 ～ K7+030	4	1	9	1	/	3.43	0.91	5.13	（2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB; （3）Use Ultra-low noise cooling tower （4）moved 8m to the center of the road		46.76	46.84	0.10	0.89
22	Zhengzhou Textile Machinery Apartment 30#	Layer 1	K7+000 ～ K7+030	12	16	4	25	/	0.38	0.15	2.18			38.65	41.34	0.02	0.27
22	Zhengzhou Textile Machinery Apartment 30#	Layer 3	K7+000 ～ K7+030	12	16	4	25	/	/	0.13	1.29			38.02	39.10	0.01	0.15
23	Zhengzhou Textile Machinery Apartment 18#	Layer 1	K7+000 ～ K7+030	16	16	16	11	7.34	10.34	0.54	4.04			34.94	35.25	0.01	0.11
23	Zhengzhou Textile Machinery Apartment 18#	Layer 2	K7+000 ～ K7+030	16	16	16	11	8.11	10.25	0.41	3.65			34.82	35.14	0.01	0.10
23	Zhengzhou Textile Machinery Apartment 18#	Layer 5	K7+000 ～ K7+030	16	16	16	11	7.33	8.49	0.23	2.29			33.42	33.77	0.01	0.08
24	Zhengzhou Textile Machinery Apartment 19#	Layer 1	K7+000 ～ K7+030	38	34	42	19	5.96	9.07	0.26	1.47			34.12	34.27	0.01	0.06
24	Zhengzhou Textile Machinery Apartment 19#	Layer 2	K7+000 ～ K7+030	38	34	42	19	5.01	8.89	0.31	1.49			34.01	34.16	0.01	0.06
24	Zhengzhou Textile Machinery Apartment 19#	Layer 5	K7+000 ～ K7+030	38	34	42	19	4.36	8.05	0.26	1.25			32.65	32.84	0.01	0.05
25	Huayuan Community 5#	Layer 1	K7+240 ～ K7+320	13	11	18	/	2.45	7.22	0.25	1.02	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB;	15	34.87	35.43	0.03	0.11
25	Huayuan Community 5#	Layer 3	K7+240 ～ K7+320	13	11	18	/	3.84	8.30	0.14	0.60			33.82	34.44	0.01	0.06
26	Huayuan Community6#	Layer 1	K7+240 ～ K7+320	37	32	42	/	3.23	7.34	0.03	0.14			26.67	27.44	0.00	0.01
26	Huayuan Community6#	Layer 3	K7+240 ～ K7+320	37	32	42	/	4.32	5.51	0.02	0.21			26.52	27.31	0.00	0.02
27	Film Bureau Family Area 6# building	Layer 1	K8+200 ～ K8+330	22	25	10	15	/	0.02	0.25	2.22	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB; （3）Use low noise cooling	35	40.60	41.04	0.03	0.28
27	Film Bureau Family Area 6# building	Layer 2	K8+200 ～ K8+330	22	25	10	15	/	0.50	0.33	1.80			40.41	40.82	0.03	0.22
27	Film Bureau Family Area 6# building	Layer 5	K8+200 ～ K8+330	22	25	10	15	/	/	0.16	1.14			38.28	38.56	0.02	0.13
28	Film Bureau Family Area 5#	Layer 1	K8+200 ～	45	45	45	35	7.17	10.07	0.07	0.37			34.10	34.24	0.01	0.04

SN	Name of sensitive spot	The measuring points	Mileage	Distence(m)				Superscalar of predicated value during the air conditioning period		Increment of predicated value from the current value		Measures	Investment (10,000 yuan)	Contribution value in the air conditioning period after taking measures		Increment of predicated value after taking measures	
				Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Day	Night	Day	Night			Day	Night	Day	Night
	building		K8+330									tower					
28	Film Bureau Family Area 5# building	Layer 2	K8+200 ～ K8+330	45	45	45	35	7.66	9.71	0.06	0.41			34.07	34.20	0.01	0.04
28	Film Bureau Family Area 5# building	Layer 5	K8+200 ～ K8+330	45	45	45	35	6.77	9.20	0.07	0.40			33.55	33.69	0.01	0.04
29	Zhengzhou City Library	Layer 1	K8+200 ～ K8+330	32	29	41	31	9.85	/	0.05	/			35.32	35.44	0.00	#VALUE!
30	Downtown Community Phase II 1# building	Layer 1	K8+400 ～ K8+420	31	31	31	/	2.65	6.73	0.05	0.23	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB;	15	27.87	28.86	0.00	0.02
30	Downtown Community Phase II 1# building	Layer 2	K8+400 ～ K8+420	31	31	31	/	3.64	6.07	0.04	0.27			27.82	28.82	0.00	0.03
30	Downtown Community Phase II 1# building	Layer 5	K8+400 ～ K8+420	31	31	31	/	3.73	5.65	0.03	0.25			27.15	28.14	0.00	0.03
30	Downtown Community Phase II 1# building	Layer 8	K8+400 ～ K8+420	31	31	31	/	3.42	6.07	0.02	0.17			25.97	26.97	0.00	0.02
31	Nanyang Road No. 326 (Zhengzhou National Oil Reserve Base Family Area) 1#	Layer 1	K8+400 ～ K8+420	39	37	45	/	2.73	8.01	0.03	0.11	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB;	15	26.14	26.91	0.00	0.01
31	Nanyang Road No. 326 (Zhengzhou National Oil Reserve Base Family Area) 1#	Layer 3	K8+400 ～ K8+420	39	37	45	/	4.42	8.20	0.02	0.10			26.01	26.79	0.00	0.01
32	Xicai Community (Minggong Road 240# Yard) 2#, 3# building	Layer 1	K9+275 ～ K9+315	44	40	48	27	/	/	0.19	1.15	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB; （3）Use Ultra-low noise cooling tower （4）moved 8m to the center of the road	45	35.95	36.03	0.02	0.13
32	Xicai Community (Minggong Road 240# Yard) 2#, 3# building	Layer 3	K9+275 ～ K9+315	44	40	48	27	/	/	0.20	1.22			35.71	35.79	0.02	0.14
33	Minggong Road No.245 (Xiqian Street 85# Yard 1#, 2# building)	Layer 1	K9+340 ～ K9+375	20	17	24	4	/	6.76	1.53	6.16			39.09	39.21	0.01	0.10
33	Minggong Road No.245 (Xiqian Street 85# Yard 1#, 2# building)	Layer 3	K9+340 ～ K9+375	20	17	24	4	/	3.02	0.48	3.22			37.73	37.88	0.01	0.09
34	Huigang New Town 3# building	Layer 1	K9+890 ～ K9+980	21	25	10	/	12.51	10.41	0.01	0.31	（1）Main exhaust port backing to the sensitive spot.	15	30.75	33.79	0.00	0.03

