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Preface

(1) Origin of project and construction background

In December 2007, the State Council formally approved Wuhan city circle to be the "pilot area of comprehensive supporting reforms of national construction of resource-saving and environment-friendly society". The construction goal of Wuhan city circle is to make the whole city circle vigorous, convenient, safe and ecological. To achieve the goal, integrated construction of the city circle should be promoted and six integration processes should be accelerated, namely the integration of infrastructures, industrial distribution, regional markets, urban and rural construction, ecological and environmental protection and public services.

Anlu City is located in the northwest of Wuhan city circle and is called the throat of the north of Hubei. With continuous advance of integrated construction of Wuhan city circle, the transfer of personnel, physical distribution and information exchange among Anlu and Xiaogan, Wuhan and other cities in the city circle have become more frequent. In order to support industrialization and integrated development of the area, improvement of traffic environments in Anlu and Wuhan has become the priority of urban development at present. Therefore, "urban transport infrastructure subproject in Anlu, Xiaogan" of "traffic integration demonstration project of Wuhan city circle supported by World Bank loan" has been put forward to develop the integration of hardware and software facilities in Anlu and Wuhan and to be the demonstration of traffic integration in Wuhan city circle.

With development of the city, the external traffic volume of Anlu has continuously increased and stricter requirements have been put forward by further regional integration of Anlu, Wuhan, Xiaogan and Yunmeng for regional traffic integration. The current urban spatial form and scale in Anlu is suitable for slow traffic. Energetically promoting and developing slow traffic plays an active role in construction of a resource-saving and environment-friendly city.

The public facilities in Anlu gather in the core area of the old city, while people are mainly distributed in the east of the core area; the infrastructure provision of road network in core area cannot meet traffic demand and the access road of core area is seriously jammed during peak period; the supporting facilities of public transport in Anlu are insufficient, the service mechanism is unsound and the service level is low, production and living needs of residents cannot be met and illegal passenger transport affects normal order of passenger transport in the city and safety of traffic participants; in addition, there is no special public parking lot in Anlu at present, while curb parking prevails; the parking space arranged in core area causes reduction of road capacity and traffic jam is easy to occur during peak period; on the other hand, curb parking occupies the space of non-motor vehicle lane and the traffic on motor and non-vehicle lanes is seriously disordered, reducing the security of road traffic.

Anlu meets the prerequisite of sustainable development, but has many traffic problems such as imperfect road network, insufficient traffic facilities, low development level of public transport system and out-dated road safety management facility. Therefore, the urban transport infrastructure subproject in Anlu, Xiaogan plans to start with road network improvement in downtown, integrated improvement of existing main traffic corridors and enhancement of service ability of public transport and level of road safety management facility to mitigate current traffic problems and play a demonstrative role in future construction of transport infrastructure.

(2) Necessity of construction

①Need of elimination of absolute poverty and promotion of common prosperity

“Elimination of absolute poverty and promotion of common prosperity” are the construction goals of World Bank loan project. The Project will closely center on reduction of transportation expense of low-income group (for example, by improving public transport convenience and preferential ticket price for public transport transfer), enhance road safety to reduce travel risks of vulnerable groups and create a excellent slow traffic system for travel convenience of vulnerable groups through project construction of integrated traffic corridor and road network improvement, supporting facility of public transport system, road safety and slow traffic system, and promote good development of society and economy in Anlu through improvement of road network in downtown to fit with future urban development. The implementation of the Project will benefit 172,200 people in downtown and even 642,500 people in the city and is significant for “elimination of absolute poverty and promotion of common prosperity”.

②Need of implementation of national public transport priority strategy

The travel modes of residents in Anlu are typical in the region and are mainly private traffic modes led by motorcycle and electric bicycle and the public transport is in early stage. Taking “push and pull” measures at initial development stage of mechanization, namely increasing input in public transport facilities (station, vehicle, hub), strengthening construction of intelligent public transport system and enhancing competitive power of public transport, is of demonstrative significance for implementation of national public transport priority strategy.

The project construction is the demonstration of public transport priority in Wuhan city circle and of significance for implementation of national public transport priority strategy, guidance on optimization of travel modes of residents in small and medium-sized cities and construction of “resource-saving and environment-friendly” society in Wuhan city circle.

③Need of traffic integration construction in Wuhan city circle

According to the planning of Wuhan city circle, Anlu is an important component of the main development axis of Beijing-Guangzhou line and Wuhan-Danjiangkou line among three major development axes in the city circle. The industrial axis is led by autos and auto parts, electronics, chemical industry, textile, building materials and metal products, matching with the present competitive industries. Anlu is also the major component of high-quality bee product base of two counties and cities in west of Wuhan city circle. The base is one of the eight excellent and special agricultural product manufacturing and processing bases mainly developed in the city circle.

The traffic connection is planned to be realized by uniform standards for traffic sign, language and IC card system for public transport. Seamless joint between external traffic of railways and highways connecting Anlu and other cities in the city circle and public transport in downtown will be strengthened to promote integrated traffic connection in downtown of Anlu and the city circle. The seamless joint will also be realized by township road passenger transport, urban public transport, external railway and highway traffic to extend the integration to the whole Anlu City, realize chained traffic integration of “central city in the city circle, nodal city in the city circle and villages” and play a demonstrative role in supporting construction of strong hinterland of Wuhan city circle.

④Need of implementation of urban master planning

Pursuant to the requirements of Xiaogan urban system planning and Anlu overall planning, Anlu will develop into a medium-sized city with over 300,000 people. The Project expands urban space of Anlu, provides public transport service for new area in the city and leads Anlu to healthily and orderly develop from a small city to a medium-sized city through construction of road network system framework and public transport system and meets the need of implementation of Xiaogan urban system planning and Anlu overall planning.

The Project focuses on public transport service, slow traffic facility and road safety facility, plays a good demonstrative role in driving transformation and development of urban traffic in Anlu and indicates the development direction of urban comprehensive traffic system to realize the urban development goal of "a livable, civilized and happy city strong in industry and famous for tourism" put forward in urban master planning of Anlu.

To sum up, construction of the Project is necessary and urgent.

(3) Construction contents

The Project includes five subprojects: improvement project of integrated traffic corridor and road network, supporting facility project of public transport system, road safety project, slow traffic system improvement and institution building and technical assistance. The related construction contents are as follows:

The integrated traffic corridor project includes 4.49km expanded road, 20.36km reconstructed road and 4.29km new road and the specific construction contents are shown in Table 1;

Table 1 – Overview of Improvement Project of Integrated Traffic Corridor and Road Network

No.	Road name	Starting point	Ending point	Design speed (km/h)	Road grade	Length (km)	Width of red line (m)	Project contents
1	Taibai Road	Yinxing Avenue	Jiangxia Avenue	50	Urban arterial road	4.49	60	Reconstruction in the red line, not involving land acquisition. The reconstruction contents include: reconstruction engineering, building road traffic

								safety facilities.
2	Biyun Road	Yunshui Road	New G316	40	Urban sub-arterial road	6.13	24~52	Reconstruction in the red line, not involving land acquisition. The reconstruction contents include: paving asphalt on the pavement by sections, increasing guardrail, improving water drainage, greening, road traffic safety facilities, etc.
3	Jiefang Avenue	Fuhe Avenue	Jinqiu Avenue	50	Urban arterial road	3.34	43~53	Reconstruction in the red line, not involving land acquisition. The reconstruction contents include: paving asphalt on the pavement by sections, increasing

								guardrail, improving water drainage, greening, road traffic safety facilities, etc.
4	Jinqiu Avenue	Yinxing Avenue	Biyun Road	40	Urban sub-arterial road	4.46	60	Reconstruction in the red line, not involving land acquisition. The reconstruction contents include: paving asphalt on the lane, improving public transport and slow-moving system and other supporting facilities.
5	Yinxing Avenue	Fucheng Avenue	New G316	50	Urban arterial road	4.49	40	Reconstruction in the red line, not involving land acquisition. The construction contents include: expanding according to 40m red

								line on the basis of existing section width and reconstructing highway to urban sub-arterial road.
6	Zhanqian Road	Anlu-Beijing line (Extended line of Jiefang Avenue)	Connecting line of the Third Bridge (Hengyi Road)	40	Urban sub-arterial road	2.10	40	The newly-built road connects Anlu West Railway Station of interurban railway, with overall length of 2.10km and width of red line of 40m
7	Fucheng Avenue	Yinxing Avenue	Jiefang Avenue	40	Urban sub-arterial road	2.19	40	Overall length of the newly-built road is 2.10km with width of red line of 40m.

The supporting facility project of public transport system includes 3 public transport hubs, 1 small public transport hub, 2 public transport hubs+ highway passenger terminals, e-card system for public transport, intelligent public transport system and purchase of a batch of buses and the specific construction contents are shown in Table 2;

Road safety project includes equipment and system construction of command center, self-adaptive traffic signal control system, video monitoring system for traffic, electronic police system and traffic safety publicity and education;

Slow traffic system improvement project is mainly to improve slow traffic in the area enclosed by Wuhan-Danjiangkou Railway, Jiefang Avenue and Fuhe Avenue. The slow traffic facilities of existing branches and public roads in the enclosed area in old downtown will be improved. The construction contents mainly include reconstruction of special roads for slow traffic in old downtown, improvement of slow traffic sign and marking system, construction of non-motor vehicle parking facility and improvement of railway passage for slow traffic. The specific construction contents of slow traffic system improvement project are as follows:

Pave and repair sidewalks for Shuanglongqiao First Road and Third Road, Zhongshan Street, Upper and Lower Yushi Street, Wuyicun First Lane and improve pedestrian space; transform the nodal stairs in 5 streets and lanes including those in Fenghuang West District, near Shuanglong Bridge and Wenchang Road into gentle slopes for barrier-free access of non-motor vehicles.

Break through the cul-de-sacs such as Lower Yushi Street and Wuyicun First Lane, construct a road connecting with Handan West Road for slow traffic, connect sidewalk with surrounding streets and lanes and enhance the connectivity of sidewalk.

Set up 7 road humps at the gates of hospitals and schools including Anlu No. 2 Hospital, Experimental Middle School, Experimental Primary School, De'an Middle School, Zijinlu Primary School, Yong'an Shopping Mall and New Century Kindergarten to reduce the traveling speed of vehicles and guarantee the safety of students and patients; optimize the crossing facilities at 13 intersections including those between Fenghuang Road and Fuhe Avenue, De'an Road, Handan Road and Wenchang Road, between De'an Road and Handan Road, between Zijin Road and Fuhe Avenue, between De'an Road and Ruxue Road, between De'an Road and Zijin Road and between Wenchang Road and Handan Road to reduce the traveling speed of vehicles and guarantee the safety of disadvantaged groups; repair the special bridge for slow traffic in Wuyi Community to guarantee the safety of slow traffic.

Set up traffic guardrail or isolating pole on sections like Handan Road, Ruxue Road, Longmen Road, Zijin Road (Fuhe Avenue – De'an Road, Biyun Road – Zijin Road) and Wenchang Road to separate motor vehicles and non-motor vehicles and construct non-motor vehicle lane by isolation with marking for roads like De'an Road to guarantee continuous and safe traveling space of non-motor vehicles.

Set up parking facilities for non-motor vehicles in sidewalk facility zones of De'an Road, Handan Road, Longmen Road, Wenchang Road, Ruxue Road, Fenghuang Road, Biyun Road, Zijin Road and Jiefang Avenue; set up 9 public parking lots for non-motor vehicles in Riverside Park, Jiefang Middle School, Taibai Square, Yong'an Shopping Mall and other places where there is a large population.

Comprehensively improve slow traffic signs and markings from crossing and slow traffic sign and marking or direction system.

Institution building and technical assistance include institution operation, research on traffic strategy of Anlu, research on Anlu annual optimization and reorganization of bus routes, research on traffic characteristics of non-motor vehicles in Anlu, research on public bike system in Anlu and consultation service, investigation and training of World Bank project and technical management.

Table 2 Basic Information of Supporting Facility Project of Public Transport System

Name	Total covering area (m^2)	Construction contents
Public transport transfer hub at passenger terminal	7,490	Reconstruction and expansion within red line without newly increasing land; 40 parking spaces for public transportation; parking lot for non-motor vehicles accommodating 200 vehicles; furnished with 2-story public transportation supporting space and 1-story motor repair shop; build 10 motor vehicles and 21 non-motor vehicles.
Small public transport hub for arrival and dispatch at railway station	2,030	Reconstruction and expansion within red line without newly increasing land; set up 6 parking spaces for public transportation, passenger getting-on and getting-off platform for public transportation, 1 1-story public transportation dispatching space and 2 waiting areas.
Public transport transfer hub at short-distance bus station	10,600	Reconstruction and expansion within red line without newly increasing land; set up 50 (9m)+22 (6m) parking spaces for public transportation; reconstruct public transportation supporting space with original 2-story current ticket sales station house (including public transportation dispatching center), along with 5 motor vehicles for parking and 10 non-motor vehicles for parking; set up 1-story public transport motor repair shop; set up 1 100-parking-lot underground public parking lot.
Public transport transfer hub at long-distance bus station	7,280	Reconstruction and expansion within red line without newly increasing land; set up 30 (9m)+20 (6m) parking spaces for public transportation; set up 2 public transportation motor repair shops on one floor; reconstruct public transportation supporting space with original 2-story current ticket sales station house, along with 20 motor vehicles for parking and 10 non-motor vehicles for parking.
Qiliqiao Highway Passenger Terminal+ public transport transfer hub	16,410	New construction, land acquisition area of 16410 $m^{2;}$ highway passenger transportation center: passenger transport occupying an area of 9130 m^2, 64 parking spaces for passenger car, newly-built 3-story passenger transport center with total area of 6480 m^2, with public transportation supporting space of 750 m^2 and bus transfer hub: public transport hub occupying an area of 7280m^2, setting up 54 (9m)+22 (6m) bus parking spaces, setting up 2 public transport motor repair shops on one floor, with area of 180 m^2, newly built 3-story passenger transportation center including public transportation supporting space.
Highway passenger terminal at high-speed rail station+ public	5,000	New construction, land acquisition area of 5000 m^2; design as Class-III station of highway passenger transportation center and public transportation transfer hub.

transport transfer hub		

Slow-moving traffic system improvement subproject involves small quantities of civil engineering and environmental assessment will not analyze specific road. However, general mitigation measures in the environmental management plan will be applicable to all these activities involving civil engineering. The assessment will focus on two subprojects, "integration traffic corridor and road network improvement engineering" and "supporting facility engineering of public transport system".

(4) Procedure, requirement and progress of environmental impact assessment of World Bank loan project

World Bank divides the possible environmental impacts of construction of the Project into 3 classes A, B and C in the order of high degree to low degree and defines the Project as Class A project according to the characteristics. That is to say, a comprehensive environmental impact assessment of the Project should be conducted. For Class A project, the environmental impact assessment shall be completed pursuant to the following procedure and requirements:

①Preparation of environmental impact assessment program and online publicity;

②The first public consultation;

③Preparation of environmental impact report draft and environmental management plan and online publicity of report draft;

④The second public consultation;

⑤Preparation of a comprehensive environmental impact assessment report;

⑥Submission of environmental impact assessment report and environmental management plan 120 days before project review of the board of directors;

⑦Publicity of environmental impact assessment and environmental management plan on official website of World Bank for 120 days.

The environmental impact report and environmental management plan of the Project have been prepared pursuant to the requirements of both China and World Bank for environmental impact assessment and submitted to World Bank for internal review.

(5) Profile of preparations

On November 1, 2013, the experts and leaders of World Bank inspection team, Hubei Development and Reform Commission, Hubei Department of Finance, Xiaogan Development and

Reform Commission and Xiaogan Finance Bureau inspected the project site in Anlu and identified the Project;

On May 12, 2014, Hubei Development and Reform Commission gave an official reply to *Proposal for Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan*;

On May 19, 2014, the Developer formally entrusted us to conduct environmental impact assessment of the Project;

On June 4, 2014, we released the basic information of the Project on website of Hubei Environmental Protection Bureau for the first time;

On October 15, 2014, World Bank inspection team conducted pre-assessment of project preparations in Anlu;

On October 23, 2014, we assisted the Developer in public consultation of *Environmental Assessment Program of Project* and released it on the website of Anlu government;

On December 23, 2014, we assisted the Developer in public consultation of *Environmental Assessment Draft of Project and Environmental Assessment Management Plan of Project* and released them on the website of Anlu government;

On December 25, 2014, we released project profile on the website of Hubei Environmental Protection Bureau;

From December 26 to 30, 2014, public investigation was conducted through questionnaire;

In December 2014, Wuhan University Engineering-caused Migration Research Center prepared *Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan – Inhabitant Resettlement Plan of Urban Transport Infrastructure Subproject in Anlu, Xiaogan (first draft)*.

In December 2014, Anlu Institute of Water Resources and Hydropower Research undertook the preparation task of *Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan – Water and Soil Conservation Scheme of Urban Transport Infrastructure Subproject in Anlu, Xiaogan* and prepared the first draft in February 2015.

(6) Process of environmental impact assessment

The road design grade of the Project is urban traffic artery which belongs to the class of "T Urban traffic facilities – 2. Road – New construction and reconstruction" under *Classified Management Directory of Environmental Impact Assessment on Construction Projects* (Order No. 2

of the Ministry of Environmental Protection). Pursuant to relevant requirements of the *Law of the People's Republic of China on Environmental Impact Assessment* and *Management Regulations for Environmental Protection of Construction Project* (Order No. 253 of the State Council) as well as *Classified Management Directory of Environmental Impact Assessment on Construction Projects*, an environmental impact report on the Project shall be prepared. Anlu Management Office of World Bank Loan Project contacted us in December 2013, preliminarily reached an agreement on entrusting us to undertake the task of environmental impact assessment of "traffic integration demonstration project of Wuhan city circle supported by World Bank loan – urban transport infrastructure subproject in Anlu, Xiaogan" and issued a formal power of attorney in May 2014.

Based on project design and with the assistance of Developer, we repeatedly organize technicians to conduct detailed field investigation of the project site and its surrounding environment and collect, check and analyze related data. According to field investigation and preliminary project analysis, the major environmental impacts during project construction period would include raise dust, noise, regional ecological and environmental changes and water and soil loss caused by change of land use type, pollution of automobile exhaust during operation period, surface source pollution of surface runoff, traffic noise pollution and pollution of automobile exhaust and noise after construction of public transport hub and passenger terminal. We predicted and assessed main environmental impacts during construction and operation periods according to project analysis, put forward corresponding environmental protection measures no matter the predictions would reach the standard or not, released related information through internet and media, concluded the statistical result and finally came to a conclusion.

We completed *Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan – Environmental Impact Report on Urban Transport Infrastructure Subproject in Anlu, Xiaogan (first draft)* (hereinafter referred to as "the Report") in April 2015 and now have submitted it to World Bank for internal review.

(7) Conclusion

The Report indicates that the project construction and operation processes will have adverse impacts on ecological environment, acoustic environment and air environment of the project area to some extent. Under the premise of ensuring capital investment in environmental protection, strict execution of the system of "simultaneous design, construction and operation" and comprehensive implementation of environmental protection measures stated by the approve Report, the Developer can effectively control and mitigate possible environmental impacts caused by construction. In respect of environmental protection, the project construction is feasible.

(8) Acknowledgements

Anlu Environmental Protection Monitoring Station, Anlu Leading Group of World Bank Loan Project, Anlu Construction and Development Investment Co., Ltd., Anlu Yun’an Asset Management Co., Ltd., Wuhan Municipal Engineering Design and Research Institute, Wuhan Foreign Investment office, Hubei Environmental Protection Bureau and other units and departments have provided strong support and assistance for preparation of this environmental impact report. Gratitude is hereby expressed.

1 General

1.1 Preparation references

1.1.1 Laws and regulations

(1) *Environmental Protection Law of the People's Republic of China*, issued on November 26, 1989, revised on April 24, 2014 in the eighth session of the 12th National People's Congress Standing Committee, implemented as from January 1, 2015;

(2) *Law of the People's Republic of China on Environment Impact Assessment*, implemented as from September 1, 2003;

(3) *Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution*, implemented as from September 1, 2000;

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

(5) *Noise Pollution Prevention Law of the People's Republic of China,* implemented as from March 1, 1997;

(6) *Solid Pollution Prevention Law of the People's Republic of China* (Revised in 2003);

(7) *Decisions of the National People's Congress Standing Committee on Revision of Twelve Laws including Law of the People's Republic of China on Protection of Cultural Relics* (No.5 Order of the President of the PRC, adopted and announced on June 29, 2013 at the third session of the 12th National People' Congress Standing Committee, implemented as from the date of announcement);

(8) *Land Administration Law of the People's Republic of China,* implemented as from revision on August 28, 2004;

(9) *Soil and Water Conservation Law of the People's Republic of China,* revised on December 25, 2010, implemented as from March 1, 2011;

(10) *Urban and Rural Planning Law of the People's Republic of China*, implemented as from January 1, 2008;

(11) *Regulations on the Administration of Construction Project Environmental Protection*, promulgated by Decree No. 253 of the State Council of the People's Republic of China, implemented as of November 29, 1998;

(12) *Regulations on the Expropriation of Buildings on the State-owned Land and Relevant Compensation*, No. 590 Decree [2011] issued by the State Council of the People's Republic of China, implemented as of January 21, 2011;

(13) *Decisions of the State Council of the People's Republic of China on Implementing Scientific Viewpoint of Development and Strengthening Environmental Protection*, Document GF [2005] No. 39 issued by the State Council of the People's Republic of China;

(14) *Catalogue for the Classified Administration of Environmental Impact Assessments for Construction Projects*, No. 2 Decree of the Ministry of Environmental Protection of the People's Republic of China, implemented as of October 1, 2008;

(15) *Notice on Strengthening the Supervision and Administration of Environmental Impact Assessments for Urban Construction Projects*, Document HB [2008] No. 70 issued by the General Office of the Ministry of Environmental Protection of the People's Republic of China on September 18, 2008;

(16) *Notice on Issuance of Ground Traffic Noise Pollution Prevention Policies*, Document HF [2010] No. 7 issued by the Ministry of Environmental Protection of the People's Republic of China on January 11, 2010;

(17) *Instructions on Strengthening Environmental Noise Pollution Prevention and Improving Urban and Rural Acoustic Environment Quality*, Document HF [2010] No. 144 issued by the Ministry of Environmental Protection of the People's Republic of China;

(18) *Notice on Strengthening Administration of Environmental Impact Assessment and Environmental Risks Prevention*, Document HF [2012] No. 77 issued by the Ministry of Environmental Protection of the People's Republic of China;

(19) *Provisional Measure of Public Participating in Environmental Impact Assessment*, Document HF [2006] No. 28 issued by the original State Environmental Protection Administration;

(20) *Measures for the Administration of Environmental Protection of Transport Construction Projects*, No.5 Decree of the Ministry of Transport of the People's Republic of China in 2003;

(21) *Notice on Implementation of Environmental Supervision for Traffic Projects*, Document JHF [2004] No. 314 issued by the Ministry of Transport of the People's Republic of China;

(22) *Notice on Forbidding Spot Mixing Concrete in Urban Area within Limited Period*, Document SGF [2003] No. 341 issued by the Ministry of Commerce, the Ministry of Public Security, the Ministry of Construction and the Ministry of Transport;

(23) *Guiding Catalogue of Industrial Structure Regulation in 2011*, No. 9 Decree of the National Development and Reform Commission of the People's Republic of China;

(24) *Decisions of the National Development and Reform Commission of the People's Republic of China on Revision of Relevant Articles in Guiding Catalogue of Industrial Structure Regulation in 2011*, No. 21 Decree of the National Development and Reform Commission of the People's Republic of China in 2013;

(25) *Regulations on Administration of Urban House Removal*, No. 305 Decree of the State Council of the People's Republic of China, implemented as of November 1, 2001;

1.1.2 Department rules and other normative documents

(1) *Notice on Strengthening Administration of Environmental Impact Assessment and Environmental Risks Prevention*, Document [2012] No.77 issued by the Ministry of Environmental Protection;

(2) *Catalogue for the Classified Administration of Environmental Impact Assessments for Construction Projects*, No. 2 Decree of the Ministry of Environmental Protection on October 1, 2008;

(3) *Opinions of the State Council on Strengthening Major Environmental Protection Work*, Document GF [2011] No. 35 on October 17, 2011;

(4) *Provisional Measure of Public Participating in Environmental Impact Assessment*, Document HF [2006] No. 28 on March 18, 2006;

(5) *Notice on Implementation of Environmental Supervision for Traffic Projects*, Document JHF [2004] No. 314 on June 15, 2004;

(6) *Regulations on Water and Soil Conservation for Road Construction Projects*, Document SB [2011] No. 12 issued by the Ministry of Water Resources and the Ministry of Communications on January 16, 2001;

(7) *Technical Specifications for Urban Fugitive Dust Pollution Prevention*, industrial standard for environmental protection in the People's Republic of China HJ/T393-2007;

(8) Technical Policies on Ground Traffic Noise Pollution Prevention, Document HF [2010] No. 7, implemented as from January 11, 2010;

(9) No. 51 Announcement of the Ministry of Environmental Protection on Publishing *Requirements for Formulating Environmental Impact Statement of Construction Projects*, issued on August 15, 2012;

(10) No. 19 Announcement of Hubei Province People's Congress Standing Committee on *Regulations on Administration of Transportation Construction in Hubei*, implemented as from March 1, 2002;

(11) *Reply of the General Office of the Provincial People's Government on Issues related to Regulations on Types of Functional Zone of Surface Water in Wuhan and Ranks of Centralized Drinking Water Source of Surface Water*, Document E ZBH [2000] No. 74 issued by the General Office of Hubei Provincial People's Government, issued in 2000.

1.1.3 Relevant planning and environmental regionalization documents

(1) *2013-2030 Urban Master Planning of Anlu City*, jointly prepared by China International Engineering Design and Consult Co., Ltd. and Architectural Design & Research Institute of Tsinghua University Co., Ltd. in October 2014;

(2) *Letter of Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan – Executive Standard for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan from Anlu World Bank Loan Project Management Office of* Anlu Environmental Protection Administration (see Appendixes).

1.1.4 Authorizing documents, project data and relevant official documents

(1) Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan – Letter of Authorization for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan (see Appendix 1);

(2) *Feasibility Study Report of Urban Transport Infrastructure Subproject in Anlu, Xiaogan* (Wuhan Municipal Engineering Design & Research Institute Co., Ltd. in December 2014);

(3) *Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan - Environmental Impact Report on Urban Transport Infrastructure Subproject in Anlu, Xiaogan* (Hubei Anlu Supervision and Management Station of Water and Soil Conservation, in February 2015);

(4) *Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan - Inhabitant Resettlement Plan of Urban Transport Infrastructure Subproject in Anlu, Xiaogan (first draft)* (Wuhan University Engineering Research Center of Immigrant, dated in December 2014)

(5) Other materials supplied by Anlu World Bank Loan Project Management Office

1.1.5 Technical specifications for environmental impact assessment

(1) HJ2.1-2011 *Guideline for Environment Impact Assessment Technique – General Program*, implemented on January 1, 2012;

(2) HJ2.2-2008 *Guideline for Environment Impact Assessment Technique – Atmospheric Environment*, implemented on April 1, 2009;

(3) HJ/T2.3-93 *Guideline for Environment Impact Assessment Technique – Surface Water Environment*, implemented on April 1, 1994;

(4) HJ610-2011 *Guideline for Environment Impact Assessment Technique – Underground Water Environment*, implemented on June 1, 2011;

(5) HJ2.4-2009 *Guideline for Environment Impact Assessment Technique – Acoustic Environment*, implemented on April 1, 2010;

(6) HJ19-2011 *Guideline for Environment Impact Assessment Technique – Ecological Impact*, implemented on September 1, 2011;

(7) JTG B03-2006 *Specifications for Environmental Impact Assessment on Road Construction Project*;

(8) GB/T15190-2014 *Technical Specifications to Determinate the Suitable Areas for Environmental Noise of Urban Area*

(9) GB50118-2010 *Code for Design of Sound Insulation of Civil Building*;

(10) HJ/T393-2007 *Technical Specifications for Urban Fugitive Dust Pollution Prevention.*

1.1.6 Relevant regulations of the World Bank

(1) *World Bank OP4.01 Environmental Assessment*, in January 1999;

(2) *World Bank OP4.12 Involuntary Resettlement*, in June, 1990;

(3) *World Bank OP4.11Intangible Cultural Resources;*

(4) Bank Group *General Guideline of Environment, Health and Safety*.

1.2 Identification of environmental impact

Environmental impact of the proposed project in construction period and operating period is indentified by means of matrix identification method taking into consideration the property, engineering features, construction stage (preliminary period, construction period and operating period) and environmental characteristics in local areas. The project mainly causes adverse impact on surrounding atmospheric environment, acoustic environment, ecological environment along roads and water environment where bridges span and both negative and positive influences on social environment and public lives during the construction period and operating period.

Identification results of the improvement project of integrated traffic corridor and road network, supporting facilities of public transport projects are shown in Table 1-2-1 and Table 1-2-2.

Table 1-2-1 Identification Matrix of Environmental Impact Factors for the Improvement Project of Integrated Traffic Corridor and Road Network

Project activities / Environmental elements		Preliminary period		Construction period						Operating period		
		Land occupation	Demolition and resettlement	Earth borrowing	Road bed	Road surface	Bridge and culvert	Material transport	Field operation	Traffic	Greening	Water drainage of side ditch
Natural environment	Water and soil loss			-1S	-1S	-2S	-2S					
	Ground vegetation	-1L		-2S	-2L	-2S	-2S					
	Atmospheric environment			-2S	-2S			-1S	-1S	-2L		
	Acoustic environment							-1S	-1S	-1L		
	Water environment			-2S	-2S	-2S	-2S				+2L	
	Land utilization	-1L	-2L	-1S								
Social environment	Industry									+2L		
	Agriculture	-1L		-1S								
	Traffic							-2S	-2S	+2L		
	Tourism									+2L		
	Social economy	-2S	-2S							+2L		
	Public health		-2S					-2S	-2S			
	Life quality of residents		-1S							+1L		

Note: "+" – positive effect, "-" – negative effect, "L" – long-term effect, "S" – short-term effect, "1" – obvious effect, "2" – slight effect, blank means no effect.

Table 1-2-2 Identification Matrix of Environmental Impact Factors for Supporting Facilities of Public System Project

Environmental elements \ Project activities		Preliminary period		Construction period			Operating period	
		Land occupation	Demolition and resettlement	Foundation construction	Structural construction	Equipment installation	Turnover of vehicles	Greening
Natural environment	Water and soil loss			-2S	-2S			
	Ground vegetation	-1L		-2S	-2S			
	Atmospheric environment			-1S	-1S	-2S	-1L	
	Acoustic environment			-1S	-1S	-2S	-1L	
	Water environment			-2S	-2S			+2L
	Land utilization	-1L	-2L	-2S				
Social environment	Industry							
	Agriculture							
	Traffic					-2S	+1L	
	Tourism						+1L	
	Social economy	-2S	-2S				+1L	
	Public health		-2S	-2S	-2S			+2L
	Life quality of residents		-1S				+1L	+2L

Note: "+" – positive effect, "-" – negative effect, "L" – long-term effect, "S" – short-term effect, "1" – obvious effect, "2" – slight effect, blank means no effect.

1.3 Factors and scope of assessment

Assessment factors are determined according to project contents, identification of environmental impact, characteristics of environmental elements in project areas and existing environmental problems; assessment scope is determined according to *Guideline for Environment Impact Assessment Technique* and *Code for Environmental Impact Assessment of Road Construction*. See details in Table 1-3-1.

Table 1-3-1 Assessment Factors and Scope

Type			Assessment factors	Assessment scope
Evaluation of current environmental quality		Current situation of air quality	NO_2, CO, PM_{10}, SO_2	Two sides of road center line and the Ares within 200m of station yard
		Current quality condition of surface water environment	pH, BOD_5, SS, TP, NH_3-N, petroleum, DO, permanganate index	With proposed project area as boundary Scope of waste contained water to be extended if necessary
		Current quality condition of local acoustic environment	Equivalent A sound level	Two sides of road center line and the areas within 200m of station yard
		Ecological environment	Loss of flora and fauna, water, soil	Two sides of the proposed projects and the areas within 300m
expectation and evaluative of environmental impact	Construction period	Environmental impact assessment of surface water	SS, COD, petroleum, BOD_5, NH_3-N	Water segment of Fuhe River from the section of Jiefang Mountain to the section of Yuxiuge
		Environmental impact assessment of atmosphere	Fugitive dust and asphalt fume	Areas within 200m at both sides of road center line, any possible area might involved in construction of public transport hub and passenger transport center project
		Acoustic environmental impact assessment	Equivalent A sound level	Areas within 200m at both sides of road center line, any possible area might

Type			Assessment factors	Assessment scope
				involved in construction of public transport hub and passenger transport center project
		Environmental impact assessment of solid waste	Waster slag, construction garbage, domestic garbage	Both sides of the proposed projects and areas within 300m surrounded
		Ecological environment	Loss of flora and fauna, water and soil	Areas within 100m at both sides of road center line, any possible area might involved in construction of public transport hub and passenger transport center project
	Operating period	Environmental impact assessment of surface water	SS, COD, petroleum, BOD_5, NH_3-N	Water segment of Fuhe River from the section of Jiefang Mountain to the section of Yuxiuge
		Environmental impact assessment of atmosphere	CO, NO_2, NMHS, lamp black, etc.	Two sides of road center line and the areas within 200m of station yard
		Acoustic environmental impact assessment	Equivalent A sound level	Two sides of road center line and the areas within 200m of station yard
		Ecological environment	Loss of flora and fauna, water and soil	Areas within 100m at both sides of road center line, any possible area might involved in construction of public transport hub and passenger transport center project

1.4 Zoning of environmental function areas

The zoning of environmental function areas in the Project is shown in Table 1-4-1 according to *Letter of Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan – Executive Standard for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan from Anlu World Bank Loan Project Management Office of Anlu Environmental Protection Administration*.

Table 1-4-1 Zoning of Environmental Function Areas in the Project Sites

Environment elements	Area and scope	Types of function	Reference
Atmospheric environment	Project site and neighboring areas	Class II	*Letter of Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan – Executive Standard for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan from Anlu World Bank Loan Project Management Office* of *Anlu Environmental Protection Administration*
Surface water	Upstream of Fuhe River in Jiefang Mountain Anlu	Class II	
	Downstream of Fuhe River in Jiefang Mountain Anlu	Class III	
	Maohe River, Qili River	Class III	
Acoustic environmen	Certain scope beyond the boundary lines of construction road of the Project	Class 4a	

t	Public transport hub, passenger transportation center, sides of arterial roads and sub-arterial roads as well as certain scope beyond the boundary lines of road		
	Concentrated industrial areas within the elevation scope	Class 3	
	Concentrated areas within the elevation scope such as residential buildings, health care, cultural education, administration office.	Class 2	
	Other areas		

1.5 Evaluation standard

Evaluation standard of the Project is determined according to preliminary research of environmental state in and along the proposed projects combined with construction scale, features of works, main requirements for zoning of environmental function within evaluation scope, *Environmental Quality Standard for Noise* (GB3096-2008), *Technical Specifications to Determinate the Suitable Areas for Environmental Noise of Urban Area* (GB/T15190-2014) as well as *Letter of Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan – Executive Standard for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan from Anlu World Bank Loan Project Management Office of Anlu Environmental Protection Administration.*

1.5.1 Environmental quality standard

Ambient air quality in the Project Site shall comply with the Class II standard of *Ambient Air Quality Standards* GB3095-2012; see details in Table 1-5-1.

Table 1-5-1 Notes of Ambient Air Quality Standards

Name of standard	Type	Standard limit	
		Parameter	Concentration limits
GB3095-2012 *Ambient Air Quality Standards*	Class II	Sulfur dioxide (SO_2)	Annual average 60μg /m^3
			24-hours average 150μg/m^3
			1-hour average 500μg/m^3
		Nitrogen dioxide (NO_2)	Annual average 40μg/m^3
			24-hours average 80μg/m^3
			1-hour average 200μg/m^3
		Particulate matter (PM_{10})	Annual average 70μg/m^3
			24-hours average 150μg/m^3
		Carbon monoxide (CO)	24-hours average 4mg/m^3
			1-hour average 10mg/m^3

Main surface water in the project area is Fuhe River while also involves Maohe River and Qili River. The upstream of Fuhe River in Jiefang Mountain Anlu shall comply with Class II water standard of *Surface Water Quality Standard* (GB3838-2002), while the downstream of Fuhe River in Jiefang Mountain Anlu shall comply with Class III water standard of *Surface Water Quality Standard* (GB3838-2002). Water quality of streams such as Maohe River, Qili River and so on shall comply with *Surface Water Quality Standard* (GB3838-2002). See details in Table 1-5-2.

Table 1-5-2 Lists of Surface Water Quality Standard Unit: mg/L (pH dimensionless)

Water body	Applicable standard	pH	Dissolved oxygen	SS	Permanganate index	BOD_5	NH_3-N	Total phosphorus	Petroleum
Upstream of Fuhe River in Jiefang Mountain Anlu	GB3838-2002 Class II	6~9	≥6	/	≤4	≤3	≤0.5	≤0.1	≤0.05
Downstream of Fuhe River in Jiefang Mountain, Maohe River Qili River	GB3838-2002 Class III	6~9	≥5	/	≤6	≤4	≤1.0	≤0.2	≤0.05

The improvement project of integrated traffic corridor and road network consists of Taibai Avenue, Biyun Road, Jiefang Avenue, Jinqiu Avenue, Yinxing Avenue, Zhanqian Road and Fucheng Avenue, in which Taibai Avenue, Jiefang Avenue and Yinxing Avenue are arterial roads, while Biyun Road, Jinqiu Road, Zhanqian Road and Fucheng Avenue are sub-arterial roads; The Project of supporting facilities for public transport consists of 6 public transfer junction hubs (including 3 public transfer junction hubs, 1 small arrival-departure public transport hub and 2 public transfer junction hubs and highway passenger transportation centers). Related noise-affected area of the Project is subject to noise standard of corresponding categories in *Environmental Quality Standard for Noise* (GB3096-2008). The standard system aims to prevent noise pollution, guarantee sound environment quality of normal life, working and study of residents, conforming to related requirements in *General Guideline of Environment, Health and Safety*. See Table 1-5-3.

Table 1-5-3 Environmental Quality Standard for Noise

Types of areas	Day	Night	Applicable scope
Class 4a area	70 dB(A)	55 dB(A)	Certain areas at both sides of urban arterial traffic
Class 3 area	65 dB(A)	55 dB(A)	Industrial concentration district within the evaluation scope
Class 2 area	60 dB(A)	50 dB(A)	Area requiring residence quietness integrating commerce, technician, business, residence and industry
Class 1 area	55 dB(A)	45 dB(A)	Concentration districts requiring quietness such as residential building, health care, culture and education and administration office
Class 0 area	50 dB(A)	40 dB(A)	Area especially requiring quietness such as convalescent district

1.5.2 Discharge standard of pollutants

In construction stage of the Project, discharge of air pollutants such as fugitive dust shall comply with Class II standard in Table 2 of the *Integrated Emission Standard of Air Pollutants* (GB16297-1996). See details in Table 1-5-4.

Table 1-5-4 *Integrated Emission Standard of Air Pollutants* (GB16297-1996)

Pollutants	Maximum permissible emission concentration（mg/m^3）	Concentration limit at fugitive emission reference point (mg/m^3)
Particulate matter	120	Maximum concentration beyond the perimeter1.0
Asphalt fume	40 (smelt, dip-coating)	Production equipment without obvious emission
	75 (construction mixing)	/

In operation stage of the Project, exhaust gas is mainly cooking fume in mess hall and automobile exhaust generated from the public transport hub and passenger transportation center, in which the emission of automobile exhaust shall comply with the concentration limit of fugitive emission in Table 2 of GB16297-1996 *Integrated Emission Standard of Air Pollutants*, while the emission of cooking fume in mess hall shall comply with the “small” standard limit in GB18483-2001 *Emission Standard of Cooking Fume* (Trial). In utilization stage of the Project, standards for emission of pollutants are given in Table 1-5-5.

Table 1-5-5 Standards for Emission of Pollutants in Utilization Stage

Source of pollutants	Source of standard	Pollutants	Standard value
Automobile exhaust	GB16297-1996 Table 2	NO_2	Fugitive emission monitoring point, $0.12mg/m^3$
		NMHC	Fugitive emission monitoring point, $4.0mg/m^3$
Cooking fume	GB18483-2001	Cooking fume	$2.0mg/m^3$
			Treatment efficiency: small size ≥60%; middle size ≥75%; large size ≥85%

In construction stage of the Project, waste water shall be discharged into municipal sewage plant (Sewage Treatment Plant at Yangling Village in the south of city) in compliance with Class III standard of *Integrated Waste Water Discharge Standard* (GB8978-1996); waste water discharged into water body shall comply with Class I standard of *Integrated Waste Water Discharge Standard* (GB8978-1996). Waste water (domestic sewage, waster water from mess, vehicle washing sewage in the public transport hubs and passenger transportation centers) in operation stage of the Project shall be treated in municipal sewage plant, of which the emission shall comply with Class III standard of *Integrated Waste Water Discharge Standard* (GB8978-1996). Discharge standards for water pollutants of the Project are given in Table 1-5-6.

Table 1-5-6 Integrated Waste Water Discharge Standard (GB8978-1996) Unit: mg/L

No.	Pollutants	Class III (discharged into municipal sewage plant)	Class I (discharged into surface water body)
1	COD	≤500	≤100
2	BOD_5	≤300	≤20

3	SS	≤400	≤70
4	Petroleum	≤100	≤5
5	Ammonia nitrogen	≤45*	≤15

***NH_3-N shall comply with Class B standard of CJ343-2010 *Waste Water Quality for Discharge to Municipal Sewers*.**

Noise in the construction stage shall comply with *Emission Standard of Environment Noise for Boundary of Construction Site* (GB12523-2011); see details in Table 1-5-7.

Table 1-5-7 Emission Standard of Environment Noise for Boundary of Construction Site (GB12523-2011)

Period	Day	Night
Boundary of Construction Site	70	55

1.6 Grade and key points of evaluation

1.6.1 Evaluation grade

According to *Guideline for Environment Impact Assessment Technique* (HJ2.1-2011, HJ2.2-2008, HJ/T2.3-93, HJ2.4-2009 and HJ19-2011) of environmental protection sector standards in China and integrate engineering property and local environment characteristics, the evaluation grade used for the Project is as shown in Table 1-6-1.

Table 1-6-1 Classification of Evaluation Grade

Evaluation content	Grade	Basis
Acoustic environment	Grade I	According to HJ2.4-2009, the Project includes the new construction, reconstruction and extension of urban main road, urban secondary main road, public transport hub and passenger transportation center, and project construction area belongs to class-2 and class-3 area. Sensitive target noise level increment within the evaluation scope before and after construction is 3~5dB (A).
Atmospheric environment	Grade II	According to HJ 2.2-2008, construction of integrated traffic corridor is subject to urban main roads and secondary roads, etc.
Ecological impact	Grade III	According to HJ19-2011, floor area ≤2km^2, length≤50km, not belonging to special sensitive area or important ecologically sensitive area.
Surface water environment	Grade III	Constructed road is not provided with service facility, without sewage discharge; wastewater quantity discharged from each public transport hub and passenger transportation center is less than 200 m^3/d, water pollutants discharged are mainly non-persistent pollutants and number of water quality parameters of concentration to be predicted is less than 7; wastewater quality has a “simple” complexity, which will be discharged to civil sewage pipe network after being processed, finally being introduced to municipal sewage treatment plant.

1.6.2 Thinking and key points of evaluation

According to project analysis and combining potential environmental impact of the Project, acoustic environment and water environment around the land will be evaluated mainly; in terms of urban ecology and landscape, acoustic environment, air environment, influence range and degree of the Project on surrounding area environment will be predicted as per construction period and operation period; at the same time, according to relevant laws, regulations and standards in China and Anlu City and combining requirements of local overall planning and environmental protection, environmental protection measures proposed for the Project shall be analyzed to put forward a technically feasible and economically reasonable alternative solution or supplement pollution control measures so as to reduce and control pollutant discharge; evaluation conclusion and relevant suggestion shall be reported to construction company promptly and construction and operation management shall be directed from the point of environmental protection to minimize the influence of the Project on the environment.

According to main potential environmental influence and local environmental sensitivity, construction may cause different influences on sensitive areas, so acoustic environment impact, air environment impact, resettlement impact and public involvement during construction period and operation period shall be evaluated mainly and feasible environmental protection measures and management plan shall be proposed for negative environmental impact during construction period and operation period.