SN	Name of sensitive spot	The measuring points	Mileage	Distence(m)				Superscalar of predicated value during the air conditioning period		Increment of predicated value from the current value		Measures	Investment (10,000 yuan)	Contribution value in the air conditioning period after taking measures		Increment of predicated value after taking measures	
				Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Day	Night	Day	Night			Day	Night	Day	Night
35	Female Mosque	Layer 2	K10+010 ～ K10+020	41	41	41	/	/	/	0.01	/	（2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB;		25.66	26.65	0.00	#VALUE!
35	Female Mosque	Layer 5	K10+010 ～ K10+020	41	41	41	/	/	/	0.01	/			25.25	26.25	0.00	#VALUE!
36	Hongxin Garden 1# building	Layer 2	K10+915 ～ K10+990	35	32	39	32	/	/	0.04	0.59	（1）Main exhaust port backing to the sensitive spot.		34.95	35.09	0.00	0.06
36	Hongxin Garden 1# building	Layer 5	K10+915 ～ K10+990	35	32	39	32	/	/	0.03	0.45			34.33	34.47	0.00	0.05
37	Xidan Apartment 3#	Layer 1	K11+070 ～ K11+151	36	36	36	26	/	/	0.07	0.84			36.36	36.48	0.01	0.09
37	Xidan Apartment 3#	Layer 3	K11+070 ～ K11+151	36	36	36	26	/	/	0.08	0.73			36.10	36.22	0.01	0.08
38	Xidan Apartment 1#	Layer 1	K11+070 ～ K11+151	41	46	30	39	/	/	0.05	0.44			33.46	33.78	0.00	0.05
38	Xidan Apartment 1#	Layer 3	K11+070 ～ K11+151	41	46	30	39	/	/	0.04	0.49			33.34	33.65	0.00	0.05
39	East Street 220# Yard	Layer 1	K11+978 ～ K12+105	/	/	/	5	/	4.52	2.70	7.92	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB; （3）Use low noise cooling tower	35	48.75	48.75	0.36	1.82
39	East Street 220# Yard	Layer 3	K11+978 ～ K12+105	/	/	/	5	/	1.05	1.35	5.25			44.51	44.51	0.16	0.92
40	Shangcheng Licun (East Street 248# Yard)	Layer 1	K12+110 ～ K12+200	/	/	/	5	/	4.96	0.80	6.16			48.75	48.75	0.09	1.18
41	Shangcheng Garden 1# building	Layer 1	K12+600 ～ K12+650	60	56	53	43	7.74	9.68	0.04	0.28	（1）Main exhaust port backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB; （3）Use low noise cooling tower	35	32.43	32.58	0.00	0.03
41	Shangcheng Garden 1# building	Layer 3	K12+600 ～ K12+650	60	56	53	43	7.54	10.71	0.04	0.21			32.33	32.48	0.00	0.02
42		Layer 1	K12+716 ～	29	32	16	/	/	/	0.03	0.50	（1）Main exhaust port	15	28.29	30.77	0.00	0.05

SN	Name of sensitive spot	The measuring points	Mileage	Distence(m)				Superscalar of predicated value during the air conditioning period		Increment of predicated value from the current value		Measures	Investment (10,000 yuan)	Contribution value in the air conditioning period after taking measures		Increment of predicated value after taking measures	
				Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Exhaust wind pavilion	Day	Night	Day	Night			Day	Night	Day	Night
	Dongguandongli 96# Yard 1# building		K12+830									backing to the sensitive spot. （2）Extend the silencer to more than 3m to reduce the noise of ventilation pavilion for 10dB;					
42	Dongguandongli 96# Yard 1# building	Layer 3	K12+716 ～ K12+830	29	32	16	/	/	/	0.04	0.20			28.08	30.35	0.00	0.02
43	Dongguandongli 96# Yard 2# building	Layer 1	K12+716 ～ K12+830	28	32	16	/	4.14	8.64	0.04	0.24			28.54	30.90	0.00	0.02
43	Dongguandongli 96# Yard 2# building	Layer 3	K12+716 ～ K12+830	28	32	16	/	5.72	8.71	0.02	0.21			28.30	30.49	0.00	0.02
44	Dongguandongli 96# Yard 6# building	Layer 1	K12+716 ～ K12+830	37	39	28	/	7.51	7.94	0.01	0.14			26.43	27.99	0.00	0.01
44	Dongguandongli 96# Yard 6# building	Layer 3	K12+716 ～ K12+830	37	39	28	/	5.32	4.23	0.02	0.33			26.30	27.82	0.00	0.03

Table 11.6-2f .Table Of Sensitive Point Vibration Control Measures

SN	Target Name	Mileage	Relationship with the line position（m）	Location	Using function	Prediction point Location	VLZmax(dB)	VLZ10（dB)	Structural noise prediction	Superscalar of VLZmax		Superscalar of Structural noise prediction		Sensitive Point Vibration Control Measures	Mileage of Sensitive Point Vibration Control Measures	Length (m)	Total investment (Ten thousand yuan)
										Day	Night	Day	Night				
1	New Hope Ao Garden, 17 #, 3 #	K00-195～K00-472	47	Right	House	Outdoor 0.5m	59.0	54.6	/	/	/	/	/				
2	Fuwa beauty area, Building 3, Building 1,	K00+843～K00+921	18	Left	House	Outdoor 0.5m	69.5	55.2	/	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K0+793 ～ K1+150	357	178.5
3	Taili community, Building 1,	K00+940～K00+968	16	Left	House	Outdoor 0.5m	68.1	56.0	/	/	/	/	/				
4	Hongda district, 11 #, 10 #, 9 #, 5 # Buildinsg	K00+986～K01+100	18	Left	House	Outdoor 0.5m	69.7	56.4	/	/	/	/	/				
5	Huiji District, Changxing Road, Street office	K01+454～K01+537	15	Left	institution	Outdoor 0.5m	69.6	56.9	/	/	/	/	/				
6	Changxing Road, No. 2 Courtyard	K01+476～K01+539	38	Left	House	Outdoor 0.5m	61.7	57.1	/	/	/	/	/				
7	Yuhua ninth city, Building 1 #~ 3 #	K00+100～K00+280	46	Right	House	Outdoor 0.5m	58.2	57.6	/	/	/	/	/				
8	Angel Kindergarten	K00+310～K00+320	18	Right	House	Outdoor 0.5m	68.6	57.6	/	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K0+260 ～ K0+370	110	55
9	Sanquan Food Co., Ltd., staff quarters	K00+644～K00+670	20	Right	House	Outdoor 0.5m	71.6	57.7	/	/	/	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K0+594 ～ K0+720	126	126
10	ChengHuang 5-rings Mansion	K01+010～K01+030	25	Right	institutio	Outdoor	66.0	57.7	/	/	/	/	/				

					n	0.5m										
11	Hualian family member courtyard, Buildings 2, 4, 5,	K01+362～K01+450	23	Right	House	Outdoor 0.5m	66.8	57.8	/	/	/	/	/			
12	Cityorth Shore District, 1 # building	K01+450～K01+540	18	Right	House	Outdoor 0.5m	66.6	57.8	/	/	/	/	/			
13	Baiwen courtyard, 1 #, 2 #,6#,7# Buildings	K01+587～K01+700	17	Left	House	Outdoor 0.5m	66.9	57.8	/	/	/	/	/			
14	Phosphate fertilizer factory family member courtyard, 1 #, 2 # Buildings	K02+411～K02+440	17	Left	House	Outdoor 0.5m	69.6	58.1	/	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K2+361 ～ K2+573	212	106
15	Huiji District's office building of Land and Resources	K02+444～K02+495	5	Left	institution	Outdoor 0.5m	73.8	58.2	47.3	/	1.8	2.3	5.3				
15	Huiji District's office building of Land and Resources	K02+444～K02+495	5	Left	institution	Indoor	73.8	58.3	47.3	/	1.8	2.3	5.3				
16	Peaceful residential homes, Building 8,	K02+500～K02+619	9	Left	House	Outdoor 0.5m	68.2	58.5	38.7	/	/	/	/				
16	Peaceful residential homes, Building 8,	K02+500～K02+619	9	Left	House	Indoor	68.2	58.7	38.7	/	/	/	/				
17	RCC family member courtyard (Gadameilin district)	K02+623～K02+663	0	Left	House	Outdoor 0.5m	72.3	59.2	42.8	/	0.3	/	0.8	Steel springs, floating slab,or The same level of vibration reduction measures	K2+573 ～ K2+950	377	565.5
17	RCC family member courtyard (Gadameilin district)	K02+623～K02+663	0	Left	House	Indoor	72.3	59.6	42.8	/	0.3	/	0.8				
18	CR City Concert (Xinyu Garden) district ,1 #, 5 # Buildings	K02+800～K02+900	9	Left	House	Outdoor 0.5m	70.6	59.7	44.2	/	/	/	2.2				
18	CR City Concert (Xinyu Garden) district ,1 #, 5 # Buildings	K02+800～K02+900	9	Left	House	Indoor	70.6	59.8	44.2	0.6	3.6	/	2.2				
19	Changxing Building	K01+650～K01+790	32	Right	House	Outdoor 0.5m	62.8	59.8	/	/	/	/	/				
20	Huiji District, Tumor Courtyard of Traditional Chinese Medicine	K01+801～K01+871	29	Right	Hospital	Outdoor 0.5m	65.8	60.0	/	/	/	/	/		//		
21	City bus company, family member courtyard	K02+800～K02+910	15	Right	House	Outdoor 0.5m	69.5	60.2	/	/	2.5	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K2+750 ～ K2+960	210	105
22	Zhongji urban spring	K03+080～K03+140	33	Left	House	Outdoor 0.5m	60.8	60.2	/	/	/	/	/				

23	Jianye Yihao Chengbang District, 1 #, 7 #, 8 # Building	K03+144～K03+266	33	Left	House	Outdoor 0.5m	60.8	60.4	/	/	/	/	/				
24	National Food Authority's Zhengzhou Institute of Science and family Courtyard	K03+280～K03+550	15	Left	institution	Outdoor 0.5m	73.1	60.7	/	/	1.1	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K3+230 ～ K3+378	148	148
24	National Food Authority's Zhengzhou Institute of Science and family Courtyard	K03+280～K03+550	44	Left	House	Outdoor 0.5m	66.5	60.9	/	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K3+378 ～ K3+560	182	91
25	Tianxiu home district, 1 # ~ 4 # Building	K03+610～K03+723	16	Left	House	Outdoor 0.5m	72.0	61.1	/	/	0.0	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K3+560 ～ K4+479	919	919
26	Zhengzhou Oriental Tumor Courtyard	K03+730～K03+784	15	Left	Hospital	Outdoor 0.5m	72.1	61.3	/	2.1	5.1	/	/				
27	ICBC family member building	K03+957～K03+990	11	Left	House	Outdoor 0.5m	72.7	61.5	/	2.7	5.7	/	/				
28	Zhang Zhaicun	K04+000～K04+213	17	Left	House	Outdoor 0.5m	71.9	62.1	/	/	/	/	/				
29	Fun district, 1 #, 2 #, 3 #, 4 #, 5 # Building	K04+291～K04+463	11	Left	House	Outdoor 0.5m	70.5	62.2	/	/	/	/	/				
29	Fun district, 6 # - 11 # building	K04+291～K04+463	28	Left	House	Outdoor 0.5m	65.9	62.4	/	/	/	/	/				
30	Projects under construction (Chang Jian.Yufeng)	K02+940～K03+170	50	Right	House	Outdoor 0.5m	57.6	62.5	/	/	/	/	/				
31	Grain transport community, Building 9, Building 10	K03+200～K03+328	11	Right	House	Outdoor 0.5m	74.7	62.6	/	/	2.7	/	/	Steel springs, floating slab,or The same level of vibration reduction measures	K3+150 ～ K3+378	228	342
31	Grain transport community, 3 #~ 8 # Building	K03+200～K03+328	23	Right	House	Outdoor 0.5m	71.2	62.6	/	/	/	/	/				
32	Huiji District's Board of Education	K03+611～K03+621	13	Right	House	Outdoor	72.7	62.7	/	/	0.7	/	/	Flexible short	K3+561 ～	606	606

	family member building					0.5m										
33	Yuhua Wen Hui Garden District, Building 1 to 5	K03+635～K03+773	16	Right	House	Outdoor 0.5m	69.9	62.8	/	/	/	/	/	sleeper and monolithic track bedb,or The same level of vibration reduction measures	K4+167		
34	Yuhua Wen Qing Garden District Building 1 to 4	K03+917～K04+049	13	Right	House	Outdoor 0.5m	70.4	62.8	/	/	/	/	/				
35	City Brewery, family member courtyard north courtyard Building 25,	K04+056～K04+120	18	Right	House	Outdoor 0.5m	71.4	62.8	/	/	/	/	/				
36	Yaxin good times area, 3 to 4 Building	K04+129～K04+211	13	Right	House	Outdoor 0.5m	72.8	62.9	/	/	0.8	/	/				
37	Chuangye Homes	K04+217～K04+277	9	Right	House	Outdoor 0.5m	74.4	62.9	47.9	4.4	7.4	2.9	5.9	Steel springs, floating slab,or The same level of vibration reduction measures	K4+167 ～ K4+550	383	574.5
37	Chuangye Homes	K04+217～K04+277	9	Right	House	Indoor	74.4	62.9	47.9	4.4	7.4	2.9	5.9				
38	Sunshine Holiday district, 1 #, 2 # Building	K04+286～K04+500	10	Right	House	Outdoor 0.5m	70.8	63.0	44.4	/	/	/	2.4				
38	Sunshine Holiday district, 1 #, 2 # Building	K04+286～K04+500	10	Right	House	Indoor	70.8	63.0	44.4	0.8	3.8	/	2.4				
38	Sunshine Holiday district Building 3# ~ 9 #	K04+286～K04+500	30	Right	House	Outdoor 0.5m	65.4	63.2	/	/	/	/	/				
39	Nanyang Road, No. 111 Courtyard	K04+529～K04+558	6	Left	House	Outdoor 0.5m	72.0	63.2	45.5	2.0	5.0	0.5	3.5	Steel springs, floating slab,or The same level of vibration reduction measures	K4+479 ～ K4+608	129	193.5
39	Nanyang Road, No. 111 Courtyard	K04+529～K04+558	6	Left	House	Indoor	72.0	63.3	45.5	/	/	0.5	3.5				
39	Fun district, Southern District, fun district building 46, 61	K04+560～K04+600	36	Left	House	Outdoor 0.5m	64.1	63.5	/	/	/	/	/				
40	Xinyuan Garden 3 #, 4 #	K04+620～K04+700	52	Left	House	Outdoor 0.5m	61.2	63.6	/	/	/	/	/				
41	Nanyang Road, No. 97 Courtyard (Henan Engineering College family member courtyard), 1 #, 4 #, 5 # Building	K04+720～K04+900	16	Left	House	Outdoor 0.5m	72.3	63.6	/	/	0.3	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K4+670 ～ K4+879	209	209
42	Henan Engineering college family member courtyard's five buildings	K04+720～K04+900	34	Left	House	Outdoor 0.5m	68.2	63.7	/	/	1.2	/	/				
43	China Railway Bridge Bureau family member courtyard 1 #	K04+929～K05+010	8	Left	House	Outdoor 0.5m	73.4	63.8	46.9	/	1.4	1.9	4.9	Steel springs, floating	K4+879 ～ K5+060	181	271.5

43	China Railway Bridge Bureau family member courtyard 1 #	K04+929～K05+010	8	Left	House	Indoor	73.4	63.8	46.9	/	1.4	1.9	4.9	slab,or The same level of vibration reduction measures			
44	Home world community 1 #, 2 # Building	K05+024～K05+105	27	Left	House	Outdoor 0.5m	66.3	63.8	/	/	/	/	/				
45	Zhengzhou Boiler Factory family member courtyard 1 #, 2 #	K05+116～K05+247	11	Left	House	Outdoor 0.5m	72.7	63.8	/	/	0.7	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K5+066 ～ K5+218	152	152
45	Zhengzhou Boiler Factory, family member courtyard 3 # - 8 #	K05+116～K05+247	27	Left	House	Outdoor 0.5m	69.4	63.9	/	/	/	/	/				
46	Zhengrong Group Limited family member courtyard, 3 #, 6 # building	K05+268～K05+318	8	Left	House	Outdoor 0.5m	73.2	63.9	46.8	/	1.2	1.8	4.8	Steel springs, floating slab,or The same level of vibration reduction measures	K5+218 ～ K5+368	150	225
46	Zhengrong Group Limited family member courtyard, 3 #, 6 # building	K05+268～K05+318	8	Left	House	Indoor	73.2	64.2	46.8	3.2	6.2	1.8	4.8				
47	Home world community 1 # Building	K05+328～K05+390	13	Left	House	Outdoor 0.5m	72.4	64.2	/	/	0.4	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K5+368 ～ K5+740	372	372
47	Home world community 3 #, 2 # Building	K05+328～K05+390	33	Left	House	Outdoor 0.5m	68.3	64.3	/	/	/	/	/				
48	Old meat processing factory family member courtyard, 1 #, 3 #, 5 # Building	K05+392～K05+456	12	Left	House	Outdoor 0.5m	73.4	64.5	/	/	1.4	/	/				
49	Nanyang Road 68 homes, 1 #, 2 #, 3 #, 10 #, 41 # Building	K05+480～K05+679	12	Left	House	Outdoor 0.5m	70.4	64.6	/	0.4	3.4	/	/				
50	Fu Tian Lijing Garden District, 39 #, 40 # Building	K04+585～K04+774	17	Right	House	Outdoor 0.5m	66.8	64.6	/	/	/	/	/				
51	Mold factory family member courtyard 1 # building	K04+785～K04+833	12	Right	House	Outdoor 0.5m	73.4	64.7	/	3.4	6.4	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration	K4+735 ～ K5+075	340	340
52	Vision garden, 1 # building	K04+845～K04+900	14	Right	House	Outdoor 0.5m	72.5	64.8	/	/	0.5	/	/				
53	Nanyang Road, No. 239 Courtyard	K04+937～K05+025	14	Right	House	Outdoor 0.5m	72.1	64.8	/	/	0.1	/	/				
53	Mineral Homeworld 2 # ~ 5 #	K04+937～K05+025	37	Right	House	Outdoor	67.5	65.0	/	/	/	/	/				