1.7 Surrounding environment characteristics and environmental protection goal

Environmental protection goal of the Project is mainly the acoustic environment quality, surface water environment quality, ambient air quality and population health and environmental safety in the evaluation area. Main surrounding environment characteristics are as follows:

①A large number of houses, offices, commercial buildings and schools are distributed on both sides of roads, with a lot of sensitive points;

②Roads in Hedong District is mainly surrounded by urban ecological environment, land for roads in Hexi District is dominated by mountains and ponds, not involved in special ecological sensitive area and important ecological sensitive area.

Auxiliary facilities for public transportation system include public transit hub reconstructed from original passenger station, new passenger transportation center and public transit hub, with main environment characteristics as follows:

①There are a large number of houses, commercial buildings around the reconstructed and new public transit hub and passenger transportation center in Hedong District, with a lot of sensitive points and there are fewer sensitive points around the new passenger transportation center and public transit hub in Hexi District;

②The project in Hedong District is mainly surrounded by urban ecological environment, project in Hexi District is mainly surrounded by mountains and ponds, not involved in special ecological sensitive area and important ecological sensitive area.

1.7.1 Main ambient air and acoustic environmental protection goal

According to site survey, atmospheric and acoustic environment protection goal within 200m on both sides of roads can be determined in recommended scheme. Environmental protection goal is as shown in Table 1-7-1~Table 1-7-8.

Table 1-7-1 Distribution of Atmospheric and Acoustic Environmental Protection Goal on Both Sides along Taibai Road

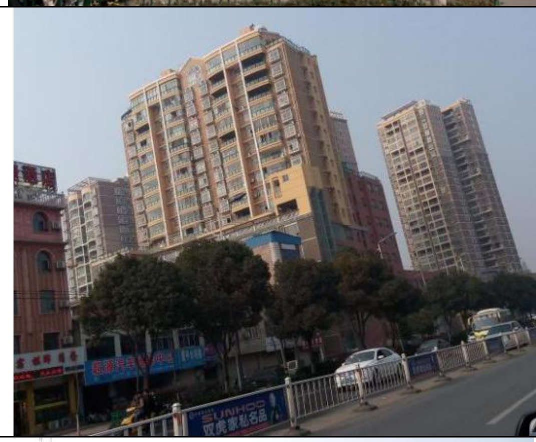
No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line				Atmospheric environment	Acoustic environment
1	Taihe Village	East side	30	0	F24, opposite to road	Residence		Class 2	Class 2/4a
2	Taihe Paradise	East side	45	15	F11, broadside facing road	Residence		Class 2	Class 2/4a
3	Yuantong Community	West side	110	80	F2/4, broadside facing road	Residence		Class 2	Class 2
4	Jintai Community	East side	60	30	F2/3, broadside facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line				Atmospheric environment	Acoustic environment
5	Anlu Quality and Technology Supervision Bureau	West side	35	5	F4, broadside facing road	Institution		Class 2	Class 2/4a
6	Fucheng Sub-district Office	West side	35	5	F6, broadside facing road	Institution		Class 2	Class 2/4a
7	North Area of Linyu Huadu Building	East side	32	2	F16, broadside facing road, under construction	Residence		Class 2	Class 2/4a
8	Xiaotai Community	West side	30	0	F3/4, broadside facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line				Atmospheric environment	Acoustic environment
9	Fengda International City	East side 和 West side	31	1	F24, directly facing road	Residence		Class 2	Class 2/4a
10	Demian Dormitory Building	East side	31	1	F5, broadside facing road	Residence		Class 2	Class 2/4a
11	Anlu Secondary Vocational School	East side	65	35	F6, directly facing road	School		Class 2	Class 2/4a
12	Delin Garden	West side	33	3	5/7 层，broadside facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line				Atmospheric environment	Acoustic environment
13	Jinbang Famous City	West side	32	2	F18, directly facing road	Residence		Class 2	Class 2/4a
14	Chengdong Community	East side and west side	31	1	F2/5, directly facing road	Residence		Class 2	Class 2/4a
15	Pu’ai Hospital	East side	58	28	F8, directly facing road	医院		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line				Atmospheric environment	Acoustic environment
16	China Post	West side	35	5	F6, directly facing road	Institution		Class 2	Class 2/4a
17	Jingang Garden	West side	33	3	F7, directly facing road	Residence		Class 2	Class 2/4a
18	Lu’s Orthopedic Clinic	West side	35	5	F1, directly facing road	Hospital		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line				Atmospheric environment	Acoustic environment
19	Anlu Economic Development Zone	East side	33	3	F5/6, directly facing road	Residence		Class 2	Class 2/4a
20	An’er Homeland	East side	33	3	F33/5, directly facing road	Residence		Class 2	Class 2/4a
21	Anlu Second Middle School		32	2	F6, directly facing road	School		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line				Atmospheric environment	Acoustic environment
22	Power Supply Community	West side	30	0	F6/5, directly or broadside facing road	Residence		Class 2	Class 2/4a
23	Chuyue Community	East side	32	2	F6, broadside facing road	Residence		Class 2	Class 2/4a
24	Jijiawan	East side	33	3	F3/5, directly or broadside facing road	Residence		Class 2	Class 2/4a

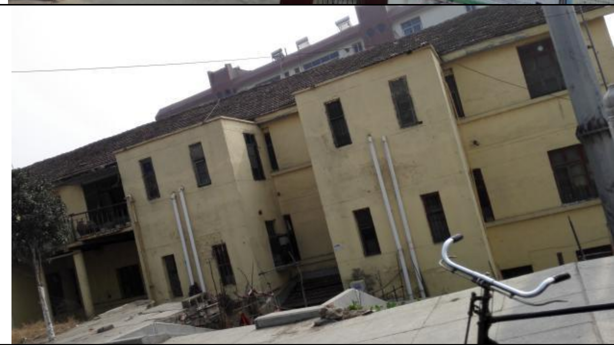
No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line				Atmospheric environment	Acoustic environment
25	Haocheng Jiayuan Building	East side	32	2	F6, directly facing road	Residence		Class 2	Class 2/4a
26	Fenghuang City	West side	33	3	F16, F1~5 as shops, residence broadside facing road, under construction	Residence		Class 2	Class 2/4a
27	Anlu First Middle School	East side	36	6	F2~6, directly facing road	School		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line				Atmospheric environment	Acoustic environment
28	Fenghuang Village	Southeast side	36	6	F2/3, directly facing road	Residence		Class 2	Class 2/4a
29	Hubei Aluminum Manufacturer Dormitory Building	East side	55	25	F6, broadside facing road	Residence		Class 2	Class 2/4a
30	Sili Community	East side	35	5	F7/8 in the first row (F1~3 as shops), F17 in the second row, directly facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line				Atmospheric environment	Acoustic environment
31	Sili Village	West side	33	3	F2/4, directly facing road	Residence		Class 2	Class 2/4a
32	Nancheng Police Station of Public Security Bureau	East side	38	8	F3, directly facing road	Institution		Class 2	Class 2/4a
33	Zhongyi Community	East side	35	5	F6, directly facing road	Residence		Class 2	Class 2/4a

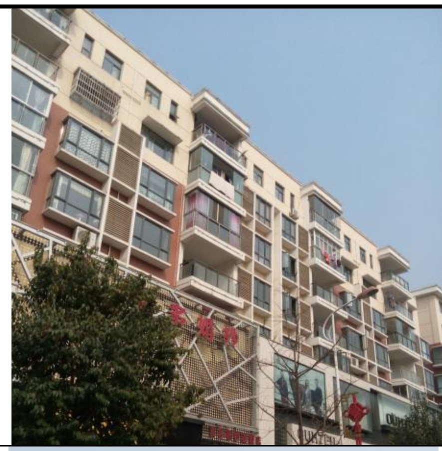
No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line				Atmospheric environment	Acoustic environment
34	Caomiao Village	East side	60	30	F2/4, directly facing road	Residence		Class 2	Class 2/4a

Table 1-7-2 Distribution of Atmospheric and Acoustic Environmental Protection Goal on Both Sides along Biyun Road

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
1	Health Supervision Institute	Southwest	45	15	F3/4, broadside facing road	Institution		Class 2	Class 2
2	Original Waterworks Dormitory	South side	16	8	F2/3, directly or broadside facing road	Residence		Class 2	Class 2/4a
3	Jiahe Community	North side	29	21	F6, directly facing road	Residence		Class 2	Class 2/4a
4	Fuhe Community	South side	16	4	F5/6, directly or broadside facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
5	Zijin Garden	North side	13	1	F6, directly facing road	Residence		Class 2	Class 2/4a
6	Nanda Community	South side	14	2	F5/6, directly facing road	Residence		Class 2	Class 2/4a
7	Yushi Community	North side	13	1	F6, directly facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
8	Cultural Center	North side	12	0	F6, directly facing road	办公		Class 2	Class 2/4a
9	Fuhe Community	North side	14	2	F5, directly facing road	Residence		Class 2	Class 2/4a
10	Anlu Government	South side	52	40	F3, directly facing road	Institution		Class 2	Class 2

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
11	Yangguang Century City	North side	13	1	F7, directly facing road	Residence		Class 2	Class 2/4a
12	Shiyou Community	North side	13	1	F5, directly or broadside facing road			Class 2	Class 2/4a
13	Zhongshan Community	South side	12	0	F6, directly facing road				Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
14	Apartment Building in Railway Station	South side	12	0	F5, directly facing road	Residence		Class 2	Class 2/4a
15	Fucheng Branch of Land and Resources Bureau	North side	31	6	F6, directly facing road	Institution		Class 2	Class 2/4a
16	Fudong Community	Both sides	31	6	F3~7, directly facing road	Residence		Class 2	Class 2/4a
17	Anlu National Tax Bureau	North side	27	1	F10, directly facing road	Institution		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
18	Civil Affairs Bureau	North side	27	1	F6, directly facing road	Institution		Class 2	Class 2/4a
19	Hongshi Community	South side	35	15	F4~7, directly facing road	Residence		Class 2	Class 2/4a
20	Fuli Community	North side	35	15	F4~7, directly facing road	Residence		Class 2	Class 2/4a
21	Chuyue Community	Both sides	35	15	F2~7, directly or broadside facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
22	Shili Community Garden	North side	60	40	F7, directly facing road	Residence		Class 2	Class 2
23	Land and Resources Bureau	South side	37	17	F5, directly facing road	Institution		Class 2	Class 2/4a
24	Shili Community	Both sides	35	15	F3~6, directly or broadside facing road	Residence		Class 2	Class 2/4a
25	Shili Primary School	South side	160	140	F2~3, broadside facing road	School	/	Class 2	Class 2
26	Vehicle Administration	North side	32	12	F3, directly facing road	Institution		Class 2	Class 2/4a
27	Shili Middle School	South side	80	60	F3, broadside facing road	School	/	Class 2	Class 2

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
28	Dapeng Village	South side	35	15	F3`6, directly or broadside facing road	Residence		Class 2	Class 2/4a

Table 1-7-3 Distribution of Atmospheric and Acoustic Environmental Protection Goal on Both Sides along Jiefang Avenue

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
1	Hexi Village	North side	24	2	F2/3, broadside facing road	Residence		Class 2	Class 2/4a
2	Guilin Jiayuan Building	North side	38	13	F5/6, directly facing road	Residence		Class 2	Class 2/4a
3	Wuqi Dormitory	South side	31	6	F6, directly facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
	Anlu Bureau of Radio and Television	South side	28	3	F5, directly facing road	Institution		Class 2	Class 2/4a
	Anlu Development and Reform Bureau	South side	28	3	F5, directly facing road	Institution		Class 2	Class 2/4a
4	Huguo Village	South side and north side	27	2	F2/3, broadside facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
5	Dean Garden	South side	30	5	F5/6, broadside facing road	Residence		Class 2	Class 2/4a
6	Junior Middle School in Anlu Jiefang Avenue	South side	33	8	F4/5, directly or broadside facing road	School		Class 2	Class 2/4a
7	Huguo Village	North side	32	7	F3, directly or broadside facing road	Residence		Class 2	Class 2/4a
8	People's Procuratorate	South side	65	40	F6, directly or broadside facing road	Institution		Class 2	Class 2

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
9	Shuanglongqiao Community	South side	30	5	F4/7, directly facing road	Residence		Class 2	Class 2/4a
10	Traffic Police Battalion	North side	30	5	F2/5, directly facing road	Institution		Class 2	Class 2/4a
	Anlu Public Security Bureau	North side	35	10	F2/4, directly facing road	Institution		Class 2	Class 2/4a
11	Science and Technology Department	South side	33	8	F5, directly facing road	Institution		Class 2	Class 2/4a

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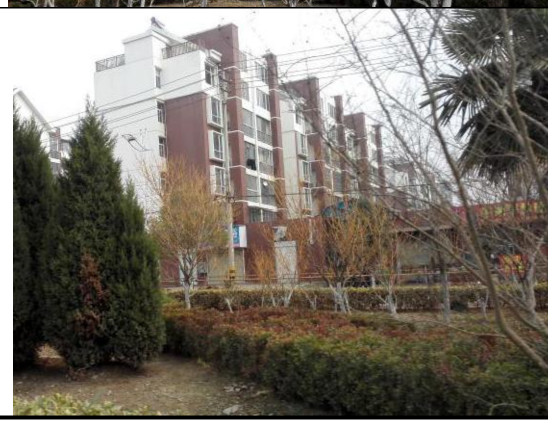
No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
12	Beicheng Health Center	South side	32	7	F5/6, directly facing road	Hospital		Class 2	Class 2/4a
13	Jiefang Community	North side and south side	30	5	F3/5, directly facing road	Residence		Class 2	Class 2/4a
14	Fengda International City	North side and south side	26	0	F24, directly facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
15	Hegang Village	South side and north side	29	3	F2/3, directly or broadside facing road	Residence		Class 2	Class 2/4a
16	Anlu Court	South side	35	10	F6, directly facing road	办公		Class 2	Class 2/4a
17	Linyu Huadu Building	South side	31	5	F12/15, directly facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
18	Gaojiawan	North side	28	2	F2/3, directly or broadside facing road	Residence		Class 2	Class 2/4a

Table 1-7-4 Distribution of Atmospheric and Acoustic Environmental Protection Goal on Both Sides along Jinqui Avenue

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
1	Fashion-International Garden	East side	32	2	F12, directly facing road, under construction	Residence		Class 2	Class 2/4a
2	Zhongye Huafu Building	East side	32.5	2.5	F7, broadside facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
3	Gaojiawan	West side	35	5	F2/3, directly or broadside facing road	Residence		Class 2	Class 2/4a
4	Linyu Huadu Building	East side and west side	32.5	2.5	F6, 12 and 15 in first row in the west side, F11 and 16 in the first row in east side, broadside facing road	Residence		Class 2	Class 2/4a
5	Fenghai Tiancheng Building	West side	48	18	F27, broadside facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
6	Shui'an Xingcheng Building	East side	38	8	F10/15/23, broadside facing road	Residence		Class 2	Class 2/4a
7	Jiuqiu Garden	East side	33	3	F7/11, broadside facing road	Residence		Class 2	Class 2/4a
8	Shangri-La City Garden	East side	31	1	F18/6, broadside facing road	Residence		Class 2	Class 2/4a
9	Chengdong Community	East side 和 West side	30	0	F2/3, broadside facing road	Residence		Class 2	Class 2/4a

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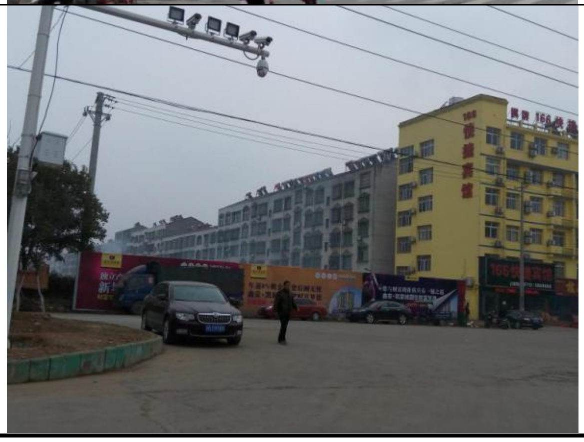
No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
10	New Zhoujiawan	West side	30	0	F5/7, broadside facing road	Residence		Class 2	Class 2/4a
11	Kaixuan City	East side	31	1	F16, broadside facing road	Residence		Class 2	Class 2/4a
12	Fuli Community	West side	30	0	F6, broadside facing road	Residence		Class 2	Class 2/4a
13	Chuyue Community	East side	30	0	F3/6, broadside facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
14	Fudong Community	East side and west side	30	0	F3/5, broadside facing road	Residence		Class 2	Class 2/4a

Table 1-7-5 Distribution of Atmospheric and Acoustic Environmental Protection Goal on Both Sides along Yinxing Avenue

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
1	Anlu Supervision Center	North side	Survey- forbidden area	Survey- forbidden area	F2/3, directly facing road	Residence		Class 2	Class 2/4a
2	People's Armed Police	North side	Survey- forbidden area	Survey- forbidden area	F5, directly facing road	Residence		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
3	Zhaohe Community	South side	150	130	F2/3, directly or broadside facing road	Residence		Class 2	Class 2
4	Shimiao Village	South side/north side	22	2	F2, directly or broadside facing road	Residence		Class 2	Class 2/4a
5	Shimiao Community	North side	100	80	F6, directly facing road	Residence		Class 2	Class 2
6	Anlu People Hospital	North side	23	3	F5, directly facing road	Hospital		Class 2	Class 2/4a

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
7	Qiliqiao Middle School	North side	60	40	F5, directly facing road	School		Class 2	Class 2
8	Taihe Villa	South side	50	30	F2/4, back facing road	Residence		Class 2	Class 2/4a
9	Xugang Community	North side	55	35	F3/7, slantwise facing road	Residence		Class 2	Class 2
10	Shitang Community	North side	22	2	F3, directly facing road	Residence		Class 2	Class 2

Table 1-7-6Distribution of Atmospheric and Acoustic Environmental Protection Goal on Both Sides along Fucheng Avenue

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
1	Zhaohe Village	East side	22	2	F2/3, directly facing or broadside facing road	Residence			
2	Lvjiafang	Northeast side	25	5	F3, broadside facing road	Residence		Class 2	Class 2/4a
3	Huguo Village	Southwest side	20	0	F3, directly facing road	Residence			

Table 1-7-7 Distribution of Atmospheric and Acoustic Environmental Protection Goal on Both Sides along Zhanqian Road

No.	Name	Position opposite to road	Distance to road (m)		First-row buildings in planning road	Classification of sensitive point	Realistic picture	Environmental protection goal	
			Distance to center line	Distance to red line					
1	Lilong Village	East and west side	20	0	F2/3, broadside facing road	Residence		Class 2	Class 2/4a
2	Jinquan Village	East and west side	20	0	F3, broadside facing road	Residence			

Table 1-7-8 Table of Ambient Air and Acoustic Environmental Protection Goals for Supporting Infrastructure Project of Public Traffic System

Depot name	Name of sensitive point	Direction	Distance (m)	Purpose and scale	Control objective
Public transfer hub in passenger transportation station	Aluminum Manufacturer Dormitory	North	Close to	Dormitory, residence	GB3096-2008 Class 2 GB3095-2012 Grade 2
	Sili Village	West	60	Residence	
Small railway station to public transport hub	Building 6, No. 21 Wenchang Road	South	85	Residence	
	Shengli Community, Baiyun Community	West	25	Residence	
	Residential area in Wenchang Road	North	30	Residence	
Public transfer hub in short distance station	Residential buildings in Fudong Community	East, South, West, North	Close to	Residence	
Public transfer hub in long distance station	Residential buildings in Fudong Community	East, West, North	Close to	Residence	
Qiliqiao Road Passenger transportation center + Public transfer hub	Taihe Villa	East	90	Residence	
	Taihe Paradise	East	110	Residence	
	Jinyuan Community (part of Yuantong Community)	South	140	Residence	
	Qiliqiao Middle School	Northwest	95	Residence	
	Shimiao Community	Northwest	180	Residence	
Highway station Passenger transportation center + Public transfer hub	Jinquan Village	Surrounding	——	Residence	
	——	——	——	Army camp	

1.7.2 Protection goal for ecological influence

Project evaluation range is not involved in ecological sensitive area. Ecological environment goal within the range of project evaluation is to protect arable land, vegetation and wild animals along the road.

1.7.3 Protection goal for water environment

Rain sewage is discharged into Fuhe River; quality objective for upper reaches of Jiefang Mountain in Anlu section of Fuhe River is based on class-II water area standard *Environmental Quality Standard for Surface Water* (GB3838-2002), and quality objective for lower reaches is based on class-III water area standard *Environmental Quality Standard for Surface Water* (GB3838-2002).

Bridges for the project mainly cross Maohe River and Qili River, of which the quality objective is based on class-III water area standard *Environmental Quality Standard for Surface Water* (GB3838-2002).

Fuhe River is the water source for Anlu City and there is an intake for drinking water source within the drainage basin in Anlu City. The bridge section (Fuhe River Dam Bridge) in Jiefang Avenue is located at about 850m of lower reaches of this intake, not within the secondary protection area in drinking water sources.

Huguo River, Maohe River, Chashan River and Qili River along the project have no drinking water source intake, not involved in the drinking water source protection area.

1.7.4 Protection goal for social environment

Main goals for social environment protection along the project are as shown in Table 1-7-9.

Table 1-7-9 Social Environmental Protection Goal within the Range of Evaluation

Protection goal	Location	Main influences
Both sides along the road and surrounding residents	Both sides along the road, residents around bus station, as shown in Table 1-7-2	Routine travel and life quality
Residents affected by land demolition	Residents within the range of land acquisition, mainly including Lilong Village, Jinquan Village, Huguo Village, Zhaohe Village, Shitang Village, Xugang Village	Ensure no loss of residents' living quality due to land demolition for road and public transport hub and protect interests of the masses and maintain social stability

1.7.5 Material culture resources

It is found through site survey that there are two private tombs (Fig. 1-7-5-1) in Jinquan Village within the scope of the Project and after consulting relevant departments and public involvement in the survey, it can be determined that there is no other cultural resources defined of species the evaluation

Fig. 1-7-5-1 Picture of Private Tomb in Jinquan Village

1.8 Evaluation method and time period

1.8.1 Evaluation method

According to the principle of “point dominated, combining point with line”, model calculation, analogy method and survey analysis method will be used for evaluation, of which survey analysis method is mainly used for evaluating social environment, model calculation method is mainly used for evaluating acoustic environment and atmospheric environment and site monitoring, analogy analysis and data access method are mainly used for evaluating water environment.

1.8.2 Evaluation time period

The evaluation time period is divided into construction period and operation period. Construction period is the same as construction period and operation period of Public transport hub and passenger transportation center is normal operation period. Operation period for road works keeps consistence with forecast year for road traffic flow. Forecast year for road traffic flow is 2030 (long-term).

2. Project Overview

2.1 General introduction

Project name: Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan - Urban Transport Infrastructure Subproject in Anlu, Xiaogan; the Project is divided into five subdivisional works:

(1) Integrated traffic corridor and road network improvement works;

(2) Supporting infrastructure works for public transportation system;

(3) Road safety works;

(4) Slow traffic system;

(5) Institution building and technical assistance

In above five subdivisional works, construction involved in civil work and that may have influence on environment mainly focuses on Integrated traffic corridor and road network improvement works and supporting infrastructure works for public traffic system; the evaluation will also focus on these two subdivisional works.

Competent Department: leading group of the project to be supported by World Bank Loan in Anlu

Executing agency: Anlu Construction & Development Investment Co., Ltd, Anlu Yunan Asset Management Co., Ltd

Implementing agency: Anlu Yunan Asset Management Co., Ltd is the legal entity of the Project, responsible for fund raising, debt repayment and construction and implementation. Anlu Construction & Development Investment Co., Ltd is responsible for organization and coordination. Anlu Urban-rural Construction Agency, Transport Agency and Traffic Police Battalion are responsible for concrete implementation of each subproject.

2.2 Integrated traffic corridor and road network improvement works

2.2.1 Construction content and project scale

7 roads are involved in the construction project, including expansion road of 4.49km, reconstructed road of 20.36km and new road of 4.29km. Road reconstruction and expansion are constructed within the scope of original road redline and scope of redline is not widened, not involving land acquisition. The scope of red line of newly-built road is the scope of land acquisition.

Reconstructed road: ①Taibai Road (Yinxing Avenue-Jiangxia Avenue), through the central city area, with overall length of 7.8km and red line width of 60m, reconstruction works including construction road traffic safety facilities; ②Biyun Road (Yunshui Road-New G316), through old city in east-west direction, overall length of 5.63km; Binhe Avenue-Jinqiu Avenue maintains existing section width (24~52m), Jinqiu Avenue-New G316 has red line width of 40m, reconstruction works including asphalt addition on part of pavement, adding guardrail, drainage improvement, greening and road traffic safety facilities, etc.; ③Jiefang Avenue (Fuhe Avenue-Jinqiu Avenue), connecting east area to west area of Fuhe River, with overall length of 2.56km and existing road width of 43~53m, reconstruction works including asphalt addition on part of pavement, adding guardrail, drainage improvement, greening and road traffic safety facilities, etc.; ④Jinqiu Avenue (Yinxing Avenue-Biyun Road), located in the east of urban area, with overall length of 4.46km and red line width of 60m, existing motorized vehicle road formed, reconstruction works mainly including asphalt addition on driveway, public transport improvement, slow-traffic system and other supporting facilities.

Expansion road: Yinxing Avenue (Fucheng Avenue-New G316), located at outer ring of Hexi District, with overall length of 4.49km and red line width of 40m, existing two-way 2 driveways and 12m wide secondary road; according to future traffic demand, extension will be performed as per 40m of red line based on existing section width and road will be reconstructed to sub-arterial road.

New road: ①Zhanqian Road (Sanqiao connecting line-Anjing line), located at the west of urban area, connecting Anlu West Station in interurban railway from Wuhan to Shiyan via Xiangyang, with overall length of 2.10km and red line width of 40m; ②Fucheng Avenue (Yinxing Avenue-Jiefang Avenue), located at the west of Handan railway in northern urban area, with overall length of 2.19km and red line width of 40m. New road construction includes road works, water supply and sewerage works, traffic safety works, greening works and lighting works, not including ancillary works such as service area and toll station.

Road distribution is as shown in the following figure.

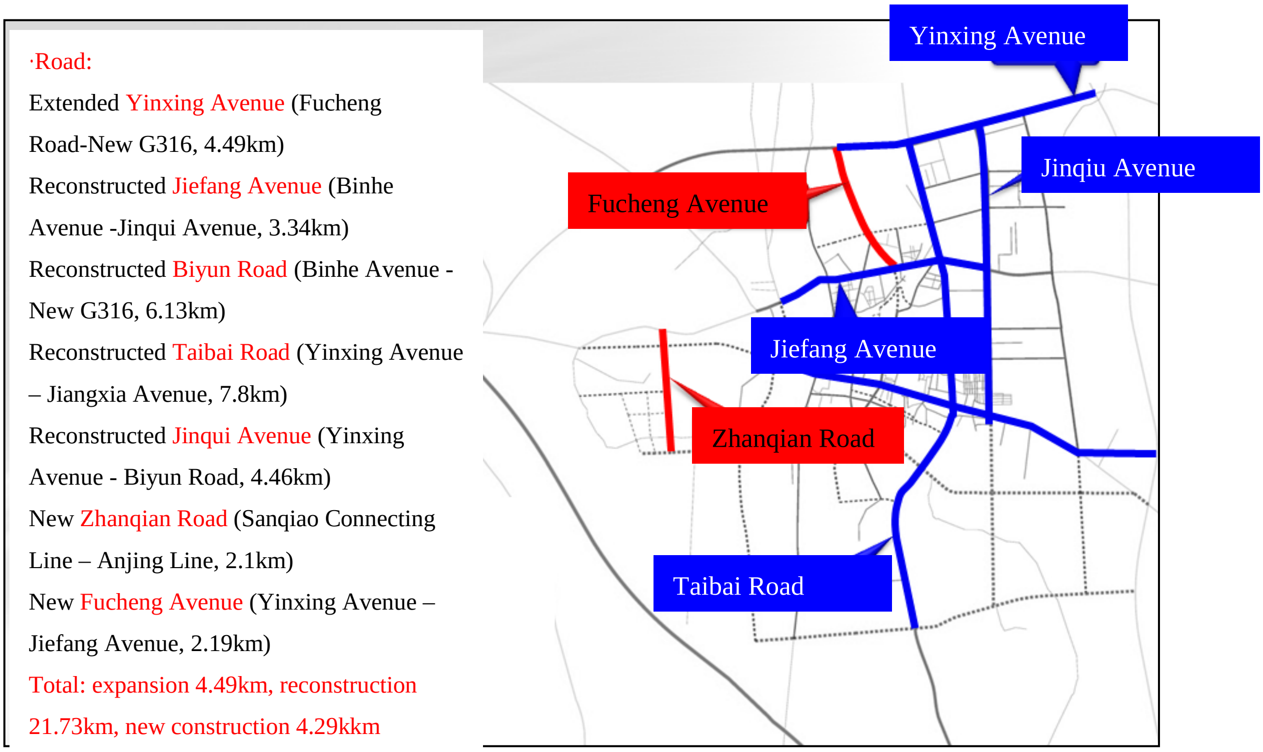


Fig. 2-2-1-1 Road Distribution Diagram for Integrated Traffic Corridor and Road Network Improvement Works

2.2.2 Main technical standards

2.2.2.1 Standards for road engineering

1) Road grade and design speed

Road grades and related design speeds are shown in Table 2-2-1.

Table 2-2-1 Road Grades and Design Speed

Road names	Road grades		Design speed (km/h)
Taibai Road	Arterial road		50
Biyun Road	Sub-arterial road		40
Jiefang Avenue	Arterial road		50
Zhanqian Road	Sub-arterial road		40
Fucheng Avenue	Sub-arterial road		40
Yinxing Avenue	Arterial road		50
Jinqiu Avenue	Sub-arterial road		40

2) Pavement structure

Standard axle load for pavement structure design: BZZ-100. Design working life of pavement structure is presented in following table.

Table 2-2-2 Pavement Structure Design and Working Life

Road grade	Type of pavement structure	
	Bituminous pavement	Cement concrete pavement
Arterial road	15	30
Sub-arterial road	10	20

2.2.2.2 Standards for drainage works

1) Drainage system

Separate drainage systems of rainwater and sewage will be provided for expanded roads and new roads. Existing drainage system will be applied to reconstructed roads.

2) Standards for structural design

The structural safety class is of Second Class and design working life is 50 years. Seismic fortification intensity reaches Seven Degree. Seismic fortification category of the main sewer is of Category B while others are of Category B. The site is in Category II and the design grade of the foundation is of Grade C. Quality level for brickwork should be Level B.

2.2.2.3 Standards for road traffic safety facilities

1) Traffic sign

(1) Warning sign

The warning signs should be yellow-based with black edge and black patterns. The warning signs should be in the form of equilateral triangle, with vertex angle pointing upwards. The yellow base should be able to reflect light while the black patterns and rim cannot reflect light.

(2) Prohibition sign

All prohibition signs should be white based with red circle, red line and black patterns except for the signs of lifting “No Overtaking” and of removing “Limiting Speed” which are white based with black circle and black patterns. The prohibition signs should be in the form of round or equilateral triangle whose vertex angle points downwards. All parts of the signs that consist of red and white such as “No Entry” and “No Passing” should be capable of reflecting light. Other signs should be able to reflect light by white base, red circle and red line, with their black patterns not reflecting light.

(3) Indication sign

The indication signs should be blue based with white patterns. They should be in the form of round or rectangle or square. All parts of the indication signs should be able to reflect light (except for complex signs whose white patterns can reflect light, with blue case not able to reflect light).

(4) Guide sign

The guide signs should be blue based with white patterns. They should be in the form of rectangle. The white patterns should be able to reflect light while the blue base cannot reflect light.

(5) Sign board

The sign boards should be made of hard aluminum alloy plates, with tensile strength ≥290MPa, yield point ≥241.2MPa and ductility of 4%～10%. Their section dimension should comply with *Specification for Road Traffic Signs*.

(6) Reflection film

In order to improve road safety in urban areas, reflection films of traffic signs should be of diamond-level films and their chromaticity should be in accordance with *Specification for Road Traffic Signs*.

(7) Installation angle of sign boards

Installation angle of sign boards refers to the angle between sign board and road axis. Where the sign is installed in curve road, the sign board should be consistent to the curve radius and vertical to the tangential direction of the curve. Installation angle of roadside signs, guide signs and warning signs should be or approximate to right angle (80°～90°). Installation angle of indication signs and prohibition signs should be right angle or acute angle (45°～90°). Installation angle of signs in other places is normally right angle.

(8) Font

In case of Chinese characters, they should be in uniformly bold font and both their height and width should be 40cm; in case of signs in both Chinese and English, the Chinese should be written above the English.

2) Traffic marking

Traffic markings should be made by hot-melt paint. The paint should be in accordance with *Pavement Marking Paint*. Edge line of roadway, dividing line of roadway should be 15cm in width and total width of double amber lines should be 50cm with line width of 15cm.

3) Traffic monitoring level

The traffic monitoring level should be Level III.

Traffic video monitoring system, electronic police for red-light running capture, and security systems should apply HD systems and adaptive signal control system should be applied for signal control.

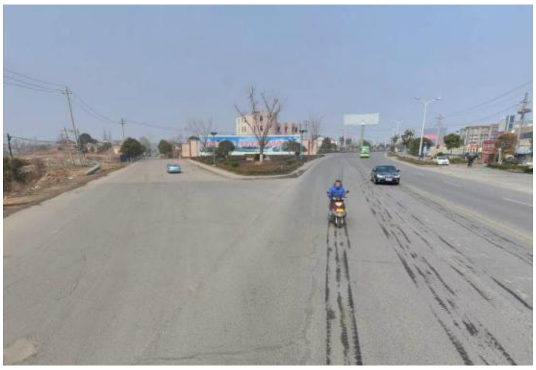
2.2.3 Project description

2.2.3.1 Taibai Road

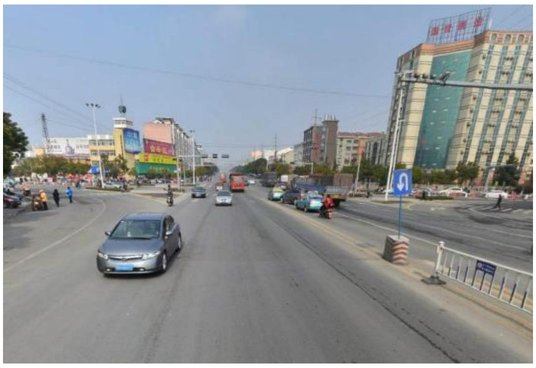
The Project will, on the basis of reconstruction of roadway, drainage, greening and illumination in Taibai Road, build road traffic safety facilities by World Bank loan.

1) Existing road condition

Taibai Road starts from Yinxing Avenue and ends up in Jiangxia Avenue, stretching for 7.8 km in total. Taibai Road is originally a part of National Highway 316. New National Highway 316 is under construction and once it is built up, Taibai Road will become an urban arterial road, connecting south and north. Taibai Road intersects with 9 existing arterial and sub-arterial roads, including Jiangxia Avenue (under construction), Handan Road, Biyun Road, Bishan Road, Bixia Road, Jiefang Avenue, South Liangji Road, Baodi Road and Yinxing Avenue. Other roads intersecting with Taibai Road are exits of neighboring villages and towns.

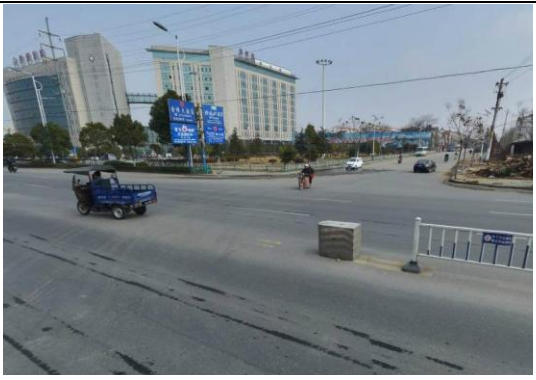


Intersection of Handan Road



Intersection of Biyun Road

Intersection of Bishan Road



Intersection of Bixia Road

Intersection of Jiefang Avenue

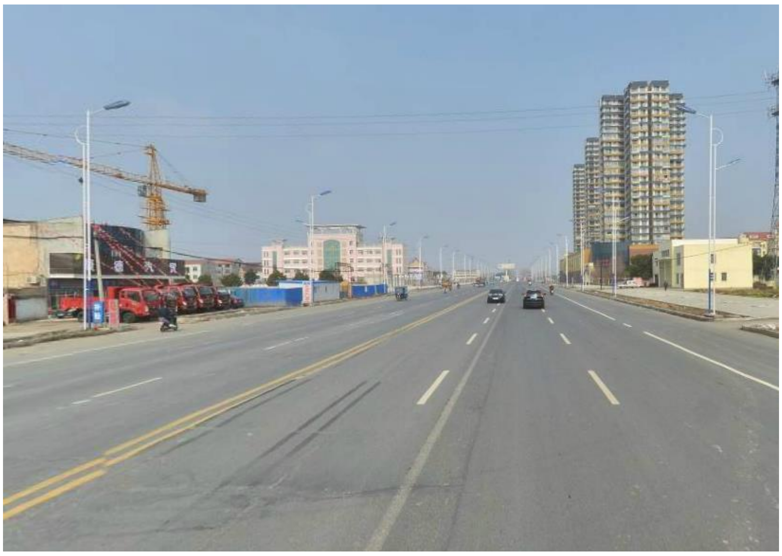
Intersection of South Liangji Road

Intersection of Baodi Road

Intersection of Yinxing Avenue

Fig. 2-2-3-1-1 Existing Conditions for Intersection along Taibai Road

Existing conditions: Taibai Road is divided into urban section and outer section by Anwei Bridge. The urban section stretches from Yinxing Avenue to Anwei Bridge. Currently, the urban section is a two-way six-lane three breadth road, with vehicle lane and non-motorized vehicle lane placed in the same plane. The vehicle lane is 23m in width while non-motorized vehicle lanes at both sides are 5.5 in width and the vehicle lane and the non-motorized vehicle lanes are separated by traffic markings. 3-meter-wide green belt is located at outer sides of the roadway. Besides, the sidewalk is 6-10m wide. Along the urban section, there are education institutions, medical units, enterprise and public institutions as well as business development project. The outer section stretches from Jiangxia Avenue to Anwei Bridge. As for now, the outer section is a two-way four-lane three breadth road. Lane separator between vehicle lane and non-motorized vehicle lane is 3m in width. The width of non-motorized vehicle lane is 4-6m while the width of sidewalk is 9-13m. Non-motorized vehicle lanes and sidewalk are not developed yet in some road sections and therefore buildings at both sides are mainly residential houses and factories as well as enterprises.



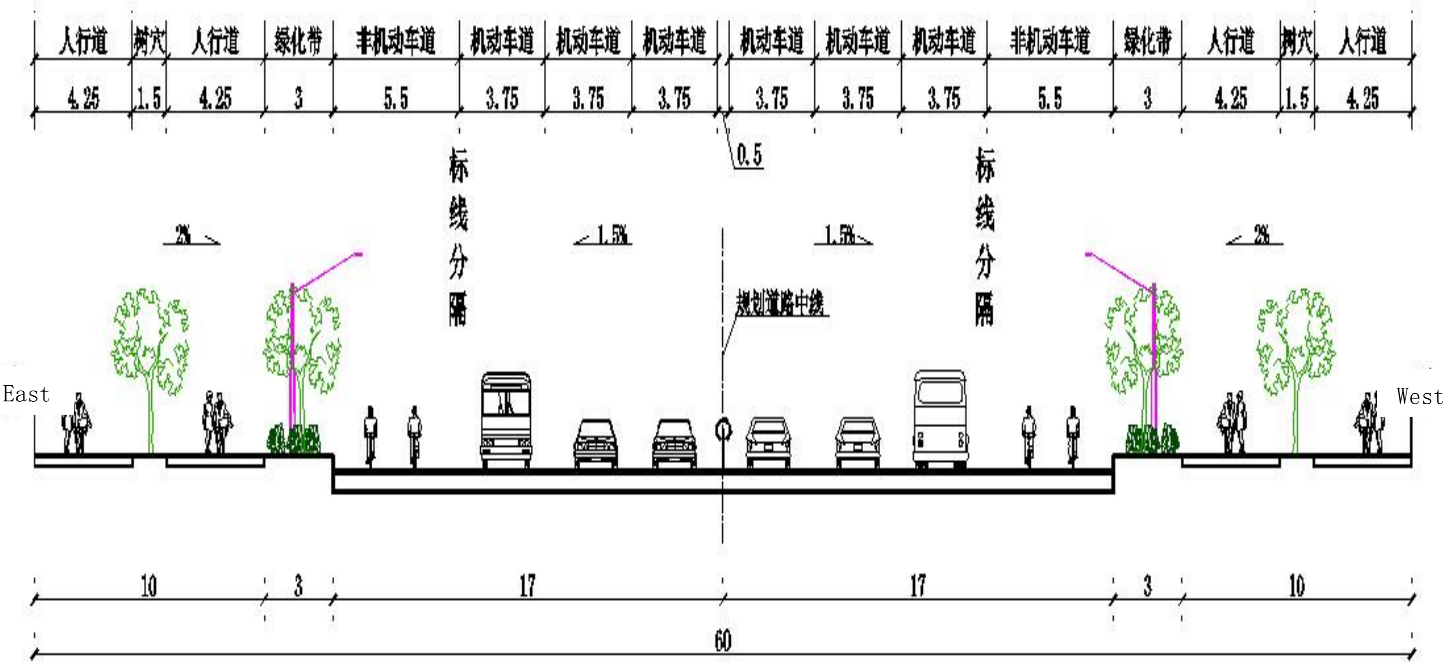


Fig. 2-2-3-1-2 Sectional View of Existing Six-lane Taibai Road (from Yinxing Avenue to Anwei Bridge)

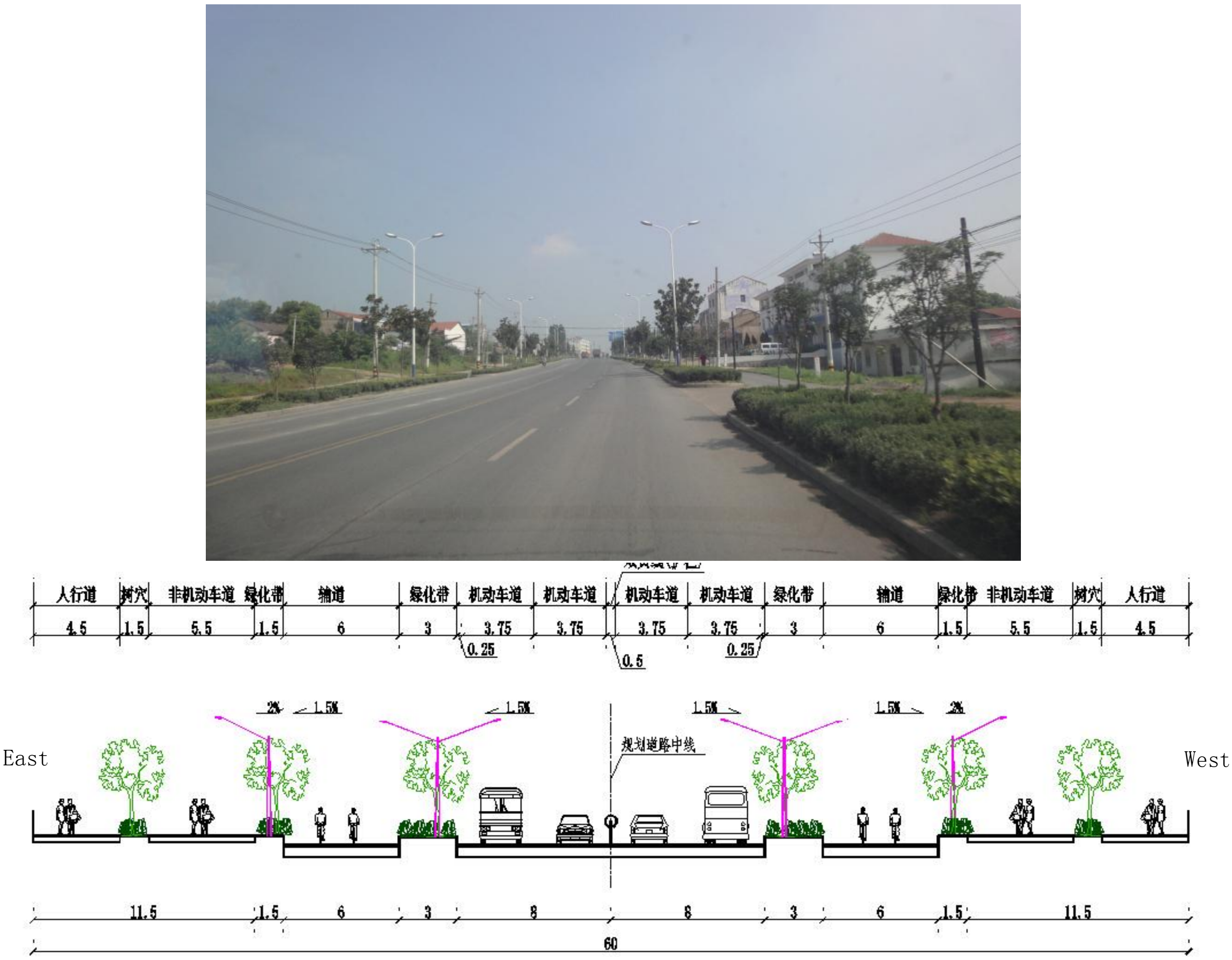


Fig. 2-2-3-1-3 Sectional View of Existing Four-lane Taibai Road (from Anwei Bridge to Jiangxia Avenue)

There are 3 bridges along Taibai Road, including Handan Bridge that spans Hankou-Danjiangkou Railway, Anwei Bridge that spans Anlu-Weijiadian Railway as well as the Maohe Bridge that spans Maohe River. Handan Bridge and Anwei Bridge are four-lane bridges while Maohe Bridge belongs to six-lane bridges.