						0.5m								reduction measures			
54	Nanyang Road, No. 244 Courtyard # 1 (aquaculture company family member courtyard)	K05+325～K05+349	16	Right	House	Outdoor 0.5m	71.8	65.0	/	/	/	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K5+275 ～ K5+427	152	152
55	Ronghua community, 1 # Building	K05+390～K05+441	12	Right	House	Outdoor 0.5m	73.3	65.1	/	3.3	6.3	/	/				
56	Nanyang Road 253 (food company meat branch family member building) 1 #, 3 #	K05+477～K05+520	11	Right	House	Outdoor 0.5m	74.2	65.1	/	4.2	7.2	/	/	Steel springs, floating slab,or The same level of vibration reduction measures	K5+427 ～ K5+570	143	214.5
56	Residential Community of Meat Product Branch of Food Company	K05+570～K05+700	40	Right	House	Outdoor 0.5m	63.4	65.2	/	/	/	/	/				
57	Zhengzhou ceramics factory family member courtyard, 1 #, 3 # Building, Nanyang Road 62	K05+790～K05+890	10	Left	House	Outdoor 0.5m	70.9	65.2	44.5	/	/	/	2.5	Steel springs, floating slab,or The same level of vibration reduction measures	K5+740 ～ K6+132	392	588
57	Zhengzhou ceramics factory family member courtyard, 1 #, 3 # Building, Nanyang Road 62	K05+790～K05+890	10	Left	House	Indoor	70.9	65.2	44.5	/	/	/	2.5				
57	Zhengzhou ceramics factory family member courtyard, 2 #, 4 #, 5 #, 6 #	K05+790～K05+890	25	Left	House	Outdoor 0.5m	66.7	65.2	/	/	/	/	/				
58	Provincial Prospecting machinery factory family member courtyard 1 #, 5 #, 6 # building	K05+900～K05+965	12	Left	House	Outdoor 0.5m	74.6	65.2	/	/	2.6	/	/				
59	Henan Geology and Mineral Resources Building	K05+986～K06+032	22	Left	institution	Outdoor 0.5m	67.6	65.3	/	/	/	/	/				
60	Nanyang Road, No. 52 (Yuhua Wen Jinyuan), three buildings	K06+043～K06+082	13	Left	House	Outdoor 0.5m	74.4	65.4	/	/	2.4	/	/				
61	Sipo Road 9	K06+205～K06+234	12	Left	House	Outdoor 0.5m	70.6	65.5	/	0.6	3.6	/	/	Flexible short sleeper and monolithic track bedb,or The same	K6+132 ～ K6+467	335	335
62	Nantong district, (Sipo Road 7th courtyard) 1 #	K06+250～K06+350	34	Left	House	Outdoor 0.5m	68.7	65.5	/	/	/	/	/				
63	College family member courtyard	K06+364～K06+406	28	Left	House	Outdoor	70.1	65.6	/	/	/	/	/				

	1 # 3 #					0.5m								level of vibration reduction measures			
64	Nanyang Road, No. 46）	K06+429～K06+500	11	Left	House	Outdoor 0.5m	69.3	65.6	/	/	/	/	/				
65	Nanyang Road, No. 41 courtyard, 5 # Building	K06+517～K06+548	9	Left	House	Outdoor 0.5m	74.0	65.6	47.6	4.0	7.0	2.6	5.6	Steel springs, floating slab,or The same level of vibration reduction measures	K6+467 ～ K6+598	131	196.5
65	Nanyang Road, No. 41 courtyard, 5 # Building	K06+517～K06+548	9	Left	House	Indoor	74.0	65.6	47.6	/	2.0	2.6	5.6				
66	Taiji Kindergarten, Beijia Education	K06+550～K06+590	6	Left	School	Outdoor 0.5m	70.8	65.6	41.3	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K6+598 ～ K7+123	525	262.5
66	Taiji Kindergarten, Beijia Education	K06+550～K06+590	6	Left	School	Indoor	70.8	65.6	41.3	/	/	/	/				
67	Huafu Institute of Dermatology,	K06+613～K06+679	10	Left	institution	Outdoor 0.5m	73.8	65.6	47.3	/	1.8	2.3	5.3				
67	Huafu Institute of Dermatology,	K06+613～K06+679	10	Left	institution	Indoor	73.8	65.7	47.3	/	1.8	2.3	5.3				
68	City No. 71 high school	K06+690～K06+762	11	Left	School	Outdoor 0.5m	71.4	66.1	/	/	/	/	/				
69	The 2nd Hospital, Zhengzhou University	K06+825～K06+878	23	Left	Hospital	Outdoor 0.5m	69.8	66.1	/	/	/	/	/				
70	Zhengzhou Textile staff apartments, 29 #, 30 # Building	K06+900～K07+073	14	Left	House	Outdoor 0.5m	69.8	66.2	/	/	/	/	/				
71	Zhengzhou Textile staff apartments, 18 # to 20 # buildings	K07+000～K07+100	37	Left	House	Outdoor 0.5m	63.9	66.3	/	/	/	/	/				
72	Small Yuzhai (Nanyang Road courtyard 266--279)	K05+753～K06+085	15	Right	House	Outdoor 0.5m	69.5	66.3	/	/	/	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K5+703 ～ K6+050	347	173.5
73	Pearl Factory, family member courtyard, 1 #, 2 #, 3 # Building (Nanyang Road 275)	K06+100～K06+180	9	Right	House	Outdoor 0.5m	75.6	66.3	49.1	0.6	3.6	4.1	7.1	Steel springs, floating slab,or The same level of	K6+050 ～ K6+355	305	457.5
73	Pearl Factory, family member	K06+100～K06+180	9	Right	House	Indoor	75.6	66.4	49.1	0.6	3.6	4.1	7.1				

	courtyard, 1 #, 2 #, 3 # Building (Nanyang Road 275)													vibration reduction measures			
74	Nanyang Road, No. 283 Courtyard	K06+260～K06+305	13	Right	House	Outdoor 0.5m	74.4	66.4	/	4.4	7.4	/	/				
75	Municipal Corporation family member courtyard (Nanyang Road No. 289 courtyard), 1 #, 2 #, 3 #, 4 # Building	K06+455～K06+511	36	Right	House	Outdoor 0.5m	66.6	66.5	/	/	/	/	/				
76	Hengtian Heavy Industry Co., Ltd family area	K06+600～K06+975	14	Right	House	Outdoor 0.5m	72.4	66.5	/	/	0.4	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K6+598 ～ K7+170	572	286
77	Nanyang Road, No. 296 Courtyard, 1 #, 2 #, 3 #	K07+032～K07+168	15	Right	House	Outdoor 0.5m	67.7	66.5	/	/	0.7	/	/				
78	Zhengzhou Jianguo Medicine Institute	K07+280～K07+400	15	Left	Hospital	Outdoor 0.5m	69.7	66.5	/	/	/	/	/				
79	Nanyang Road branch of Shiyan Kindergarten, Zhengzhou	K07+280～K07+400	54	Left	School	室外 0.6m	61.5	66.6	/	/	/	/	/				
80	Buildings 6#, 5#, 4#, and Buildings 3# and 2# in the south of Community of Zhengzhou Textile Machinery Co., Ltd.	K07+214～K07+696	15	Left	House	Outdoor 0.5m	72.2	66.6	/	/	0.2	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K7+164 ～ K7+780	616	616
81	Hongyihua Hong Kong City	K07+770～K07+900	20	Left	House	Outdoor 0.5m	65.6	66.7	/	/	/	/	/				
82	Nanyang Road No. 12 courtyard, 1 #, 2 # Building	K07+900～K08+150	10	Left	House	Outdoor 0.5m	71.9	66.7	45.4	1.9	4.9	0.4	3.4	Steel springs, floating slab,or The same level of vibration reduction measures	K7+850 ～ K8+350	500	750
82	Nanyang Road No. 12 courtyard, 1 #, 2 # Building	K07+900～K08+150	10	Left	House	Indoor	69.4	66.8	42.9	/	/	/	0.9				
83	Jinshui District Police Fire Brigade	K07+970～K08+010	14	Left	institution	Outdoor 0.5m	68.6	66.8	/	/	/	/	/				
84	Nanyang Road No. 8courtyard,	K08+110～K08+180	14	Left	House	Outdoor 0.5m	68.6	66.9	/	/	/	/	/				
85	Film Bureau, family member courtyard, 6 #, 7 # F (Nanyang	K08+190～K08+220	0	Left	House	Outdoor 0.5m	74.5	67.0	48.0	4.5	7.5	3.0	6.0				