Currently, Taibai Road is generally covered by asphalt concrete. According to site survey, road section from Jiangxia Avenue to Anwei Bridge is seriously damaged while road section from Anwei Bridge to Yinxing Avenue is slightly damaged.

There are three bus lines in Taibai Road and buses will stop upon hand waving of roadside people.

2) Overview of road reconstruction (domestic project that is not included in the Project supported by World Bank loan).

(1) Section reconstruction scheme

The scheme covers two sections which are separated by Anwei Bridge.

①Yinxing Avenue ～ Anwei Bridge

Currently, the width of red line in this section is 60m, constituting one breadth road from a sectional view. Vehicles and non-motorized vehicles coexist in the road and the road is symmetrical from a sectional view. In detail, the road is made of 23m vehicle lane + 2×5.5m non-motorized vehicle lane + 2×3m roadside green belt + 2×10m sidewalk. According to the scheme, the vehicle lane and non-motorized vehicle lane will be separated so as to ensure safety of drivers of non-motorized vehicles.

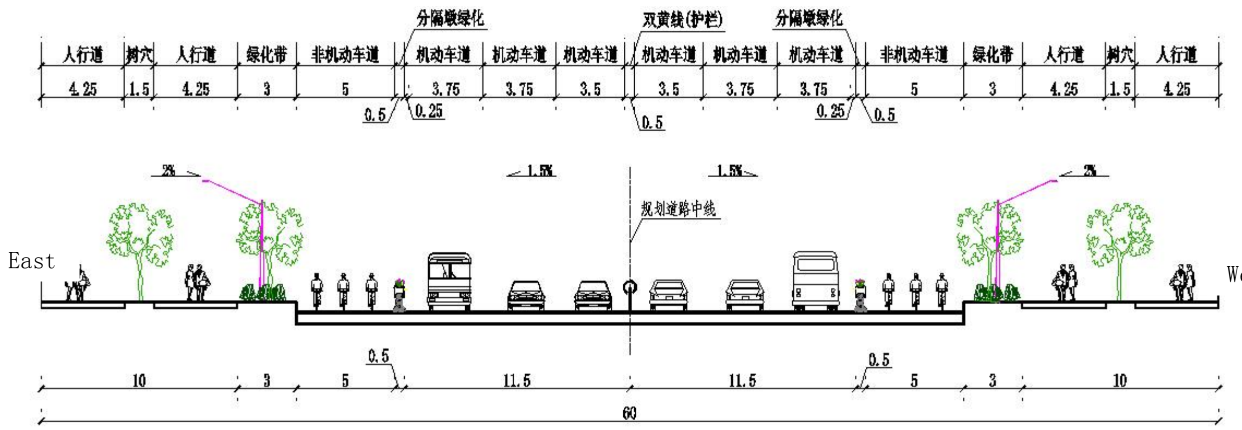


Fig. 2-2-3-1-4 Standard Sectional View of Planed Taibai Road (Yinxing Avenue to Anwei Bridge)

Current width of roadway will be maintained. The vehicle lane and non-motorized vehicle lane will be separated by pier + planters so as to ensure safety of drivers of non-motorized vehicles. In detail, the roadway will be made of 23m vehicle lane + 2x0.5m separating pier + 2x5m non-motorized vehicle lane + 3m roadside green belt + 10m sidewalk.

②Anwei Bridge ～ Jiangxia Avenue

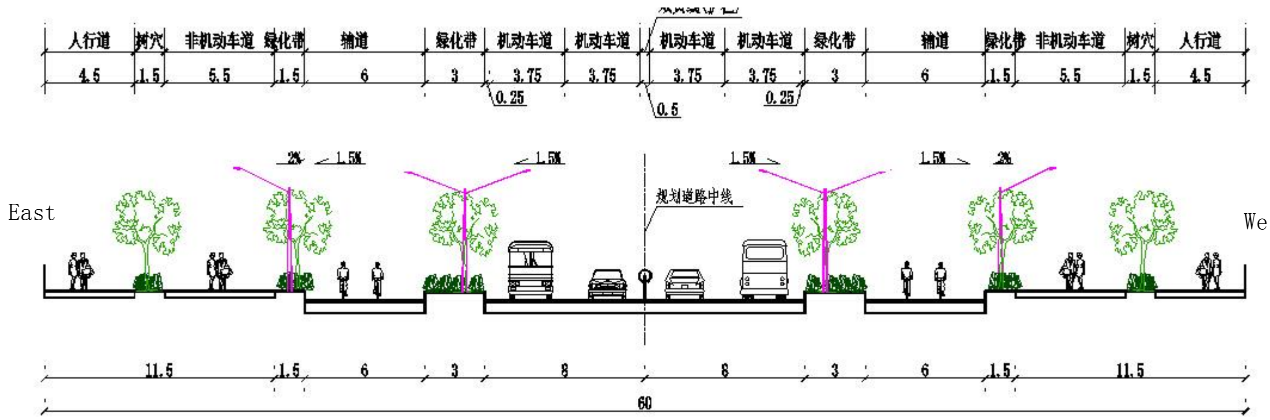


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Fig. 2-2-3-1-5 Standard Sectional View of Planed Taibai Road (Anwei Bridge to Jinqiu Avenue)

Currently, this road section belongs to three breadth road from the sectional view. Existing problem lies in the fact that widths of non-motorized vehicle lanes are not the same. Meanwhile, there is no non-motorized vehicle lane or sidewalk in some sections, giving rise to insufficient traffic functions. Since this section is a part of outer section, it is mainly used to connect the highway and downtown. Currently, the four-lane road can meet the requirements for transportation. Therefore, it is recommended in the scheme to maintain the existing three breadth road, unify the width of non-motorized vehicle lanes and construct sidewalk and non-motorized vehicle lanes for insufficient sections. It is recommended that the road should be made of 16m vehicle lane + 2×3m lane separator + 2×6m non-motorized vehicle lane + 13m sidewalk from the sectional view.

(2) Reconstruction of intersection

There are 13 intersections along the whole line and average space between intersections is 600m. Yinxing Avenue, Jiefang Avenue, Biyun Road and Jiangxia Avenue are arterial roads while others belong to sub-arterial roads or branches. All intersections will be reconstructed into channelized signal light control point except for intersection in Jiefang Avenue where original ring road structure will be maintained.

(3) Bus stop

There are 12 pairs of bus stops along the whole line and average space between stops is 600m. All the stops are of harbor style. Since the section may be in different forms, major stops will be established between Yinxing Avenue and Anwei Bridge. In addition, pedestrian crosswalk will be applied to achieve transfer in both directions. Bus stops are mainly established at the same side as the exit of intersection with consideration of expanded vehicle lane.

(4) Barrier free design

Disabled facilities are taken in account through the whole line. Such facilities will be installed in sidewalk, road intersection, and pedestrian crosswalk so that blind people and disabled people as well as the aged and children can travel by utilizing traffic facilities.

Go-ahead blind sidewalks are paved continuously and they are usually 0.5m away from sideline of sidewalks; the width of go-ahead blind sidewalk is 0.5m. Set warning blind sidewalks around the bend of go-ahead blind sidewalks. For actually existing barriers or objects that may cause danger to pedestrians with visual impairments, warning blind sidewalk corrals can be used as prompts. Additionally, to make sure that the road is accessible to wheelchairs, there shall be no abrupt height difference and cross raised paths, or otherwise there shall be slope transitions with gradient being 1:20.

As to intersection sidewalks, set curb ramps in places where curbs is located on corresponding pedestrian crosswalks. The gradient of curb ramp of single-face slopes is 1:20 and the gradient of curb ramps of three-face slopes is 1:12. Set warning blind sidewalks at intersections and connect warning blind sidewalks and go-ahead blind sidewalks.

(5) Others

Domestic assets can also be used for construction of subgrade and pavement, non-motorized vehicle lane, sidewalk, drainage system, afforestation, integrated pipeline as well as illuminating system.

2) Road traffic safety facilities (included in the Project supported by World Bank loan)

The road traffic safety facilities cover traffic signs and markings, traffic guardrail, traffic pipeline, adaptive signal control intersections, electronic police system capturing anyone who runs the red light in intersections, electronic police system capturing anyone who runs the red light in pedestrian crosswalk and road sections with lamp control, traffic monitoring and supervision system, as well as communication system.

The road traffic safety facilities include 7400m of 1.5m-traffic guardrail, 15300m traffic control pipeline, 15 adaptive signal control intersections, 15 intersections with electronic police system capturing anyone who runs the red light, 8 pedestrian crossings with lamp control, 8 pedestrian crossings with electronic police system capturing anyone who runs the red light, 8 sections with traffic monitoring, and 1 sections with bayonet system.

2.2.3.2 Biyun Road

Biyun Road starts from Binhe Avenue in the west, leading to New G316. Overall design length is 6.13km with red line with of 24m~52m. Ground reconstruction is needed in the whole line. Stake No. scope is K0+000~K6+130.449. Engineering reconstruction includes road works, sewage works, and auxiliary works with regard to greening, transportation, lightning and transport safety facilities.

1) Existing road conditions

Biyun Road, located in central area of old downtown as sub-arterial road, stretches for 6.13km. Biyun Road acts as the east–west axis in Anlu downtown and also an important traffic corridor that connects Hexi, old downtown and east city.

Biyun Road (Binhe Road ~ Handan Road) is 24m in width. It is one-breadth road. It has 2 two-way lanes, including 12m-wide vehicle lane. Vehicles and non-motorized vehicle coexist in the roadway and are separated by traffic markings. The roadway is paved by asphalt, leading to good road condition.

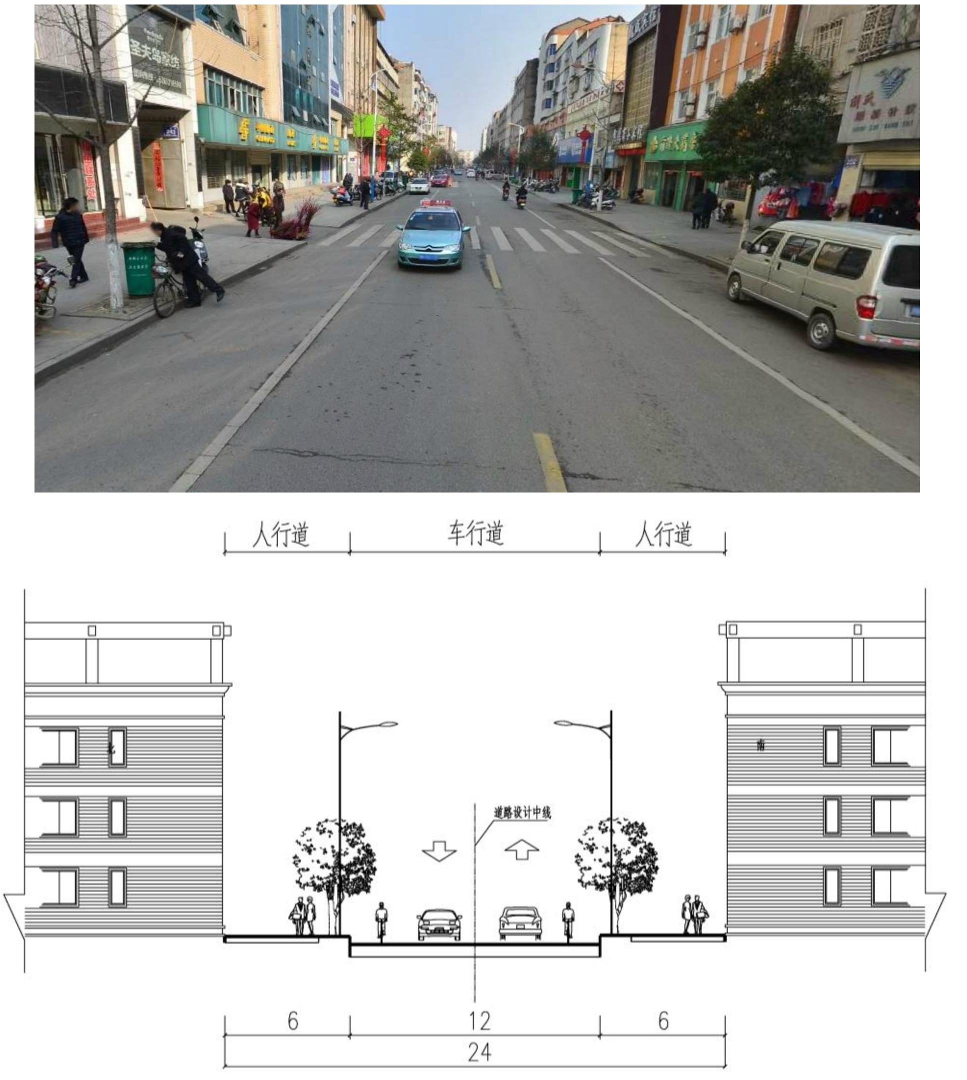


Fig. 2-2-3-2-1 Sectional View of Existing Biyun Road (Binhe Road ~ Handan Road)

Biyun Road (Handan Road ~ Wenchang Road) is 25m in width. It is one-breadth road. It has 4 two-way lanes, including 16m-wide vehicle lane. Vehicles and non-motorized vehicle coexist in the vehicle lane. There are separating facilities established in the center of roadway. The roadway is paved by asphalt, leading to good road condition.

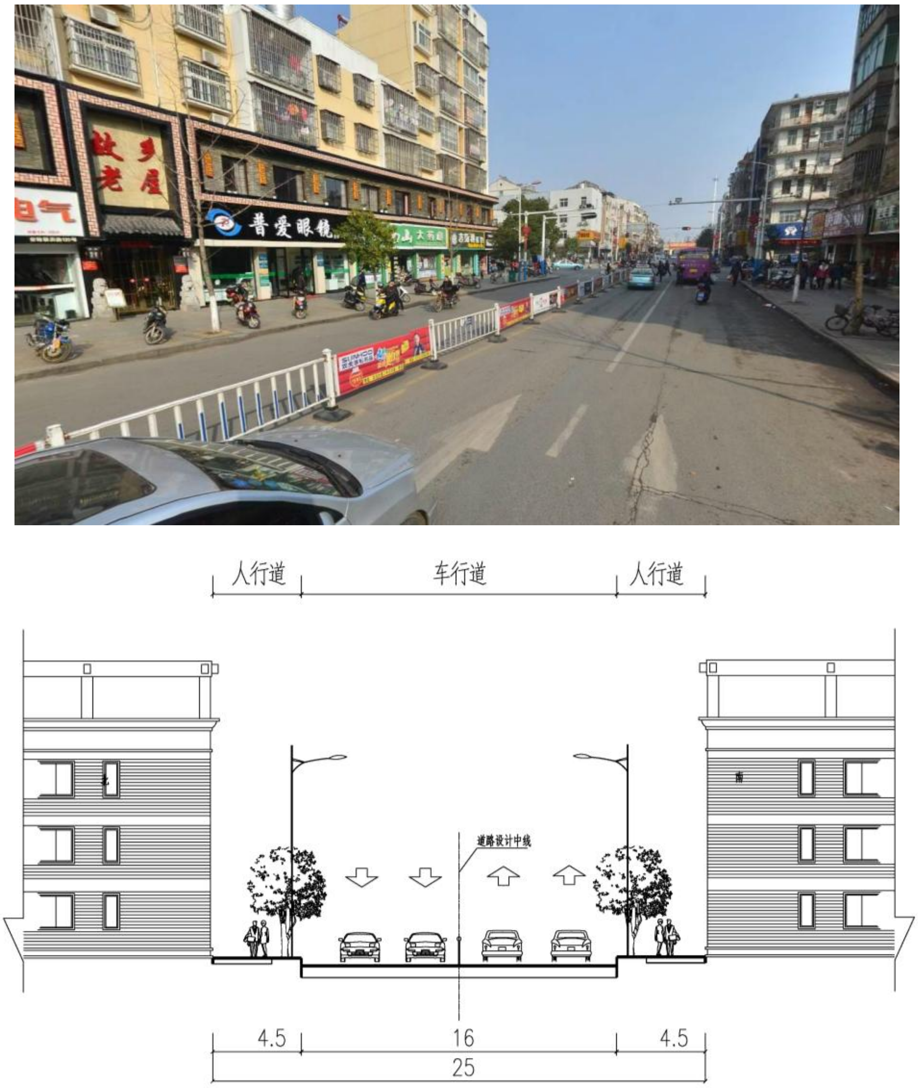


Fig. 2-2-3-2-2 Sectional View of Existing Biyun Road (Handan Road ~ Wenchang Road)

Biyun Road (Wenchang Road ~ Hankou-Danjiangkou Railway) is 25m in width. It is one-breadth road. It has 4 two-way lanes, including 14m-wide vehicle lane. Vehicles and non-motorized vehicle coexist in the vehicle lane. There are no separating facilities established in the center of roadway. The roadway is paved by asphalt, leading to good road condition.

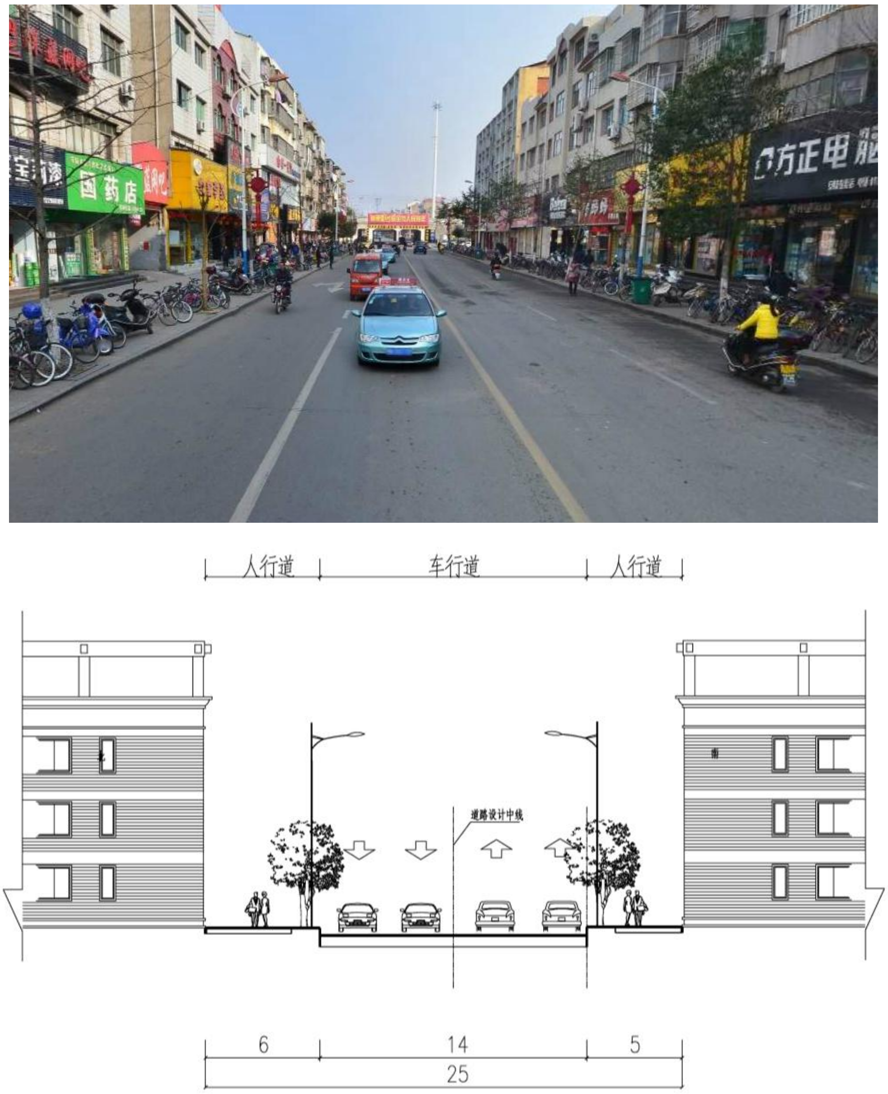


Fig. 2-2-3-2-3 Sectional View of Existing Biyun Road (Wenchang Road ~ Hankou-Danjiangkou Railway)

Biyun Road (Hankou-Danjiangkou Railway ~ Jinqiu Avenue) is 52m in width. It is three-breadth road. It has 4 two-way lanes, including 16m-wide vehicle lane, 6m-wide non-motorized vehicle lane and 9m-wide sidewalk. There are no separating facilities established in the center of roadway. Vehicle lane and non-motorized vehicle lane are paved by asphalt, leading to good road condition.

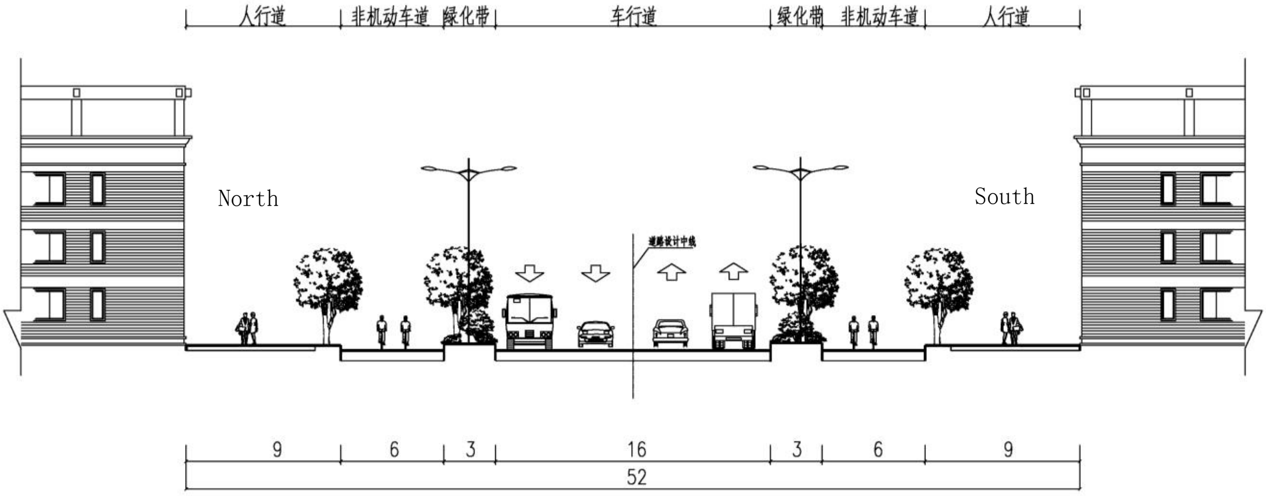


Fig. 2-2-3-2-4 Sectional View of Existing Biyun Road (Hankou-Danjiangkou Railway ~ Jinqiu Avenue)

Red line width in Biyun Road (Jinqiu Avenue ~ Everest Food Company) is 40m. Currently, there are 4 lanes, among which the vehicle lanes are 16m in width. 3m-wide separating guardrails have been established. There is no non-motorized vehicle lane or sidewalk. Separating facilities are not established in fast traffic lane yet. The roadway is paved by concrete, constituting normal road condition.

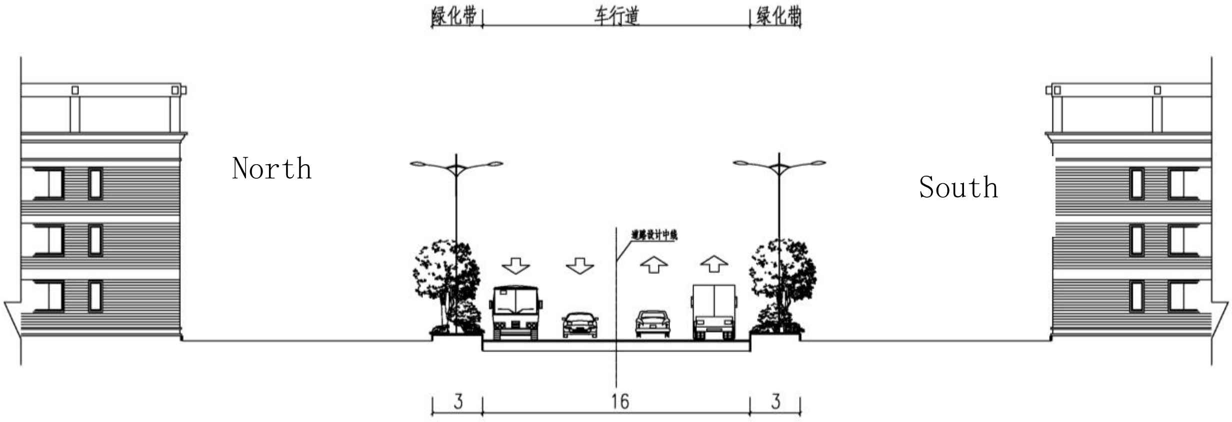


Fig. 2-2-3-2-5 Sectional View of Existing Biyun Road (Jinqiu Avenue ~ Everest Food Company)

Biyun Road (Everest Food Company ~ New G316) lasts for 800m. Relevant design institute has completed the design on the basis of 40m-wide red line. Currently, the construction is undergoing.

Fig. 2-2-3-2-6 Construction Site of Biyun Road （Everest Food Company ~ New G316）

Existing 9 bus lines pass through Handan Road to Taibai Road.

2) Reconstruction-road works

(1) Road plane

Binhe Avenue ~ Jinqiu Avenue: Maintain the width of existing cross section of the road (24~52m);

Jinqiu Avenue ~ New G316: red line width is 40m. Road centerline is the geometric center line of existing vehicle lanes.

(2) Reconstructed cross section of the road

Binhe Avenue ~ Handan Road: Maintain the width and composition of existing cross section of the road and establish center separation guardrails.

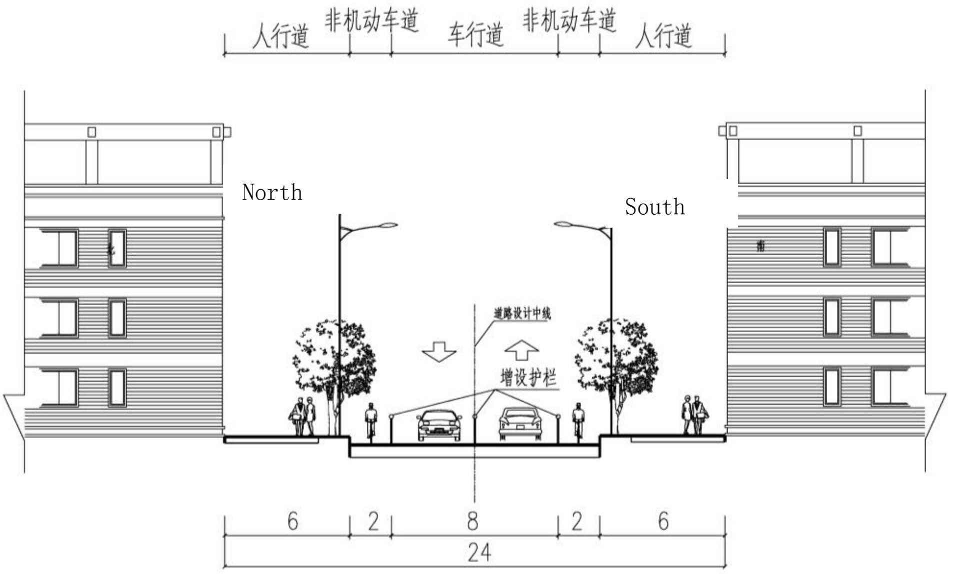


Fig. 2-2-3-2-7 Sectional View for Reconstruction of Biyun Road (Binhe Avenue ~ Handan Road)

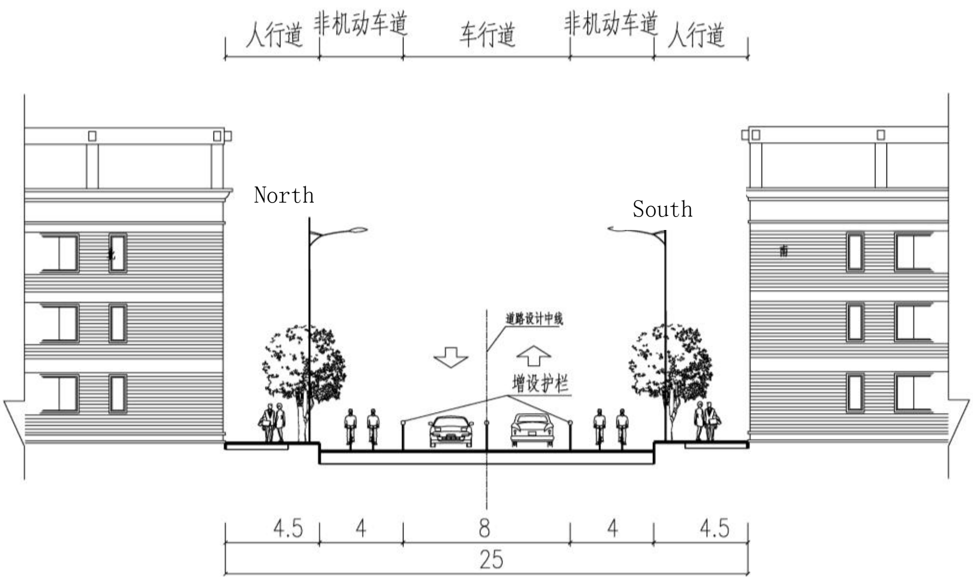


Fig. 2-2-3-2-8 Sectional View for Reconstruction of Biyun Road (Handan Road ~ Wenchang Road)

Wenchang Road ~ Hankou-Danjiangkou Railway: maintain the width and composition of existing cross section of the road. Change two-way 4-lane roadway into two-way 2-lane roadway and establish non-motorized vehicle lane. Establish separating guardrail between vehicle lane and non-motorized vehicle lane and also build center separation guardrails

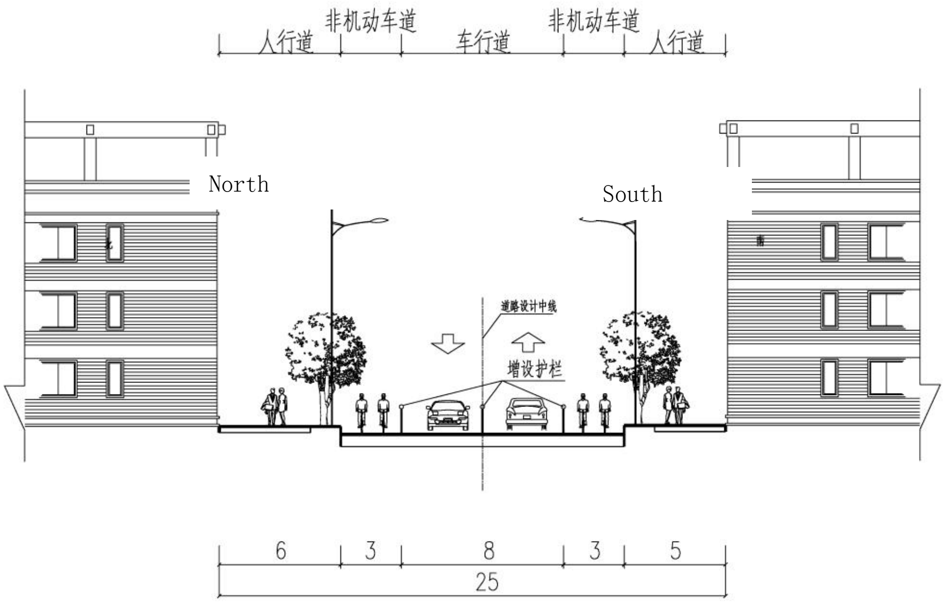


Fig. 2-2-3-2-9 Sectional View for Reconstruction of Biyun Road (Wenchang Road ~ Hankou-Danjiangkou Railway)

Hankou-Danjiangkou Railway ~ Jinqiu Avenue: maintain the width and composition of existing cross section of the road and establish center separation guardrails.

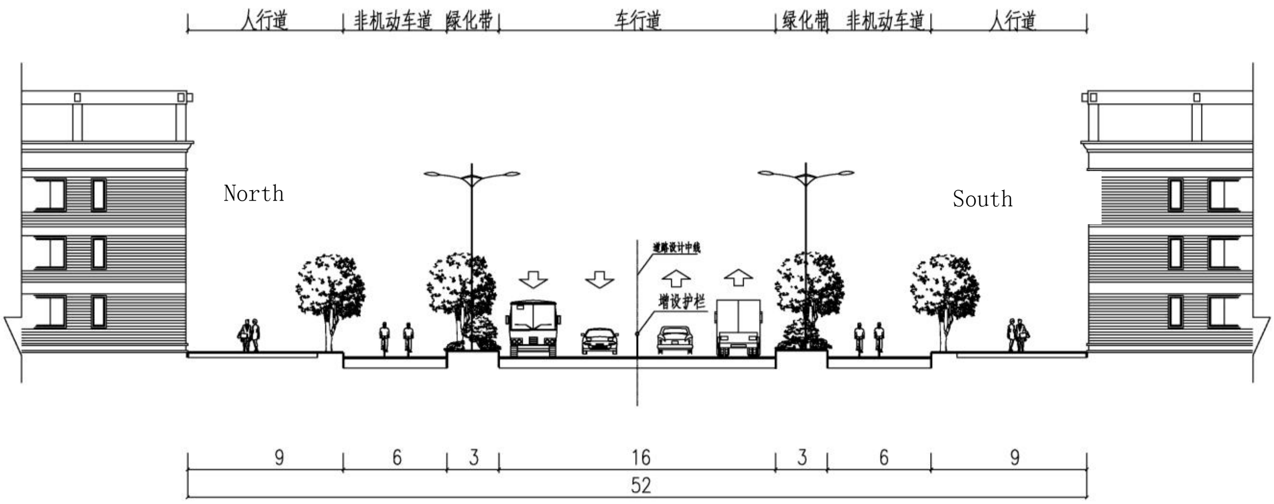


Fig. 2-2-3-2-10 Sectional View for Reconstruction of Biyun Road (Hankou-Danjiangkou Railway ~ Jinqiu Avenue)

Red line width from Jinqiu Avenue to New G316 is 40m. According to current sectional layout as well as the existing sectional layout in west of Jinqiu Avenue, it is determined that the reconstructed section should include: 40m=4.5m sidewalk (including tree pit, newly built) + 4.5m non-motorized vehicle lane (newly built) + 3m green belt (existing) + 16m vehicle lane (existing) + 3m green belt (existing) + 4.5m non-motorized vehicle lane (newly built) + 4.5m sidewalk (including tree pit, newly built). In addition, center separation guardrails will be established in vehicle lane.

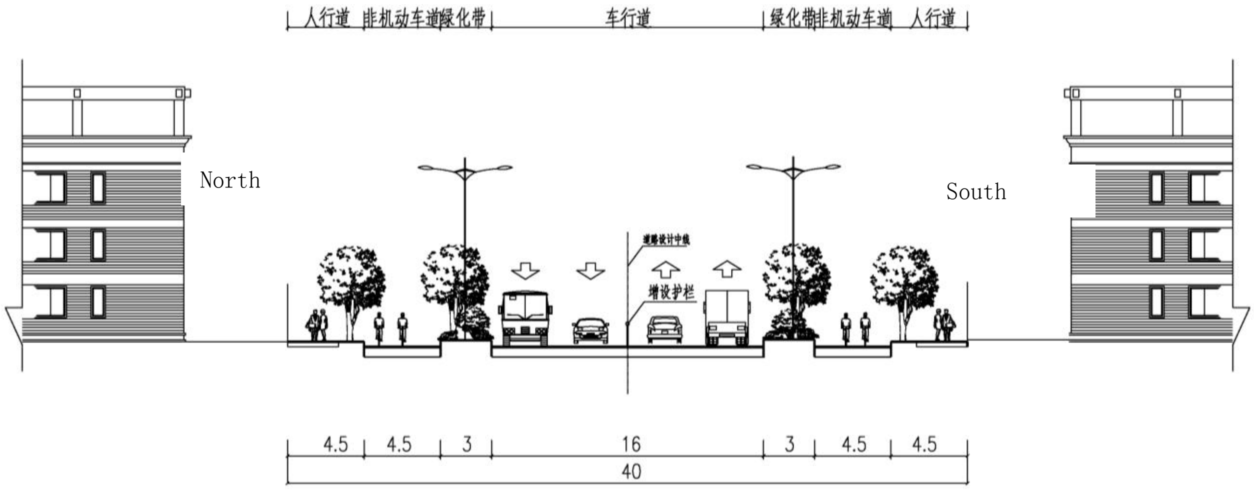


Fig. 2-2-3-2-11 Sectional View for Reconstruction of Biyun Road (Jinqiu Avenue ~ New G316)

(3) Road profile design

Pavement of Biyun Road (Jinqiu Avenue ~ New G316) will be repaved and reconstructed. Along the road, control the elevation and additional pavement thickness of existing road. Adopt the minimum longitudinal gradient satisfying the requirement of road drainage as far as possible.

(4) Subgrade design

According to land survey data of neighboring engineering as well as other experience concerning engineering, Anlu downtown area enjoys good geological conditions and therefore, subgrade treatment is mainly shallow treatment.

Common subgrade treatment: replacement fill shall be mainly adopted along the line with good soil; macadam shall be filled in soft segments.

Subgrade treatment in shallow soft soil: when the depth of soft soil subgrade such as sludge and mucky soil is less than 5.0m, the treatment shall be as per shallow soft subgrade and adopt the combinatorial method of riprap crowed silting method and dredging soil replacement method. When the mud thickness is less than 2m, remove sludge and replace good soil; when the mud thickness is 2～5m, use ripraps with about 2.0m thickness to displace sludge and the width shall exceed 2.0m beyond the road slope line.

(5) Pavement design

Biyun Road (Binhe Avenue ~ Jinqiu Avenue) currently enjoys bituminous pavement with good road condition. Therefore, no reconstruction will be made to its pavement structure this time; Biyun Road (Jinqiu Avenue ~ New G316) currently appreciates concrete pavement. In order to improve road structure function and landscape effects so as to make Jinqiu Avenue consistent with western pavement, it is proposed to use asphalt for road repaving and reconstruction.

a) Repaved pavement structure of vehicle lane in Biyun Road (Jinqiu Avenue ~ New G316)

4cm-thick AC-13C fine modified asphalt concrete (with fiber of 3.0Kg/T) + 8cm-thick AC-25C coarse asphalt concrete + existing concrete slab (processed)

b) Pavement structure of non-motorized vehicle lane in newly-constructed section of Biyun Road (Jinqiu Avenue ~ New G316)

4cm-thick AC-13C fine asphalt concrete + 6cm-thick AC-16C medium asphalt concrete + 36cm-thick subbase of rubbles stabilized by 5% cement

c) Sidewalk structure

6cm-thick precast C30 concrete bricks+ 2cm-thick M10 cement bed mortar +15cm-thick cast-in-situ cement stabilized macadam (9:95)

(6) Sidewalk and crossing facilities, bus stop as well as disabled facilities, etc

a) Pedestrian crosswalk and crossing facilities

Set pedestrian crosswalks at crossroads on road segments, the spacing shall be within 300m.

b) Bus stop

The spacing of bus stops shall be controlled within 300m～400m on the basis of actual condition of Anlu and for the convenience of passengers. In addition, bus stops shall be 50～80m out of crossroad exits. Facilities of intermediate stops along bus routines are usually on the side of intersection exit lane, if restricted, they can be seated on the side of entrance lane. Attention shall be paid to the stagger of buses leaving stops for entrance lanes or relative positions of signals.

The overall line has 17 pairs of bus sops, all of which are of harbor style except for the road section from Binhe Avenue to Handan Road where roadside stop is applied due to limited width.

c) Disabled facilities

For disabled facilities of the road works, pave go-ahead blind sidewalks for pedestrians with visual impairments, so that they can walk according to the sense of touch on feet. Go-ahead blind sidewalks are paved continuously and they are usually 0.25～0.5m away from tree pits of green belts or sidewalks; the width of go-ahead blind sidewalk is 0.30～0.60m. Set warning blind sidewalks around the bend of go-ahead blind sidewalks. For actually existing barriers or objects that may cause danger to pedestrians with visual impairments, warning blind sidewalk corrals can be used as prompts. Additionally, to make sure that the road is accessible to wheelchairs, there shall be no abrupt height difference and cross raised paths, or otherwise there shall be slope transitions with gradient being 1:20.

As to intersection sidewalks, set curb ramps in places where curbs is located on corresponding pedestrian crosswalks. The gradient of curb ramp of single-face slopes is 1:20 and the gradient of curb ramps of three-face slopes is 1:12. The distance between the lower entrances of ramps above the roadway shall be no more than 20mm. Intersection pedestrian crosswalks connect both sides of the road and on lane separators, the altitude of intersection pedestrian crosswalks shall be lowered to ensure wheelchair passage. Set warning blind sidewalks at intersections and connect warning blind sidewalks and go-ahead blind sidewalks. Set stereo facilities to help visually handicapped pedestrians to judge whether they can cross the intersection.

Build warning blind sidewalks and wheelchair ramps at bus stops to make it easier for visually handicapped pedestrians to wait for, get in and out of buses. Warning blind sidewalks and go-ahead blind sidewalks are connected. Set warning blind sidewalks at the bend of go-ahead- blind sidewalks and on the side of stop boards. The gradient of wheelchair ramps is 1:20.

3) Reconstruction – drainage works

(1) Existing drainage condition:

Binhe Avenue ~ Jinqiu Avenue: place d600mm~d1500mm drain pipes in two non-motorized vehicle lanes at both sides of the road to collect rainwater and sewage. Sewage will be drained into sewage pipes placed along Huguo River and Fuhe River and then released to sewage treatment works. Rainwater will be drained to Huguo River and Fuhe River.

Jinqiu Avenue ~ New G316: there are no sewage pipes along the line and rainwater runs into nearby body of water.

(2) Design of drainage works

Binhe Avenue ~ Jinqiu Avenue: keep current drainage system and combine road reconstruction to reconstruct rainwater inlets and connecting pipelines for road water.

Jinqiu Avenue ~ New G316: two lines of d500mm~d800mm rain pipes and two lines of d400mm sewage pipes will be placed in two non-motorized vehicle lanes at both sides of the road to collect rainwater and sewage. Rainwater and sewage will then be drained separately to First Fazhan Road and Second Fazhan Road.

(3) Pipes, interface and foundation

When diameter of designed rainwater and wastewater pipes is≤1200mm, adopt socket and spigot reinforced concrete pipeline. When pipe diameter is＞1200mm, adopt tongue and groove reinforced concrete pipeline. In case of earthing H≤4.5m, adopt socket and spigot reinforced concrete pipe (Grade Ⅱ) and rubber ring joint. In case of H≤3.5m, adopt 120° sand and gravel foundation. In case of 3.5m＜H≤4.5m, adopt 180° sand and gravel foundation. In case of earthing 4.5＜H≤7m, adopt socket and spigot reinforced concrete pipe (Grade Ⅲ), rubber ring joint and 180° sand and gravel foundation.

Pavement drainage pipeline should adopt socket and spigot reinforced concrete pipe (Grade Ⅱ), rubber ring joint and 180° sand and gravel foundation.