	Road 7)）																
85	Film Bureau, family member courtyard, 6 #, 7 # F (Nanyang Road 7)）	K08+190～K08+220	0	Left	House	Indoor	74.5	67.0	48.0	/	2.5	3.0	6.0				
86	Zhengzhou City Library	K08+250～K08+300	5	Left	Library	Outdoor 0.5m	74.7	67.0	48.3	/	2.7	3.3	6.3				
86	Zhengzhou City Library	K08+250～K08+300	5	Left	Library	Indoor	74.7	67.1	48.3	/	2.7	3.3	6.3				
87	Garden community, (Nanyang Road 300) 5 # building	K07+220～K07+320	14	Right	House	Outdoor 0.5m	70.2	67.2	/	/	/	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K7+170 ～ K7+370	200	200
88	Zhongheng Garden	K07+420～K07+580	40	Right	House	Outdoor 0.5m	65.8	67.4	/	/	/	/	/				
89	Zhongheng	K07+710～K07+825	32	Right	House	Outdoor 0.5m	63.0	67.4	/	/	/	/	/				
90	Nanyang Road No. 309--314 courtyard,	K07+900～K08+020	8	Right	House	Outdoor 0.5m	72.0	67.4	45.5	/	/	0.5	3.5	Steel springs, floating slab,or The same level of vibration reduction measures	K7+780 ～ K8+070	290	435
90	Nanyang Road No. 309--314 courtyard,	K07+900～K08+020	8	Right	House	Indoor	72.0	67.4	45.5	/	/	0.5	3.5				
91	Zhongheng garden, 4 # to 10 #	K07+830～K07+950	27	Right	House	Outdoor 0.5m	68.0	67.5	/	/	/	/	/				
92	Qinghua Garden A, B, D, E Block	K08+136～K08+280	25	Right	House	Outdoor 0.5m	62.7	67.6	/	/	/	/	/				
93	Zhengzhou National Oil Reserve Depot, family member courtyard 1 # building	K08+290～K08+360	20	Right	House	Outdoor 0.5m	68.1	67.6	/	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K8+350 ～ K8+410	60	30
94	Jinshui Road, 11th courtyard, 1 # building	K08+485～K08+495	11	Left	House	Outdoor 0.5m	70.8	67.6	/	/	/	/	/	Flexible short sleeper and monolithic track bedb,or	K8+435 ～ K8+545	110	110

														The same level of vibration reduction measures			
95	Municipal Supply and Marketing Trading Corporation, family member courtyard, 1 #, 10 #, 11 # building	K08+985～K09+058	20	Left	House	Outdoor 0.5m	69.2	67.7	/	/	/	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K8+935 ～ K9+108	173	86.5
96	Minggong Road No. 67 courtyard, (Jinfeng Golden Coast International), 1 # Building	K09+158～K09+183	33	Left	House	Outdoor 0.5m	60.8	67.8	/	/	/	/	/				
97	Minggong Road, No. 139 Courtyard(Grain Bureau family member building)	K08+640～K08+690	6	Right	House	Outdoor 0.5m	72.6	67.8	46.1	/	0.6	1.1	4.1	Steel springs, floating slab,or The same level of vibration reduction measures	K8+590 ～ K9+150	560	840
97	Minggong Road, No. 139 Courtyard(Grain Bureau family member building)	K08+640～K08+690	6	Right	House	Indoor	72.6	67.8	46.1	/	0.6	1.1	4.1				
98	Minggong Road, No. 156 Courtyard, 1 #, 2 # Building	K08+920～K09+017	6	Right	House	Outdoor 0.5m	71.8	67.8	45.4	/	/	0.4	3.4				
98	Minggong Road, No. 156 Courtyard, 1 #, 2 # Building	K08+920～K09+017	6	Right	House	Indoor	71.8	67.8	45.4	/	/	0.4	3.4				
99	Jin Ming Yuan building and the building of South	K09+030～K09+100	4	Right	House	Outdoor 0.5m	72.0	67.9	44.6	/	0.0	/	2.6				
99	Jin Ming Yuan building and the building of South	K09+030～K09+100	4	Right	House	Indoor	72.0	67.9	44.6	/	0.0	/	2.6				
100	Huarun Yue House (under construction)	K09+245～K09+610	45	Left	House	Outdoor 0.5m	60.6	68.0	/	/	/	/	/				
101	Huigang New Town 1 #, 2 #, 3 # Building	K09+700～K09+860	0	Left	House	Outdoor 0.5m	70.4	68.0	40.9	/	/	/	/	Steel springs, floating slab,or The same level of vibration reduction measures	K9+650 ～ K10+109	459	688.5
101	Huigang New Town 1 #, 2 #, 3 # Building	K09+700～K09+860	0	Left	House	Indoor	70.4	68.2	40.9	/	/	/	/				
102	Small building mosques	K10+000～K10+059	6	Left	Religion	Outdoor 0.5m	68.2	68.2	41.7	/	/	/	/				
102	Small building mosques	K10+000～K10+059	6	Left	Religion	Indoor	68.2	68.4	41.7	/	/	/	/				
103	West Cai district, (Ming Gong	K09+275～K09+315	0	Right	House	Outdoor	74.8	68.4	48.4	/	2.8	3.4	6.4	Steel springs,	K9+225 ～	544	816

	Road No. 240 Courtyard) 1 #					0.5m											
103	West Cai district, (Ming Gong Road No. 240 Courtyard) 1 #	K09+275～K09+315	0	Right	House	Indoor	74.8	68.4	48.4	/	2.8	3.4	6.4	floating slab,or The same level of vibration reduction measures	K9+769		
103	West Cai district, (Ming Gong Road, No. 240 Courtyard), 2 #, 3 # Building	K09+275～K09+315	16	Right	House	Outdoor 0.5m	69.3	68.4	/	/	/	/	/				
104	Courtyard No. 85 West Front Street, 1 # Building (Ming Gong Road, No. 245 Courtyard)	K09+325～K09+410	9	Right	House	Outdoor 0.5m	71.4	68.4	44.9	/	/	/	2.9				
104	Courtyard No. 85 West Front Street, 1 # Building (Ming Gong Road, No. 245 Courtyard)	K09+325～K09+410	9	Right	House	Indoor	71.4	68.4	44.9	/	/	/	2.9				
106	Ming Gong Road No. 272, (Rural Credit Cooperative Union, family member building)	K09+545～K09+608	0	Right	House	Outdoor 0.5m	75.6	68.6	49.2	0.6	3.6	4.2	7.2				
106	Ming Gong Road No. 272, (Rural Credit Cooperative Union, family member building)	K09+545～K09+608	0	Right	House	Indoor	75.6	68.7	49.2	0.6	3.6	4.2	7.2				
107	Yalong district, 17 # Building	K09+638～K09+674	0	Right	House	Outdoor 0.5m	75.1	68.8	48.7	0.1	3.1	3.7	6.7				
107	Yalong district, 17 # Building	K09+638～K09+674	0	Right	House	Indoor	75.1	68.8	48.7	0.1	3.1	3.7	6.7				
108	Yalong districtl 16 # Building, 1 #, 2 # Building	K09+638～K09+674	16	Right	House	Outdoor 0.5m	70.7	68.8	/	/	/	/	/				
109	Catholic Church	K09+687～K09+719	2	Right	Religion	Outdoor 0.5m	74.6	68.9	48.1	/	2.6	3.1	6.1				
109	Catholic Church	K09+687～K09+719	2	Right	Religion	Indoor	74.6	68.9	48.1	/	2.6	3.1	6.1				
110	Jiefang Road Elementary School	K09+719～K09+750	42	Right	School	Outdoor 0.5m	65.1	69.0	/	/	/	/	/				
111	Shangfuxin Village House 1#	K10+510～K10+614	6	Left	House	Outdoor 0.5m	68.6	69.0	39.1	/	/	/	/	Steel springs, floating slab,or The same level of vibration reduction measures	K10+460 ～ K10+664	204	306
111	Shangfuxin Village House 1#	K10+510～K10+614	6	Left	House	Indoor	68.6	69.0	39.1	/	/	/	/				
111	Shangfuxin Village 2 #, 3#	K10+510～K10+614	41	Left	House	Outdoor 0.5m	61.3	69.0	/	/	/	/	/				
112	Fuchun Apartment 1 # building	K10+625～K10+779	15	Left	House	Outdoor 0.5m	70.0	69.0	/	/	/	/	/	Flexible short sleeper and monolithic track bedb,or	K10+664 ～ K10+829	165	82.5