(4) Pavement drainage

Road pavement drainage is to collect through gutter inlet and drain to rainwater mains through rainwater branch pipe. Diameter of gutter inlet connecting pipe is d300mm, which adopts socket and spigot reinforced concrete pipe Grade Ⅱ, rubber ring joint and 180° sand and gravel foundation. All gutter inlets should adopt partial groove type single gutter inlets. Gutter inlets in roads newly constructed, reconstructed and expanded should all be constructed again.

(5) Integrated pipeline

Water supply pipes and gas pipes are easily destroyed during operation, thus it is necessary to implement breaking ground maintenance and overhaul frequently and such pipes shall be laid under the sidewalks.

Since rainwater pipes have big section area and large earthwork amount, they should be laid on sides of the road to collect rainwater in the neighbor and on the road.

Cable trench and telecommunication pipeline are generally installed under the sidewalks or non-motorized vehicle lane.

Rainwater and sewage pipes should be laid under non-motorized vehicle lanes or green belts.

4) Reconstruction – landscape works

The whole road is about 6.13km. Landscape works mainly include 3m-wide separating belt + border trees.

3m-wide separating belt: plantation style of 3m-wide separating belt at west side of extended roads

Border trees: variety of border trees at west side of extended roads

5) Reconstruction – illumination works

From Hankou-Danjiangkou Railway to G316 National Highway, the illumination adopts double-arm street lamps symmetrically installed on both sides, and the light poles are installed on separating belt between vehicle lane and non-motorized vehicle lane; from Binhe Avenue to Hankou-Danjiangkou Railway, the illumination adopts one-arm street lamps symmetrically installed on both sides, and the light poles are installed on both sides of sidewalk.

Currently, road lamps are supplied by 10kV municipal public power with single-phase pole transformer + electric illumination cabinet (uniform distribution) and 220V outgoing line.

6) Reconstruction – road transport safety facility works

Improve traffic signs and lines along the line. Newly construct 2,400m 1.2m-traffic guardrail, 4,500m 1.5m-traffic guardrail, 9,000m traffic control pipeline, 13 adaptive signal control intersections, 13 intersections with electronic police system capturing anyone who runs the red light, 5 pedestrian crossings on lamp control section, 5 pedestrian crossings with electronic police system capturing anyone who runs the red light, 15 sections with traffic monitoring, 2 sections with bayonet system and matched transportation communication system.

2.2.3.3 Jiefang Avenue

Jiefang Avenue, with its west from Binhe Avenue and east from Jinqiu Avenue, is designed to be 3.34 km in length and the width of red line is 43m~53m. Stake No. scope is -K0+000~K3+332.837. Engineering reconstruction includes road works, sewage works, bridge works and auxiliary works with regard to greening, transportation, lightning and transport safety facilities.

1) Road condition

Jiefang Avenue, (Fuhe Avenue-Jinqiu Avenue) is an arterial road, connecting east and east districts of Fuhe River, with a total length of 2.56 km and width of 43~53 m. It is of three-block type. The cross section arrangement is: 5~10m of sidewalk+ 5.5m of bicycle lane+ 3m of green belt+ 16m of motorway+ 3m of green belt+ 5.5m of bicycle lane+ 5~10m of sidewalk.

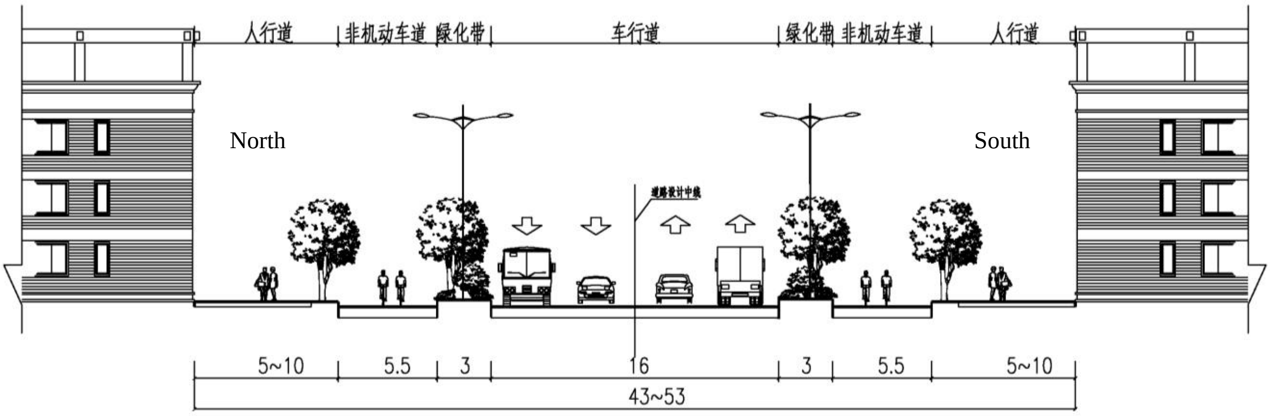


Fig. 2-2-3-3-1 Existing Cross Section of Jiefang Avenue (Binhe Avenue~Jinqiu Avenue)

The motorway from Binhe Avenue to Taibai Avenue is of bituminous pavement, the condition of which is good; the motorway from Taibai Avenue to Jinqiu Avenue is of concrete pavement, the condition of which is acceptable; bicycle lanes of the overall line are of concrete pavement, the condition of which is acceptable; sidewalks of the overall line are pavements constructed of various materials, which in some sections are seriously damaged, partial sections are not paved and disabled facilities on sidewalks are badly lacking.

At present this road has 4 bus routines, 2 of which are on the maximum cross section.

2) Reconstruction-road works

Road reconstruction starts from Binhe Avenue in the west to Jinqiu Avenue in the east, connecting east and west districts of Fuhe River, with a total length of 3.34 km. Existing width of the road is 43~53 m; center line of the avenue is designated according to the geometric centerline of existing roadway.

(2) Reconstructed cross section of the road

Maintain the width and composition of existing cross section of the road and establish center separation guardrails.

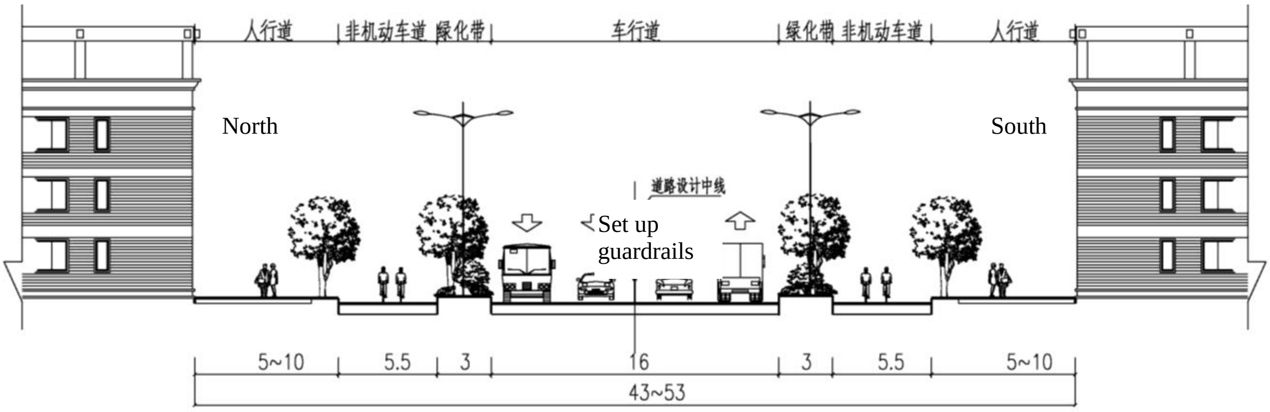


Fig. 2-2-3-3-2 Reconstructed Cross Section of Jiefang Avenue (Binhe Avenue~Jinqiu Avenue)

(3) Road profile design

Concrete pavement of the overall line will be repaved and reconstructed. Along the road, control the elevation and additional pavement thickness of existing road. Adopt the minimum longitudinal gradient satisfying the requirement of road drainage as far as possible.

(4) Subgrade design

Subgrade treatment is mainly shallow treatment.

Common foundation treatment: replacement fill shall be mainly adopted along the line with good soil; macadam shall be filled in soft segments.

Subgrade treatment in shallow soft soil: when the depth of soft soil subgrade such as sludge and mucky soil is less than 5.0m, the treatment shall be as per shallow soft subgrade and adopt the combinatorial method of riprap crowed silting method and dredging soil replacement method. When the mud thickness is less than 2m, remove sludge and replace good soil; when the mud thickness is 2～5m, use ripraps with about 2.0m thickness to displace sludge and the width shall exceed 2.0m beyond the road slope line.

(5) Pavement design

As the motorway from Binhe Avenue to Taibai Avenue is of bituminous pavement and the road condition is good, it will be excluded from the reconstruction; the motorway from Taibai Avenue to Jinqiu Avenue and the overall non-motorized vehicle lane of Jiefang Avenue (Binhe Avenue~Jinqiu Avenue) are of concrete pavement, to improve road structure function and landscape effects, pavement materials are proposed to be unified to be asphalt for road repaving and reconstruction.

Pavement scheme of the overall line is as follows:

a) Add pavement structure for roadways of Jiefang Avenue (Taibai Avenue~Jinqiu Avenue)

4cm-thick AC-13C fine modified asphalt concrete (mixing amount of fiber is 3Kg/T)+ 5cm-thick AC-20C medium asphalt concrete+ 7cm-thick AC-25C coarse asphalt concrete+ existing concrete blocks (disposed)

b) Add pavement structure for non-motorized vehicle lanes of overall Jiefang Avenue (Binhe Avenue~Jinqiu Avenue)

4cm-thick AC-13C fine asphalt concrete + 6cm-thick AC-16C medium asphalt concrete+ existing concrete blocks (disposed)

c) Sidewalk structure

6cm-thick precast C30 concrete bricks+ 2cm-thick M10 cement bed mortar +15cm-thick cast-in-situ C20 concrete base

(6) Sidewalk and crossing facilities, bus stop as well as disabled facilities, etc

a) Pedestrian crosswalk and crossing facilities

Set pedestrian crosswalks at crossroads on road segments, the spacing shall be within 300m.

b) Bus stop

The spacing of bus stops shall be controlled within 300m～400m on the basis of actual condition of Anlu and for the convenience of passengers. In addition, bus stops shall be 50～80m out of crossroad exits. Facilities of intermediate stops along bus routines are usually on the side of intersection exit lane, if restricted, they can be seated on the side of entrance lane. Attention shall be paid to the stagger of buses leaving stops for entrance lanes or relative positions of signals.

The overall line has 6 pairs of bus stops, all of which are of harbor style.

c) Disabled facilities

For disabled facilities of the road works, pave go-ahead blind sidewalks for pedestrians with visual impairments, so that they can walk according to the sense of touch on feet. Go-ahead blind sidewalks are paved continuously and they are usually 0.25～0.5m away from tree pits of green belts or sidewalks; the width of go-ahead blind sidewalk is 0.30～0.60m. Set warning blind sidewalks around the bend of go-ahead blind sidewalks. For actually existing barriers or objects that may cause danger to pedestrians with visual impairments, warning blind sidewalk corrals can be used as prompts. Additionally, to make sure that the road is accessible to wheelchairs, there shall be no abrupt height difference and cross raised paths, or otherwise there shall be slope transitions with gradient being 1:20.

As to intersection sidewalks, set curb ramps in places where curbs is located on corresponding pedestrian crosswalks. The gradient of curb ramp of single-face slopes is 1:20 and the gradient of curb ramps of three-face slopes is 1:12. The distance between the lower entrances of ramps above the roadway shall be no more than 20mm. Intersection pedestrian crosswalks connect both sides of the road and on lane separators, the altitude of intersection pedestrian crosswalks shall be lowered to ensure wheelchair passage. Set warning blind sidewalks at intersections and connect warning blind sidewalks and go-ahead blind sidewalks. Set stereo facilities to help visually handicapped pedestrians to judge whether they can cross the intersection.

Build warning blind sidewalks and wheelchair ramps at bus stops to make it easier for visually handicapped pedestrians to wait for, get in and out of buses. Warning blind sidewalks and go-ahead blind sidewalks are connected. Set warning blind sidewalks at the bend of go-ahead- blind sidewalks and on the side of stop boards. The gradient of wheelchair ramps is 1:20.

3) Re construction-drainage works

(1) Existing drainage condition

On both sides of the road, there is a row of d800mm drainage pipes in non-motorized vehicle lanes to collect rainwater and sewage along the line. The sewage flows to sewage interception pipelines along Maohe River, Huguo River and Fuhe River and then discharges into sewage disposal plants; rain flows in Maohe River, Huguo River and Fuhe River.

(2) Design of drainage works

Keep current drainage system and combine road reconstruction to reconstruct rainwater inlets and connecting pipelines for road water.

(3) Pipe, joint and foundation

When the designed pipe diameter of rainwater and sewage pipe is smaller than or equal to 1200mm, adopt socket type reinforced concrete pipe, when the pipe diameter is larger than 1200mm, adopt tongue and groove reinforced concrete pipe. When the earthing $H \leq 4.5m$, adopt half-through reinforced concrete pipe (Level II) and rubber ring joint, when $H \leq 3.5m$, adopt 120° sand and gravel foundation; when $3.5m < H \leq 4.5m$, adopt 180° sand and gravel foundation; when earthing $4.5 < H \leq 7m$, adopt half-through reinforced concrete pipe (level III) and rubber joint as well as 180° sand and gravel foundation.

The surface drainage pipeline shall adopt half-through reinforced concrete pipe (level II) and rubber joint as well as 180° sand and gravel foundation.

(4) Pavement drainage

The pavement drainage of road is collected by gutter inlets and drained into rainwater main pipes through rainwater branch pipes. The pipe diameter of connecting pipe of gutter inlet is d300mm, which adopts half-through reinforced concrete level II pipe and rubber joint as well as 180° sand and gravel foundation. All gutter inlets adopt partial groove type single gutter inlets. All gutter inlets in newly constructed and reconstructed segments are newly constructed.

(5) Integrated pipelines

Water supply pipes and gas pipes are easily destroyed during operation, thus it is necessary to implement breaking ground maintenance and overhaul frequently and such pipes shall be laid under the pavement.

Due to a large sectional area and huge volume of earthwork, rainwater pipes shall be laid on both sides of roads so as to join up street eave rainwater and road rainwater.

The cable trench and telecommunication pipelines are generally laid under the sidewalks or non-motorized vehicle lanes.

Rain and sewage pipes shall be laid under non-motorized vehicle lanes or green belts.

4) Reconstruction – landscape works

The whole road is about 3.34km in length with good afforestation condition. The Project will preserve existing afforestation condition of this road, and only replant partial border trees lost or damaged.

5) Reconstruction– illumination works

As Illumination facilities along the line are complete and in good condition and the adjustments in cross sections and planes made by the Project are not great, therefore, existing illumination facilities will be reserved and utilized as far as possible. In the following conditions, illumination facilities will be reconstructed: the establishment of harbor-typed bus stops; intersection adding; intersection and road partial extension; setting green belts on where existing lights is located and sidewalk changes.

Road illumination should maintain existing double-arm street lamps symmetrically installed on both sides, and the light poles should be installed on green belt or sidewalk on both sides. Since existing light poles are in good condition, we may consider relocating the existing light poles as much as possible. In case that existing light poles cannot meet illumination requirement after transformation due to widening of the road, type of the light poles newly installed should be the same as that of existing ones. As required by standards, compared to illumination in straight sections, illumination at intersections shall be improved by adding light poles according to the condition of intersections.

6) Reconstruction – road transport safety facility works

Improve traffic signs and lines along the roads. Newly construct 3343m of 1.2m-traffic guardrail, 10843m traffic control pipeline, 8 adaptive signal control intersections, 8 intersections with electronic police system capturing anyone who runs the red light, 3 pedestrian crossings on lamp control section, 3 pedestrian crossings with electronic police system capturing anyone who runs the red light, 8 sections with traffic monitoring, 1 sections with bayonet system and matched transportation communication system.

The reconstruction works of Jiefang Avenue include a bridge, which crosses Chashan River. The original bridge of a one-hole ribbed arch bridge with a length of 26.8 m and a width of 22 m. Water flow direction of Chashan River is heterotropic to heading direction of bridge . The deck of the old bridge is heterotropic to the river but the lower structure is perpendicular to the river. According to the general cross section arrangement requirements of road and slow traffic demands, it is proposed to widen both sides of the original bridge to 6m, therefore, a 22m-wide bridge will be expanded to 34m.

(1) Main design standard

Road degree: urban arterial road;

Calculated driving speed: 50km/h;

Bridge deck width: the old one is 22m and the reconstructed and expanded one is 34m in total.

Standard cross section composition: 3.0m (sidewalk) +6m (non-motored vehicle lane) +16m (vehicle lane) +6m (non-motored vehicle lane) + 3.0m (sidewalk) =34m

Design load of bridge: crowd load

Seismic fortification criterion: seismic fortification is of C type, the degree is Level 6 (corresponding to basic seismic peak acceleration 0.05g), the degree of seismic fortification measure is Level 7.

(2) Existing bridge condition

The original bridge is of a one-hole ribbed arch bridge with a length of 26.8m, a width of 22m and gravity abutment, consisting of 6 arch ribs. The cross section composition is 3.0m (sidewalk) +16m (vehicle lane) + 3.0m (sidewalk)=22m. Water flow direction is heterotropic to heading direction of deck but perpendicular to lower structure.

Fig. 2-2-3-3-3 Bridge Crossing Chashan River on Jiefang Avenue

(3) Bridge structural plane design

Horizontal, longitudinal and transversal design of bridge is subject to general road design

a) Program overview

Remove railings and sidewalk slabs on both sides of the old bridge and then widen both sides of the bridge to 6m. As the old bridge is a one-hole arch bridge and there is no pier in the middle of riverbed, the reconstructed bridge shall adopt one-span bridge girder. If the new bridge is built as arch type, the reconstruction surely will affect the stress of gravity abutment of the old one and consequently impair the safety of the old bridge. Therefore, the program adopts one-span 30m prestressed concrete small box girder structure for one side. The length of bridge on one side is 37.08, the width is 6m; the cross slope is single-face slope 1.5%. Bridge direction is heterotropic to water flow direction to and the lower structure is perpendicular to water flow direction to keep consistent with the old one. The abutment is buried abutment. The foundation is single-row cast-in-situ bored pile foundation. 2cm of spacing is reserved between the old and new bridges so that the old and new bridges can bear loads individually.

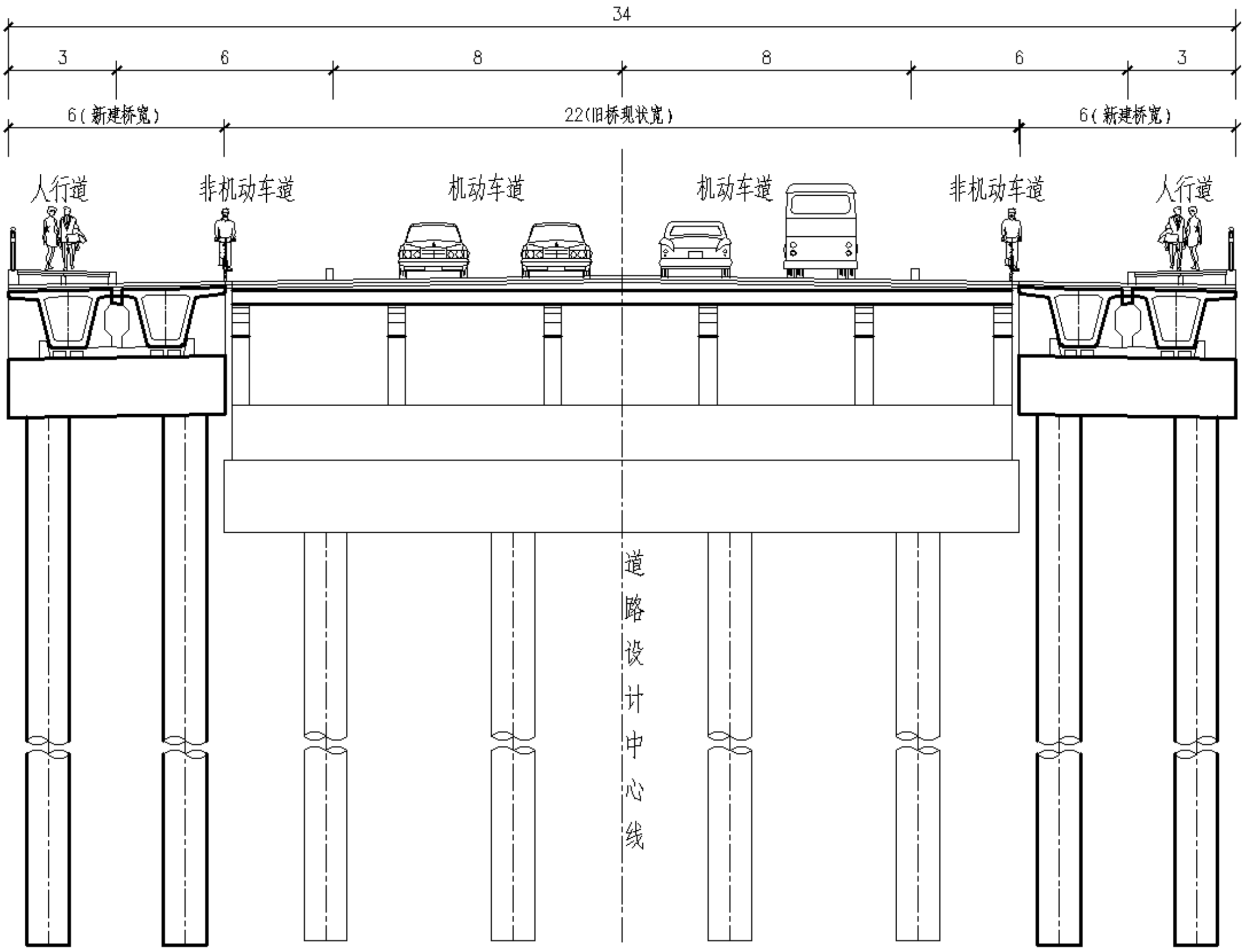


Fig. 2-2-3-3-4 Cross Section Arrangement of Chashan River on Jiefang Avenue

b) Upper structure

Upper structure adopts a simply supported 30m prestressed concrete small box girder structure. The full bridge is a one system. One span on one side has 2 boundary beams with a height of 1.6m and width of 2.85m. Wet joint between the two boundary beams is 30cm in width. The height of beam wing is 0.18m, the thickness of web in span is 0.18m, and the thickness of baseboards on upper and lower apexes is 0.18m. Set a 0.1m-thick cast-in-situ layer on top surface of the beam and then place a layer of 0.09,-thick asphalt paving.

c) Lower structure

The abutment is buried abutment. Abutment capping beam is 5.98m in length and 1.6m in height; the distance between old and new abutment is 2cm. The foundation adopts single-row piles with two in each row. Pile foundation, with 1.2m of diameter and spacing is 3.8m of pile spacing, is poured by cast-in-situ bored pile foundation.

2.2.3.4 Jinqiu Avenue

Jinqiu Avenue, with its north from Yinxing Avenue and east from Biyun Road, is designed to be 4.46 km in length and the width of red line is 60m. Stake No. scope is -K0+000~K3+332.837. Engineering reconstruction includes road works, sewage works, bridge works and auxiliary works with regard to greening, transportation, lightning and transport safety facilities.

2) Road condition

Jinqiu Avenue (Yinxing Avenue-Biyun Road), located in the east of the city and with a total length of 4.46 km, is a north-south traffic corridor in east district of the city and is divided into sub-arterial roads. Its ambient buildings have stepped back according to the 60m red line of Jinqiu Avenue to form the pattern 15cm roadways+ 14m intermediate belts+ 15m roadway. Sidewalks of most segments of the overall avenue have not built yet. Existing roadways are of concrete pavement and concrete slabs along the overall line are seriously damaged. Cross sections do not clearly cover bicycle lanes. In addition, intermediate belts along the line do not have high-voltage corridors. The overall line has no bus stop platforms and secondary crossing facilities.

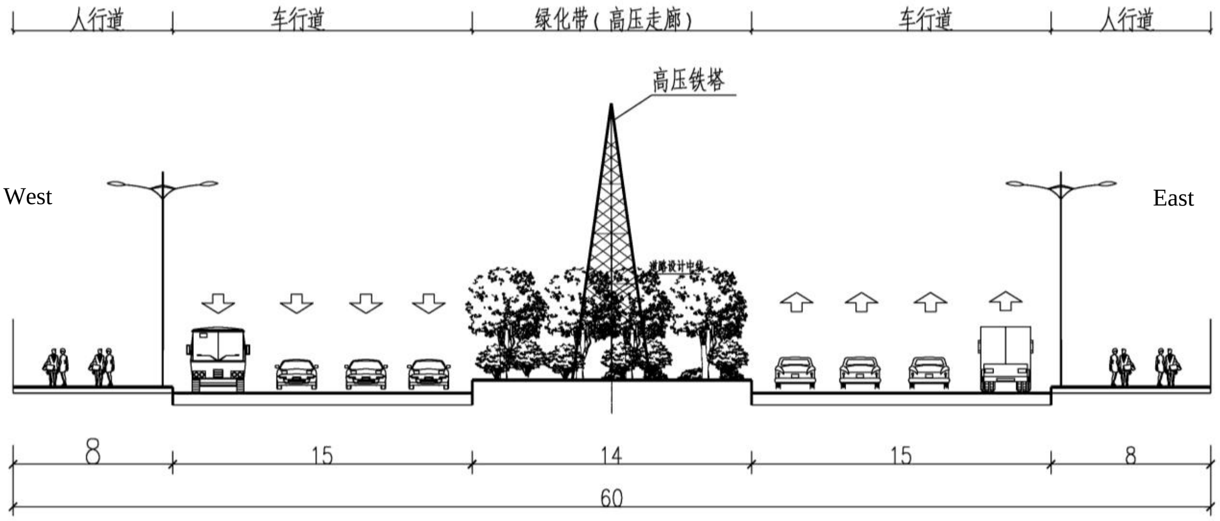


Fig. 2-2-3-4-1 Existing Cross Section of Jinqiu Avenue (Yinxing Avenue~Biyun Road)

2) Reconstruction-road works

(1) Road plane

The total length of Jinqiu Avenue (Yinxing Avenue-Biyun Road) is 4.46 km and the width of red line is 60 m. At present, the intermediate belt and motorway have formed and the centerline is determined according to the geometric centerline of existing roadway.

(2) Reconstructed cross section of the road

Maintain the width of existing cross section of the road, draw 6 bi-directional lane markings for standard road segments and add non-motorized vehicle lane on the side of roadway. Guardrails are set to separate roadways and non-motorized vehicle lanes. Set 8m-wide sidewalks on road side as required by the Plan.

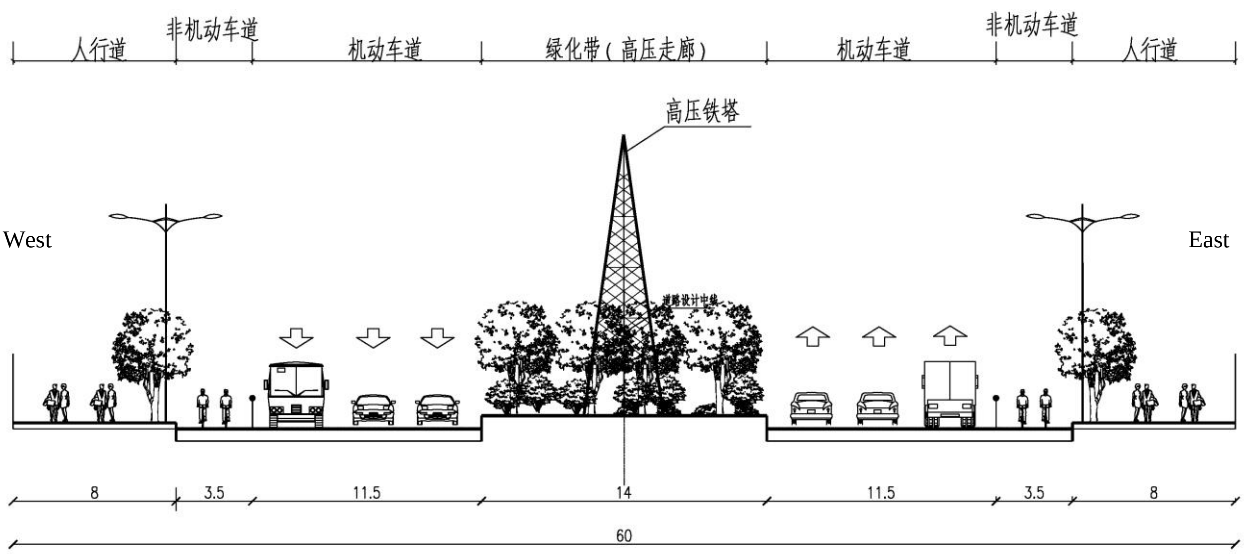


Fig. 2-2-3-4-2 Reconstructed Cross Section of Jinqiu Avenue (Yinxing Avenue~Biyun Road)

(3) Road profile design

Concrete pavement of the overall line will be repaved and reconstructed. Along the road, control the elevation and additional pavement thickness of existing road. Adopt the minimum longitudinal gradient satisfying the requirement of road drainage as far as possible.

(4) Subgrade design

On the basis of adjacent engineering geologic data, other engineering experience and relatively good geological condition of urban districts Anlu, subgrade treatment is mainly shallow treatment.

Common subgrade treatment: replacement fill shall be mainly adopted along the line with good soil; macadam shall be filled in soft segments.

Subgrade treatment in shallow soft soil: when the depth of soft soil subgrade such as sludge and mucky soil is less than 5.0m, the treatment shall be as per shallow soft subgrade and adopt the combinatorial method of riprap crowed silting method and dredging soil replacement method. When the mud thickness is less than 2m, remove sludge and replace good soil; when the mud thickness is 2～5m, use ripraps with about 2.0m thickness to displace sludge and the width shall exceed 2.0m beyond the road slope line.

(5) Pavement design

The existing status of the works is of concrete pavement, to improve road structure function and landscape effects, it is proposed to use asphalt for road repaving and reconstruction.

Pavement scheme of the overall line in this stage is as follows:

a) Add pavement structure for roadways to be reconstructed

4cm-thick AC-13C fine modified asphalt concrete above layer+ 5cm-thick AC-20C medium asphalt concrete intermediate layer+ 7cm-thick AC-25C coarse asphalt concrete underlying layer+ existing concrete blocks (disposed).

b) Sidewalk structure

6cm-thick precast C30 step bricks+ 2cm-thick M10 cement bed mortar +15cm-thick cast-in-situ cement stabilized macadam (9:95)

(6) Sidewalk and crossing facilities, bus stop as well as disabled facilities, etc

a) Pedestrian crosswalk and crossing facilities

Set pedestrian crosswalks at crossroads on road segments, the spacing shall be within 300m.

b) Bus stop

The spacing of bus stops shall be controlled within 300m～400m on the basis of actual condition of Anlu and for the convenience of passengers. In addition, bus stops shall be 50～80m out of crossroad exits. Facilities of intermediate stops along bus routines are usually on the side of intersection exit lane, if restricted, they can be seated on the side of entrance lane. Attention shall be paid to the stagger of buses leaving stops for entrance lanes or relative positions of signals.

The overall line has 12 pairs of bus stops, all of which are of harbor style.

For disabled facilities of the road works, pave go-ahead blind sidewalks for pedestrians with visual impairments, so that they can walk according to the sense of touch on feet. Go-ahead blind sidewalks are paved continuously and they are usually 0.25～0.5m away from tree pits of green belts or sidewalks; the width of go-ahead blind sidewalk is 0.30～0.60m. Set warning blind sidewalks around the bend of go-ahead blind sidewalks. For actually existing barriers or objects that may cause danger to pedestrians with visual impairments, warning blind sidewalk corrals can be used as prompts. Additionally, to make sure that the road is accessible to wheelchairs, there shall be no abrupt height difference and cross raised paths, or otherwise there shall be slope transitions with gradient being 1:20.

As to intersection sidewalks, set curb ramps in places where curbs is located on corresponding pedestrian crosswalks. The gradient of curb ramp of single-face slopes is 1:20 and the gradient of curb ramps of three-face slopes is 1:12. The distance between the lower entrances of ramps above the roadway shall be no more than 20mm. Intersection pedestrian crosswalks connect both sides of the road and on lane separators, the altitude of intersection pedestrian crosswalks shall be lowered to ensure wheelchair passage. Set warning blind sidewalks at intersections and connect warning blind sidewalks and go-ahead blind sidewalks. Set stereo facilities to help visually handicapped pedestrians to judge whether they can cross the intersection.

Build warning blind sidewalks and wheelchair ramps at bus stops to make it easier for visually handicapped pedestrians to wait for, get in and out of buses. Warning blind sidewalks and go-ahead blind sidewalks are connected. Set warning blind sidewalks at the bend of go-ahead- blind sidewalks and on the side of stop boards. The gradient of wheelchair ramps is 1:20.

3) Reconstruction – drainage works

(1) Existing drainage condition:

There is d800mm~BH=2.5m×2.0m drainage pipe culvert along the road, and there is no any other drainage facility along the proposed road.

(2) Design of drainage works

Preserve existing rainwater pipeline and newly build d800mm~d1500mm rainwater pipeline at the place where drainage ability of partial pipelines cannot meet requirements. Transform according to the road. Transform the existing gutter inlet and rainwater connecting pipe on the road pavement. Lay two rows of d400mm~d500mm wastewater pipes along the road.

(3) Pipes, interface and foundation

When diameter of designed rainwater and wastewater pipes is≤1200mm, adopt socket and spigot reinforced concrete pipeline. When pipe diameter is＞1200mm, adopt tongue and groove reinforced concrete pipeline. In case of earthing H≤4.5m, adopt socket and spigot reinforced concrete pipe (Grade Ⅱ) and rubber ring joint. In case of H≤3.5m, adopt 120° sand and gravel foundation. In case of 3.5m＜H≤4.5m, adopt 180° sand and gravel foundation. In case of earthing 4.5＜H≤7m, adopt socket and spigot reinforced concrete pipe (Grade Ⅲ), rubber ring joint and 180° sand and gravel foundation.

Pavement drainage pipeline should adopt socket and spigot reinforced concrete pipe (Grade Ⅱ), rubber ring joint and 180° sand and gravel foundation.

(4) Pavement drainage

Road pavement drainage is to collect through gutter inlet and drain to rainwater mains through rainwater branch pipe. Diameter of gutter inlet connecting pipe is d300mm, which adopts socket and spigot reinforced concrete pipe Grade Ⅱ, rubber ring joint and 180° sand and gravel foundation. All gutter inlets should adopt partial groove type single gutter inlets. Gutter inlets in roads newly constructed, reconstructed and expanded should all be constructed again.

(5) Integrated pipeline

Water supply pipes and gas pipes are easily destroyed during operation, thus it is necessary to implement breaking ground maintenance and overhaul frequently and such pipes shall be laid under the sidewalks.

Since rainwater pipes have big section area and large earthwork amount, they should be laid on sides of the road to collect rainwater in the neighbor and on the road.

Cable trench and telecommunication pipeline are generally installed under the sidewalks or non-motorized vehicle lane.

Rainwater and sewage pipes should be laid under non-motorized vehicle lanes or green belts.

4) Reconstruction – landscape works

The whole road is about 4.46km with good existing afforestation condition. The Project will preserve existing afforestation condition of this road, and only replant partial border trees lost or damaged.

5) Reconstruction – illumination works

Existing illumination of Jinqiu Avenue (Baodi Road-Jiefang Avenue) adopts one-arm street lamps symmetrically installed on both sides, and the light poles are installed on green belt or sidewalk on both sides. Other sections are not equipped with perfect road illumination facility, except some street lamps installed by building developers in the neighborhood.

Existing Baodi Road-Jiefang Avenue is equipped with perfect illumination facilities and good illumination effect. There is no big change in road section and plane during construction of the Project, so it is necessary to preserve and use existing illumination facilities as much as possible. Road illumination should maintain existing one-arm street lamps symmetrically installed on both sides, and the light poles should be installed on green belt or sidewalk on both sides. Since existing light poles are in good condition, we may consider relocating the existing light poles as much as possible. In case that existing light poles cannot meet illumination requirement after transformation due to widening of the road, type of the light poles newly installed should be the same as that of existing ones. Illumination facilities newly installed in other sections adopt one-arm street lamps symmetrically installed on both sides, and the light poles are installed on green belt or sidewalk on both sides.

6) Reconstruction – road transport safety facility works

Improve traffic signs and lines along the roads. Newly construct 8,200m 1.2m-traffic guardrail, 15,300m traffic control pipeline, 9 adaptive signal control intersections, 9 intersections with electronic police system capturing anyone who runs the red light, 5 pedestrian crossings on lamp control section, 5 pedestrian crossings with electronic police system capturing anyone who runs the red light, 18 sections with traffic monitoring, 4 sections with bayonet system and matched transportation communication system.

7) Reconstruction – bridge and culvert works

There is a bridge work in transformation of Jinqiu Avenue, which crosses the Maohe River. The original bridge is of double-width one-hole 50m-span through arch bridge type. Width of a single bridge is 10.5m, and the two bridges are 14m away from each other. Direction of water flowing is orthorhombic with that of road heading. According to general requirement of road section and slow traffic, original bridge on current Jinqiu Avenue will be widened by 5.5m bridge on both sides, and width of a single bridge will be increased from 10.5m to 16m. The total section width will be 46m after completion.

(1) Main design standard

Road level: urban secondary main road;

Calculated running speed: 50km/h;

Width of bridge surface: it will be increased to a total 46m from original 35m after expansion.

The standard section is composed of 3.0m (sidewalk)+4.5m (non-motorized vehicle lane)+8.5m (carriageway)+14m (space)+8.5m (carriageway)+4.5m (non-motorized vehicle lane)+3.0m (sidewalk), which is =46m.

Design load of the bridge: crowd load

Seismic fortification standard: seismic fortification is of type C, seismic fortification intensity is of degree 6 (corresponding to basic seismic peak acceleration 0.05g), and seismic fortification measure is of level 7.

(2) Existing bridge condition

The original bridge is of double-width one-hole 50m-span through arch bridge type. Width of a single bridge is 10.5m, and the two bridges are 14m away from each other. The arch ring has a 50m span and a height of 7.5m with a rise span ratio of 1:6.67. The bridge abutment is of gravity type, and its cross section is composed of 2m (sidewalk)+8.5m(carriageway)+14m (space)+8.5m(carriageway)+2m(sidewalk) =35m. Direction of water flowing is orthorhombic with that of road heading.

Fig. 2-2-3-4-3 Existing Condition of Jinqiu Avenue Where Crosses the Maohe River

(4) Scheme design of bridge structure

Plane, vertical and transverse design of the bridge conforms to the general road design.

a) Scheme overview

Remove handrails on both sides of original, and add the bridge width to 5.5m on both sides. The bridge on one side is 59.04m long and 5.5m wide, and the cross slope is single 1.5% groove. Direction of water flowing is orthorhombic with that of the bridge. The bridge pier is of column-pile type. The bridge abutment is of embedding type. All bridges abutments adopt single-row pile foundation which applies cast-in-situ bored pile. There should be 2cm gap between the old and new bridges for them to bear stress separately.

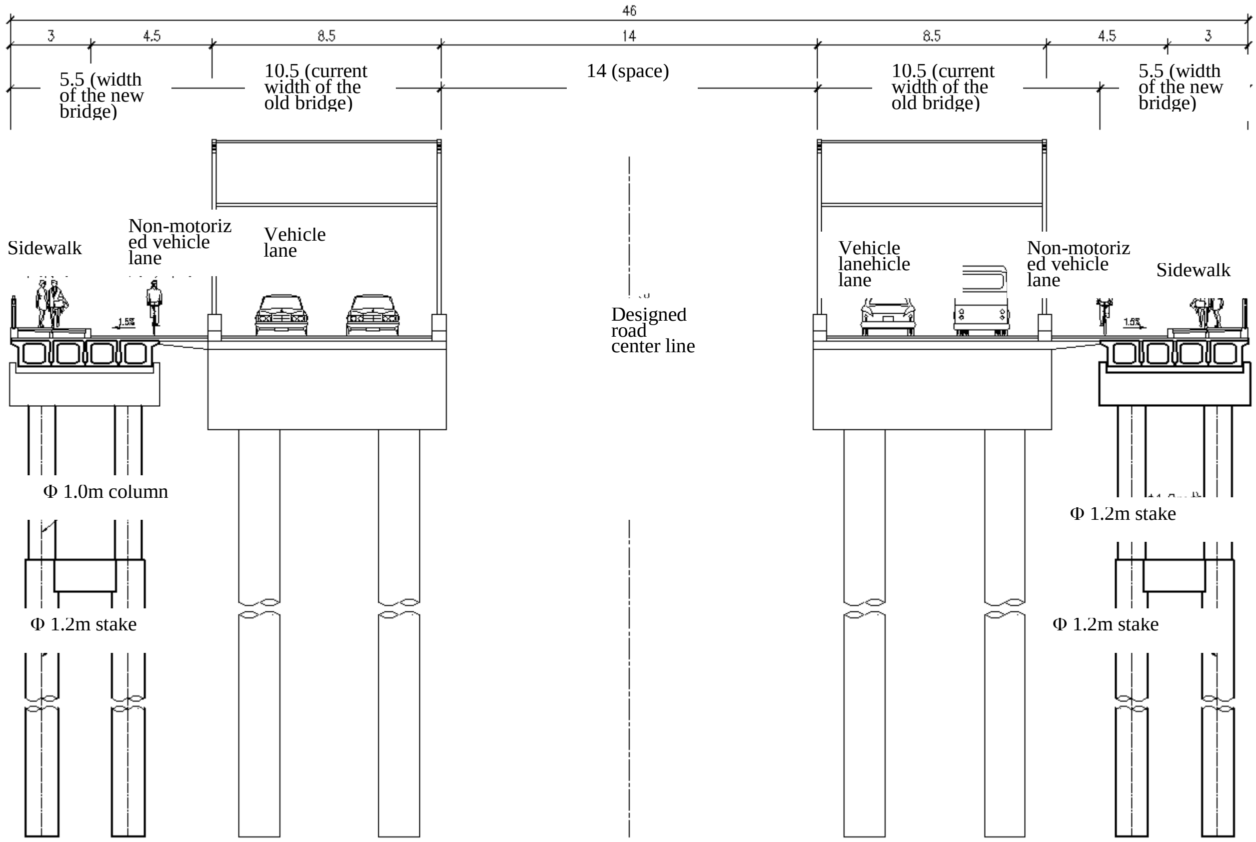


Fig. 2-2-3-4-4 Layout of the Bridge Section

b) Upper structure

The upper structure applies 3-span simple-support 18m prestressing hollow concrete slab. The whole bridge has 1 joint. There are 4 plates in one span on one side, including 2 middle plates and 2 side plates. The beam is 0.95m high. The side plate is 1.495m wide at the top and 1.25m at the bottom. The wing wedge end is 0.12m high and the wing wedge is 0.255m long. The middle plate is 1.25m. The top and bottom plates are both 0.12m wide. Lay a 0.1m thick cast-in-place layer at the top beam, on which a 0.09m thick asphalt paving should be laid.

c) Lower structure

The pier is of column-pile type. Cover beam of the pier column is 5.59m long, 1.2m high and 1.7m wide with a diameter of 1.0m. Diameter of the pile foundations is 1.2m, which is of single row type and each row has two piles. The pile foundations have a space of 3.2m and are of cast-in-situ bored type. The bridge abutment is of embedding type with a 5.5m long and 1.1m high cover beam. There is 2cm gap between the old and new bridge abutments. The foundation adopts single row pile, each of which has two piles. Diameter of the pile foundation is 1.2m, which has a space of 3.2m and is cast-in-situ bored type.

2.2.3.5 Yinxing Avenue

Yinxing Avenue is from Fucheng Avenue in the west to the New G316 in the east with a designed total length of 4.49km and a red line of 40m wide. Stake No. scope is K0+000~K4+420. Engineering expansion includes road works, sewage works, bridge works and auxiliary works with regard to greening, transportation, lightning and transport safety facilities.

1) Existing road condition

Yinxing Avenue is in the northern edge of the city, a passage connecting Hexi and Hedong and a main road of the planned city. In addition, it boasts No. 243 Provincial Highway, being a corridor for the east and west passing Anlu. It is now a Level road with 12m wide asphalt pavement. It is arranged by two-way double-lane + hardened verge section and rows of aspens on both sides.