														The same level of vibration reduction measures			
113	Huating Apartments, Dehua Street community 1 #, 2 # Building	K10+528～K10+614	15	Right	House	Outdoor 0.5m	66.8	69.0	/	/	/	/	/				
114	Jinding Huafu House, front 1 #	K10+630～K10+775	13	Right	House	Outdoor 0.5m	66.0	69.0	/	/	/	/	/				
114	Jinding Huafu House, rear	K10+630～K10+775	8	Right	House	Outdoor 0.5m	71.4	69.1	45.0	/	/	/	3.0	Steel springs, floating slab,or The same level of vibration reduction measures	K10+580 ～ K10+825	245	367.5
114	Jinding Huafu House, rear	K10+630～K10+775	8	Right	House	Indoor	71.4	69.1	45.0	/	/	/	3.0				
115	Modern XingYuan 1 #	K10+800～K10+873	23	Right	House	Outdoor 0.5m	63.2	69.2	/	/	/	/	/				
116	Hongxin Jia Yuan 1 # building	K10+915～K10+990	14	Left	House	Outdoor 0.5m	67.8	69.2	/	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K10+865 ～ K11+020	155	77.5
117	Xidan apartments, two buildings	K11+070～K11+151	8	Left	House	Outdoor 0.5m	69.3	69.3	41.9	/	/	/	/	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K11+020 ～ K11+201	181	181
117	Xidan apartments, two buildings	K11+070～K11+151	8	Left	House	Indoor	73.4	69.3	46.0	/	1.4	1.0	4.0				
118	West Street, No. 231	K11+250～K11+286	13	Left	House	Outdoor 0.5m	69.5	69.3	/	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent	K11+201 ～ K11+400	199	99.5
119	Zhongkai City Lights Clove Court, 1 #, Building	K11+380～K11+446	12	Left	House	Outdoor 0.5m	70.0	69.3	/	/	/	/	/				

														moderate shock-absorbing measures.			
120	Fuhua Building	K11+450～K11+550	8	Left	House	Outdoor 0.5m	71.7	69.3	42.1	/	/	/	0.1	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K11+400 ～ K11+600	200	200
120	Fuhua Building	K11+450～K11+550	8	Left	House	Indoor	72.2	69.4	42.5	/	0.2	/	0.5				
121	Zi Yan Huating 1 #, 2 # Building	K11+821～K11+917	23	Left	House	Outdoor 0.5m	63.2	69.4	/	/	/	/	/				
122	Ginza International	K10+956～K11+025	14	Right	House	Outdoor 0.5m	65.9	69.5	/	/	/	/	/				
123	233 West Main Street (the third secondary school, family member building)	K11+038～K11+100	11	Right	House	Outdoor 0.5m	66.8	69.5	/	/	/	/	/				
124	218 West Main Street	K11+168～K11+221	20	Right	House	Outdoor 0.5m	65.7	69.6	/	/	/	/	/				
125	Sun Moon Star City, 1 # building	K11+230～K11+300	14	Right	House	Outdoor 0.5m	65.2	69.6	/	/	/	/	/				
126	Zhongkai City Lights Clove Court, 1 #, 2 # Building	K11+328～K11+450	15	Right	House	Outdoor 0.5m	67.3	69.6	/	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K11+278 ～ K11+716	438	219
127	Tangzi Lane (Bo'ai Street Community)	K11+328～K11+666	38	Right	House	Outdoor 0.5m	63.7	69.6	/	/	/	/	/				
128	Changcheng City in City	K11+460～K11+666	13	Right	House	Outdoor 0.5m	67.6	69.7	/	/	/	/	/				
129	Yuhong Garden, 1 #, 2 #, 3 # Buildings	K11+675～K11+800	25	Right	House	Outdoor 0.5m	62.6	69.7	/	/	/	/	/				
130	Municipal Guancheng State Taxation office services hall	K11+929～K11+978	33	Left	institution	Outdoor 0.5m	62.8	69.7	/	/	/	/	/				
131	First People's Courtyard of Zhengzhou	K11+990～K12+055	22	Left	Hospital	Outdoor 0.5m	65.5	69.8	/	/	/	/	/		/ /		
132	Guancheng District Education Center	K12+133～K12+211	21	Left	institution	Outdoor 0.5m	65.9	70.1	/	/	/	/	/				
133	Zhigong Road, Building 1	K12+230～K12+335	18	Left	House	Outdoor 0.5m	71.2	70.1	/	/	/	/	/	Steel springs, floating	K12+180 ～ K12+450	270	405

														slab,or The same level of vibration reduction measures			
134	Residential community of Zhengzhou Electric Power College	K12+400～K12+500	43	Left	House	Outdoor 0.5m	65.6	70.2	/	/	/	/	/				
135	220 East Main Street	K11+978～K12+105	10	Right	House	Outdoor 0.5m	69.1	70.2	42.6	/	/	/	0.6	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K11+928 ～ K12+083	155	77.5
135	220 East Main Street	K11+978～K12+105	10	Right	House	Indoor	69.1	70.2	42.6	/	/	/	0.6				
136	Mall Village, (248 East Main Street courtyard)	K12+000～K12+500	28	Right	House	Outdoor 0.5m	68.5	70.2	/	/	/	/	/				
137	Zhongkai City Lights Guangjingcui Court, 1 #, 2 # Building	K12+133～K12+366	8	Right	House	Outdoor 0.5m	72.3	70.3	44.8	/	0.3	/	2.8	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K12+083 ～ K12+450	367	367
137	Zhongkai City Lights Guangjingcui Court, 1 #, 2 # Building	K12+133～K12+366	8	Right	House	Indoor	72.3	70.4	44.8	/	0.3	/	2.8				
138	East Main Street, No. 1 Court, Building 2	K12+550～K12+600	38	Right	House	Outdoor 0.5m	61.1	70.4	/	/	/	/	/				
139	Dolidongguan96,1#	K12+716～K12+830	11	Left	House	Outdoor 0.5m	68.6	70.4	/	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K12+666 ～ K12+880	214	107
139	Dolidongguan96,2#	K12+716～K12+830	32	Left	House	Outdoor 0.5m	64.3	70.4	/	/	/	/	/				
140	Knitting mill family member courtyard, 1 # building	K12+992～K13+072	12	Left	House	Outdoor 0.5m	72.5	70.4	/	/	0.5	/	/	Flexible short sleeper and monolithic track bedb,or The same	K12+942 ～ K13+458	516	516
140	Knitting mill family member courtyard, 2 # Building	K12+992～K13+072	32	Left	House	Outdoor 0.5m	68.4	70.4	/	/	/	/	/				
141	Yutong Garden Building 1#	K13+076～K13+226	12	Left	House	Outdoor	73.1	70.7	/	/	1.1	/	/				

						0.5m										
141	Yutong Garden Building 2#	K13+076～K13+226	36	Left	House	Outdoor 0.5m	67.8	70.8	/	/	/	/	/	level of vibration reduction measures			
142	Municipal underwear factory family member courtyard, 1 #, 2 #, 3 # Building	K13+230～K13+408	14	Left	House	Outdoor 0.5m	73.4	70.8	/	/	1.4	/	/				
142	Municipal underwear factory, family member courtyard, 5 #, 4 # Building	K13+230～K13+408	34	Left	House	Outdoor 0.5m	68.5	70.8	/	/	/	/	/				
143	Zheng Bian Road, Building 60,	K13+414～K13+473	28	Left	House	Outdoor 0.5m	65.8	70.8	/	/	/	/	/				
144	Zheng Bian Road, Building 23,	K12+820～K12+857	7	Right	House	Outdoor 0.5m	67.2	71.0	39.7	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K12+770 ～ K12+907	137	68.5
144	Zheng Bian Road, Building 23,	K12+820～K12+857	7	Right	House	Indoor	67.2	71.0	39.7	/	/	/	/				
145	Great Wall Cambridge Garden	K13+038～K13+091	21	Right	House	Outdoor 0.5m	66.9	71.2	/	/	/	/	/				
146	Cargo Terminal No. 23 North Street Courtyard, 1 #, (Phoenix Road Community)	K13+158～K13+180	18	Right	House	Outdoor 0.5m	70.0	71.4	/	/	/	/	/	adopt GJ-III vibration reduction fasteners or equivalent moderate shock-absorbing measures.	K13+108 ～ K13+282	174	87
146	Cargo Terminal No. 23 North Street Courtyard, 3 #, (Phoenix Road Community)	K13+180～K13+225	18	Right	House	Outdoor 0.5m	68.0	71.4	/	/	/	/	/				
147	Langui district 1 # Building	K13+230～K13+325	16	Right	House	Outdoor 0.5m	68.6	71.4	/	/	/	/	/				
148	Boai ENT Hospital of Zhengzhou	K13+332～K13+390	9	Right	Hospital	Outdoor 0.5m	72.6	71.4	45.2	/	0.6	0.2	3.2	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K13+282 ～ K13+700	418	418
148	Boai ENT Hospital of Zhengzhou	K13+332～K13+390	9	Right	Hospital	Indoor	72.6	71.5	45.2	/	0.6	0.2	3.2				
149	Zheng Bian Road, No. 49, family member courtyard, 1 # Building	K13+398～K13+430	13	Right	House	Outdoor 0.5m	73.7	71.5	/	/	1.7	/	/				
150	Dongming Road 30 Courtyard, (electric power district), 1 #, 2 # Building	K13+512～K13+650	9	Right	House	Outdoor 0.5m	73.2	71.6	45.7	/	1.2	0.7	3.7				
150	Dongming Road 30 courtyard (electric power district), 3 #, 4 # Building	K13+512～K13+650	9	Right	House	Indoor	73.2	71.6	45.7	/	1.2	0.7	3.7				
150	Zhengzhou Huimin High School	K13+512～K13+650	45	Right	House	Outdoor	64.5	71.6	/	/	/	/	/				

						0.5m										
151	Zhengzhou City Public Security Bureau Police Detachment	K14+686～K14+769	47	Left	School	Outdoor 0.5m	60.1	71.7	/	/	/	/	/			
152	Henan Provincial People's Procuratorate	K14+793～K14+942	27	Left	institution	Outdoor 0.5m	62.2	71.7	/	/	/	/	/			
153	Dongming Road 30 Courtyard, (electric power district), 1 #, 2 # Building	K14+942～K15+052	26	Left	institution	Outdoor 0.5m	66.2	71.7	/	/	/	/	/			
154	Yingxie Garden 1 #, 2 # Building	K15+194～K15+485	55	Left	House	Outdoor 0.5m	60.6	71.8	/	/	/	/	/			
155	District under construction 1 #, 2 # Building	K16+878～K17+052	54	Left	House	Outdoor 0.5m	59.4	71.8	/	/	/	/	/			
156	Henan Zhongdu Dermatology Hospital	K17+147～K17+199	24	Left	Hospital	Outdoor 0.5m	66.2	72.1	/	/	/	/	/			
157	Guancheng Traditional Chinese Medicine Hospital	K17+206～K17+266	10	Left	Hospital	Outdoor 0.5m	71.0	72.1	43.6	/	/	/	1.6	Flexible short sleeper and monolithic track bedb,or The same level of vibration reduction measures	K17+156 ～ K17+316	160	160
157	Guancheng Traditional Chinese Medicine Hospital	K17+206～K17+266	10	Left	Hospital	Indoor	71.0	72.6	43.6	/	/	/	1.6				
158	Caixin Triana district, 1 #, 2 #, 3 #, 4 # Building	K17+390～K17+766	51	Right	House	Outdoor 0.5m	59.9	72.6	/	/	/	/	/			
159	Zhengshang Eastern Harbour, 1 #, 2 # Building	K19+152～K19+300	56	Left	House	Outdoor 0.5m	60.7	72.6	/	/	/	/	/			
160	Sinosun New World	K20+320～K20+680	60	Left	House	室外 0.6m	60.7	72.6	/	/	/	/	/			
161	Dongyinggang Village	K24+300～K24+800	0	Left and Right	House	Outdoor 0.5m	80.7	77.7	56.2	5.7	8.7	11.2	14.2	Steel springs, floating slab,or The same level of vibration reduction measures	K24+250 ～ K24+850	1200	1800
161	Dongyinggang Village	K24+300～K24+800	0	Left and Right	House	Indoor	80.7	77.7	56.2	5.7	8.7	11.2	14.2				

Table 11.6-2g List for vibration control measures for cultural relics sensitive spots

No.	Target to be protected	Mileage	District where it is located	Position relative to the line	Line type	Current value of vibration speed (mm/s)	Predicted value of vibration speed (mm/s)	Exceedance	Measures	Extend 50 from both ends		Length (m)	Investment (× 10^4RMB)
										Start	end		
1	Shanhaimomuduha Tomb	K09+900～K09+930	Jinshui District	Left	Underground	0.08	2.019858	1.57	Steel springs, floating slab,or The same level of vibration reduction measures	9850	9980	130	195
2	2/7 Strike Monument	K10+317～K10+348	Erqi district	Right	Underground	0.09	1.333207	1.18		10267	10398	131	196.5
3	Zhengzhou Confucius Temple	K12+340～K12+400	Guancheng Hui-ethnic district	Left	Underground	0.08	1.226718	0.96		12290	12450	160	240
4	Shang-dynasty relic, Zhegnzhou	K12+500～K12+580	Ditto	Both left and right	Underground	0.08	/	0.00		12450	12630	180	270

4 Environmental Monitoring

4.1 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.