Fig. 2-2-3-5-1 Existing Section of Yinxing Avenue (Fucheng Avenue ~ Handan Railway)

Yinxing Avenue has 3 holes of framework channel where it passes Handan Railway. The main traffic passage is 12m wide, and pedestrian passages on both sides are about 5m, where pedestrian passage on the south has a piece of water supply pipeline with a diameter of about 1m.

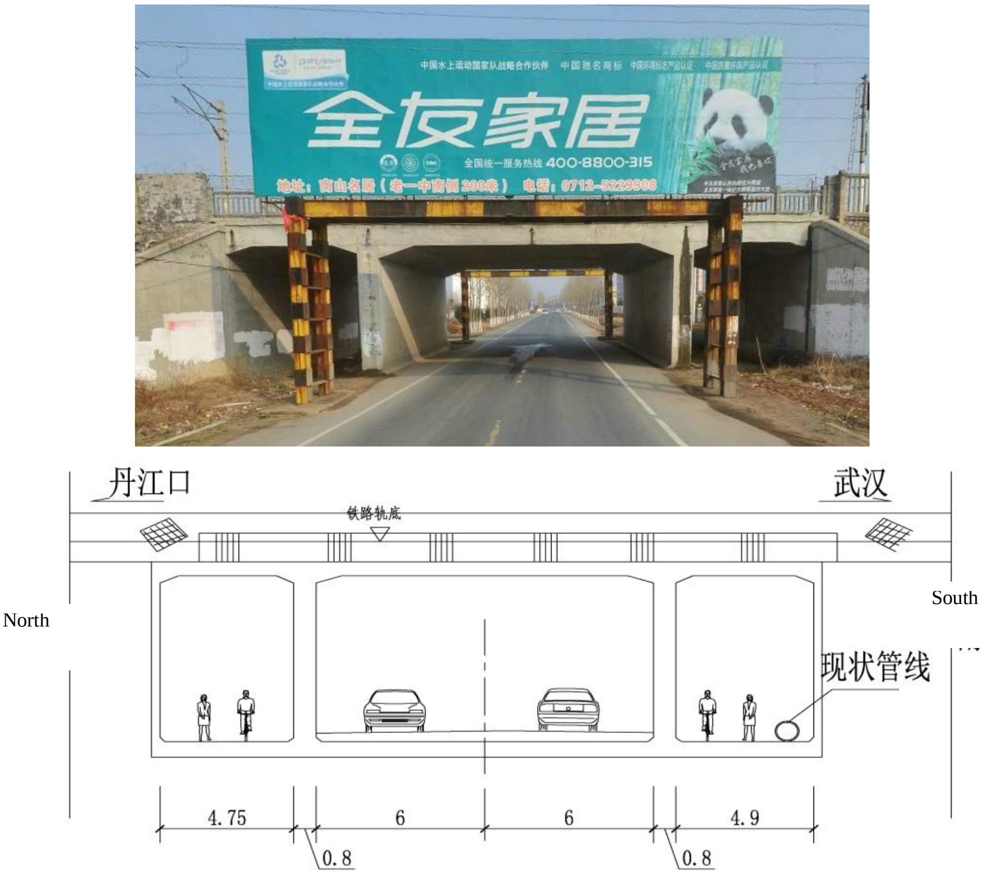


Fig. 2-2-3-5-2 Existing Cross Section of Culvert in Handan Railway

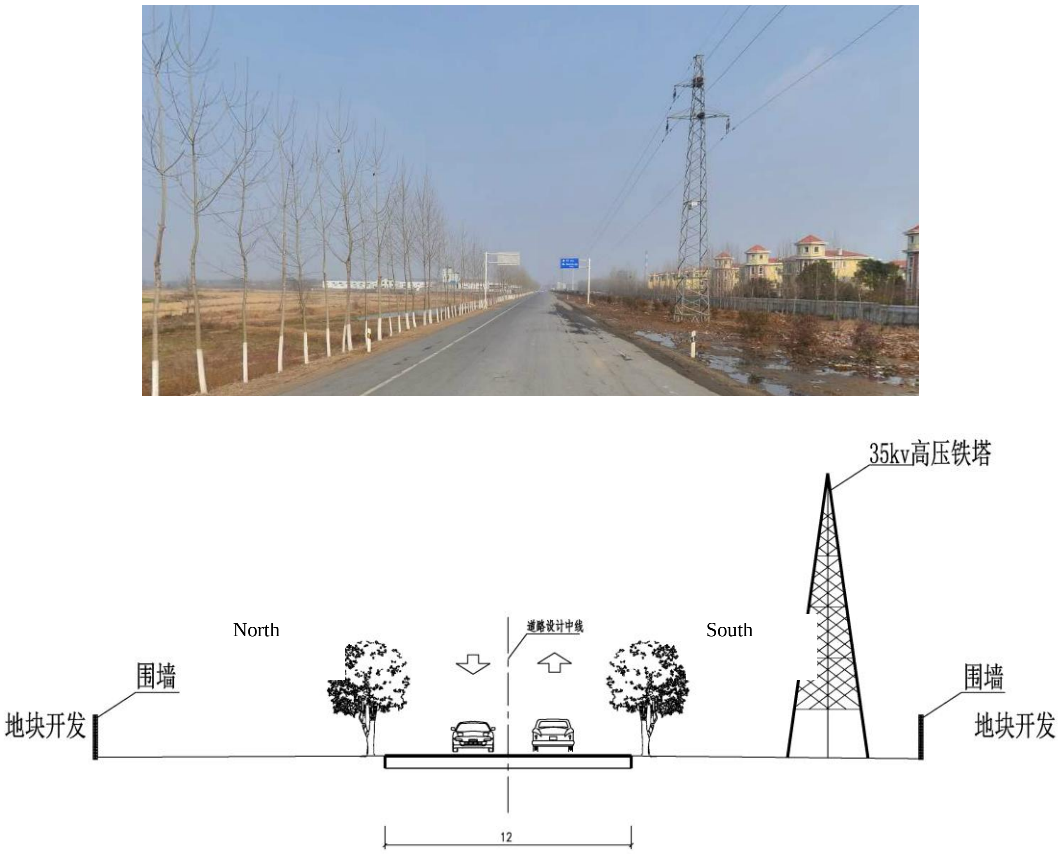


Fig. 2-2-3-5-3 Existing Section of Yinxing Avenue (Handan Railway ~ New 316)

Partial lot on both sides of Handan Railway ~ New G316 and Handan Railway ~ New 316 has been developed. Enclosure of the developed lot is generally 40m near the red line, where there is a row of 35kv high-voltage corridor on the south, of which the iron tower base is 2~8m wide.

There is no bus route on Yinxing Avenue at present.

2) Expansion – road works

(1) Road plane

The road is in outer ring of the city and has 12m wide asphalt pavement as required by secondary highway standard. This reconstruction is from the planned Fuhe Avenue in the west and to the New G316 under progress in the east. The road is 4.49km long in total and the red line is 40m wide.

(2) Cross section of road reconstruction

Red line of the road is 40m. It is of three-block type: The cross section arrangement is: 4m sidewalk + 4.5m non-motorized vehicle lane + 3.5m green belt + 16m vehicle lane +3.5m green belt + 4.5m non-motorized vehicle lane + 4m side walk.

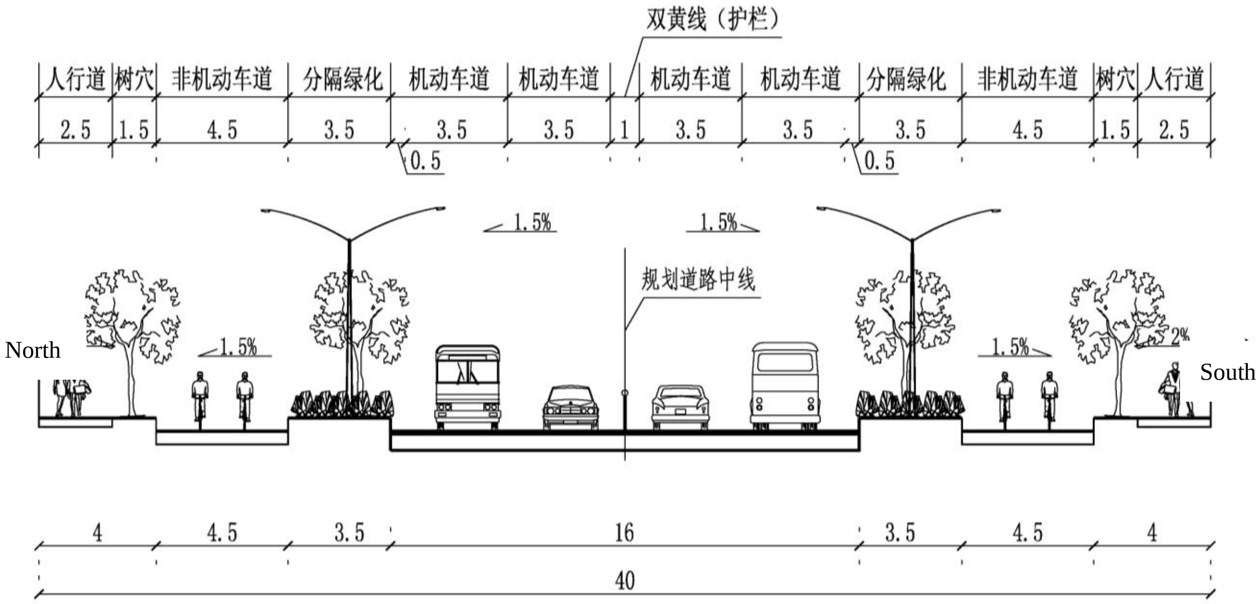


Fig. 2-2-3-5-4 Reconstructed Cross Section of Yinxing Avenue (Fucheng Avenue ~ New G316)

Traffic passage in culvert of Handan Railway has 3 lanes, 2 of which are from west to east and one is from east to west. Then an east-to west lane was arranged through the northern sidewalk, and the rest is to arrange sidewalk. Pedestrian passage on the south is divided into non-motorized vehicle lane and sidewalk, and the elevation is increased properly to meet earthing of current exposed water supply pipe.

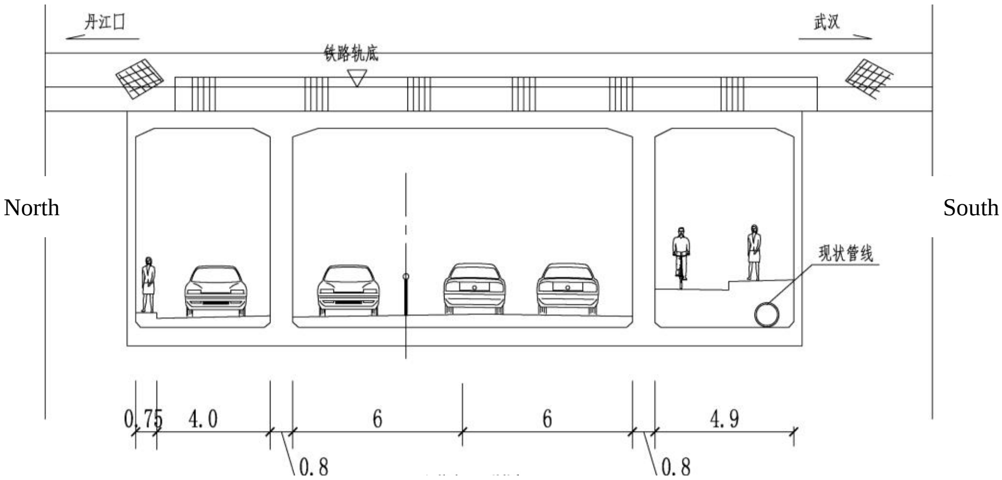


Fig. 2-2-3-5-5 Reconstructed Cross Section of Culvert in Handan Railway

(3) Road profile design

Since it is expansion of existing road, elevation of vertical road can be controlled based on existing road elevation. Adopt the minimum longitudinal gradient satisfying the requirement of road drainage as far as possible.

(4) Subgrade design

According to information about nearby engineering geological exploration, geological condition of Anlu City is good and subgrade treatment is mainly of shallow type.

a) Common foundation treatment:

Replacement fill shall be mainly adopting along the line with good soil; macadam shall be filled in soft segments with quick lime treatment.

b) Subgrade treatment in shallow soft soil

When the depth of soft soil subgrade such as sludge and mucky soil is less than 5.0m, the treatment shall be as per shallow soft subgrade and adopt the combinatorial method of riprap crowed silting method and dredging soil replacement method. When the mud thickness is less than 2m, remove sludge and replace good soil; when the mud thickness is 2～5m, use ripraps with about 2.0m thickness to displace sludge and the width shall exceed 2.0m beyond the road slope line.

c) Treatment for overlap joint of the old and new subgrade

Road widening and reconstruction is subject to natural condition of the old road, and it is impossible to consider special condition of landform, geology and soil texture in case of line selection. With the premise of ensuring stability of existing embankment, fully consider various factors influencing stability of the old and new roads, and conform to the principle of "prevention first and prompt treatment". Reduce differential settlement of the old and new subgrades as much as possible during design and construction. Pay much attention to subgrade treatment and take measures to control construction efficiency. Improve performance of subgrade filling and other key construction steps to increase subgrade strength and reduce treatment after subgrade work to effectively avoid longitudinal crack.

(5) Pavement design

Existing road in this works is of asphalt pavement. To keep structural consistency and use to the best degree, expansion works should also choose asphalt pavement

According to the investigation, since there is no crack or track in this road at present, it is judged to be in good condition at the preliminary stage. It can be used as below-layer or surface without large-scale removal. The project can directly use original asphalt pavement for covering to recover superficial function and beauty.

a) Add pavement structure for vehicle lane

4cm-thick AC-13C fine modified asphalt concrete above-layer + 5cm-thick AC-20C medium asphalt concrete middle-layer + 7cm-thick AC-25C coarse asphalt concrete below-layer + 45cm-thick 5% cement stabilized macadam.

b) Add pavement structure for original pavement

Mill 4cm old asphalt pavement before adding 4cm-thick AC-13C fine asphalt concrete above-layer.

c) Structure of non-motorized vehicle lane

4cm-thick AC-13C fine asphalt concrete above-layer + 6cm-thick AC-16C medium asphalt concrete middle-layer + 36cm-thick 5% cement stabilized macadam base layer.

d) Sidewalk structure

6cm-thick precast C30 concrete bricks + 2cm-thick M10 cement bed mortar + 15cm-thick cement stabilized macadam (5:95).

(6) Sidewalk and crossing facilities, bus stop as well as disabled facilities, etc.

a) Pedestrian crosswalk and crossing facilities

Set pedestrian crosswalks at crossroads on road segments, the spacing shall be within 300m.

b) Bus stop

The spacing of bus stops shall be controlled within 300m～400m on the basis of actual condition of Anlu and for the convenience of passengers. In addition, bus stops shall be 50～80m out of crossroad exits. Facilities of intermediate stops along bus routines are usually on the side of intersection exit lane, if restricted, they can be seated on the side of entrance lane. Attention shall be paid to the stagger of buses leaving stops for entrance lanes or relative positions of signals.

The overall line has 9 pairs of bus stops, all of which are of harbor style.

c) Disabled facilities

For disabled facilities of the road works, pave go-ahead blind sidewalks for pedestrians with visual impairments, so that they can walk according to the sense of touch on feet. Go-ahead blind sidewalks are paved continuously and they are usually 0.25～0.5m away from tree pits of green belts or sidewalks; the width of go-ahead blind sidewalk is 0.30～0.60m. Set warning blind sidewalks around the bend of go-ahead blind sidewalks. For actually existing barriers or objects that may cause danger to pedestrians with visual impairments, warning blind sidewalk corrals can be used as prompts. Additionally, to make sure that the road is accessible to wheelchairs, there shall be no abrupt height difference and cross raised paths, or otherwise there shall be slope transitions with gradient being 1:20.

As to intersection sidewalks, set curb ramps in places where curbs is located on corresponding pedestrian crosswalks. The gradient of curb ramp of single-face slopes is 1:20 and the gradient of curb ramps of three-face slopes is 1:12. The distance between the lower entrances of ramps above the roadway shall be no more than 20mm. Intersection pedestrian crosswalks connect both sides of the road and on lane separators, the altitude of intersection pedestrian crosswalks shall be lowered to ensure wheelchair passage. Set warning blind sidewalks at intersections and connect warning blind sidewalks and go-ahead blind sidewalks. Set stereo facilities to help visually handicapped pedestrians to judge whether they can cross the intersection.

Build warning blind sidewalks and wheelchair ramps at bus stops to make it easier for visually handicapped pedestrians to wait for, get in and out of buses. Warning blind sidewalks and go-ahead blind sidewalks are connected. Set warning blind sidewalks at the bend of go-ahead- blind sidewalks and on the side of stop boards. The gradient of wheelchair ramps is 1:20.

3) Reconstruction-drainage words

(1) Existing drainage condition

There are no sewage pipes along the line and rainwater runs into nearby body of water.

(2) Design of drainage works

Arrange a row of d800mm~d1200mm rainwater pipeline and a row of d400mm~d500mm sewage pipeline within the two sides of non-motorized vehicle lane of road. Dam sewage to sewage pipes laid along Fuguo River and Fuhe River then drain it to a sewage treatment plant; rainwater shall be discharged into Huguo River and Fuhe River respectively.

(3) Pipe, joint and foundation

When the designed pipe diameter of rainwater and sewage pipe is smaller than or equal to 1200mm, adopt half-through reinforced concrete pipe, when the pipe diameter is larger than 1200mm, adopt tongue and groove reinforced concrete pipe. When the earthing H≤4.5m, adopt half-through reinforced concrete pipe (level II) and rubber ring joint, when H≤3.5m, adopt 120° sand and gravel foundation; when 3.5m＜H≤4.5m, adopt 180° sand and gravel foundation; when earthing 4.5＜H≤7m, adopt half-through reinforced concrete pipe (level III) and rubber joint as well as 180° sand and gravel foundation.

The pavement drainage pipeline shall adopt half-through reinforced concrete pipe (level II) and rubber joint as well as 180° sand and gravel foundation.

(4) Pavement drainage

The pavement drainage of road is collected by gutter inlets and drained into rainwater main pipes through rainwater branch pipes. The pipe diameter of connecting pipe of gutter inlet is d300mm, which adopts half-through reinforced concrete level II pipe and rubber joint as well as 180° sand and gravel foundation. All gutter inlets adopt partial groove type single gutter inlets. All gutter inlets in newly constructed and reconstructed segments are newly constructed.

(5) Integrated pipelines

Water supply pipes and gas pipes are easily destroyed during operation, thus it is necessary to implement breaking ground maintenance and overhaul frequently and such pipes shall be laid under the pavement.

Due to a large sectional area and huge volume of earthwork, rainwater pipes shall be laid on both sides of roads so as to join up street eave rainwater and road rainwater.

The cable trench and telecommunication pipelines are generally laid under the sidewalks or non-motorized vehicle lanes.

Rain and sewage pipes shall be laid under non-motorized vehicle lanes or green belts.

4) Reconstruction- landscape works

The overall length of road is about 4.49km and the landscape design is mainly 3.5m wide two-side vehicle division green belt+ border tree.

3.5m wide two-side vehicle division green belt: plant cinnamomun camphcra with 5m spacing, plant two-row purple-leaf plum or pittosporum tobiras between them, and plant photinia serrulata and Sabina chinensis under them with 40m as an unit interval.

Border tree: select Yinxing as the border tree with 5m spacing which shall be planted in the plant pit of about 1.5m square. The plant pits shall fully be covered by radix ophiopogonis with fine leaves without loess exposed.

5) Reconstruction- illumination works

There are no illumination facilities in Yinxing Avenue currently, and the road has been rebuilt to be urban road by road section, therefore road illumination facilities shall be constructed along the line at the same time. The newly constructed illumination adopts double-arm street lights which are arranged in form of bilateral symmetry and light poles are set on the two sides of non-separation green belts. Power of illumination source within motor vehicle lanes is NG250W with NG150W in sidewalks. Lamps and lanterns are semi cut-off lighting fittings with 1.5m arm length and the installed height for such lights is 9m. In theory, the pole span of lighting poles in the standard segments of works is about 32m

5) Reconstruction- road transportation safety facility works

Improve traffic signs and lines along the roads. Newly construct 11700m traffic control pipeline, 9 adaptive signal control intersections, 9 intersections with electronic police system capturing anyone who runs the red light, 3 pedestrian crossings on lamp control section, 3 pedestrian crossings with electronic police system capturing anyone who runs the red light, 9 sections with traffic monitoring, 2 sections with bayonet system and matched transportation communication system.

4) Reconstruction-bridge works

There is a bridge work crossing Qili River in the reconstruction work of Yinxing Avenue. The original bridge is a 10m plate-type bridge with 3 holes with 15m width, and the water flow direction intersects with the forward direction of road. Each 7.5m bridge shall be widened on both sides of the old bridge on Yinxing Avenue now according to the demand of setting of overall road section and the need of slow-moving traffic, the original 15m width of bridge shall be widen to be 30m section width.

(1) Main design standards

Road level: urban main road;

Expected running speed: 50km/h;

Bridge width: the width of the old bridge is 15m, total width for reconstructed one is 30m.

The standard section comprises 3.0 (sidewalks)+ (non-motor vehicle lane)+ 15m (drive way)+ 4.5m (non-motor vehicle lane)=30m

Designed load for the bridge: pedestrian load

Seismic fortification criterion: the seismic fortification criterion is class C with 6 degrees of seismic fortification intensity (accelerate speed of 0.05g corresponding to the basic seismic peak) and the level of seismic fortification measures is level 7.

（2）Current situation of bridge

Figure 2-2-3-5-6 Current Situation of the Bridge Crossing Qili River on Yinxing Avenue

The former bridge is a 10m plate-type bridge with 3 holes and piers are column piers with buried bridge abutments. The width of the bridge is 15m and its transverse section comprises: 1.5m (sidewalks)+ 12m (drive way)+ 1.5m (sidewalks)=15m, and the water flow direction intersects with the forward direction of road.

(4) Scheme design of bridge structure

Leveled and horizontal and longitudinal design of the bridge all comply with the road overall design.

a) Scheme overview

Handrails and sidewalks on both sides of the old bridge will be removed, and 7.5m wide bridge shall be widen to both sides respectively. The new bridge shall adopt the same span with the old one, setting 3 crossing 10m prestressed concrete simply supported hollow slab structures at each side of bridge. The length of unilateral is 35.08m with 7.5m width, and the cross slope is 1.5% single slope. Direction of the bridge intersects with water flow direction. Piers adopt column piers with buried bridge abutments and bridge piers and abutments all adopt single row of pile foundations which adopt cast-in-situ bored piles. 2cm crack shall be set between the new bridge and the old one so as to the new bridge and the old one can stress separately.

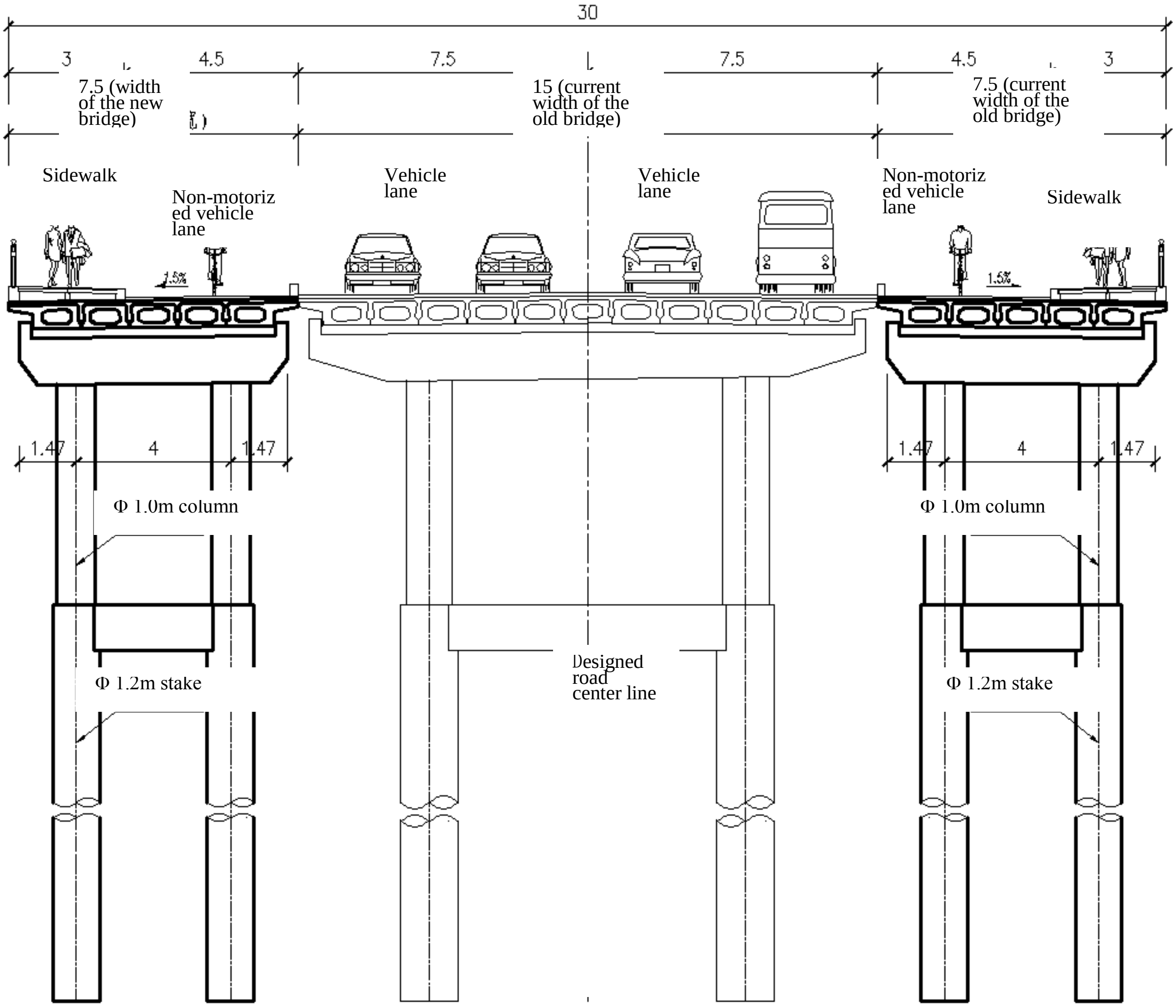


Figure 2-2-3-5-7 Arrangement of Bridge Section

b) Upper structure

The upper structure adopts the structure of 3 crossing simply supported 10m prestressed concrete hollow slab and there is only one couplet on the whole bridge. The single side of bridge crosses 5 plates in total, of which 3 pieces of medium plates as well as 2 pieces of margin plates. The girder is 0.6m high and the top of margin plate is 1.875m wide with 1.25m of bottom width. The height of bridge wing is 0.12m with 0.63m long. The width for margin plates is 1.25m and the thickness for upper and lower baseplates is 0.12 meter. 0.1m thick cast-in-place layer covered by a layer of 0.09m thick asphalt overlaid pavement is set on the top of girder.

c) Substructure

Piers adopt column piers and the bent cap of piers is 6,95m with 1.2 height and 1.6m width. The diameter of pier stud is 1.0m with 1.m diameter of the pile foundation. There are two piles in a rank for single rank of piles and the distance between pile foundations is 4m, which adopt cast-in-situ bored pile foundations. Adopt buried bridge abutment and the bent cap of bridge abutment is 6.98m long with 1.1m height. 2cm crack is set between the new bridge abutment and the old abutment. The foundations adopt single rank of piles with two piles in a row. The diameter of pile foundation is 1.2m with 4.2m spacing between piles, and the foundations are cast-in-situ bored pile foundations.

2.2.3.6 Fucheng Avenue

Fucheng Avenue shares a boarder to the north with Yinxing Avenue and a boarder to the south with Jiefang Avenue with FK0+048~FK2+188.69 of stake mark range. The new construction contents include road works, rain and sewage works and auxiliary works such as virescence, transportation, lighting and traffic safety facilities.

1) Existing road condition

Fucheng Avenue lies in the north of Hedong urban area, crossing Zhaohe Village and Huguo Village along the way. There is only an about three-meter wide cement road in the red line scope currently.

2) New construction-road works

(1) Road plane

The road shares a boarder to the north with Yinxing Avenue and a boarder to the south with Liberation Road with 2.19km of total length and 40m of red line width.

(2) Road cross-section

The red line of road is 40m wide and the breadth of road applies to a section form of “four boards”: 5m sidewalk+4.5m non-motorized vehicle lane+ 1.5m green belt+7.5m vehicle lane+3m middle distribution belt+7.5m vehicle lane+1.5m green belt+4.5m non-motorized vehicle lane +5m sidewalk.

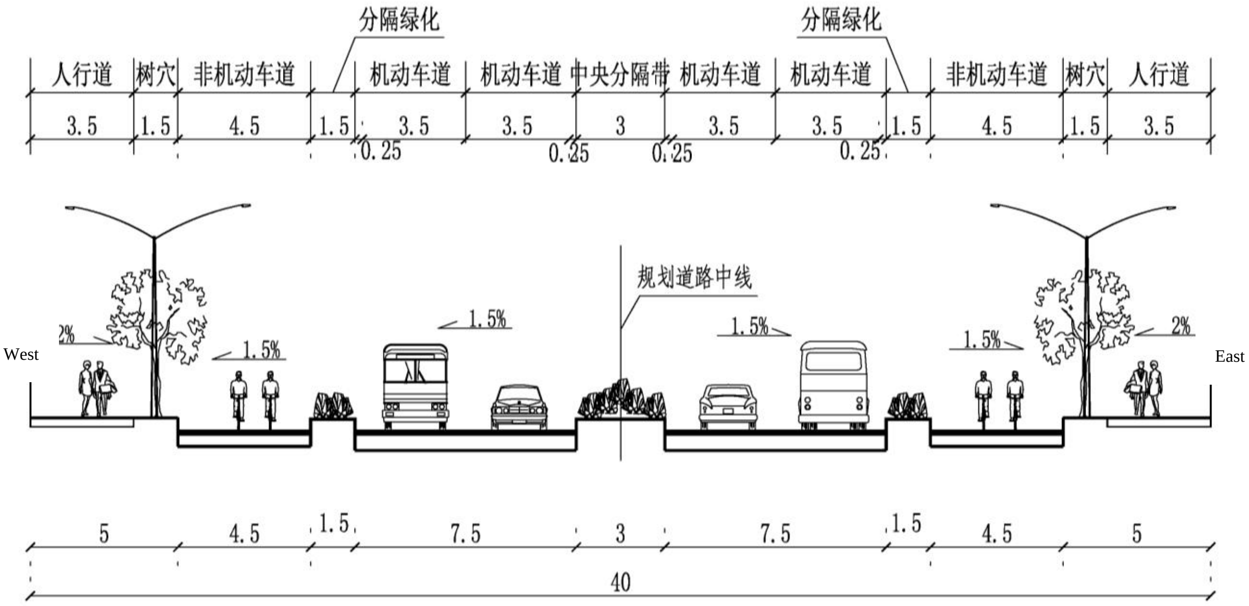


Figure 2-2-3-6-1 Standard Cross-Section of Fucheng Avenue (Yinxing Avenue ~ Jiefang Avenue)

(3) Profile design of road

Start and stop points of profile design connect the elevation of the current road, taking site elevation of natural village, pond water level and other controlling factors into consideration along the line and also referring to the current terrain to reduce earth volume as much as possible and give consideration to the minimum buried depth requirements of various pipelines. The road slope shall be controlled within 0.3%~3%.

(4) Subgrade design

Refer to geological exploration data of nearby projects and other engineering experience. Due to good geological conditions in Anlu urban district, the subgrade treatment shall mainly be shallow treatment.

General subgrade treatment: replacement fill shall be mainly adopted along the line with good soil; macadams shall be filled in soft segments.

Subgrade treatment in shallow soft soil: when the depth of soft soil subgrade such as sludge and mucky soil is less than 5.0m, the treatment shall be as per shallow soft subgrade and adopt the combinatorial method of riprap crowed silting method and dredging soil replacement method. When the mud thickness is less than 2m, remove sludge and replace good soil; when the mud thickness is 2～5m, use ripraps with about 2.0m thickness to displace sludge and the width shall exceed 2.0m beyond the road slope line.

(5) Pavement design

Taking driving comfort and landscape needs into consideration, it is recommended to adopt asphalt concrete pavement for pavement structure.

Pavement structure of vehicle road: from top to down are 4cm thick AC-13C fine grained type modified asphalt concrete (with 3.0Kg/T fiber content)+ 8cm thick AC-25C coarse grain type asphalt concrete+ 0.6cm ES-2 type slurry seal+ 45cm thick cement stabilized macadam (5%) respectively.

Pavement structure of non-motorized vehicle lane: form top to down are 4cm thick AC-13C fine grained type modified asphalt concrete+ 6cm thick AC-20C medium sized asphalt concrete+ 36cm thick cement stabilized macadam (5%) respectively.

Sidewalk structure: 6cm thick prefabricated C30 step brick+2cm thick M10 grouting cement mortar+15cm thick cement stabilized macadam (5:59).

(6) Sidewalk, crossing facility, bus stop and barrier-free facility.

a) Pedestrian crossing and crossing facility

Set pedestrian in intersection and road segment and the spacing shall be controlled within 300m.

b) Bus stop

The spacing of bus stops shall be controlled within 300m～400m on the basis of actual condition of Anlu and for the convenience of passengers. In addition, bus stops shall be 50～80m out of crossroad exits. Facilities of intermediate stops along bus routines are usually on the side of intersection exit lane, if restricted, they can be seated on the side of entrance lane. Attention shall be paid to the stagger of buses leaving stops for entrance lanes or relative positions of signals.

The overall line has 7 pairs of bus sops, all of which are of harbor style.

c) Barrier-free facilities

For barrier-free facilities of the road works, pave go-ahead blind sidewalks for pedestrians with visual impairments, so that they can walk according to the sense of touch on feet. Go-ahead blind sidewalks are paved continuously and they are usually 0.25～0.5m away from tree pits of green belts or sidewalks; the width of go-ahead blind sidewalk is 0.30～0.60m. Set warning blind sidewalks around the bend of go-ahead blind sidewalks. For actually existing barriers or objects that may cause danger to pedestrians with visual impairments, warning blind sidewalk corrals can be used as prompts. Additionally, to make sure that the road is accessible to wheelchairs, there shall be no abrupt height difference and cross raised paths, or otherwise there shall be slope transitions with gradient being 1:20.

As to intersection sidewalks, set curb ramps in places where curbs are located on corresponding pedestrian crosswalks. The gradient of curb ramp of single-face slopes is 1:20 and the gradient of curb ramps of three-face slopes is 1:12. The distance between the lower entrances of ramps above the roadway shall be no more than 20mm. Intersection pedestrian crosswalks connect both sides of the road and on lane separators, the altitude of intersection pedestrian crosswalks shall be lowered to ensure wheelchair passage. Set warning blind sidewalks at intersections and connect warning blind sidewalks and go-ahead blind sidewalks. Set stereo facilities to help visually handicapped pedestrians to judge whether they can cross the intersection.

Build warning blind sidewalks and wheelchair ramps at bus stops to make it easier for visually handicapped pedestrians to wait for, get on and off buses. Warning blind sidewalks and go-ahead blind sidewalks are connected. Set warning blind sidewalks at the bend of go-ahead- blind sidewalks and on the side of stop boards. The gradient of wheelchair ramps is 1:20.

3) New construction-drainage works

(1) Existing drainage condition

There are no sewage pipes along the line and rainwater runs into nearby body of water.

(2) Design of drainage works

Arrange a row of d800mm~d1200mm rainwater pipeline and a row of d400mm sewage pipeline within the two sides of non-motorized vehicle lane of road. Dam sewage to sewage pipes laid along Fuhe River than drain it to a sewage treatment plant; rainwater shall run into Fuhe River.

(3) Pipe, joint and foundation

When the designed pipe diameter of rainwater and sewage pipe is smaller than or equal to 1200mm, adopt half-through reinforced concrete pipe, when the pipe diameter is larger than 1200mm, adopt tongue and groove reinforced concrete pipe. When the earthing H≤4.5m, adopt half-through reinforced concrete pipe (level II) and rubber ring joint, when H≤3.5m, adopt 120° sand and gravel foundation; when 3.5m＜H≤4.5m, adopt 180° sand and gravel foundation; when earthing 4.5＜H≤7m, adopt half-through reinforced concrete pipe (level III) and rubber joint as well as 180° sand and gravel foundation.

The pavement drainage pipeline shall adopt half-through reinforced concrete pipe (level II) and rubber joint as well as 180° sand and gravel foundation.

(4) Pavement drainage

The pavement drainage of road is collected by gutter inlets and drained into rainwater main pipes through rainwater branch pipes. The pipe diameter of connecting pipe of gutter inlet is d300mm, which adopts half-through reinforced concrete level II pipe and rubber joint as well as 180° sand and gravel foundation. All gutter inlets adopt partial groove type single gutter inlets. All gutter inlets in newly constructed and reconstructed segments are newly constructed.

(5) Integrated pipelines

Water supply pipes and gas pipes are easily destroyed during operation, thus it is necessary to implement breaking ground maintenance and overhaul frequently and such pipes shall be laid under the pavement.

Due to a large sectional area and huge volume of earthwork, rainwater pipes shall be laid on both sides of roads so as to join up street eave rainwater and road rainwater.

The cable trench and telecommunication pipelines are generally laid under the sidewalks or non-motorized vehicle lanes.

Rain and sewage pipes shall be laid under non-motorized vehicle lanes or green belts.

4) New construction-landscape works

The overall length of road is about 2.19km and the landscape design is mainly 3m wide central vehicle division green belt + 1.5m wide two-side vehicle division green belt+border tree.

3m wide central vehicle division green belt: plant four-season fragrans with 5m spacing in a line, under which plant China loropetal and Dickinson privet.

1.5m wide two-side vehicle division green belt: plan pittosporum tobiras and select China loropetals, France hollies, Dickinson privets and other shrubs to form greening model pattern.

Border tree: select cinnamomun camphcra to be border tree with 5m spacing.

5) New construction-illumination works

Fucheng Avenue is a newly constructed avenue with synchronously newly constructed lighting facilities along the line. The newly constructed illumination adopts double-arm street lights which are arranged in form of bilateral symmetry and light poles are set on the two sides of non-separation green belts. The lighting source power is NG150W. Lamps and lanterns are semi cut-off lighting fittings with 1.5m arm length and the installed height for such lights is 9m. In theory, the pole span of lighting poles in the standard segments of works is about 32m, which shall be adjusted in accordance with the fracture distribution of roads correspondingly.

6) New construction-road transportation safety facility works

Improve traffic signs and lines along the roads. Newly construct 3300m traffic control pipeline, 6 adaptive signal control intersections, 6 intersections with electronic police system capturing anyone who runs the red light, 3 pedestrian crossings on lamp control section, 3 pedestrian crossings with electronic police system capturing anyone who runs the red light, 6 sections with traffic monitoring, 2 sections with bayonet system and matched transportation communication system.

2.2.3.7 Zhanqian Road

Zhanqian Road initiates in the north to Anjing line (the extension line of Jiefang Avenue), connects Hengyi Road (connecting line of three bridges). The designed overall length is 2.10km with 40m wide red line. Scope of stake mark is K0+000~K2+089.109. Newly constructed works include road works, rain and sewage works and auxiliary works such as virescence, transportation, lighting and traffic safety facilities.

1) Existing road condition

Zhanqian Road lies is Hexi high speed rail station, which connects the connecting line of three bridges in the south and connects with Jiefang Avenue and Biyun Road in the north. It is the vertical channel connecting with high speed rail station and urban area.

2) New construction-road engineering

(1) Road plane

The road starts from Jiefang Avenue in the north and connects Hengyi Road in the south with 2.1km total length and 40m wide red line.

(2) Road cross-section

The red line of road is 40m wide and the breadth of road applies to a section form of "four boards": 5m sidewalk+4.5m non-motorized vehicle lane+ 1.5m green belt+7.5m vehicle road+3m middle distribution belt+7.5m vehicle road+1.5m green belt+4.5m non-motorized vehicle lane +5m sidewalk.

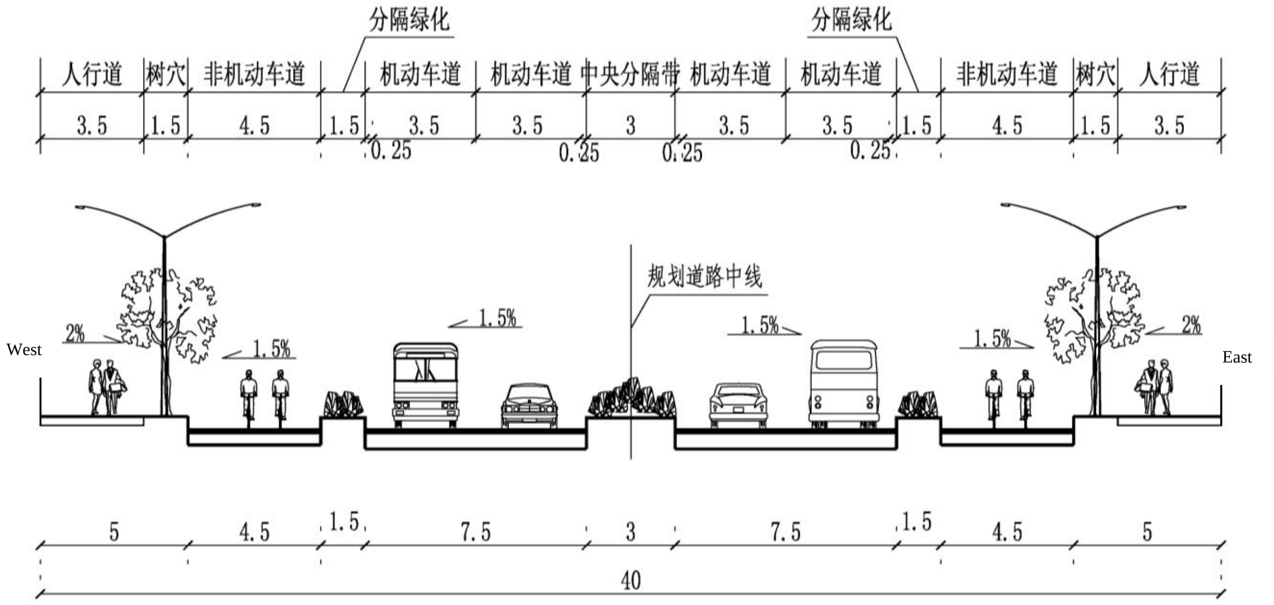


Figure 2-2-3-7-1 Standard Cross-Section of Zhanqian Road (Connecting Line of Three Bridges ~ Anjing Line)

(3) Profile design of road

The profile design shall be controlled by road network planning elevation and shall refer to the current terrain to reduce earth volume as much as possible. Meanwhile give consideration to meet the minimum buried depth requirements of various pipelines. The road slope shall be controlled within 0.3%~3%.

(4) Subgrade design

Refer to geological exploration data of nearby projects and other engineering experience. Due to good geological conditions in Anlu urban district, the subgrade treatment shall mainly be shallow treatment.

General subgrade treatment: replacement fill shall be mainly adopted along the line with good soil; macadam shall be filled in soft segments.

Subgrade treatment in shallow soft soil: when the depth of soft soil subgrade such as sludge and mucky soil is less than 5.0m, the treatment shall be as per shallow soft subgrade and adopt the combinatorial method of riprap crowed silting method and dredging soil replacement method. When the mud thickness is less than 2m, remove sludge and replace good soil; when the mud thickness is 2～5m, use ripraps with about 2.0m thickness to displace sludge and the width shall exceed 2.0m beyond the road slope line.

(5) Pavement design

Zhanqian Road lies in Hexi New District, it is recommended to adopt asphalt concrete pavement for pavement structure considering driving comfort and landscape needs.

Pavement structure of vehicle road: from top to down are 4cm thick AC-13C fine grained type modified asphalt concrete (with 3.0Kg/T fiber content)+ 8cm thick AC-25C coarse grain type asphalt concrete+ 0.6cm ES-2 type slurry seal+ 45cm thick cement stabilized macadam (5%) respectively.

Pavement structure of non-motorized vehicle lane: form top to down are 4cm thick AC-13C fine grained type modified asphalt concrete+ 6cm thick AC-20C medium sized asphalt concrete+ 36cm thick cement stabilized macadam (5%) respectively.

Sidewalk structure: 6cm thick prefabricated C30 step brick+2cm thick M10 grouting cement mortar+15cm thick cement stabilized macadam (5:59).