4.2 Monitoring Plan

According to the engineering characteristics of various projects, phased environmental monitoring plans will be formulated for the construction period and operational period. See Table 4.1

Table 4-1 List of the Environmental Protection Monitoring Plan for Phase I Project of the Zhengzhou Rail Transit Line3 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	Building 1 of Yuhua ninth city,Huiji District Changxing Road Subdistrict Office, Changxing Road 2# Yard 13#, 10# buildin, Baiwen Garden 1#, 2#, 6#, 7# building, Chengshi Bei'an Community 1# building, Huarun Chengshi Zhiyin (Xinyu Yayuan) Community 1#, 5# building, City bus company, family member courtyard, Projects under construction (Chang Jian.Yufeng), Fun district, Northern District, fun district building 1#、2#、3#、4#、5#, Zhengzhou Huimin High School and Dongyinggang Village so on.	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)	60	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 senstivie points ,and same as above(Ambient air)	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	65	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
	Vibration	Dept construction site and surrounding sensitive points and sensitive points the project line runs under(represented by Fuwa beauty area, Building 3, Building 1, Film Bureau Family Area 2# building, Tingdao Foreign Language training, Minggong Road 240# Yard)2#, 3# building, Minggong Road N0.245 (Xiqian Street 85# Yard 1#, 2# building), Guancheng Traditional Chinese Medicine Hospital and Dongyinggang Village so on.	Vibration level	Monitor once every monthduring 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	20	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)
		Memorial Tower for February 7th Strike, Zhengzhou Confucius Temple，Zhengzhou Shang Dynasty Ruins	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	10	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 Water	Surrounding buildings of the base pit at the station, sensitive points the project runs under	Ground settlement	Rainfall period during construction, 1 time every day	60	Professional testing organ	Project Owner	Municipal and district environmental	/

Stage	Monitoring Objects		Monitoring Sites	Monitoring Items	Frequency	Total Expense (RMB10,000)	Monitoring Organ	Responsible Organization	Supervisory Organ	Executive Standards and Norms
			Station and sections constructed with open digging	Underground water level	Rainfall period during construction, 1 time every day				protection bureau	/
			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（Building 1 of Yuhua ninth city，Hualian family member courtyard’s, Buildings 4，Cityorth Shore District, 1 # ,4#building，City bus company, family member courtyard 2#，Projects under construction (Chang Jian.Yufeng)，and Nanyang Road, No. 219 Courtyard4#,6# Sunshine Holiday district, 3 #, 2 # Building so on	Equivalent sound level A	2 time in the first year,; 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	“Quality Standards for Sound Environment” GB3096-2008 and “Discharge Standard for Environmental Noise in Factory Area of Industrial Enterprise” GB12348-2008
	Vibration		New Hope Ao Garden, 17 #, 3 #，Fuwa beauty area, Building 3, Building 1，Taili community, Building 1, Hongda district, 11 #, 10 #, 9 #, 5 # Buildinsg，Huiji District, Changxing Road, Street office，Changxing Road, No. 2 Courtyard and Dongyinggang Village so on.	Vibration level	2 time in the first year,; 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	“Measurement Methods for Urban Environmental Vibration”(GB10071-88)
			Memorial Tower for February 7th Strike, Zhengzhou Confucius Temple，Zhengzhou Shang Dynasty Ruins	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		The main substation field	Power frequenxcy electromagnetic field, strong radio interference field	1 time in the first 3 years, 1 hour per time	5				

5 Estimation of Environmental Protection Expenses and Analysis of Econoic Profit and Losses

5.1 Estimation of Environmental Protection Expesnes

The total environmental protection investement listed for rail transit line 3 of Zhengzhou City is 225419000yuan. See Table 5-1 for summary table of project environmental protection measures and investment:

Table 5-1 Summary Table for Estimated Envrionmental Protection Investment

environmental elements	content of measures	investment estimation (10,000 yuan)
Noise	Ventilation kiosk silencers at 16 ventilation kiosk areas are extended from 2m to 3m or 4m in length.	240
	3 cooling towers adopt ultra-low noise cross-flow type.	90
	3 cooling towers adopt low noise cross-flow type.	100
	Jialu River Parking Lot is surrounded by enclosing walls (high enclosing wall at west) and green belt with width of 10m.	60.9
	The car depot on East Hanghai Road is set with acoustic barrier with height of 2m.	135
	Temporary sound insulation measures during construction period.	225
	Subtotal	850.9
Vibration	For three cultural relics protection units of Shanhaimomuduha Tomb ,Zhengzhou Memorial Tower for February 7th Strike, Zhengzhou Confucius Temple and Zhengzhou Shang Dynasty Relics 4 along both sides of the line in this project, set the steel spring floating slab ballast beds or equivalent moderate shock-absorbing measures., totaling 780m at both sides and requiring 1.95million yuan investment.	195
	For 38 over-limit sensitive spots where the line passes just through (in 5m range from the outer rail center line just above track) such as school, hospital and residence areas, including RCC family member courtyard (Gadameilin district) so on, arrange the steel spring floating slab integral	10578

environmental elements	content of measures	investment estimation (10,000 yuan)
	ballast beds, totaling 7052m at both sides and requiring investment of 105.78 million yuan..	
	For 45 over-limit sensitive spots within 10--15m range mainly including City bus company, family member courtyard, and Tianxiu courtyard so on, use the flexible support block type integral ballast bed or equivalent moderate shock-absorbing measures, totaling 8753m for double line and the investment of 87.53 million yuan..	8753
	For the environment sensitive spot with over-limit environment vibration VLz10, or VLz10 is qualified, but VLzmax exceeds the standard environment requirements, including 28 locations of Peaceful residential homes, Building 8 and so on,, use type III vibration reduction fasteners or equivalent moderate shock-absorbing measures, totaling for 5239mm and investment of 17.45 million yuan..	1745
	Subtotal	21271
Water environment	Charges for sewage treatment during construction period	50
Electromagnetic environment	It is suggested to rationally arrange land for main transformer station and rationally plan surrounding land of the main transformer station to make enclosing walls of main transformer station at least 15m from residential areas.	/
Environmental monitoring fees during construction period	Monitoring for noise, vibration, water, air, groundwater level and sedimentation etc.	275
Environmental monitoring fees during operational period	Monitoring for noise, vibration, water and electromagnetism etc.	90 (each year)
Total investment (excluding investment for monitoring during operational period)		22541.9

5.2 Analysis of Economic Gains and Lossed 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.

5.2.1Means 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 Evironmental 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 总=(B 措-K)+B 工–L 前:

As shown in the formula：B 总: Net benefits of environmental protection investment;

B 措: Environmental economic benefits produced by environmental protection investment;

K : Environmental protection investment and expenses;

B 工: Environmenal and economic benefits due to environmental impacts of the project;

L 前: Environmental and economic lossed 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 总=(B 措+B 工–L 前)/K

In case E 总≥1, it shows that the environmental economic benefits of the project are larger than the environmental protection expenses, and the project is accpetab le. In case E 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 总 is, the better effect of environmental protection investment will be.

(1) 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.

5.2.2 Analysis of Economic Gains an 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 前

(1) Environmental economic losses caused by noise: L 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 coefficiency for environmental and economic lossed 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 10101 persons will be influenced by the noise of the project, and L 前声 is 27.87 million yuan per year.

(2) Environmental economic losses(L 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 310,000 yuan per year as the sewage discharge expenses. Thus L 前水 is 310,000 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=28.18 Million yuan per year

(III) Investment on Environmental Protection K

The investment on environmental protection of the project is 225419000 yuan, which will be amortized over 4.25 years. Thus K is 53039764 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 27.87 million yuan per year.

(1) 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 50,000 yuan per year shall be paid after sewage treatment through calculation, and 310,000 yuan per year shall be paid before sewage treatment. Thus the environmental economic benefits produced through treatment of water pollution(B 措水) is 260,000 yuan per year.

(1) Total environmental economic losses produced by investment on environmental protection(B 措):

B 措= B 措声 + B 措房 + B 措水 =28.13 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 Zhengzhou City.

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

To compare the environmental economic losses casued 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 traffil route will be larger than that of subway, and is estimated to be 104,000. 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 路声) is 406.55 million yuan per year through calculation.

The environmental economic benefits(B 工声) caused by noise pollution in the two ways is B 工声= L 路声- L 后声=406.55 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 工气=47.83 Million yuan per Year.

(3)Total environmental economic benefits(B 工) due to engineering environmental impacts:

B 工= B 工声 + B 工气 =454.38 Million yuan Per Year

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

(1) In case B 总 is larger than 0, it shows the environmental impacts of the project are mainly beneficial.

Net benefits from envrionemental protection investment B 总=(B 措-K)+B 工-L 前 =397,610,000 yuan per year.

(2) Environmental protection investment efficiency E 总=(B 措+B 工-L 前)/K=8.01

E 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 225419000 yuan, and the estimated total investment of the project is 197699790000 yuan, thus the environmental protection investment/capital construction investment is 1.14%, which is similar to that of the environmental protection investment of similar domestic project. Thus the environmental protection investment is rational.

5 .3Conclusion:

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 Sources of funds

According to the current financial strength of Zhengzhou, the capital of Zhengzhou

rail transit Line 3 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 Zhengzhou 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 zhenghzou rail transit Line 3 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.