(6) Sidewalks, crossing facilities, bus stops and barrier-free facilities.

a) Pedestrain crossing and crossing facility

Set pedestrian in intersection and road segment and the spacing shall be controlled within 300m.

b) Bus stop

The spacing of bus stops shall be controlled within 300m～400m on the basis of actual condition of Anlu and for the convenience of passengers. In addition, bus stops shall be 50～80m out of crossroad exits. Facilities of intermediate stops along bus routines are usually on the side of intersection exit lane, if restricted, they can be seated on the side of entrance lane. Attention shall be paid to the stagger of buses leaving stops for entrance lanes or relative positions of signals.

The overall line has 6 pairs of bus sops, all of which are of harbor style.

c) Barrier-free facilities

For barrier-free facilities in road works, pave go-ahead blind sidewalks for pedestrians with visual impairments, so that they can walk according to the sense of touch on feet. Go-ahead blind sidewalks are paved continuously and they are usually 0.25～0.5m away from tree pits of green belts or sidewalks; the width of go-ahead blind sidewalk is 0.30～0.60m. Set warning blind sidewalks around the bend of go-ahead blind sidewalks. For actually existing barriers or objects that may cause danger to pedestrians with visual impairments, warning blind sidewalk corrals can be used as prompts. Additionally, to make sure that the road is accessible to wheelchairs, there shall be no abrupt height difference and cross raised paths, or otherwise there shall be slope transitions with gradient being 1:20.

As to intersection sidewalks, set curb ramps in places where curbs are located on corresponding pedestrian crosswalks. The gradient of curb ramp of single-face slopes is 1:20 and the gradient of curb ramps of three-face slopes is 1:12. The distance between the lower entrances of ramps above the roadway shall be no more than 20mm. Intersection pedestrian crosswalks connect both sides of the road and on lane separators, the altitude of intersection pedestrian crosswalks shall be lowered to ensure wheelchair passage. Set warning blind sidewalks at intersections and connect warning blind sidewalks and go-ahead blind sidewalks. Set stereo facilities to help visually handicapped pedestrians to judge whether they can cross the intersection.

Build warning blind sidewalks and wheelchair ramps at bus stops to make it easier for visually handicapped pedestrians to wait for, get on and off buses. Warning blind sidewalks and go-ahead blind sidewalks are connected. Set warning blind sidewalks at the bend of go-ahead- blind sidewalks and on the side of stop boards. The gradient of wheelchair ramps is 1:20.

3) New construction-drainage works

(1) Existing drainage condition:

There are no sewage pipes along the line and rainwater runs into nearby body of water.

(2) Design of drainage works

Arrange a row of d800mm~d1200mm rainwater pipeline and a row of d400mm sewage pipeline within the two sides of non-motorized vehicle lane of road.

(3) Pipe, joint and foundation

When the designed pipe diameter of rainwater and sewage pipe is smaller than or equal to 1200mm, adopt half-through reinforced concrete pipe, when the pipe diameter is larger than 1200mm, adopt tongue and groove reinforced concrete pipe. When the earthing H≤4.5m, adopt half-through reinforced concrete pipe (level II) and rubber ring joint, when H≤3.5m, adopt 120° sand and gravel foundation; when 3.5m＜H≤4.5m, adopt 180° sand and gravel foundation; when earthing 4.5＜H≤7m, adopt half-through reinforced concrete pipe (level III) and rubber joint as well as 180° sand and gravel foundation.

The surface drainage pipeline shall adopt half-through reinforced concrete pipe (level II) and rubber joint as well as 180° sand and gravel foundation.

(4) Pavement drainage

The pavement drainage of road is collected by gutter inlets and drained into rainwater main pipes through rainwater branch pipes. The pipe diameter of connecting pipe of gutter inlet is d300mm, which adopts half-through reinforced concrete level II pipe and rubber joint as well as 180° sand and gravel foundation. All gutter inlets adopt partial groove type single gutter inlets. All gutter inlets in newly constructed and reconstructed segments are newly constructed.

(5) Integrated pipelines

Water supply pipes and gas pipes are easily destroyed during operation, thus it is necessary to implement breaking ground maintenance and overhaul frequently and such pipes shall be laid under the pavement.

Due to a large sectional area and huge volume of earthwork, rainwater pipes shall be laid on both sides of roads so as to join up street eave rainwater and road rainwater.

The cable trench and telecommunication pipelines are generally laid under the sidewalks or non-motorized vehicle lanes.

Rain and sewage pipes shall be laid under non-motorized vehicle lanes or green belts.

4) New construction-landscape works

The overall length of road is about 2.1km and the landscape design is mainly 3m wide central vehicle division green belt+1.5m wide two-side vehicle division green belt+border tree.

3m wide central vehicle division green belt: plant four-season fragrans with 5m spacing in a line, under which plant China loropetal and Dickinson privet.

1.5m wide two-side vehicle division green belt: plan pittosporum tobiras and select China loropetals, France hollies, Dickinson privets and other shrubs to form greening model pattern.

Border tree: select cinnamomun camphcra to be border tree with 5m spacing.

5) New construction-illumination works

Zhanqian Road is a newly constructed avenue with synchronously newly constructed lighting facilities along the line. The newly constructed illumination adopts double-arm street lights which are arranged in form of bilateral symmetry and light poles are set on the two sides of non-separation green belts. The lighting source power is NG150W. Lamps and lanterns are semi cut-off lighting fittings with 1.5m arm length and the installed height for such lights is 9m. In theory, the pole span of lighting poles in the standard segments of works is about 32m, which shall be adjusted in accordance with the fracture distribution of roads correspondingly.

6) New construction-road transportation safety facility works

Improve traffic signs and lines along the roads. Newly construct 3150m traffic control pipeline, 6 adaptive signal control intersections, 6 intersections with electronic police system capturing anyone who runs the red light, 3 pedestrian crossings on lamp control section, 3 pedestrian crossings with electronic police system capturing anyone who runs the red light, 6 sections with traffic monitoring, 2 sections with bayonet system and matched transportation communication system.

2.2.4 Road traffic volume

Through survey and with comprehensive consideration of regional land use conditions, road use function, travel mode and other factors, travel modes on newly-built reconstruction and expansion roads are dominated by cars, taxies, buses and other small and medium vehicles and truck and other large vehicles accounts for a small proportion. According to existing growth rule of traffic volume and on the baiss of related survey and prediction analysis of raod, municipal road volume is mainly concentrated in the daytime, with ratio of volume daytime to volume nighttime of 8:1. Namely, the volume in the daytime (6:00-22:00) approximately accounts for 89% in volume of the whole day and volume in the nighttime (22:00-6:00 in the next day) approximately accounts for 11% in volume of the whole day. Hence, hour volume ratio between daytime to nighttime is approximately 4:1.

Typical section of road is provided with medium-term (2020) and long-term (2030) prediction according to project feasibility study and predicted traffic volume is shown in Table 2-2-3.

Table 2-2-3 Medium-term (2020) and Long-term (2030) Prediction of Road Traffic Unit: vehicle/h

Operation period	Road names	Starting point	Peak hour	Day				Night			
				Average hour	Small	Medium	Large	Average hour	Small	Medium	Large
2020	Taibai Road	Ginkgo Avenue~Jiefang Avenue	1970	873	777	61	35	216	192	15	9
		Jiefang Avenue~Biyun Road	2814	1247	1110	87	50	308	274	22	12
		Biyun Road~Anwei Bridge	2785	1234	1098	86	49	305	271	21	12
		Anwei Bridge ~Jiangxia Avenue	1876	831	740	58	33	205	183	14	8
	Biyun Road	Binhe Avenue-Handan Road	1031	457	407	32	18	113	100	8	5
		Handan Road -Taibai Road	1615	715	637	50	29	177	157	12	7
		Taibai Road-Jinqiu Avenue	1424	631	561	44	25	156	139	11	6
		Jinqiu Avenue –new 316 National Highway	896	397	353	28	16	98	87	7	4
	Jiefang Avenue	Binhe Avenue~Taibai Road	1683	746	664	52	30	184	164	13	7
		Taibai Road~Jinqiu Avenue	1415	627	558	44	25	155	138	11	6

	Jinqiu Avenue	Ginkgo Avenue~Jiefang Avenue	886	393	349	27	16	97	86	7	4
		Jiefang Avenue~Biyun Road	1012	448	399	31	18	111	99	8	4
	Ginkgo Avenue	Fucheng Avenue~Taibai Road	896	397	353	28	16	98	87	7	4
		Taibai Road~ new 316 National Highway	742	329	293	23	13	81	72	6	3
	Zhanqian Road	Connection line of three bridges~ Anjing Line	674	299	266	21	12	74	66	5	3
	Fucheng Avenue	Jiefang Avenue- De’an North Road	654	290	258	20	12	72	64	5	3
		De’an North Road -Ginkgo Avenue	684	303	270	21	12	75	67	5	3
2030	Taibai Road	Ginkgo Avenue~Jiefang Avenue	2987	1323	1178	93	53	327	291	23	13
		Jiefang Avenue~Biyun Road	3259	1444	1285	101	58	357	318	25	14
		Biyun Road ~Anwei Bridge	3560	1577	1404	110	63	390	347	27	16
		Anwei Bridge ~Jiangxia Avenue	2604	1154	1027	81	46	285	254	20	11
	Biyun Road	Binhe Avenue-Handan Road	1474	653	581	46	26	161	144	11	6
		Handan Road-Taibai Road	1872	829	738	58	33	205	182	14	8
		Taibai Road-Jinqiu Avenue	2003	887	790	62	35	219	195	15	9
		Jinqiu Avenue- new 316 National Highway	1716	760	677	53	30	188	167	13	8

	Jiefang Avenue	Binhe Avenue~Taibai Road	2150	953	848	67	38	235	210	16	9
		Taibai Road~Jinqiu Avenue	1895	840	747	59	34	208	185	15	8
	Jinqiu Avenue	Ginkgo Avenue~Jiefang Avenue	1726	765	681	54	31	189	168	13	8
		Jiefang Avenue~Biyun Road	1864	826	735	58	33	204	182	14	8
	Ginkgo Avenue	Fucheng Avenue~Taibai Road	1910	846	753	59	34	209	186	15	8
		Taibai Road~ new 316 National Highway	1754	777	692	54	31	192	171	13	8
	Zhanqian Road	Connection line of three bridges~ Anjing Line	1612	714	636	50	29	177	157	12	7
	Fucheng Avenue	Jiefang Avenue- De'an North Road	1678	743	662	52	30	184	164	13	7
		De'an North Road -Ginkgo Avenue	1813	803	715	56	32	199	177	14	8

2.3 Project of ancillary facility of public traffic system

2.3.1 Construction contents and project scale

The subproject contains construction of 6 public transportation transfer junctions (including 3 public transportation transfer junctions, 1 small public transit hub at terminal and 2 transportation transfer junctions+highway passenger transportation centers) as well as 194 buses and an intelligent bus system (including bus dispatch, passenger information service and e-card system).

Public transportation hubs include railway-public/township highway passenger transportation transfer junctions, long-distance passenger transportation-public transportation transfer junctions, public transportation-public transportation transfer junctions and public transportation-township highway passenger transportation transfer junctions. Public transportation transfer junctions of passenger transportation stations refer to long-distance highway passenger transportation and urban public transportation transfer junctions. Small public transportation hubs at terminal of railways stations include common-speed railway transportation of passengers of Wuhan-Danjiang Railway and urban public transportation transfer junctions. Public transportation transfer junctions of long and short-distance bus stations include urban public transportation (including public transportation in urban and rural areas in suburbs) and internal transfer junctions of interurban public transportation. Highway passenger transportation centers of high speed rail stations and public transportation transfer junctions refer to Wuhan-Xiangyang-Shiyan Interurban Railway and urban public transportation and township highway passenger transportation transfer junctions. Qiliqiao Bridge Highway Passenger Transportation Center and public transportation transfer junctions are urban public transportation and township highway passenger transportation transfer junctions. The sketch map of distribution is shown below:

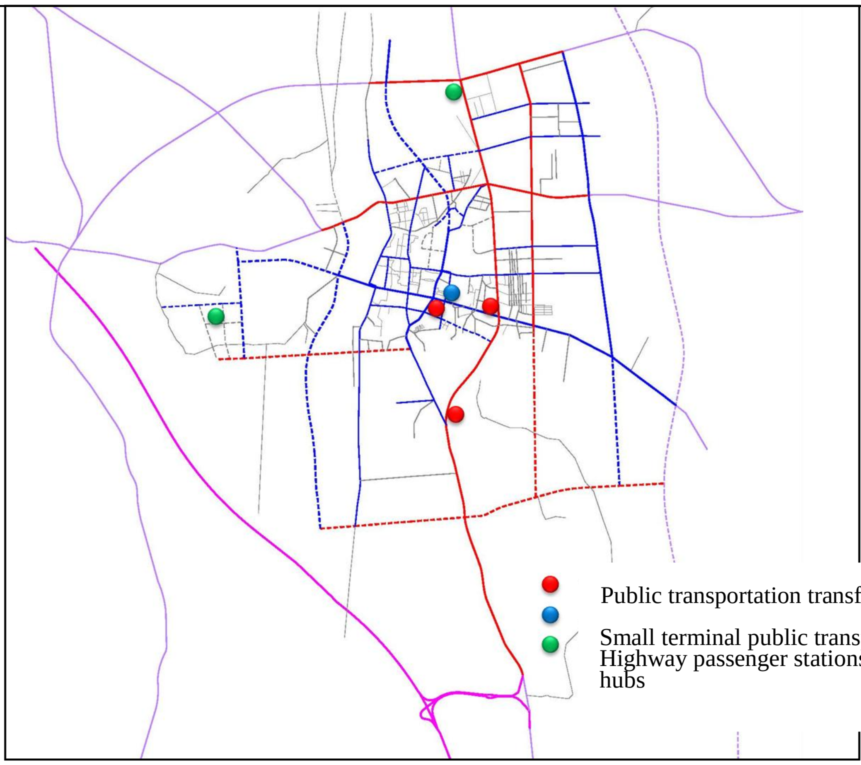


Figure 2-3-1-1 Sketch map of distribution of public transportation hub project

As vehicles in the public transportation hubs and passenger transportation stations in the subproject are driven by electricity, there are no ancillary facilities like gas stations at the stations.

2.3.2 Detailed description of projects

2.3.2.1 Public transportation transfer junctions at passenger transportation stations

1) Functional orientation

According to plan positioning of Anlu long-distance passenger stations, the passenger station is going to adjoin slip-roads like Wuhan-Shiyan Expressway and Xiaogan-Honghu Expressway and undertake long-distance inter-province passenger transportation in the future so as to improve the traffic efficiency of trans-provincial highway passenger transportation. It is estimated that by 2020 the station will have an annual passenger capacity between 420,000 and 490,000 and a daily capacity between about 1,167 and 1,361.

2) Plane layout

The public transportation hubs of the passenger station occupy a floor area of about 7,490m^2 including 40 parking lots for public transportation where the vehicles park vertically, with each stall occupying 3.5m×9m (vehicle length varying from 6 to 8m); a transfer long-distance passenger transportation for non-motor vehicle are established in the west east corners with a capacity for 200 vehicles; two platforms, with one up, one down, are built on the north side with 2 drop-off points and 4 pick-up points; an entrance is located on National Highway 316 on the west; a two-storey auxiliary house for public transportation and a one-storey motor repair shop are built (with a total building area of 847m^2); 10 motor vehicles and 21 non-motor vehicles are provided.

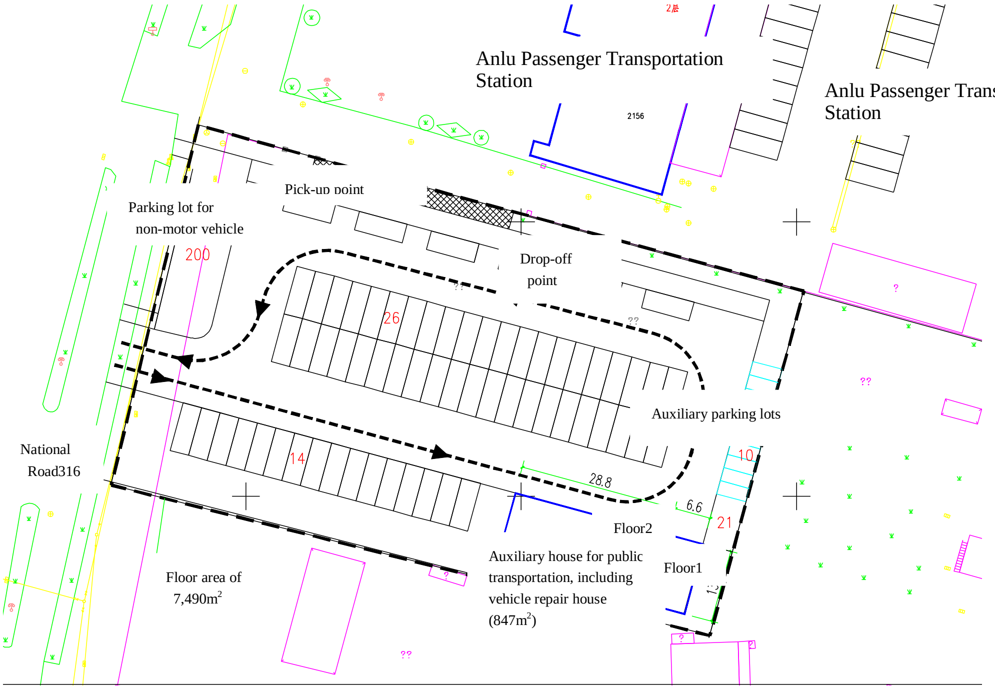


Figure2-3-2-1-1 Sketch Map of Plane Layout of Public Transportation Hubs of the Passenger Transportation Station

3) Roadbed and road surface

All the parking lots are made of 20cmC30 cement concrete pavement and 30cm-thick cement stabilized macadam.

4) Vertical plane and drainage for the sites

All the sites where the terminals are located shall not be more than 3% vertically and not more than 1% parallel to the direction of the access. The planning and design for rain water, sewage and drainage pipelines as well as ancillary facilities shall base on drainage facilities in the road network around the sites.

5) Landscape works

It covers a total floor area of about 7,490m^2, including a green area of about 1,629m^2 with a greening rate of 21.7%. The 4.5m-tall goldenrain tree, as a protector around the site in linear planting at an interval of 5m in the green belt and the groups of 4.5m-tall yellow cinnamon trees in the middle form a tree shadow in the internal courtyard, which contributes to the green quantity and acts as shadow in the summer. At the turnings of road in the site mainly stand short shrubs, which reduces sight disturbance to drives as transparent design. In consideration of the length of parking lots, vegetation is going to be planted in the greening area 2m away from the lots.

6) Illumination works

(1) Layout of lamps

In consideration of the landform features and requirements on illumination of the parking lots, intermediate-pole lamps are applied and placed in symmetric radically or asymmetric manner for illumination at different sites. Non-radial intermediate-pole lamps have 15m poles with 5xNG400W light source and project lamps; radial ones have 15m poles with 6xNG400W light source and project lamps, which are radically symmetric.

(2) Power supply facility

The project applies 380/220V power, with the lighting source for both terminals of public transportation controlled by power distribution control box at the complex building of public transportation. Lighting source of public parking lots is reported by individual construction institutions to power supply departments with the light distribution control box under control in a room.

7) Traffic management

Public traffic vehicles run in anticlockwise rotary traffic management manner and share 1 entrance, and are allowed to enter or exit out from the parking lots by turning left.

8) Condition of the existing station yard

The station is reconstructed and construction scope is within original red line of the station, not involving land acquisition. The following picture shows the condition of the reconstructed station:

Fig. 2-3-2-1-2 Picture of Current Situation of Public Transport Hub of Passenger Transport Center Station

2.3.2.2 Small terminal public transportation hubs of railway station

1) Functional orientation

Due to construction of Wuhan-Xiangyang-Shiyan interurban railway, the railway passenger traffic volume continues to increase. It is estimated that Anlu Railway station, as a leading player of the railway station, will have an annual passenger capacity between 678,000 and 787,000 in 2020 and a daily capacity between 1,883 and 2,189.

2) Plane layout

The plane layout bases on the functional orientation of the project with external conditions considered. As shown in the following diagram, the total floor area of terminal public transportation stations of the railway station is about 2,030m^2.

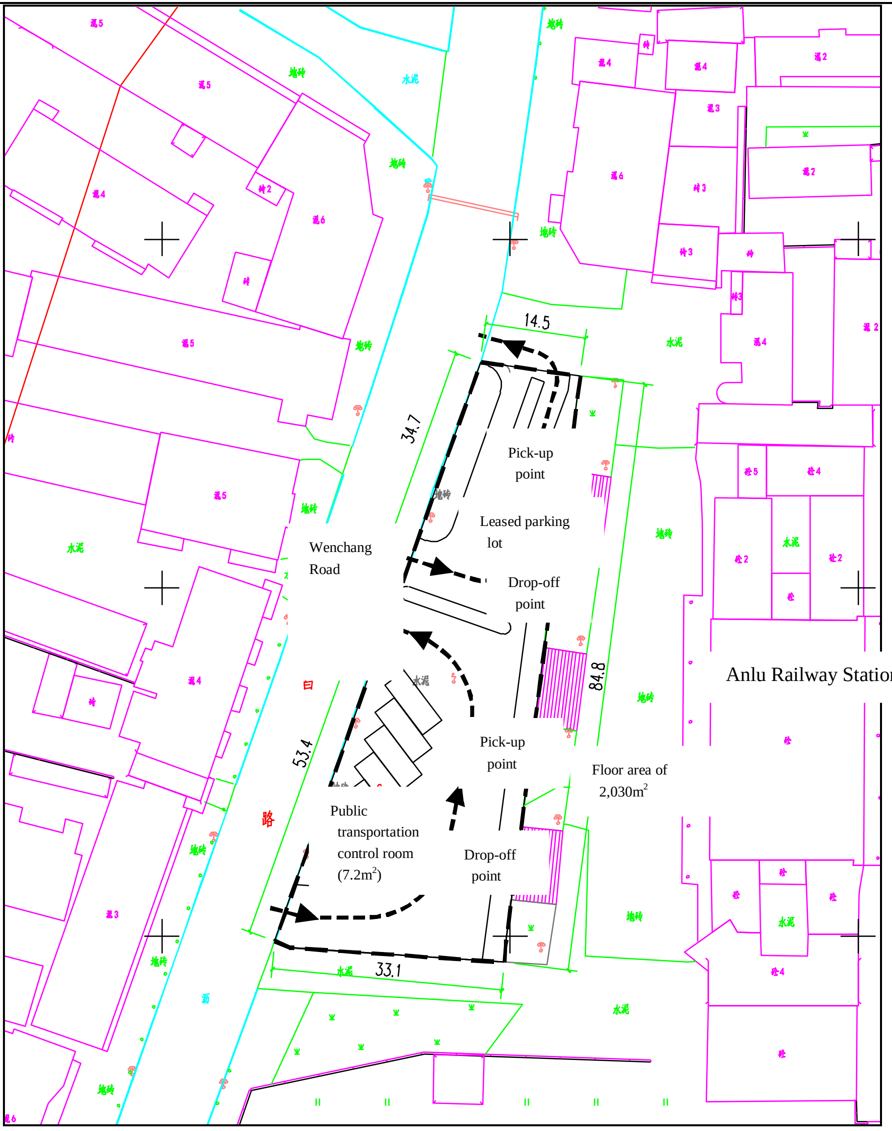


Figure2-3-2-2 Sketch Map of Plane Layout of Public Transportation Station Terminal of the Railway Station

6 parking lots in inclination for public transportation are available, each with a area of 3.5m×9m (varying from 6 to8m in length); on the east are one upper and one lower platform as well as a one-storey 7.2m^2 control room for public transportation. There are two 26m-long waiting areas for vehicle leasing with an upper on the north and a lower platform on the east. There are one entrance and one exit for buses and for taxis, both on Wenchang Road.

3) Roadbed and road surface

All the parking lots are made of 20cmC30 cement concrete pavement and 30cm-thick cement stabilized macadam.

4) Vertical plane and drainage for the sites

All the sites where the terminal stations are located shall not be more than 3% vertically and not more than 1% parallel to the direction of the access. The planning and design for rain water, sewage and drainage pipelines as well as ancillary facilities shall base on drainage facilities in the road network around the sites.

5) Landscape works

It covers a total floor area of about 2,030m^2, including a green area of about 293m^2 with a greening rate of 14.5%. The 4.5m-tall goldenrain tree, as a protector around the site in linear planting at an interval of 5m in the green belt and the groups of 4.5m-tall yellow cinnamon trees in the middle form a tree shadow in the internal courtyard, which contributes to the green quantity and acts as shadow in the summer. At the turnings of road in the site mainly stand short shrubs, which reduces sight disturbance to drives as transparent design. In consideration of the length of parking lots, vegetation is going to be planted in the greening area 2m away from the lots.

6) Illumination works

(1) Layout of lamps

In consideration of the landform features and requirements on illumination of the parking lots, intermediate-pole lamps are applied and placed in symmetric radically or asymmetric manner for illumination at different sites. Non-radial intermediate-pole lamps have 15m poles with 5XNG400W light source and project lamps; radial ones have 15m poles with 6XNG400W light source and project lamps, which are radically symmetric.

(2) Power supply facility

The project applies 380/220V power, with the lighting source for both terminal stations of public transportation controlled by power distribution control box at the complex building of public transportation. Lighting source of public parking lots is reported by individual construction institutions to power supply departments with the light distribution control box under control in a room.

7) **Traffic management**

Public transportation vehicles shall be under linear traffic management, going in from south and out from north from entrances and exits, and are allowed to enter the parking lot by turning left.

8) Condition of the existing station yard

The station is reconstructed and construction scope is within original red line of the station, not involving land acquisition.The following picture shows the condition of the reconstructed station:

Fig. 2-3-2-2-2 Picture of Current Situation of Bus Starting and Terminal Stations in the Railway Station

2.3.2.3 Public transportation transfer junctions of short-distance station

1) Functional orientation

According to the plan positioning for long-distance passenger stations and external transfer of transportation function of short-distance stations in Anlu, the station yard shall act as a public transportation junction in Anlu.

2) Plane layout

Short-distance public transportation junctions cover a floor area of about 10,600m^2 with 50 9m and 22 6m parking lots designed in vertical manner, including 3.5m×9m big stalls for (vehicle length between 6 and 8m) and 3.5m×6m small (vehicle length between 5 and 6m) ones. There are 2 drop-off points on the west and 4 pick-up points on the east. The former 2-storey ticket station now has been replaced with an auxiliary house for public transportation (including public transportation control center) with an area of 750m^2 as well as auxiliary parking lots for 5 motor vehicles and 10 non motor vehicles. A 90m^2 one-storey public transportation repair shop is built with 4 charging stalls. A 3,500 m^2 underground public parking lot with a capacity of 100 vehicles is built. Entrances and exits for motor vehicles are respectively established on the west and east of Zhongbai Warehouse at Biyun Road. A backup access on the west of the site is connected to Handan Road.

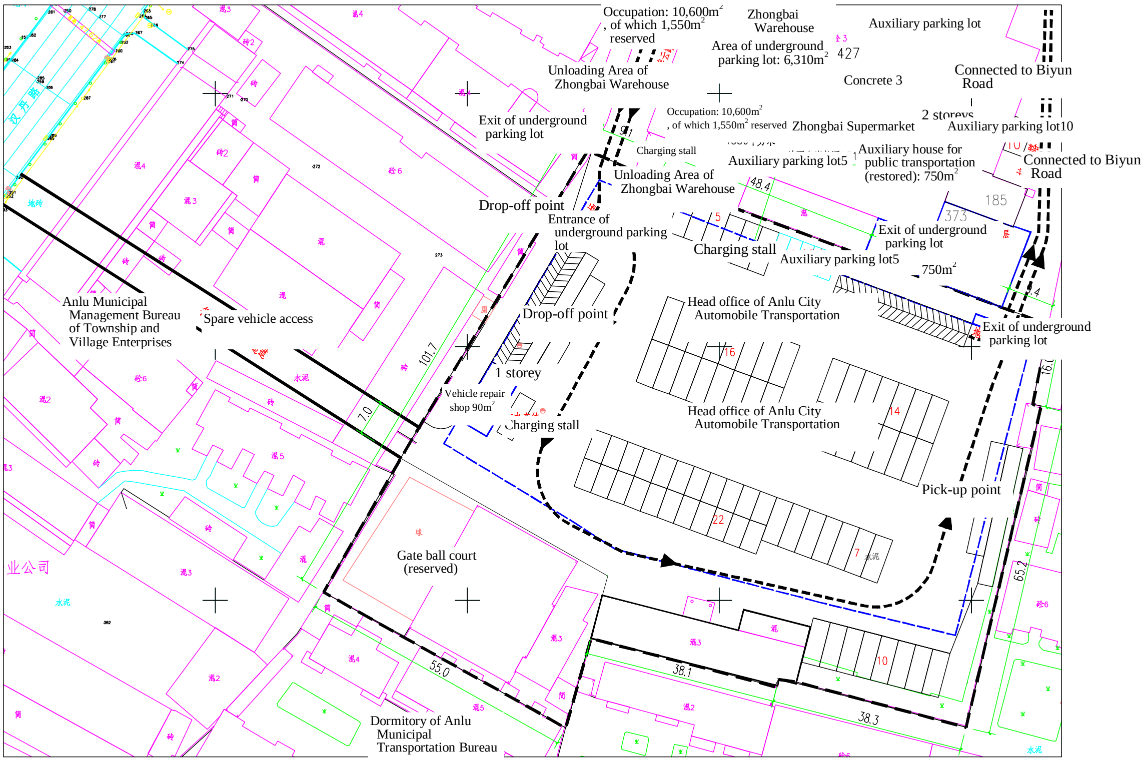


Figure 2-3-2-3-1 Sketch Map of Plane Layout Public Transportation Hubs of Short-Distance Stations

3) Roadbed and road surface

All the parking lots are made of 20cmC30 cement concrete pavement and 30cm-thick cement stabilized macadam.

4) Vertical plane and drainage for the sites

All the sites where the terminal stations are located shall not be more than 3% vertically and not more than 1% parallel to the direction of the access. The planning and design for rain water, sewage and drainage pipelines as well as ancillary facilities shall base on drainage facilities in the road network around the sites.

5) Landscape works

Junctions of short-distance stations cover a total floor area of about 10,600m^2, including a green area of about 737m^2 with a greening rate of 7.0%. The 4.5m-tall goldenrain tree, as a protector around the site in linear planting at an interval of 5m in the green belt and the groups of 4.5m-tall yellow cinnamon trees in the middle form a tree shadow in the internal courtyard, which contributes to the green quantity and acts as shadow in the summer. At the turnings of road in the site mainly stand short shrubs, which reduces sight disturbance to drives as transparent design. In consideration of the length of parking lots, vegetation is going to be planted in the greening area 2m away from the lots.

6) Illumination works

(1) Layout of lamps

In consideration of the landform features and requirements on illumination of the parking lots, intermediate-pole lamps are applied and placed in symmetric radically or asymmetric manner for illumination at different sites. Non-radial intermediate-pole lamps have 15m poles with 5×NG400W light source and project lamps; radial ones have 15m poles with 6×NG400W light source and project lamps, which are radically symmetric.

(2) Power supply facility

The project applies 380/220V power, with the lighting source for both terminal stations of public transportation controlled by power distribution control box at the complex building of public transportation. Lighting source of public parking lots is reported by individual construction institutions to power supply departments with the light distribution control box under control in a room.

7) Traffic management

Public traffic vehicles run in anticlockwise rotary traffic management manner, going in from west and out from east from separate entrances and exits, and are allowed to enter or exit out from the parking lots by turning left.

8) Condition of the existing station yard

The station is reconstructed and construction scope is within original red line of the station, not involving land acquisition.The following picture shows the condition of the reconstructed station:

Fig. 2-3-2-3-2 Picture of Current Situation of Short-Distance Station Public Transport Hub

2.3.2.4 Public transportation transfer junctions of long-distance station

1) Functional orientation

According to the plan positioning for long-distance passenger stations and external transfer of transportation function of short-distance stations in Anlu, the station yard shall act as a public transportation junction in Anlu.

2) Plane layout

Long-distance public transportation junctions cover a floor area of about 7,280m^2 with 30 9m and 20 6m parking lots designed in vertical manner, including 3.5m×9m big stalls for (vehicle length between 6 and 8m) and 3.5m×6m small (vehicle length between 5 and 6m) ones. There are 2 drop-off points and 1 pick-up point on the south and 2 pick-up points on the east. 2 one-storey public transportation repair shop with a total area of 180m^2 are built with 2 charging stalls. The former 2-storey ticket station now has been replaced with an auxiliary house for public transportation (including public transportation control center) with an area of 787m^2 as well as auxiliary parking lots for 20 motor vehicles and 10 non motor vehicles. Entrances and exits for public transportation vehicles are respectively established on the south Biyun Road and the east Taibai Avenue.

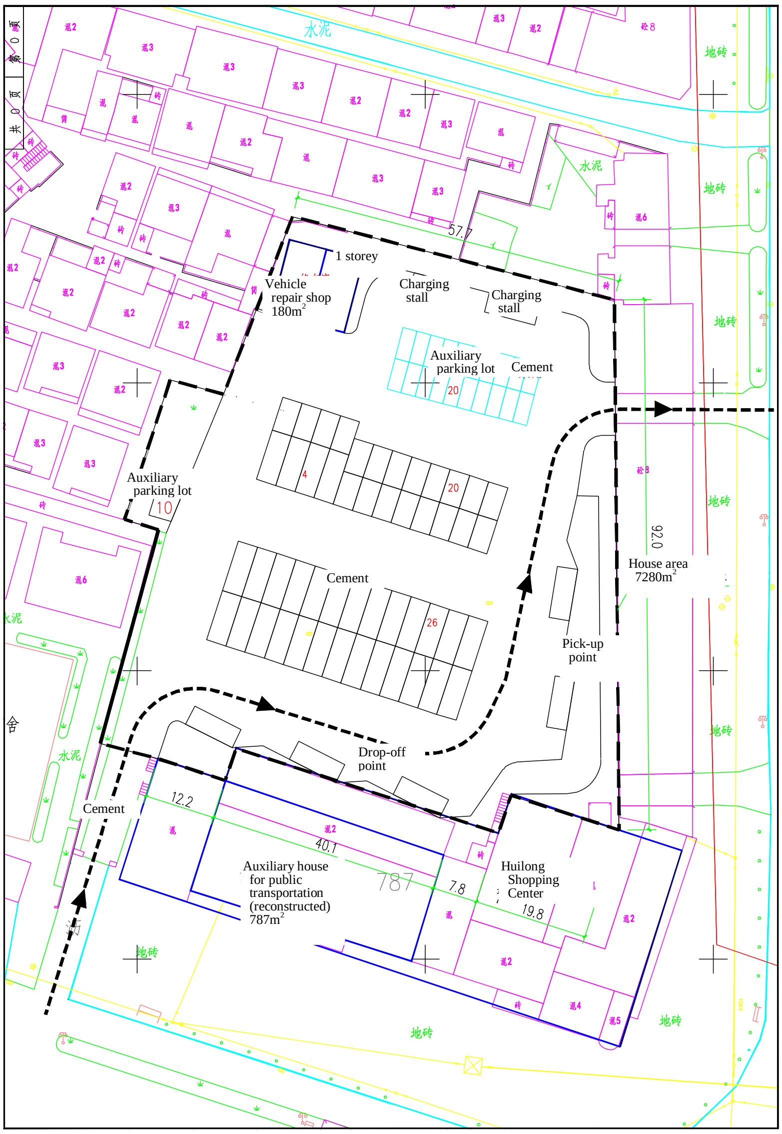


Figure 2-3-2-4-1 Sketch Map of Plane Layout Public Transportation Hubs of Long-Distance Stations

3) Roadbed and road surface

All the parking lots are made of 20cmC30 cement concrete pavement and 30cm-thick cement stabilized macadam.

4) Vertical plane and drainage for the sites

All the sites where the terminal stations are located shall not be more than 3% vertically and not more than 1% parallel to the direction of the access. The planning and design for rain water, sewage and drainage pipelines as well as ancillary facilities shall base on drainage facilities in the road network around the sites.

5) Landscape works

Junctions of short-distance stations cover a total floor area of about 7,280m^2, including a green area of about 819m^2 with a greening rate of 11.3%. The 4.5m-tall goldenrain tree, as a protector around the site in linear planting at an interval of 5m in the green belt and the groups of 4.5m-tall yellow cinnamon trees in the middle form a tree shadow in the internal courtyard, which contributes to the green quantity and acts as shadow in the summer. At the turnings of road in the site mainly stand short shrubs, which reduces sight disturbance to drives as transparent design. In consideration of the length of parking lots, vegetation is going to be planted in the greening area 2m away from the lots.

6) Illumination works

(1) Layout of lamps

In consideration of the landform features and requirements on illumination of the parking lots, intermediate-pole lamps are applied and placed in symmetric radically or asymmetric manner for illumination at different sites. Non-radial intermediate-pole lamps have 15m poles with 5×NG400W light source and project lamps; radial ones have 15m poles with 6×NG400W light source and project lamps, which are radically symmetric.

(2) Power supply facility

The project applies 380/220V power, with the lighting source for both terminal stations of public transportation controlled by power distribution control box at the complex building of public transportation. Lighting source of public parking lots is reported by individual construction institutions to power supply departments with the light distribution control box under control in a room.

7) Traffic management

Public traffic vehicles run in anticlockwise rotary traffic management manner, going in from west and out from east from separate entrances and exits, and are allowed to enter or exit out from the parking lots by turning left.

8) Condition of the existing station yard

The station is reconstructed and construction scope is within original red line of the station, not involving land acquisition.The following picture shows the condition of the reconstructed station:

Fig. 2-3-2-4-2 Picture of Current Situation of Long-Distance Station Public Transport Hub

2.3.2.5 Qiliqiao Bridge highway passenger transportation+public transportation transfer junctions

1) Functional orientation

According to the plan positioning for long-distance passenger stations in Anlu, the transportation function of long and short-distance stations is to be transferred outward to Qiliqiao Bridge. As an important node of road transportation, the station yard mainly undertakes middle and long-distance road transportation in Hubei province and short-distance transportation in some villages and towns and shall be connected to public transportation routes.

2) Plane layout

The following map shows Qiliqiao Bridge Hub with a total area of about 16,410m^2.

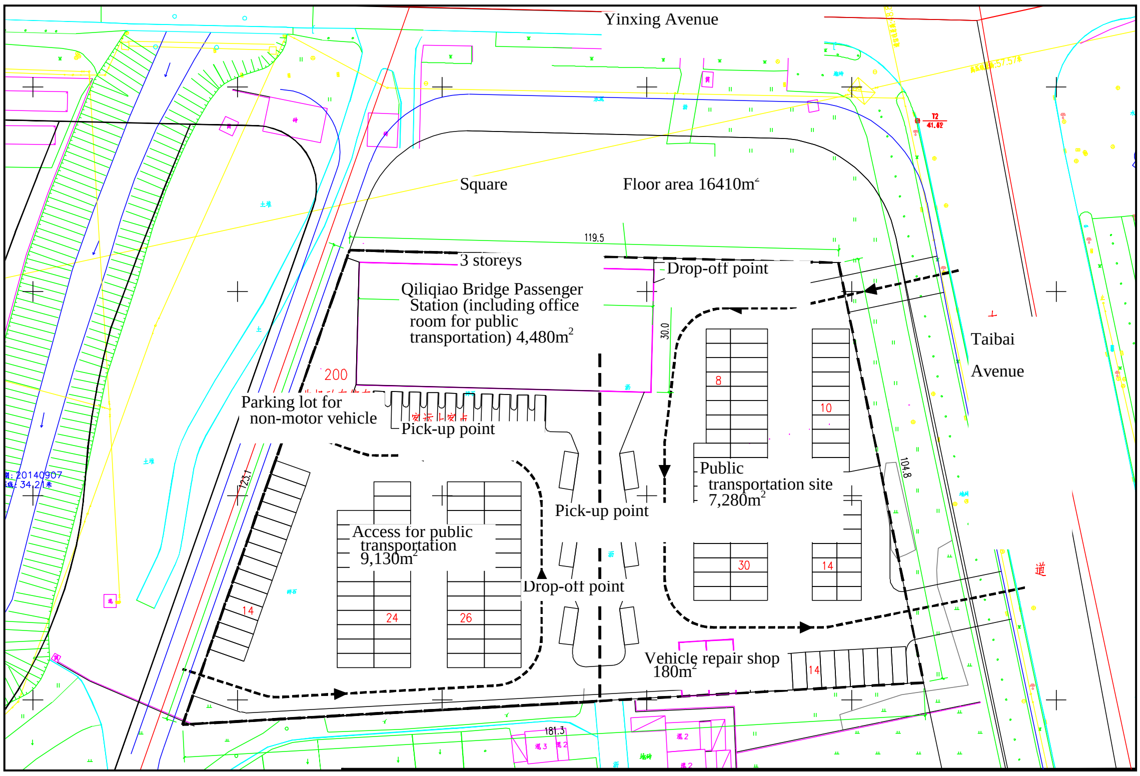


Figure 2-3-2-5-1 Sketch Map of Plane Layout of Qiliqiao Bridge Hub

(1) Public transportation transfer junction

Short-distance public transportation junctions cover a floor area of about 7,280m^2 with 54 9m and 22 6m parking lots designed in vertical manner, including 3.5m×9m big stalls for (vehicle length between 6 and 8m) and 3.5m×6m small (vehicle length between 5 and 6m) ones. There are 2 drop-off points on the north and 3 pick-up points on the island platform. 2 one-storey public transportation repair shops with a total area of 180m^2 are built. The newly built 3-storey passenger transportation center covers an area of 750 m^2 with auxiliary house for public transportation. One entrance and one exit are established on the east Taibai Avenue.

(2) Highway passenger transportation center

The passenger transportation center occupies an area of 9,130 m^2 with 64 parking lots (3.5m×9m for vehicle length between 6 and 8m) designed vertically. There are 10 guest seats for highway passenger transportation on the north and 3 guest seats nearby the public transportation transfer junctions on the east. The newly built 3-storey passenger transportation center covers an area of 6,480m^2, including an auxiliary house for public transportation of 750 m^2; one entrance and one exit are established on the project road on the west of the site.

3) R**oadbed and road surface**

All the parking lots are made of 20cmC30 cement concrete pavement and 30cm-thick cement stabilized macadam.

4) Vertical plane and drainage for the sites

All the sites where the terminal stations are located shall not be more than 3% vertically and not more than 1% parallel to the direction of the access. The planning and design for rain water, sewage and drainage pipelines as well as ancillary facilities shall base on drainage facilities in the road network around the sites.

5) Landscape works

Qiliqiao Bridge Hub covers a total area of about 16,410m ^{2}, including a green area of about 710m^2 with a greening rate of 4.3%. The 4.5m-tall goldenrain tree, as a protector around the site in linear planting at an interval of 5m in the green belt and the groups of 4.5m-tall yellow cinnamon trees in the middle form a tree shadow in the internal courtyard, which contributes to the green quantity and acts as shadow in the summer. At the turnings of road in the site mainly stand short shrubs, which reduces sight disturbance to drives as transparent design. In consideration of the length of parking lots, vegetation is going to be planted in the greening area 2m away from the lots.

6) Illumination works

(1) Layout of lamps

In consideration of the landform features and requirements on illumination of the parking lots, intermediate-pole lamps are applied and placed in symmetric radically or asymmetric manner for illumination at different sites at different sites. Non-radial intermediate-pole lamps have 15m poles with 5×NG400W light source and project lamps; radial ones have 15m poles with 6×NG400W light source and project lamps, which are radically symmetric.

(2) Power supply facility

The project applies 380/220V power, with the lighting source for both terminal stations of public transportation controlled by power distribution control box at the complex building of public transportation. Lighting source of public parking lots is reported by individual construction institutions to power supply departments with the light distribution control box under control in a room.

7) Traffic management

Public traffic vehicles run in anticlockwise rotary traffic management manner, going in from north and out from south from separate entrances and exits at the hub stations on the east, and are allowed to enter or exit out from the parking lots by turning left; passenger service vehicles run in anticlockwise rotary traffic management manner, going in from south and out from north from separate entrances and exits at the hub stations on the west, and are allowed to enter or exit out from the parking lots by turning left

8) Condition of the existing station yard

The following picture shows the newly built station, with new land acquisition area of 16410m^2, which is located in a logistics company for the moment.

Fig. 2-3-2-5-2 Picture of Current Situation of Hub Site Seletion of Qili Bridge

2.3.2.6 Highway passenger transportation of high speed rail station+ public transportation transfer junctions

1) Functional orientation

According to the annual passenger traffic volume of Anlu Railway Station, it is estimated that the west station will have an annual passenger volume between 452,000 and 525,000, which is 40% of the total annual volume of Anlu, and a daily average passenger volume between 1,255 and 1,458.

2) Details of the plan

The construction plan of the hub shall be researched on the basis on the plan for the speed railway station, which is still in preparation, with the layout of station square considered. The hub in the project is proposed to be a three-level highway passenger transportation center and public transportation transfer junction.

3) Current condition of the station yard

The following picture shows the newly built station, with new land acquisition area of about 5000m^2, which is located in an wasteland for the moment.

Fig. 2-3-2-6-1 Picture of Current Situation for Site Selection of Highway Passenger Transportation Center of High-speed Rail Station+Public Transport Transfer Hub

2.4 Road safety works

Complete construction of Anlu Traffic Monitoring and Dispatching Command Center, and build self-adaptive traffic signal control system and electronic police system at the road intersection necessary to set signal lamp within the built-up area of 2019 (excluding road involved in “integrated traffic corridor and road improvement works”); build traffic monitoring facilities at the main intersection and in road sections; build communication network and background system matching the upgrade of traffic management facility; extensively carry out a variety of traffic safety publicity and education activities towards the community, school, institution, and enterprise.

The construction content includes command center equipment and system construction, self-adaptive traffic signal control system, traffic video monitoring system, electronic police system, public traffic safety publicity and education. It is predicated to build 15 self-adaptive signal control intersections in total, where the self-adaptive signal system comprises the traffic flow detection, traffic signal controller, traffic signal lamp, and traffic signal cable, etc; build 20 high-definition traffic video monitoring systems comprising high-definition camera, communication equipment, auxiliary facility, etc; build 15 high-definition electronic police systems of bayonet type for extension of self-adaptive signal control intersections, comprising front-end high-definition electronic police camera of bayonet type, communication equipment, and traffic light detector, etc.

2.5 Slow traffic system improvement

2.5.1 Construction content and project scale

Five slow traffic regions are planned in general plan of Anlu: slow zone along the river, waterfront landscape zone, business slow zone, slow zone in business street, and slow control zone in old town. In the project, slow traffic facilities on existing secondary roads and common aisles within the old town of enclosed area of Hankou-Danjiangkou Railway, Jiefang Avenue, and Fuhe Avenue will be improved, with construction content mainly including reconstruction of special slow road in old town, improvement of slow traffic sign and marking system, construction of non-motor vehicle parking facility, and improvement of slow railway passage.

2.5.2 Project description

The project will be carried out in three aspects, i.e., walking facility improvement, non-motor vehicle facility improvement, slow traffic sign and marking system/guiding system construction.

2.5.2.1 Walking facility improvement

Pave and renovate roads including Shuanglongqiao First Road, Third Road, Zhongshan Street, Upper and Lower Yushi Street, and Wuyicun First Lane to improve the walking space; reconstruct five alley node steps including Fenghuang West District, Shuanglongqiao and Wenchang Road as gentle slope to make convenience for barrier-free travel of non-motor vehicle.

Get through to blind pass such as the Lower Yushi Street and Wuyicun First Lane, newly build slow traffic road connected to Handan West Road, and connect sidewalk with street road around to enhance walking connectivity.

Set 7 road humps at the entrance of hospitals and schools such as Anlu Second Hospital, Experimental Junior High School, Experimental Primary School, De'an Middle School, Zijinlu Primary School, Yong'an Shopping Mall, and New Century Kindergarden to reduce driving speed and guarantee the safety to go to school or a doctor; optimize crossing facilities at 13 intersections including the intersection between Fenghuang Road and Fuhe Avenue, De'an Road, Handan Road, Wenchang Road, the intersection between De'an Road and Handan Road, the intersection between Zijin Road and Fuhe Avenue, the intersection between De'an Road and Ruxue Road, between De'an Road and Zijin Road, and between Wenchang Road and Handan Road to reduce driving speed and guarantee safety of traffic vulnerable groups to cross the street; renovate the special slow traffic bridge in Wuyi Community to guarantee slow traffic safety.

2.5.2.2 Non-motor vehicle facility improvement

Build traffic guardrail/isolation column to separate motor vehicle from non-motor vehicle in road sections such as Handan Road, Ruxue Road, Longmen Road, Zijin Road (Fuhe Avenue – De'an Road), Zijin Road (Biyun Road – Zijin Road), Ruxue Road, Longmen Road and Wenchang Road, and build non-motor vehicle lane in the form of marking isolation in roads such as De'an Road to guarantee continuous and safe traveling space of non-motor vehicle.

Set non-motor vehicle parking facilities in sidewalk facility belt of roads of life including De'an Road, Handan Road, Longmen Road, Wenchang Road, Ruxue Road, Fenghuang Road, Biyun Road, Zijin Road, and Jiefang Avenue; set 9 public parking lots for non-motor vehicle outside schools, shopping malls and other places crowed with people such as the Riverside Park, Jiefang Junior High School, Taibai Square, and Yong'an Shopping Mall, etc.

2.5.2.3 Slow traffic sign and marking improvement

Fully improve slow traffic sign and marking of the old town from slow crossing sign and marking, slow traffic sign and marking/guiding system, etc.

2.6 Institution construction and technical assistance

Provide research on current issues, personnel training, project research, consultation service, study and inspection tours for successful project implementation, and normal operation and management in the future, sustainable development of urban traffic construction, etc. To be specific, it includes:

(1) Overseas investigation and training

(2) Domestic investigation and training

(3) Research on current issues

(4) Project consultation service

(5) Reinforcement of auxiliary equipment for institution operation

2.7 Construction organization

(1) Waste slag yard

Waste slag of 933,800m^3 was produced from road surface excavation of integrated traffic corridor and road network improvement works based on water conservation, stacked temporarily after excavation (within boundary line of roads), and may be used for backfilling of subgrade broken stone hardcore after treatment, with permanent waste slag output being 249,600m^3.

(2) Construction, production and living areas

Construction technology used in the project is simple, commercial concrete purchased will be used as bituminous concrete necessary for the works in urban center, and construction site such as separate mixing station will not be arranged in the works.

For line and depot in the town in the works, constructors may rent houses owned by citizens instead of setting up living camp separately; for line without such houses to rent nearby, the constructors may set up color bond temporary living house around the line.

Material storage and mechanical temporary storage during construction may be directly arranged within the boundary line of land acquisition, with area available to meet arrangement requirements of the construction site.

(3) Construction road

Semi-closed construction is adopted in the project, which basically has no influence on urban traffic, and existing urban road may be used for construction, without the necessity to build construction road.

2.8 Earthwork

Only earthwork calculation of integrated traffic corridor and road network improvement works is conducted in the Water and Soil Conservation Plan Report, with details shown in the table below.

Table 2-8-1 Earthwork Balance Sheet of Integrated Traffic Corridor and Road Network Improvement Works

Name	Total excavation and fill	Excavation				Fill			Volume used			Volume borrowed			Volume abandoned			
		Total	Earth volume	Sludge	Stone volume	Total	Earth volume	Stone volume	Total	Earth volume	Stone volume	Total	Earth volume	Stone volume	Total	Earth volume	Sludge	Stone volume
I. Yinxing Avenue		165541	143136	12447	9958	248518	238560	9958	105382	95424	9958	95424	95424	0	12447	0	12447	0
II. Jiefang Avenue		25544	8991	0	16553	2997	0	2997	2997	0	2997	0	0	0	22547	8991		13556
III. Biyun Road		55119	48399	0	6720	25800	0	25800	6720	0	6720	19080	0	19080	48399	48399		
IV. Taibai Road		142396	92393	0	50003	76409	0	76409	50003	0	50003	26406	0	26406	92393	92393	0	0
V. Jinqiu Avenue		116852	83402	0	33450	73412	0	73412	33450	0	33450	39962	0	39962	83402	83402	0	0
VI. Zhanqian Road		284016	273000	6120	4896	114096	109200	4896	114096	109200	4896	0	0		169920	163800	6120	0
VII. Fucheng Boulevard		144334	137434	6900	0	142954	137434	5520	0	0	0	5520	0	5520	6900	0	6900	0
Subtotal		933802	786755	25467	121580	684186	485194	198992	312648	204624	108024	186392	95424	90968	436008	39023	25467	13556

According to the earthwork balance, the total excavated volume is 933,800 m³, backfilling volume is 684,200 m³, borrowed earthwork volume is 186,400m³, and abandoned volume is 436,100m³, including permanently abandoned volume of 249,600m³, which is mainly used for roadway excavation and boring mud of pier foundation within the covered scope, and can be coordinately transported to the temporary storage yard before used for backfilling of other surrounding soil lack items; temporarily abandoned volume of 186,500m³, which is mainly topsoil stripped earth and used for earthing and backfilling of the green belt during later road period.

In terms of earthwork utilization and allocation, the construction time sequence, earthwork composition and material quality, transportation distance, and other factors are taken into comprehensive consideration in the main work design, and construction possibility and convenience are concerned in earthwork allocation to avoid and reduce long-distance transportation as far as possible.

Excavated earth of the works is taken into preferred consideration for comprehensive utilization in the main work, and excavated and backfilled earth volume of 312,600m³ is used for the works, accounting for 33% of the excavated volume, where 204,600m³ of excavated volume is allocated to be used for earthing and backfilling of road green belt during later road to make the rich soil fully and effectively used, which will reduce abandoned excavated material to reduce temporary ground vegetation damage and soil erosion caused by soil abandonment, and save many land resources to reduce the earthwork cost.

2.9 Displacement and resettlement

The overall design principle of less displacement and less land occupation is fully considered in site selection of the project to avoid large architectural complex. Land acquisition and house removal will be involved in the project according to the *Action Plan for Resettlement of Inhabitant*.

House removal is within the range of land for works, and the area of buildings necessary to remove in the project totals 18,214.33m^2. Among them, 49 houses of private family will be removed, with building area of 6,566.33m^2 and affected population of 204. Totally 13 enterprises and stores are involved, with building area of 11,648m^2.

Total land acquisition area for the project is 620.95 Mu (41.40 ha.), including 260.18 Mu (17.35 ha.) of state owned land, and 360.77 Mu (24.05 ha.) of collectively owned land. 9 villages are involved in acquisition of collectively owned land. See Table 2-9-1 and Table 2-9-2 respectively for specific displacement and land acquisition conditions.

Table 2-9-1 Statistical Table of Quantity of Buildings Removed

Road	Area of influence	Land acquisition	Displacement			
			Household		Enterprise and store	
		Area (Mu)	Household /person	m^2	Family	m^2
Zhanqian Road	Lilong Village, Tangdi Town, Jinquan Village	153.59	15/68	3139.00	1	1908
Fucheng Avenue	Huguo Village and Zhaohe Village in Fucheng Street	155.92	3/15	1097.00	0	0
Yinxing Avenue	Zhaohe Village and Yuantong Village in Fucheng Street; Shimiao Village, Xugang Village, Jintai Village and Shitang Village in Economic Development Zone	281.44	2/8	240.00	0	0
Qiliqiao Public Transport Hub	Fucheng Street	30.00	0	0	1	7000
Public Transport Hub for Short-distance Passenger Station	Fucheng Street	0.00	29/113	2090.33	11	3740
Total		620.95	49/204	6566.33	13	11648

Table 2-9-2 Statistical Table of Land Acquisition Type and Quantity

Subitem	Collectively owned land						State-owned construction land	Total
	Subtotal	Agricultural land		Other agricultural lands	Construction land	Unused land		
		Subtotal	Cultivated land					
Fucheng Avenue	55.83	31.25	25.51	5.74	18.84	0.00	100.09	155.92
Zhaohe Village	33.62	15.54	12.01	3.53	14.55	0.00	0.00	33.62
Huguo Village	22.21	15.71	13.50	2.21	4.29	0.00	0.00	22.21
Zhanqian Road	153.59	137.03	133.66	3.37	13.19	0.00	0.00	153.59
Lilong Village	79.38	66.19	66.19	0.00	13.19	0.00	0.00	79.38
Jinquan Village	74.21	70.84	67.47	3.37	0.00	0.00	0.00	74.21
Yinxing Avenue	50.76	27.47	23.30	4.17	18.40	0.72	230.68	281.44
Zhaohe Village	1.70	0.07	0.00	0.07	0.84	0.72	0.00	1.70
Yuantong Village	6.96	2.37	1.65	0.72	3.87	0.00	0.00	6.96
Shitang Village	2.33	1.18	0.75	0.43	0.72	0.00	0.00	2.33

Jintai Village	8.99	7.91	6.83	1.08	0.00	0.00	0.00	8.99
Xugang Village	29.90	15.32	13.65	1.67	12.91	0.00	0.00	29.90
Shimiao Village	0.88	0.62	0.42	0.20	0.06	0.00	0.00	0.88
Qiliqiao Public Transport Hub	0.00	0.00	0.00	0.00	0.00	0.00	30.00	30.00
Total	260.18	195.75	182.47	13.28	50.43	0.72	360.77	620.95

Resettlement of affected population, recovery and compensation for occupied land mainly include:

Provide monetary indemnity or house for those subject to house removal to guarantee their housing quality and environment not below the level before removal; provide reasonable compensation for those subject to land acquisition to guarantee that the affected does not lose the source of income due to land acquisition; provide labor production and employment assistance for those affected to guarantee their long term means of livelihood not affected by land acquisition; make enterprises affected recover production and operation at the original or new site, and loss from suspension due to displacement compensated reasonably.

2.10 Construction scheme and scheduling

2.10.1 Construction scheme for road works

The main work mainly consists of subgrade, pavement, bridge and ancillary works, construction method of each single project varies, but on the whole, the construction is generally conducted mechanically or manually.

Project construction is generally as per the procedure of bridge, subgrade and roadside facilities. The subgrade works, pavement works and bridge works focus on mechanical construction, and slope protection focuses on manual construction. Road greening and rehabilitation works adopt combination of mechanical and manual construction. Main constructions method and technology include:

2.10.1.1 High filled and deeply excavated subgrade and protection works

Construction of subgrade in high fill section may be conducted first; superhigh filling shall be conducted based on the computed result for overload precompaction of the subgrade to reduce differential subgrade settlement. Suitable material shall be selected and appropriate slope form and gradient shall be used for high embankment. Construction of intercepting ditch shall be conducted first for excavation section equipped with such ditch, and then subgrade excavation shall be conducted. Deep cutting requires mass mountain excavation, which is easy to cause landslide and other disasters. Therefore, corresponding preventive measures shall be taken based on different geological conditions. For half fill and half excavation or high fill and deep excavation, especially fill and excavation towards zero on the way, pay attention to setting of earthy step or adopt suitable material for earthwork to strengthen antiskid treatment of subgrade.

Pay special attention to protection during construction period, conduct slope drainage and protection promptly during excavation of through cut and fill of embankment, isolate underground water source, and increase temporary drainage and protection facilities whenever necessary to ensure overall stability of subgrade during construction period and project delivery quality.

2.10.1.2 Pavement construction

Fully mechanized construction scheme is used for pavement construction, centralized mixing in place, hot mix and hot paving construction technology is used for pavement surface, and centralized mixing in place, mechanical paving construction technology is used for the base course and the subbase course.

Reconstructed and extended pavement construction is relatively simple. It is mainly to destroy original pavement mechanically, lay gravel and rubber after the foundation leveling and compaction, and then deposit concrete directly and lay asphalt above.

1) Road widening works

The project includes partial road widening construction. Level of mechanization for pavement construction is high, construction machinery with high degree of automation and strong production capacity shall be preferred, key machine of mixing and paving shall be used, and transport vehicle and rolling equipment shall provide support in operation for optimization to make concrete pavement construction mechanized comprehensively.

2) Old road pavement reconstruction works

It is mainly to destroy the original pavement mechanically, where rock ballast from destroying will be loaded directly by forklift and transported by automobile to the designated storage yard. Lay gravel and rubber after the foundation leveling and compaction, and then deposit concrete directly and lay asphalt above.

3) New and old pavement splicing works

All structural layers on sides of the old pavement shall be excavated to the shape of step, and fiberglass grid shall be laid at the seam crossing of new and old pavement to guarantee good combination of new and old pavement, and prevent crack on the junction surface. Crack with width more than 5mm appearing on the base course shall be subject to mud jacking treatment, with mud jacking strength being 2.0MPa; crack with width less than 5mm shall be subject to cement paste or asphalt potting.

4) Bridge construction

Bored pile shall be used for bridge foundation. Method of rotary drilling combined with percussion drilling shall be adopted based on geological conditions.

For bridge wade into the water (Chashanhe Bridge, Maohe Bridge, Qilihe Bridge), cofferdam construction scheme is adopted to reduce influence on river water quality:

(1) General construction technology

Construction platform erection – pier cofferdam construction – bridge superstructure construction.

(2) Cofferdam project

Surveying and setting out – cofferdam filling – pumping inside cofferdam – soil bag piling outside cofferdam – sludge excavation inside cofferdam – rubber and blind drain inside cofferdam – impermeable geotechnical cloth laying inside cofferdam – soil bag stacking inside cofferdam – soil and stone backfilling in layers inside cofferdam – static test.

(3) Tower crane

Surveying and setting out – foundation pit excavation of tower crane – manual foundation pit leveling and bottom clearing of tower crane – formwork installation – foundation structure embedding and rebar installation – concrete pouring – formwork removal – groove backfilling.

The bridge superstructure is prestressed concrete continuous box girder of uniform section, the construction method is mainly prefabrication, and it basically has no pollution influence on water environment. Since pollutants such as SS will be produced when carrying out construction by crossing the pier substructure wade into the water, certain pollution will be caused to Bolin River water quality if effective measures are not taken. Therefore, cofferdam or open caisson construction technology will be adopted when carrying out construction by crossing the pier substructure wade into the water to effectively prevent water quality pollution caused by construction.

2.10.1.3 Construction safety and traffic organization scheme

Since coverage of the road works is large, there are many environment sensitive points on both sides of the road, and traffic flow on the road at present is great, travel of residents around is bound to be influenced negatively during the road construction period, and safety and traffic organization during the construction period is of great importance. Road construction safety management includes two parts, one of which is to conduct traffic control within the limited scope beyond the operation area, aiming at avoid hidden danger to operating personnel, equipment and travelling vehicle and guarantee a clear road; the other is to conduct necessary safety management for operating personnel within the operation area to ensure construction safety. According to characteristics of construction layout of the project, the project shall adopt the combined way of stage and section construction, and semi-range road construction (one lane closed for construction, and the other lane remaining opened to traffic), with details as follows:

(1) Since many roads are involved in the works, basically covering the whole Anlu, different construction sites will be set in the project for stage and section construction to try to reduce construction transportation distance, better carry out construction and traffic organization, guarantee a clear road, and ensure construction safety.

(2) Traffic maintenance shall adopt the method of semi-range road construction (one lane closed for construction, and the other lane remaining opened to traffic), with each construction team in middle position section of respective construction area, length of each section being 2,000-3,000m, and parallel line operation adopted.

(3) In addition, the project is located on a heavy traffic flow pavement, with centralized people, material and machine, there are many threat factors, and the construction environment is bad. Control over unsafe behavior of people and unsafe condition of object is the key to construction site safety and healthy and civilized construction management, and the fundamental link to prevent and avoid injury accident and guarantee optimum of construction to ensure safety and health of people.

①The Developer shall conduct safety education, safety disclosure and technical training for personnel on site before commencement.

②Construction mobilization must be directed by the site principal, and operating personnel shall be highly alert during road closing and removal process, especially strengthening self-protection awareness.

③The Project Department shall allocate full-time traffic coordinators responsible for daily safety facility maintenance and traffic guidance during construction, as well as supervision and guarantee with technical personnel of activity of construction personnel and construction vehicle within the construction only in construction activities.

④The operating personnel may enter the construction area for operation only after the road is closed, and road closing facilities may be removed only after the construction is completed and the operating personnel leave.

⑤The operating personnel shall not change and expand the control area, leave the safety protection zone, or put any construction tool and material outside the safety protection zone arbitrarily during construction.

⑥Construction personnel on site must wear working suits with reflective sign function, wear safety helmet, and replace working suits with old color and reflective sign promptly.

⑦Handheld power tool must be used through leakage protection device, space between oxygen bottle and acetylene cylinder shall be more than 5m, and distance with open fire shall be more than 10m. For site clearing after daily completion, special personnel shall be responsible for power cut, air valve shutdown, and other inspections.

⑧Personnel of special type of work must take appointment with certificate.

⑨Stop routine work in case of special climate such as fog or rainstorm, and complete protection of people, material, machine and safety facilities.

⑩Carry out according to special requirements of the traffic management department if any.

2.10.2 Construction scheme for public transportation system supporting facility works

Public transportation system supporting facility works include construction of six public transport hub and passenger transportation centers, including both reconstruction based on original site and new construction of new site, with concrete works basically classified into site formation, foundation works, main structure works, outer wall and interior decoration and acceptance of works, covering earthwork, pile foundation work, reinforced concrete structure work, masonry work, water proofing work, and decoration work, etc.

1) Earthwork

Earthwork includes earth (or stone) excavation, filling and transportation, etc, as well as preparation and ancillary works such as drainage, rainfall and soil wall support. The present earthwork includes site formation, foundation pit excavation, grade level filling, subgrade filling and foundation pit backfilling, etc.

Foundation pit excavation is typical earthwork, with specific procedure as follows:

Surveying and setting out→earth excavation→slope support→pit test→cushion pouring→platform bearing rebar, base plate and foundation beam rebar, embedded column, concrete wall rebar binding→underground base plate side form installation→underground base plate concrete pouring→concrete wall, column rebar binding→concrete wall waterstop embedding→concrete wall, column formwork installation→concrete wall, column concrete pouring→underground roof formwork installation→underground roof rebar binding→underground roof concrete pouring→formwork removal for curing→underground acceptance→main body construction.

Common equipment for foundation pit excavation includes earthmover, excavator, scraper and transport vehicle, etc.

2) Pile foundation work

Pile foundation is a deep foundation comprising several single piles in soil. There are precast pile and bored pile based on pile construction method. Bored pile construction method will be adopted in the project according to the project site condition analysis to reduce disturbance on surrounding soil layer.

Bored pile is made by opening pore in the designed pile position, putting reinforcement cage into the pore, and then concreting. Bored pile construction method adopted in the project may solve the problem of cleaning up sediment (soft soil) at the bottom of pile, and guarantee the bearing capacity and project quality stability. The specific process is: determine pile foundation axis based on the pile foundation plane on design drawing→set piling benchmark→skid, pile cap and pile delivery preparation→set piling rod→fold valve pile shoe (or install precast reinforced concrete pile shoe in pile position)→put steel pipe pile in place (or install on precast pile shoe) and correct the perpendicularity→start the vibratory hammer to make the pile pipe sink to reach the required penetration or elevation→measure hole depth and check to see whether the pile pipe is blocked by pile shoe→put in the reinforcement cage→concreting→vibrate and pull out the pile pipe.

Main construction equipment: bored pile equipment (including pile hammer, concrete funnel, pile frame, sleeper, etc.).

3) Reinforced concrete structure work

Reinforced concrete structure work includes formwork, steel work and concrete work. The three are closely linked in construction, and flow repetitive construction operations are carried out.

4) Structure installation work

Structure installation work is construction process of installing the precast structural member in the designed position with various hoisting machineries. Hoisting machinery is generally used for assembly in site construction.

Equipment for structure installation work generally includes:

①Rigging: steel wire rope, pulley block, winch, sling, etc;

②Hoisting equipment: tower crane and auto crane

5) Masonry work

Masonry work mainly focuses on manual operation, with construction process includes mortar preparation, material transportation, scaffold erection and masonry, etc.

6) Water proofing work

Water proofing work parts mainly include roof waterproof, underground waterproof, outer wall, waterproof box, toilet and flooring waterproof, etc. Commonly used waterproof materials include waterproof roll, waterproof paint, building sealing material and waterproof agent, etc.

7) Decoration work

It includes utility pipeline laying, wall decoration, floor laying, door & window installation, etc. Decoration work includes plastering, finish installation and construction, and painting.

Plastering includes decorative plastering, general plastering, etc. Way of decorative plastering includes spraying, roller painting, brush coating, etc.

Finish installation and construction includes natural stone veneer panel, metal veneer, wooden veneer and glass veneer, etc.

Painting includes foundation preparation, sketching, puttying and brushing, etc.

2.10.3 Scheduling

The project will be carried out from 2015 and completed in 5 years according to the preliminary plan, but actual arrangement, implementation and plan will be based on respective order of priority. Specific project construction plan is shown in the table below.

Table 2-10-1 Construction Plan for Main Item Projects

Category	Content	Construction period	Construction time	Completion time
Integrated traffic corridor and road network improvement works	Taibai Road	12 months	2015	2016
	Jinqiu Avenue	12 months	2015	2016
	Fucheng Avenue	12 months	2016	2017
	Jiefang Avenue	12 months	2017	2018
	Biyun Road	12 months	2017	2018
	Yinxing Avenue	12 months	2018	2019
	Zhanqian Road	12 months	2019	2020
Public transportation system supporting facility works	Public transportation transfer hub of passenger transportation center station	12 months	2018	2019
	Small arrival and departure public transport hub of railway station	12 months	2016	2017
	Public transportation transfer hub of short distance station	12 months	2016	2017
	Public transportation transfer hub of long distance station	12 months	2017	2018
	Qiliqiao highway passenger transportation center + Public transportation transfer hub	12 months	2015	2016
	Highway passenger transportation center of high speed rail station + Public transportation transfer hub	12 months	2019	2020
Road safety works	Command center equipment and system construction	12 months	2015	2016
	Traffic signal control system, traffic video monitoring system, electronic police system leading end	48 months	2016	2020
	Public publicity and education	36 months	2016	2019
Slow traffic system	Slow road reconstruction of old town	12 months	2016	2017
	Slow traffic sign and marking	12 months	2016	2017
	Non-motor vehicle parking facility	12 months	2016	2017

2.11 Road material source and transportation condition

Materials necessary for the project mainly include asphalt, cement, sand, stone, steels, etc. Most of them are supplied locally, and all are purchased from the market instead of self-mining. Water and power necessary for the project construction may from the line, and material transportation is convenient.

(1) Subgrade backfill

The new project site includes many excavation areas, and the excavation medium is mainly silty clay and argillaceous siltstone of residual product cause. The excavated rock mixture has good physical and mechanical properties, and rock and earth mass in excavation areas may be used as subgrade backfill of filling areas if the grain composition meets requirements. Since most excavated rocks are massive, the excavated rock must be subject to breaking treatment before backfilling, and filling construction may be conducted after determining the fill grading and optimum water content as well as maximum dry density through test. Outward transport of fill is unnecessary if amount of excavation and amount of fill can reach balance in the line, and subgrade fill shall be taken from other places if the amount of fill of subgrade exceeds the amount of excavation.

(2) Road metal and stone

According to geological survey along the line, the exposed bed rocks within the line area are argillaceous siltstone or siltstone with relatively low strength, belonging to soft-relatively soft rock. Such rock may weather or disintegrate when exposed on the ground or contacting with water, so it is not suitable to be used as masonry stone, and stone required shall be transported from outside. There is no large river within the line area, so there is no cobble and road metal resource, and road metal required shall also be transported from outside.

(3) Sand

Sand necessary for construction shall be transported from outside. Sand required may be purchase nearby since there are many sand yards around Anlu.

2.12 Project investment and fund raising

The total project investment is about RMB 1,101,365.5 thousand, including total static investment of RMB 1,012,023 thousand. The fund source composition is: USD 70 million of World Bank loan applied (about RMB 428,400 thousand as per exchange rate of 1:6.12), and internally allocated fund RMB 583,623 thousand, which includes project capital fund of RMB 253,005.7

thousand, where the capital fund is from Anlu urban fund raising, and domestic bank loan of RMB 330,617.2 thousand, where the loan repayment is from land transfer income.

3. Project analysis

3.1 Scheme comparison

Taibai Road, Biyun Road, Jiefang Avenue, Jinqiu Avenue and Ginkgo Avenue of the Project are reconstructions and expansions of existing roads and the project scope is within the red line of road, not involving red line widening of road; bus transfer hub of passenger transport center station, small public transport hub of railway station, short-distance bus transfer hub and long-distance bus transfer hub of the Project are reconstructions and expansions of existing station yards and the project scope is within the red line of station yard, not involving red line widening of road; according to urban comprehensive traffic planning contents of Anlu Urban Master Planning (2013-2030), Fuhe Avenue and Zhanqian Road are planned roads and Qili Bridge highway passenger transportation center+bus transfer hub are planned to mainly undertake provincial medium and long-distance road transportation and short-distance road transportation of partial villages as important road transportation nodes in Anlu. Highway passenger transportation center of high-speed rail+bus transfer hub are planned as supporting public transport hub of high-speed rail. Hence, all roads and site selection of station yards constructed in the Project have been confirmed, without dispute or other site selection schemes for comparison.

3.1.1 Construction scheme comparison based on economic analysis

The construction contents of the subproject in Anlu include the improvement project of 7 integrated traffic corridor and road network, 3 public transport hubs, 1 small public transport hub, 2 public transport hubs+ highway passenger terminals, e-card system for public transport, intelligent public transport system, purchase of a batch of buses, a batch of road safety projects, slow traffic system in old town, a batch of institution building and technical assistance projects.

Two new roads are taken as comparative projects and other projects are deemed as required to form three schemes for evaluation according to characteristics.

The three schemes are as follows:

Scheme 1: improvement project of 5 integrated traffic corridor and road network (Taibai Road, Jiefang Avenue, Biyun Road, Yinxing Avenue and Jinqiu Avenue) + new Fucheng Avenue, 3 public transport hubs, 1 small public transport hub, 2 public transport hubs+ highway passenger terminals, e-card system for public transport, intelligent public transport system, purchase of a batch of buses, a batch of road safety projects, slow traffic system in old town, a batch of institution building and technical assistance projects

Scheme 2: improvement project of 5 integrated traffic corridor and road network (Taibai Road, Jiefang Avenue, Biyun Road, Yinxing Avenue and Jinqiu Avenue) + new Zhanqian Road, 3 public transport hubs, 1 small public transport hub, 2 public transport hubs+ highway passenger terminals, e-card system for public transport, intelligent public transport system, purchase of a batch of buses, a batch of road safety projects, slow traffic system in old town, a batch of institution building and technical assistance projects

Scheme 3: improvement project of 5 integrated traffic corridor and road network (Taibai Road, Jiefang Avenue, Biyun Road, Yinxing Avenue and Jinqiu Avenue) + new Zhanqian Road and Fucheng Avenue, 3 public transport hubs, 1 small public transport hub, 2 public transport hubs+ highway passenger terminals, e-card system for public transport, intelligent public transport system, purchase of a batch of buses, a batch of road safety projects, slow traffic system in old town, a batch of institution building and technical assistance projects

According to analysis of net present value (NPV), internal rate of return (IRR), benefit-cost ratio, investment recovery period and social distribution of benefits, the travel benefit of vehicle and people in Scheme 1 is remarkable, economic indicators are excellent, the risk resistance capacity is strong, and there will be certain investment returns; the economic indicators in Scheme 2 are also ideal and cost can be recovered during recovery period; Scheme 3 is the combination of Scheme 1 and Scheme 2, the economic indicators are obviously better than those in Scheme 1 and Scheme 2 and balanced distribution of traffic benefits is well manifested; although the risk resistance capacity is relatively weak, cost can be recovered during recovery period, so Scheme 3 is ideal.

3.1.2 Construction scheme comparison

Traffic facilities include external highway, railway, wharf, fairway, urban road, medium-volume passenger transport system and bus lane. A strategic alternative scheme is prepared based on existing facilities and the facilities under construction as well as construction strength of facilities planned in following several years. The roads are certain to be constructed in downtown, so no site selection scheme has been put forward based on the basic planning scheme and only the cross-sectional construction schemes for Zhanqian Road has been compared and analyzed.

a) Scheme 1

The distance between boundary lines of road is 40m wide and the form of “four-plate” section is adopted: 5m sidewalk+ 4.5m non-motor vehicle lane+ 1.5m green belt+ 7.5m motorway+ 3m inter space+ 7.5m motorway+ 1.5m green belt+ 4.5m non-motor vehicle lane+ 5m sidewalk

Merit: separation based on direction and speed, improvement of safety; setting of 3m inter space in favor of twice crossing of pedestrian

Demerit: Setting of harbor station requires occupation of non-motor vehicle lane or sidewalk or partially widening road.

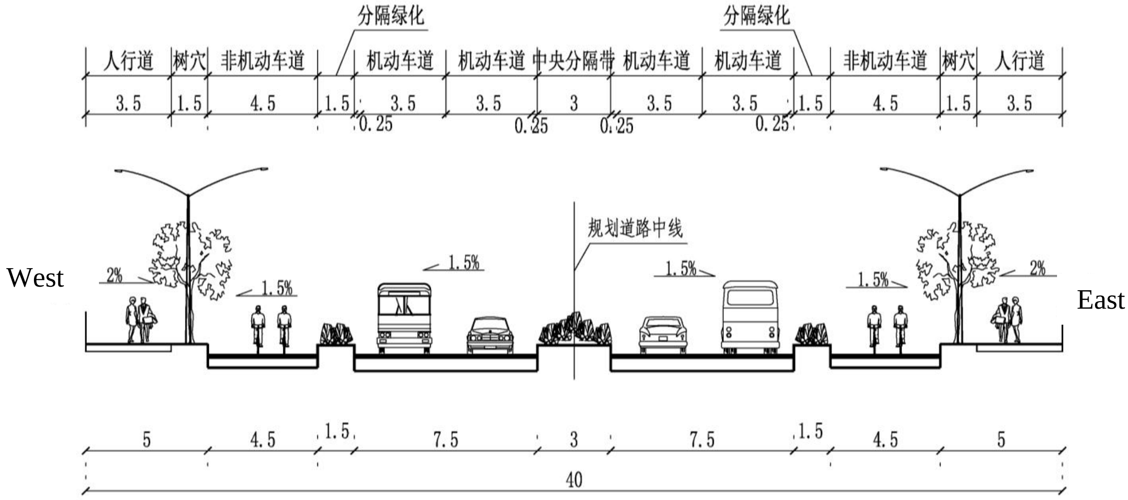


Fig. 3-1-1 Standard Cross-section Scheme 1 for Zhanqian Road (Connecting Line of the Third Bridge to Anlu-Beijing Line)

b) Scheme 2

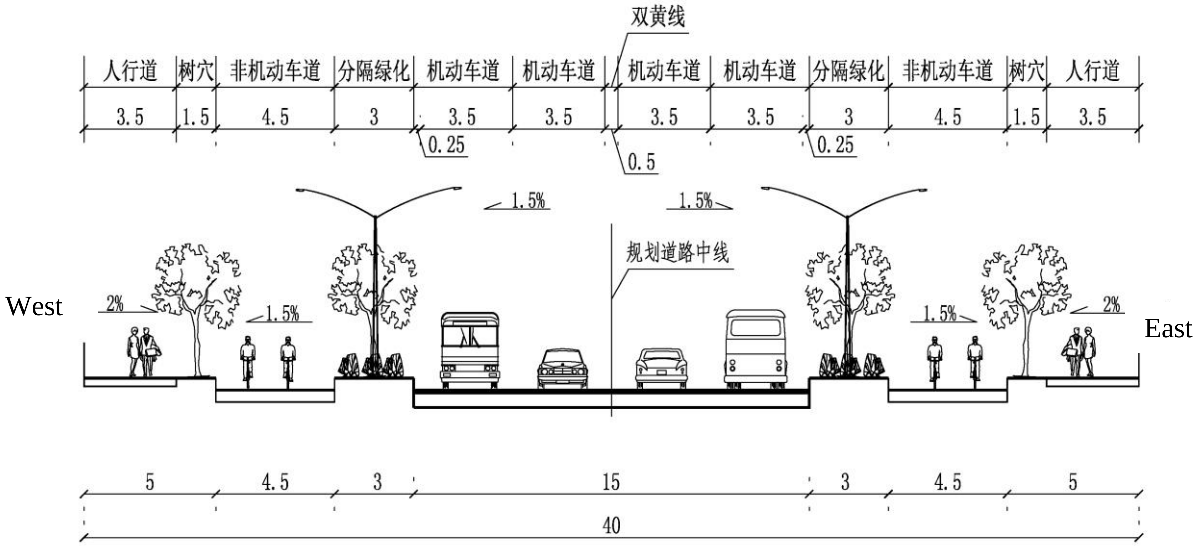


Fig. 3-1-2 Standard Cross-section Scheme 2 for Zhanqian Road (Connecting Line of the Third Bridge to Anlu-Beijing Line)

The distance between boundary lines of road is 40m wide and the form of “three-plate” section is adopted (one plate is shared by pedestrians and non-motor vehicles): 5m sidewalk+ 4.5m non-motor vehicle lane+ 3m green belt+ 15m motorway+ 3m green belt+ 4.5m non-motor vehicle lane+ 5m sidewalk

Merit: separation based on speed, improvement of safety; in favor of setting up bus station at harbor

Demerit: no separation based on direction, no anti-dazzle facility for night driving, low safety; island for twice crossing shall be separately set up, occupying lane.

c) Scheme 3

The distance between boundary lines of road is 40m wide and the form of “two-plate” section is adopted (one plate is shared by pedestrians and non-motor vehicles): 3.5m sidewalk+ 3.5m non-motor vehicle lane+ 4m green belt+ 7.5m motorway+ 3m inter space+ 7.5m motorway+ 4m green belt+ 3.5m non-motor vehicle lane+ 3.5m sidewalk

Merit: separation based on direction and speed, improvement of safety; setting of 3m inter space in favor of twice crossing of pedestrian; high road greening rate, good landscape effect; roadside green belt can provide space for harbor station and expanded intersection.

Demerit: One lane is shared by no-motor vehicles and pedestrians, but for riders, the identifiability of non-motor vehicle lane and comfort of riding are low.

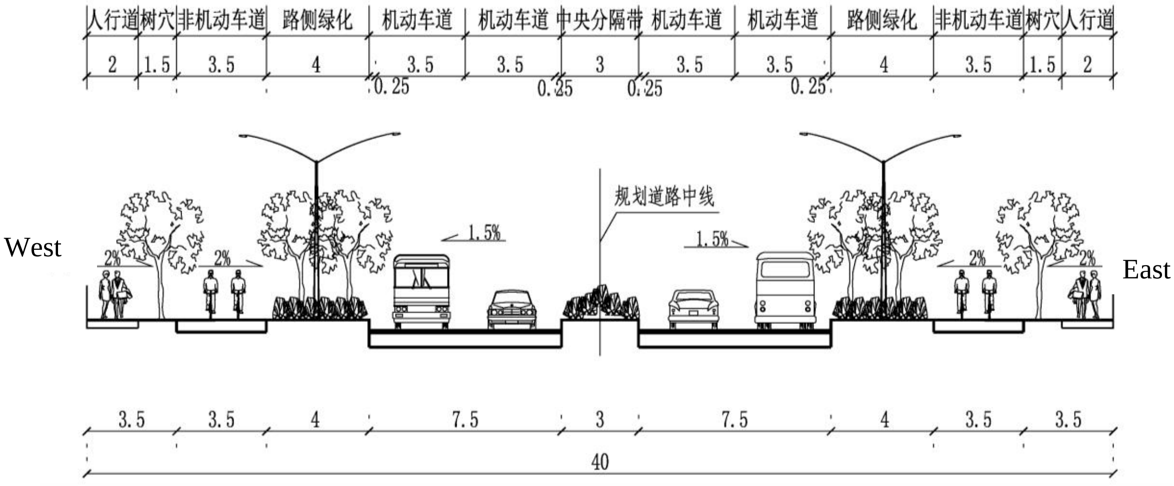


Fig. 3-1-3 Standard Cross-section Scheme 3 for Zhanqian Road (Connecting Line of the Third Bridge to Anlu-Beijing Line)

d) Scheme comparison

Scheme 1 adopts separation by green belt, realize direction-based separation of motor vehicles and separation between motor vehicle and non-motor vehicles and pedestrians and non-motor vehicles. Motor vehicles, non-motor vehicles and pedestrians travel on their respective lanes, the safety of pedestrians and vehicles is guaranteed and the functions are clear, so Scheme 1 is recommended taking environmental impact, traffic impact, social benefit, etc. into full consideration.

3.2 Analysis of compliance with industrial policy and planning

3.2.1 Analysis of compliance with industrial policy

The main construction contents of the Project include improvement project of integrated traffic corridor and road network, supporting facility project of public transport system, road safety project and improvement project of slow traffic system.

According to NDRC Order No. 9 *Directory of Guidance on Industrial Restructuring (2011)* and Order No. 21 *NDRC Decision of Clause Change of Directory of Guidance on Industrial Restructuring (2011)*, the Project belongs to “24 - Highway and road transport (including urban passenger transport)” and “22 - Urban infrastructure” in encouraged category of Class I and complies with industrial policy of China.

3.2.2 Analysis of compliance with planning

3.1.2.1 Compliance with *Overall Planning of Wuhan City Circle*

Wuhan city circle is located in the east of Hubei Province. Its administrative divisions include Wuhan, Huangshi, Ezhou, Xiaogan, Huanggang, Xianning, Xiantao, Qianjiang and Tianmen and the total land area is 57,800km^2. According to *Overall Planning of Wuhan City Circle* (2006-2020), the construction goals of Wuhan city circle are “four city circles”, namely: vigorous city circle – with rapid and good economic growth, industrial structure continuously optimized, industrial agglomeration level continuously improved and aftereffect of industrial development strengthened; convenient city circle – to complete construction of rapid intercity traffic, realize accessible, smooth and rapid intercity transportation and form a one-hour city circle; safe city circle – to construct a perfect disaster monitoring, prevention and control system, including prevention and control of natural disasters and diseases; ecological city circle – to construct a green, livable and harmonious ecological city circle.

To realize the construction goals of Wuhan city circle, five integration processes of the city circle shall be accelerated, namely the integration of infrastructures, industrial development with layout, urban and rural construction, markets and ecological construction with environmental protection.

The key zones for development in overall planning of Wuhan city circle mainly include three clusters of cities and towns, “Xiantao-Qianjiang-Tianmen”, “Xiaogan-Hanchuan-Yingcheng” and Xianning-Chibi-Jiayu”, and the cities and towns along Beijing-Guangzhou to Beijing-Zhuzhou development axis, Yangtze River to Shanghai-Wuhan-Chengdu development axis and Fuzhou-Yinchuan (Wuhan-Shiyan) development axis. They are the main carriers supporting future economic development and population agglomeration of the city circle. The key tasks of these zones in future shall be accelerating the paces of industrialization and urbanization, continuing and undertaking industrial transfer and restricting and prohibiting population transfer. More lands shall be supplied, infrastructure construction shall be accelerated and a good investment environment shall be created. Anlu is located at Wuhan-Shiyan development axis and is a constituent part of key zones of development of Wuhan city circle. Therefore, the project construction complies with the requirements of *Overall Planning of Wuhan City Circle*.

3.1.2.2 Compliance with *Xiaogan Urban Master Planning*

According to urban system planning in *Xiaogan Urban Master Planning* (2013-2030), Anlu is located at the main spatial development axis of Xiaogan – Xiaogan-Wuhan urban development axis which is the main development axis of cities and towns, industry and population. It mainly relies on traffic corridors like Fuzhou-Yinchuan Expressway and G316 and successively connects airport, Xiaogan Airport Economic Zone, Xiaogan downtown, Yunmeng County and Anlu.

Anlu is located at the concentrated development axis of modern manufacturing industry in Xiaogan and is the extension of development axis of manufacturing industries in Xiaogan and Wuhan. The concentrated development axis of modern manufacturing industry spreads along Fuzhou-Yinchuan Expressway and G316, including airport economic zone, Xiaogan downtown, Yunmeng County, Yingcheng and Anlu. High and new technology industry, modern manufacturing industry and modern logistics industry are the key points of development. The area is the main concentrated development zone of modern industries in Xiaogan and is planned to develop into an industrial heartland integrated with logistics, modern manufacturing and high and new technology industries in Wuhan city circle.

As a result, the project construction meets related requirements of *Xiaogan Urban Master Planning*.

3.1.2.3 Compliance with *Anlu Urban Master Planning*

It is mentioned in *Anlu Urban Master Planning* (2013-2030) that:

The overall goals of urban development of Anlu are: to develop the city into a comprehensively competitive and distinct medium-developed city; develop characteristic towns into influential towns in the province; clearly position the functions of general villages and towns to mainly serve modern agriculture; realize urban and rural coexistence and integration as well as cultural fusion and build a new urban-rural relationship; construct beautiful and vigorous villages, combine multiple living styles and keep facilities in good condition.

The city functions of Anlu include: an important industrial base facing the east and carrying on industrial transfer; an innovation-driven characteristic industrial base; an important pole of development of secondary industry in Xiaogan for joining with Wuhan and creation of “Suzhou in Hubei”; a model city of construction of resource-economical and environment-friendly society and integration and production and city; to form the urban culture with core of Li Po culture, Yinxing culture and historical culture and stronger cultural tension and construct a livable homeland; political, cultural and commercial centers of Anlu.

The overall development ideas of Anlu downtown are: “control in the north, progress in the south, expansion in the east and starting in the west”, to moderately develop Hexi New District, mainly develop new town in the south and realize the riverside features of livability and integration of production and city according to the structural layout of “one axis, two banks, three districts and one new area” (one axis refers to Biyun Road development axis, two banks refer to the banks of Fuhe River, three districts refer to comprehensive commercial residential district in old town, Hexi New District and economic and technological development zone and one new area refers to the new town in the south); to divide the downtown into 8 districts based on functions, namely comprehensive district in old town, east comprehensive district, east industrial district, north residential district, south comprehensive industrial district, southeast industrial district, Hexi District, reserved district and south office.

The improvement project of integrated traffic corridor and road network, supporting facility project of public transport system and other contents contained by the Project serve the two banks of river in Anlu, take all districts into consideration, make convenience for communication among surrounding villages and towns and downtown and strengthen the communication of Anlu with Xiaogan and Wuhan and will significantly promote the livability and development of Anlu. Therefore, the project construction meets the requirements of *Anlu Urban Master Planning*.

3.1.2.4 Compliance with *Plan Summary of Anlu Urban Comprehensive Transportation System*

According to *Plan Summary of Anlu Urban Comprehensive Transportation System* (2013-2030), the development vision of Anlu urban comprehensive transportation system is to construct a safe, low-carbon, convenient and intelligent modern urban comprehensive transportation system.

Provide safe traffic services involving production, life, commercial communication and entertainment for all citizens, investors and tourists to enhance life happiness of residents, create a livable city and promote tourism competitiveness.

Guide urban land use and development with public transport through integration of land use and public transport, construct a high-quality public transport system and a pleasant slow traffic system and reduce energy consumption and carbon emission to create a livable, civilized and happy city.

Reduce factor cost and serve industry and tourism of the city through construction of a comprehensive transportation system integrating external traffic with internal traffic and joining multiple modes.

Construct intelligent, public transport, parking, traffic management, highway passenger transport and logistics systems to enhance the service capacity of urban comprehensive transportation system and provide more reliable and intelligent traffic service for all citizens, investors and tourists as well as production and life.

The overall goal of Anlu urban transportation development consists of safety, low carbon, convenience and intelligence. The indicator of safety is the average annual number of people dying from traffic accidents of 10,000 motor vehicles in the city; the indicators of low carbon are proportion of slow traffic volume in total traffic volume, proportion of general bus traffic volume in motor vehicle traffic volume and bus with clean energy; the indicators of convenience are the duration for access to expressways from downtown and major towns, time for trip of 80% residents in downtown, 1h traffic circle of expressway and 30min traffic circle of intercity railway; the indicator of intelligence is the coverage of monitoring of traffic technique, intelligent bus station, highway passenger transport and public parking guidance.

The construction of public transport hub and passenger terminal can make convenience for citizens to transfer bus and save riding time; the construction of improvement project of integrated traffic corridor and road network can further improve the road network of Anlu and enhance happiness index of residents. Overall planning and construction of public transport hubs can effectively integrate system resources to form a public transport infrastructure service network with reasonable layout and perfect functions, realize reasonable resource allocation and reduce occupancy of resources and is of significance for improving urban environment of Anlu, guiding coordinated regional development and realizing sustainable development of transportation.

To sum up, the project construction complies with *Plan Summary of Anlu Urban Comprehensive Transportation System*.

3.3 Analysis of environmental impact factors and source, strength of pollution in construction stage

3.3.1 Characters of impact in construction stage

(1) Works in construction stage such as filling of roads, excavation of foundation shall lead to land vegetation deterioration, land interruption, earth bareness and change of local landform;

(2) Construction of foundation construction and transportation of materials, equipment and earthwork shall occupy and damage municipal roads, increasing traffic burden;

(3) Noises of mechanical equipment such as digger, heavy-duty loader and transport vehicles shall affect sensitive points in surrounding;

(4) Operational waste water in construction and domestic sewage from the residence of builders shall affect the surrounding area;

(5) Impact of construction operation on ambient air mainly represents fugitive dust pollutants which are from earth and stone work, surface excavation and transportation.

3.3.2 Analysis of factors for atmospheric environmental impact

No mixing units for concrete and asphalt shall be set up in the construction site, and concrete and asphalt required in the Project shall be gained through outsourcing. Therefore, major sources of air pollution in construction stage include: fugitive dust from excavation in the construction site, fugitive dust on roads due to load and unload of construction materials or earthwork and the transportation, asphalt fume resulted from pavement of roads as well as waste emissions from construction machines and transportation vehicles powered by fuel oil.

(1) Fugitive dust

Fugitive dust are mainly from demolition of buildings, explosion of road surface, excavation of earthwork within the scope of the Project; transferring of construction materials; cleaning and stacking of construction garbage; incoming and outgoing of transport vehicles and so on. All stages of construction shall to some extent deliver some fugitive dust. The volume of fugitive dust from construction and scope of impact is a complicated problem which cannot be easily quantified. Therefore, the evaluation only provides a brief analysis of the impact of fugitive dust on the surrounding areas.

Dust emission in the Project is mainly from demolition, excavation and refilling of earthwork, explosion of road surface and transport vehicles. Dust emission from a normal 10t truck which passes a certain length of road with various degree of cleanliness in different speeds is given in Table 3-3-1. From the table, conclusions can be made that a faster truck will cause more dust emission under the same degree of cleanliness of the road; more dust on the road will lead to more dust emission when the speed of the truck is the same.

Table 3-3-1 Dust Emission in the Process of Transportation (Unit: kg/km)

Dust capacity on road surface	Speed of vehicle (km/h)				
	15	20	25	30	40
0.02	0.01	0.02	0.02	0.03	0.04
0.05	0.03	0.05	0.06	0.07	0.09
0.10	0.07	0.09	0.12	0.14	0.18
0.15	0.10	0.14	0.17	0.21	0.28
0.25	0.17	0.23	0.29	0.35	0.46

According to dust monitoring for a typical construction site and its surrounding (results of monitoring given in Table 3-3-2), concentration of TSP in the air by the distances away from the construction site is given in Table 3-3-3.

Table 3-3-2 Change of Concentration of TSP in the Air of Construction Site

No.	Distance	Range of concentration	Average concentration
1	Boundary of construction site	1.259-2.308	1.784
2	10m in the downwind of the boundary	0.458-0.592	0.525
3	30m in the downwind of the boundary	0.544-0.670	0.607

Locate the data aforesaid on a rectangular coordinate system to form a curve, and then the excess scope of daily average concentration which is 80-90m away from the boundary of construction site can be gained through extrapolation.

Table 3-3-3 Concentration of TSP in the Air by the Distances from the Construction Site

No.	1	2	3	4	5	6

Distance (m)	10	20	30	40	50	100
Concentration (mg/m^3)	1.75	1.30	0.780	0.365	0.345	0.330

Transport vehicle for dust shall cause re-entrainment of dust pollution. According to monitoring results of dust site caused by transportation on similar concentration site, dust at the distance of 50m in the downwind of transport vehicle is 11.625mg/m^3; dust at the distance of 100m in the downwind is 9.694mg/m^3; dust at the distance of 150m in the downwind is 5.093mg/m^3, which exceeds the Class II standard in *Ambient Air Quality Standards* (GB3095-2012). Fugitive dust pollution caused by transport vehicle is relatively serious.

(2) Asphalt fume

Asphalt concrete pavement structure is applied along the whole lines of the Project, while smoke dust shall be generated in the process of fusion, mixing and pavement of asphalt including THC, TSP and BaP, in which THC and BaP are harmful. According to a research, asphalt heated for above 180℃shall deliver a large amount of asphalt fume of which the grain size is between 0.1 and 1.0μm with the minimum size 0.01μm and the maximum size 10.0μm. Asphalt fume shall do harm to builders' health by attaching to floating dust with size less than 8μm which shall be inhaled by people through respiratory tract.

The Project adopts commercial asphalt, and asphalt fume generated in the construction is from pavement and curing of asphalt. In the process of pavement, asphalt shall be automatically cooled down about 10min after being compacted by road roller, and then the temperature of asphalt mixture shall drop to less than 82℃ when asphalt fume is critically decreased; upon the asphalt is basically dried, the asphalt fume shall therefore disappear.

(3) Exhaust of construction vehicles

Power units and temporary generators which are normally fueled by diesel oil discharge exhaust gas of fuel oil without organization on the site, mainly covering hydrocarbon, NO_x, CO and SO_2. According to *Applied Data Book for Environmental Protection*, the emission concentration of pollutants from diesel exhaust: hydrocarbon＜0.15%, NO_x＜850ppm and CO＜0.05%; the consumption of 1000kg for incoming and outgoing of vehicles on the construction site shall lead to emission of pollutants in the exhaust with 9.1kg hydrocarbon, 40.2kg NO_x, 28.4kgCO and 34kg SO_2.

Relevant administrations have strengthened the management of motor vehicle exhaust in recent years, while the Developer also strengthen maintenance, management of construction machines and equipment; therefore, exhaust gas discharged by construction machine and vehicles leaves a relatively low effect on the surrounding environment which is limited in construction stage.

3.3.3 Analysis of impact factors for acoustic environment

Noises in the construction stage mainly represent the interruption of surrounding sensitive points such as resident and schools from traffic noise and noise of construction machines. Major sources of noise in the construction stage are crusher, transport truck, excavator, air compressor and other large construction machines in the process of construction. In accordance with Specification for Environmental Impact Assessment on Highway Construction Project (JTG B03-2006), noise source and strength for construction machines are given in Table 3-3-4.

Table 3-3-4 Noise Value of Construction Machinery (Unit: dB (A))

No.	Type of machinery	Mode	Distance between measuring point and construction machinery (m)	Maximum sound level Lmax
1	Wheel loader	ZL40	5	90
2	Wheel loader	ZL50	5	90
3	Land leveler	PY16A	5	90
4	Vibrating type road roller	YZJ10B	5	86
5	Dual-wheel double vibrating road roller	CC21	5	81
6	Three-wheel road roller	/	5	81
7	Pneumatic tyred roller	ZL16	5	76
8	Bulldozer	T140	5	86
9	Rubber-tyred hydraulic excavator	W4-60C	5	84
10	Paver (UK)	Fifond311 ABGCO	5	82
11	Paver (German)	VOGELE	5	87
12	Generator set	FKV-75	1	98
13	Impacted well drill	Type 22	1	87
14	Crusher	/	5	100

3.3.4 Analysis of impact factors for surface water environment

Impacts on surrounding water environment in the construction stage mainly represent: construction sewage, domestic sewage, impact of bridge construction on water bodies.

(1) Construction wastewater

Construction wastewater mainly covers wastewater for washing of machines and vehicles, road curing, flushing of construction site, discharge for cooling of equipment, and few alkali wastewater generated from mixing of concrete.

No repair spots shall be established on the construction site, and all maintenance of machines shall be in the charge of professional maintenance points. Construction wastewater in the Project mainly includes cleaning water of machines and vehicles. Machinery and vehicles to be cleaned for each road per day is assumed to be 50 and cleaning water used each time is assumed to be 150L/time. With discharge volume accounting for 80% of cleaning water, discharge of wastewater from cleaning of machinery and vehicles for each day is about 6t, in which typical concentration of pollutants in the wastewater: SS:300mg/L, petroleum: 25mg/L; after oil removal and sedimentation treatment, pollutants in the water: SS:60mg/L; petroleum: 4mg/L, recycled; main pollution factors for few wastewater generated from mixing of concrete are SS and alkalinity, and the water can be recycled after sedimentation and filtration of grilling.

(2) Domestic sewage

No construction camps shall be established for neighboring private houses shall be rented or private houses not removed shall be applied by builders of the Project, therefore, domestic sewage generated shall be solved by the existing septic tanks. According to similar project materials, the number of builders in rush hours of construction shall be around 400 and each person shall consume 120L water for each day with drainage coefficient 85%, thus generating 41t/d of domestic sewage in construction stage at maximum, in which concentration of major pollutants are: COD 350mg/L, ammonia nitrogen 50mg/L. Considering the number of builders is not large, domestic sewage generated shall not be much which shall be discharged to municipal pipe network after treatment of septic tank, thus no obvious impact shall be caused to the surroundings.

(3) Impact of bridge construction on water body

The Project covers three bridges (Maohe Bridge over the Maohe River in Taibai Avenue, Bridge of Chashan River in Jiefang Road and the improvement project of roads cross the Maohe River in Jinqiu Road) involved in water. Pile foundation construction shall be carried out in dry seasons by means of circular cast-in-situ pile construction process which shall decrease the emission of mud through recycling combined with cofferdam construction process which further decrease the quantity of mud discharged in water for the purpose of decreasing the impact of bridge construction (in which the improvement of road over the Maohe River in Jinqiu Road leaves no direct effect on Maohe River) on Maohe River and Chashan River. According to analysis of comparable materials, with cofferdam construction process, increment of SS in areas beyond 50m in the downstream of construction site shall not exceed 50mg/L, leaving no pollution on water areas and bodies beyond 100m in the downstream. Sediment from pile foundation excavation shall be promptly delivered to neighboring spoil ground for concentrated stacking to avoid secondary pollution on water environment due to pouring at will.

Another major pollution source of water is machine since operation of machine as well as oil spill and leak will increase the oil content of water body. As a result, equipment and machines should be regularly and appropriately maintained to avoid oil pollution.

Pollution to water caused by bridge construction is temporary. Water resources will undergo temporary adverse effects in a way where the suspended matters in water body are lifted. As completion of the Project, such effects will vanish.

3.3.5 Analysis on influential factors of solid wastes

The Project will, during construction period, produce such solid wastes as construction wastes like rock ballast from remove, demolition and excavation, waste soils from construction and household refuse from construction personnel.

(1) Construction wastes

According to statistical information, 100m^2 of demolition will produce 45m^3 construction wastes. House demolition of the Project is within the land area of the Project. It is decided that an area of 18,214.33m^2 of buildings will be removed or demolished and therefore, there will be 820,000m^3 of construction wastes.

(2) Discarded soils and stones

Report on Conservation of Water and Soil shows that in order to maintain balanced earthwork and stonework, total excavated volume is 933,800m^3, the volume of backfilling is 684,200m^3, volume of borrowed earth and stones is 186,400 m^3 and discarded amount is 436,100m^3, among which the volume of permanently discarded materials is 249,600m^3. The permanently discarded materials mainly consist of excess soils from discarded materials as well as debris from drilling bridge pier foundation. Such materials can be transported to temporary soil storage yard and be reused in neighboring projects that need soils. The volume of temporarily discarded materials is 18.65m^3. The temporarily discarded materials are mainly from topsoil stripping and they can be used for backfilling of green belt in latter period.

(3) Household refuses from construction personnel

Number of construction personnel is deemed to be 400 at most. It is estimated that one person per day will produce 1.0kg household refuge. Therefore, it is estimated that there will be about at most 400kg household refuge per day produced during construction period.

(4) Disposal of temporary construction

During construction period, remaining buildings near construction site of the Project will be used as temporary houses. In consideration of later development, such buildings can be remained as temporary houses for other projects. Such buildings will be dismantled by constructors in a unified manner.

In terms of the construction wastes produced from remove and demolition, application should be made to City Management Administrative in accordance with laws. City Management Administrative will, according to the time, place and amount of construction wastes, take into account the general conditions in the region to reuse and dispose the construction wastes within the region. As for the construction wastes which cannot be reused, City Management Administrative will, according to the time of disposal, take into account the general conditions in the region so as to direct the construction organization in transporting the construction wastes to waste treatment plant specified by the City Management Administrative.

The Project involves demolition of two enterprises, respectively Anlu Chujin Iron Tower Co., Ltd in Zhanqian Road and Anlu Hexie Logistics Company in the place where Qili Bridge public transport hub is located.

Anlu Chujin Iron Tower Co., Ltd has been closed down for many years owing to poor management and is idle at present. The business scope of the Company at the time of operation is angle iron assembled tower and main production technology is cutting and welding, not generating hazardous chemicals.

Fig. 3-3-5-1 Chujin Iron Tower Company in Bankrupt Idle Status

Business of Anlu Hexie Logistics Company includes automobile sales, automobile maintenance and logistics. The company is in normal operation at present and planned to be demolished. According to survey, the company does not invole transportation of hazardous chemicals, not generating hazardous wastes.

Fig. 3-3-5-2 Logistics Warehouse of Hexie Company

Fig. 3-3-5-3 Automobile Sales Place of Hexie Company

3.3.6 Water and soil loss

Water and soil loss will emerge during construction period. Earth and rock excavation will cause damages to original soil structure and vegetation. In addition, surface soils will become loose after excavation. Therefore, the soils can be easily eroded during rainy and windy weather. In particular, pilings of soils during rainy season will be exposed to surface runoff which will lead to water and soil loss to some extent. In case of insufficient protection measures, muddy water produced from rainwash will be released to surface water body such as ditch and ponds. In this case, drainage systems of regional ditches and ponds will be deposited with mud and thus prevent the storm flood from discharge.

3.3.7 Analysis of influential factors on ecology

The Project includes construction of 7 roads and 6 stations from 2015, lasting for 6 years. Influences caused by project construction on ecological environment mainly include: damage to green belt and vegetation due to road widening, disturbance to earth surface by temporary occupation of land as well as excavation. Major influences are reflected in following matters:

① Permanent occupation of land and temporary land use will change land use structure, which may give rise to ecological damages such as water and soil loss, vegetation deterioration.

② During construction, excavation will have a directly adverse effect on surrounding habitats of batrachians, reptiles and birds. Besides, noises from construction machinery and transportation of waste slag will affect the habitat, feeding, activities, reproduction and migration of terrestrial animals nearby.

③ Such construction activities as construction of subgrade, borrow area, spoil ground, and temporary soil storage yard will damage topographic structure, soil structure at surface and ground vegetation. In such cases, original functions of conserving water and soil will degrade and soil erosion intensity will be enhanced so that during rainy weather, the rainwash can easily cause water and soil loss in certain regions.

3.3.8 Analysis of influential factors on social environment

(1) Effects of remove, demolition and land acquisition

Remove and demolition as well as land acquisition for the purpose of the project can change the use functions of lands, which will, to some extent, have effects on people's living, transportation, social economy and infrastructure.

According to our survey, buildings of 20 households need to be dismantled, among which 15 households are located in Zhanqian Road, including the 14 households in Lilong Village and 1 household in Jinquan Village. Another 5 households include 3 households in Fucheng Avenue and 2 households in Yinxing Avenue. The buildings of the 1 household in Jinquan Village and the 2 households in Yinxing Avenue are non-resident houses which are under effects and therefore only 17 households need to be relocated.

Locations of the 17 households are within urban planning area. In accordance with regulations issued by Ministry of Land and Resources as well as local rules, no homestead will be assigned to them for building houses by themselves. After repeated negotiation, Project Management Office will provide either money as compensation or transfer property right and the families whose houses have been occupied can make their own choices.

Execution policies of World Bank on non-voluntary resettlement and relevant national laws and regulations will be observed for the relocation households. Resettlement measures for Anlu traffic infrastructure project supported by World Bank loan should be designed to make the affected people recover their living standard and production as soon as possible or even enhance their living standard and production capacity.

Resettlement and recovery of affected people will be completed from the aspects of resettlement and recovery of living and production.

Resettlement and recovery of living mainly refers to recovery of houses and living facilities, mainly including:

- providing money as compensation or house for living to the relocation households so as to ensure that their housing quality and environment are equal to or better than previous housing quality and environment.
- providing all necessary living facilities to the affected people in new living environment so that they can have easy access to such facilities.

Resettlement and recovery of production mainly include employment as well as reconstruction of production facilities, such as:

- making reasonable compensation for the occupied land so as to make sure that the affected people will still have source of income after land occupation.
- providing assistance in recovering production and employment to affected people so that the affected people's long-term livelihood can be free from the effects of land occupation.
- making the affected enterprises resume production and operation at original site or new places and providing reasonable compensation for loss from suspension caused by relocation.

(2) Effects of construction on life quality of nearby residents

Since the Project is themed on road engineering, movement of construction vehicles and occupation of existing roads during construction period will have a short-term adverse effect on travel and normal life of surrounding residents. Meanwhile, a number of transport vehicles for materials may lead to traffic jam in certain road sections. Construction vehicles will raise dusts which will degrade life quality of neighboring residents and construction noises will also play a negative role in rest and relaxation of residents. Sewage, household refuse and production rubbish from construction camps and site will also affect the water quality of rivers. Level of civilization of construction personnel may have impact on normal life of local residents. Residents who live nearby the construction site will be firstly exposed to those effects.

The placing of materials at construction site as well as excavation at construction site will leave a mess to the city, having adverse effects on city appearance. In addition, excavation during construction may cause inconvenience to surrounding residents.

(3) Effects of construction on shops along the line

Road sections to be constructed are mainly in Anlu downtown. There are many shops along the line. Since closed-off management will be applied during construction period, operation of shops along the line might be affected.

Subprojects will be constructed by separated periods of time according to construction plan. Construction period of each section is relatively short and separating boards will be removed after road construction. Therefore, effects on the shops are limited.

Project developer and constructor should conduct active coordination with the shop owners to acquire the owners' permission so as to avoid disputes and minimize adverse effects.

3.4 Analysis of environmental impact factors during operational period

The assessment analyzes environmental impact factors from roads and station yards (passenger center and public transit hub) during operational period respectively, of which impact factors for roads during operational period are mainly from impacts of motor vehicles noises and tail gases on surrounding environment and landscapes surrounded roads. Impact factors for station yards (passenger center and public transit hub) during operational period are mainly form impacts of motor vehicles noises and tail gases on surrounding environment and impacts on domestic pollution sources (domestic sewage, cooking oil fume and household refuses) of passengers and staffs at station yards.

3.4.1 Analysis of sound environmental impact factors

3.4.1.1 Analysis of road sound environmental impact factors

Noises of road works of the project during the operational period mainly are noises generated by motor vehicles passing on roads, such noises mainly include engine noises, exhaust noises, vehicle vibration noises, machine motion noises, brake noises and frictional noises generated by vehicle wheels and roads, of which engine noises are the main noises sources. The average radiation sound levels for all kinds of vehicles shall be calculated by the following formula in accordance with JTGB03-2006 *Specifications for Environmental Impact Assessment of Highways Construction*.

(1) Vehicle classification

Vehicles comprise small vehicles, middle-size vehicles and large vehicles.

(2) Radiation noise level for each driving vehicle

Small vehicle: $L_{oS}=12.6+34.73LgVs+\Delta L_{pavement}$ (formula 3-2-2)

Middle-size vehicle: $L_{oM}=8.8+40.48lgV_M+\Delta L_{longitudianl\ gradient}$ (formula 3-2-3)

Large vehicle: $L_{oL}=22.0+36.32lgV_L+\Delta L_{longitudianl\ gradient}$ (formula 3-2-4)

Whereas: S, M, L represent small vehicle, middle-size vehicle and large vehicle respectively;

V_i—the average running speed for this kind of vehicle, km/h.

3.3.1.2 Analysis of station yard sound environmental impacts

Noises of station yards of the project during the operational period mainly are traffic noises generated by passenger cars at station yards or in-out busses and noises of social activities (for example catering equipment, station broadcast etc.), source intensity of main noises in station yards during operational period is between 70~80 dB(A).

3.4.2 Analysis of air environmental impact factors

3.4.2.1 Analysis of road air environmental impact factors

Exhaust gases during roads operational period are mainly from the tail gases discharged by vehicles driving on roads, including NO_2, CO, THC and other pollutants, the intensity of emission source is calculated by the following formula:

$$Q_j = \sum_{i=1}^{3} 3600^{-1} A_i E_{ij}$$ (Formula 3-2-5)

Whereas: Q_j—intensity of emission source of j kind of gaseous pollutant, mg/(s• m);

A_i—traffic flow per hour for i kind of vehicle in forecast year, No./h;

E_{ij}—under this circumstance of operating car accommodation roads, emission factor of single car of i kind of vehicle for j kind of pollutants in forecast year (mg/No. •m)

The former SEPA and the present Ministry of Environmental Protection issued three standards about limits of motor vehicles exhaust pollutants successively to carry out *Environmental Protection Law of the People's Republic of China* and *Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution* and to improve air quality in environment.

①*Limits and Measurement Methods for Emissions form Light-Duty Vehicles (III, IV)*, which was approved by SEPA on Aril 5, 2005 and it came into effect since July 1st, 2007.

②*Limits and Measurement Methods for Exhaust Pollutants from Compression Ignition and Gas Fuelled Positive Ignition Engines of Vehicles (III, IV, V)* (GB17691-2005), which was approved by SEPA on May 30, 2005 and it came into effect since January 1st, 2007.

③*Limits and Measurement Methods for Exhaust Pollutants from Gasoline Engines of Heavy-Duty Vehicles (III, IV)*, (GB14762-2008), which was approved by SEPA on March 17, 2008, and it came into effect since July 1st, 2009.

Refer to the IV standards in above three limits of motor vehicles exhaust pollutants for emission factors of each kind of vehicle, see Table 3-4-1 for emission factors of each kind of vehicle.

Table 3-4-1 List of Suggestions on Emission Factors of Tail Gas Pollutants of Each Kind of Vehicle

Pollutants / Vehicle	Pollutants		
Vehicle	CO	NOx	THC
Small vehicle	0.75	0.16	0.1
Middle-size vehicle	1.22	0.22	0.13
Large vehicle	1.51	0.25	0.16

Note: numerical values in table are the average values of gasoline vehicles and diesel vehicles.

Substitute traffic flow, design speed and other parameters into the calculation model to forecast the intensity of emission source of vehicle tail gas pollutants, see Table 3-2-5.

Table 3-4-2 Intensity of Emission Source of Vehicle Tail Gas Pollutants in Peak Hours, Unit: mg/(s·m)

Road	Vehicle flow in peak hours	Pollutants	
		CO	NO_2
Taibai Avenue	3150	0.71	0.13
Biyun Road	1903	0.43	0.08
Jiefang Avenue	1885	0.43	0.08
Jinqiu Avenue	1611	0.36	0.07
Yinxing Avenue	1690	0.38	0.07
Fucheng Avenue	1604	0.36	0.07
Zhanqian Road	1427	0.32	0.06

Note: * Emission of NO_2 is calculated as per NO_x percentage, Q（NO_2）/Q（NO_x）=0.9

3.4.2.2 Analysis of ambient air impact factors at station yards

Ambient air impact factors at station yards mainly are catering lampblack exhaust gases and vehicle exhausts discharged by in-out vehicles.

There are 6 station yards designed in the project, of which the long distance passenger station may set a catering, but the concrete setting scheme and scale have not been determined now. The catering project generally adopt outsourcing or introducing by attracting investment according to investigating similar passenger station yards, therefore the evaluation hereof shall not analyze it in details, only raise principle requirements, i.e. the catering project setting shall meet relevant requirements in HJ554-2010 *Specification for Environmental Protection of Catering Trade*, the fume emission of catering shall meet the standard requirements of GB18483-2001 *Emission Standards for Cooking Fume* (trail implementation) and the catering unit shall handle approval procedures of environmental impact assessment before construction of catering project.

Main ingredients of vehicle exhaust discharged by in-out vehicles are CO, HC, NO_x, SO_2, black smoke and oil fog. Due to small construction scale of each station yard with long distance between them, the exhausts will not cause cumulated influences. In addition, because the construction area of project lies in a plain district, conditions for atmospheric dispersion are good, vehicle exhaust of in-out vehicles will not cause significant influences upon natural dilution diffusion, the assessment hereof does not make the quantitative analysis.

3.4.3 Analysis of water environmental impact factors

3.4.3.1 Analysis of road water environmental impact factors

(1) Road runoff

Main sewage is rainwater during road operation period, and pollution factors for rainwater mainly are SS, COD, petroleum, total phosphorus and total nitrogen.

1 Rainwater on pavement

Calculate road runoff as per the following formula:

$$W=0.9\times S\times H\times 10^{-3} \qquad \text{(formula 3-2-6)}$$

Whereas:

W-road runoff, m^3/a;

S-road area, m

H-average annual rainfall

According to meteorological data statistics in Anlu, the average annual rainfall in Anlu is about 1130mm, and the road area of the project is about 129.4hm^2, road runoff shall adopt the runoff coefficient 0.9 which is adopted for concrete or bituminous pavement in Outdoors Drainage Criterion in China. The average rainwater on pavement of the project is 1462000 m^3/a through calculating.

②Pollutant concentration in pavement rainwater

Foreign and domestic researches show that the pollutant concentration in rainwater on motor vehicle pavement is related to the traffic flow of motor vehicles, types of motor vehicles, precipitation intensity, precipitation period, road nature and nature of motor vehicles' fuels. In accordance with the actual measurement results and documents literatures of road rainwater in Hubei district, see Table 3-4-3 for the concrete values of pollutants concentration in pavement rainwater.

Table 3-4-3 Pollutant concentration in Pavement Rainwater

Pollutants	Time after beginning of runoff (minute)					Average value (mg/L)
	0~15	15~30	30~60	60~120	>120	
COD	170	130	110	97	72	120
BOD_5	28	26	23	20	12	2
Petroleum	3.0	2.5	2.0	1.5	1.0	2.0
SS	390	280	190	200	160	280
Total phosphorus	0.99	0.86	0.92	0.83	0.63	0.81
Total nitrogen	3.6	3.4	3.1	2.7	2.3	3.0

From Table 3-4-3 it is observed that the pollutant concentration in pavement rainwater has a process changing from big to small, and the pollutant concentration reached the maximum between 0～15 minutes, decreased gradually and tended to be smooth and steady an hour after rainfall.

③Discharged capacity of rainwater pollutants on pavement

The result by multiplying the average value of pollutants concentration in pavement rainwater within 2 hours by pavement rainwater may be the discharge of rainwater pollutants on pavement, see Table 3-4-74 for the discharged conditions of main pollutants.

Table 3-4-4 Discharged Conditions of Rainwater Pollutants on Pavement

Generated rainwater (m^3/a)	MAIN POLLUTANTS	Pollutant concentration (mg/L)	Generated pollutants (t/a)
1462000	COD	120	175.44
	BOD_5	20	29.24
	SS	280	409.36
	Total nitrogen	3.0	4.39
	Total phosphorus	0.81	1.18
	Petroleum	2.0	2.92

(2) Accidental pollution

Overturn accidents may occur in vehicles transporting petroleum and other hazardous articles during operation period. In the event of accident, it will pollute local water of nearby earth surface and irrigation water.

3.4.3.2 Analysis of water environmental impact factors at station yards

Waste water generated at station yards mainly includes: office and domestic sewage of staffs, domestic sewage of passengers etc. along with other domestic sewage, catering sewage of the project shall be discharged into septic tanks after processing in separation tanks, then discharged to sewage pipelines, flowing in sewage treatment plants, finally discharged into Fuhe River upon treatment.

The average water consumption is 0.014m^3/per person each day by comparing the consultation results of water consumption of Anlu long distance bus passenger stations. In the 6 station yards of the project (partial yard construction schemes and construction scales have not been determined yet), the visitors flow rate for the largest scale of passenger flow is about 2200/d (from small rail station to public transport hub), the maximum water consumption for single station yard is about 31 m^3/d with 0.85 drainage coefficient and the generated domestic sewage is about 26.4 m^3/d.

3.4.4 Analysis of solid waste impact factors

There are some household refuses generated on roads such as waste papers and waste plastic bags during road operational period. No vehicle maintenance and vehicle cleaning are set at passenger stations for the Project, Solid wastes generated at bus and passenger stations are mainly staffs' and passengers' household refuses. For such household refuses, the sanitation department needs to arrange special sanitation workers to clean roads regularly, gathering and handling these rubbishes on roads.

3.4.5 Analysis of ecological environmental impact factors

Main road construction areas of the Project lie in the central urban area, and all are artificial environment which causes relatively less influences on ecological environment during road operating period. Traffic noise of passing vehicles, exhaust gas, vibration and contaminants on road surface would have different degrees of pollution to the survival environment of animals along the line, reduce the quality of survival environment of animals along the line, therefore such animals will look for a new environment away from roads to be the inhabitance and activity space.

3.4.6 Social environment impact analysis

The Project belongs to a construction project of municipal infrastructure. Implementation of the project will relieve contradictions of urban transport effectively, improve satisfaction degree of municipal infrastructure and provide convenience for surrounding residents going out. After putting into operation, the project will perfect regional road network system, improve the efficiency of road network, improve road service efficiency and vehicle speed, save time for going out of residents, reduce exhaust emission and improve the traffic environment of city. Meanwhile, improving vehicle speed contributes to energy saving and emission reduction, which is an important part of implementing scientific development perspective, transferring economic growth pattern practically, building a resource-saving and environment friendly industry, contributing to the sustainable development of city.

4 Investigation and Evaluation of Current Situation of Environment

4.1 Overview of natural environment

4.1.1 Geographical location

Anlu City is located in the northeast of Hubei Province at middle reaches of Fu River, branch of the Yangtze River. It is located at the junction of Xiaogan, Jingmen and Suizhou in east longitude 113°18´-113°56´ and north latitude 31°03´-31°28´, about 60km long from east to west and about 46km wide from north to south. Anlu adjoins Xiaogan in the east and borders on Yunmeng County and Yingcheng City in the south, links Jingshan County in the west and Suizhou City and Guangshui City in the north, which are managed by Xiaogan. National Highway 316, Fuzhou-Yinchuan (Wuhan-Shiyan) Expressway and Hankou-Danjiangkou Railway pass through from north to south to connect National Highway 107 and Beijing-Guangzhou Line. It is 80km from Wuhan and located at the junction of Wuhan and Xiangyang urban economic circles. It is called the throat in the north of Hubei, gate of Central Plain by ancient people. Controlling three passes in the north, it is a place of military strategic importance in past dynasties.

Project construction contents cover Anlu City center and Geographical Location Map is shown in Fig. 1.

4.1.2 Landform

Anlu City is located at middle reaches of Fu River, branch of the Yangtze River, which is the junction of downland of north Hubei and Jianghan Plain. On the whole, terrain inclines from north to south in the territory and landform type is mainly hill, which approximately accounts for 90% in national territory area in the whole city. Others are plains. Anlu City center is located at northeast edge of subsidence zone of Jianghan Plain of Xinhua system and composition substance of earth surface mainly includes basalt and red sandstone. Stone deformation zone is in the north of the city and sand loam is along the Fu River.

4.1.3 Geology overview

4.1.3.1 Geological structure

The Project is located at northeast edge of subsidence zone of Jianghan Plain of Xinhua system. Owing to covering of debris of the quaternary system, the structural feature is not very clear and formation presents monoclinic dip angle. Fractures in the zone do not develop adequately and most of them are fracture structure with low order. Regional large fracture structural feature with high order does not display. A group of tension and twist fracture with high dip angle mainly develop. F1 has large fracture sale and crush bandwidth is 0.10-0.50m, with fault displacement of 1.5m, about 30m long, presenting funnel shape which is wide above and narrow underneath. Fault breccia develops and there is sandy filling matter. Adhesion bond is in good condition locally; fault is uneven and corrosion is observed. In addition, there is small druse of calcite for filling: obvious striation is observed.

4.1.3.2 Formation lithology

Formation where the Project is located is simple and lithology is single. Debris of the quaternary system is distributed widely and some bed rocks are exposed, mainly including red sandstone, basalt, gabbro, etc. of Gonganzhai Formation of upper cretaceous system.

4.1.4 Earthquake

Seismic fortification intensity in the site is VI and ground motion peak acceleration is less than 0.05g according to trend analysis of seismic activity in Three Gorges area of related geographical data of State Seismology Bureau and Hubei Province in recent years as well as *Seismic Ground Motion Parameters Zonation Map of China* (2001). Apart from bridge along the line provided with aseismic design, general structures only need to fortify simply.

4.1.5 Climate and weather

Anlu is of subtropical monsoon moist climate. Four seasons are distinct all the year round, with abundant heat, sufficient rainfall, long frost-free season, characterized with reflection of “light, heat and water” in the same season. Cold wave moves frequently in spring and temperature rises and falls suddenly. Sun and rain change discontinuously. It is mild at the end of spring and beginning of summer, with abundant rainwater and varied wind direction; there is “plum rain” in summer and plum rain season begins in the midmonth of June and ends in the midmonth of July. Afterwards, high temperature and drought occurs frequently. At the same time, south wind prevails (south ocean wind) and it is easy to cause drought and flood disasters; in autumn, it is often sunny and rarely rainy and autumn coldness begins to attack. In late autumn, there is “warm weather” with dry and crisp air; in winter, north wind prevails and it is cold with less rainfall. Ice and freeze damage often occur. Sunshine duration is 4427.2h throughout the year and it is between 10.1-14.1h every day. Owing to covering of cloud and mist, actual sunshine duration through the year is about 2150h. Percentage of sunshine is the highest in August, reaching 66.7%; the lowest in March, reaching 35.9%. It is 48.5% on the average over the years.

Total solar radiation throughout the year is 111.5kcal/cm^2 and the strength ratio increases progressively in the first half year and decreases progressively in the second half year. The maximum value occurs in July and August all the year round and the minimum value occurs in January and December. Effective radiation throughout the year is 52.5kcal/cm². Overall trend of season distribution is that: summer is more than winter and spring is higher than autumn. Heat is the most abundant in July-August all the year round and the weakest in January and December.

Average annual rainfall in Anlu is about 1130mm. Rainfall distribution varies significantly with seasons. Average annual temperature is 16.1℃ in Anlu and annual change forms a unimodal shape. Namely, it is the coldest in January all the year round, with average monthly temperature of 3.2℃ and extreme minimum temperature of -14.9℃ (December 28, 1991); it is the hottest in July, with average temperature of 28.5℃ and extreme maximum temperature of 38.5℃ (August 9, 1967). Average annual temperature range is 25.3℃ and annual range of extreme temperature is 53.4℃. General feature of daily temperature variation is that maximum temperature occurs about two o'clock in the afternoon and minimum temperature occurs about at sunrise in the early morning. Daily range of temperature generally changes between 7℃-10℃.

Wind direction in Anlu varies with season obviously. North wind prevails in winter, spring and autumn and south wind prevails in summer, with average annual wind speed of 2.6m/s. Wind speed is closely related with season. Wind speed is the largest in spring all the year round, 2.7m/s; wind speed is the least in autumn all the year round, 2.3m/s. Average monthly wind speed is the largest in April and July, 2.9m/s; the least in October, 2.3m/s. It is mostly northeast wind in the morning and south wind in the afternoon in a day. Such phenomenon is extremely obvious at the end of spring and in summer; wind speed is the least in the early morning and the largest in the afternoon; maximum wind speed varies drastically owing to impact of landform and wind speed in some areas can reach 27m/s (equaling to class 10 gale). Gale above class 8 in the whole county occurs for 14d throughout the year on the average. Low temperature damage generally occurs in October every year.

4.1.6 Hydrology and river system

4.1.6.1 Surface water

River system in Anlu is divided to Fu river system and Yun river system, belonging to the Yangtze river basin. The vast majority of it is Fu river system and drainage area accounts for 90%. Drainage area of Yun river system only accounts for 10% and is only limited to the east edge.

Main river in the city is Fu River which flows through the middle part of city from north to south. Fu River is a seasonal stream and river water is apt to rise and fall, with mean water level of 35.88m and average annual discharge of 58.5m^3/s. Hucheng River and Haizi River flow through east and north part of the city and finally flow to Fu River.

Average annual runoff of surface water is 422 million cubic meters and per capita occupation of water resources is 681 cubic meters. Ground water reserve in the whole city is 110 million cubic meters and workable reserve is 85 million cubic meters. As for local water resources quantity, owing to mutual replenishment of surface water in Fu River and Zhang River, the repletion quantity is 81.1184 million cubic meters. Total water resources quantity in Anlu is 451 million cubic meters.

4.1.6.2 Underground water

Underground water in the project area can be divided to pore water of loose rock: pore fissure water of clastic rock and karst fissure water of conglomerate.

Pore water of loose rock: underground water mainly occurs in proluvial in river, gully and eluvial rock formation on the hillside. Water in proluvial formation is abundant and groundwater buried depth is 3-5m. Water in deluvial formation in the mountain area is weak and hydraulic connection degree is poor. The underground hydration type is heavy calcium carbonate type and heavy calcium magnesium carbonate type. Underground water mainly receives atmospheric precipitation. Underground water of bed rock mainly depends on supply and underground water is discharged to places around gully and river.

Pore fissure water of clastic rock: mainly occur in Wulong Formation of cretaceous system, Yuntaiguan Formation at midstream of Devonian system, water-bearing formation of upper Permian system Huangjiadeng and medium and underground water is mainly of fissure. Water-rich degree depends on lithology, pore, fissure development degree of aquifer and it is not uniform. General underground water is poor and chemical type of underground water is heavy calcium carbonate type and heavy calcium magnesium carbonate type. Underground water mainly receives supply of atmospheric precipitation and also receives lateral supply at the junction of aquifer group of carbonatite and aquifer group of conglomerate karst fissure. Underground water is mainly discharged to the earth surface, river and gully in the form of depression spring.

Karst fissure water of conglomerate: occur in conglomerate aquifer of upper Permian Luojingtan Formtaion of cretaceous system. Underground water mainly occurs in karst hole in the rock and water-rich degree in the fissure depends on development degree of karst and fissure. According to data near Yichang City, general flow of spring in such aquifer is 10-100m^3/d and chemical type of underground water is heavy calcium carbonate. Underground water mainly receives supply of atmospheric precipitation and surface water and is mainly discharged to the earth surface and river in the form of depression spring.

4.1.7 Vegetation

Flora in the project area is northern subtropical evergreen broad-leaved-deciduous broad-leaf mixed frost zone and there are various vegetations with southern and northern floral element. Mixed frost composed of evergreen broad-leaf frost and broadleaved deciduous forest is typical vegetation type in the whole area. Main species include pinus massoniana, Chinese tallow tree, Chinese chestnut, Chinese fir, fir, camphor tree, quercus variabilis, arborvitae, Chinese ash, acacia, broussonetia papyrifera, elm, populus tomentosa, etc. Shrub includes azalea, lespedeza, vitex negundo, wild hawthorn, rhododendron fortunei, seguinii, etc.; grass seed mainly includes miscanthus floridulus, themeda triandra, Chinese wild rye, phaenosperma, etc. Artificially planted vegetation mainly includes Chinese chestnut, Chinese tallow tree, Chinese date, etc. Water and soil conservation tree species include pinus massoniana, arborvitae, acacia, amorpha fruiticosa, etc. and grass seeds include clover, bermuda grass, eremochloa ophiuroides, etc. Owing to unique weather condition in the project area, vegetation grows well.

4.1.8 Soil

Soil type in the area where the Project is located is mainly yellow brown soil and paddy soil. Yellow brown soil is that of clay in the quarternary period and develops from quaternary sediment. Soil layer is deep and the texture is medium soil-clay. Fertilization effect is slow and there is delayed effect. Cultivation history is faraway and planting property is wide. It is the planting base of grain, cotton and oil of previous dynasties. Paddy soil is waterloggogenic paddy, pelite mud field of yellow brown soil nature. It is developed from shale, slate, mica plate, sandstone, phylite, green mud stone and other weathered slope washes. Surface soil is light soil-clay and the plough layer is of subacidity-neutrality. Yellow mud with heavy texture has high organic content and good water permeability. Root system of crops is easy to be deeply rooted, with high content of total potassium and rapidly-available potassium and lack of total phosphorus and rapidly-available phosphorus.

4.2 Overview of social environment

4.2.1 Land area and population

Total area of Anlu is 1353 square kilometers and the construction land area of central city is about 18.98 square kilometers. The whole city has about 642,500 population and permanent residence population in the central city is about 172,200. The whole city governs 9 town, 4 villages, 2 offices and 1 economic and technological development zone. There are 20 minorities such as Tujia Nationality, Hui Nationality, Mongol Nationality, Tibetan Nationality, Uyghur Nationality, Miao Nationality, Yi Nationality, Zhuang Nationality, Bouyei Nationality, Korean Nationality, Manchu, Dong Nationality, Yao Nationality in the jurisdiction area.

4.2.2 Overview of social economy

Anlu has maintained a GDP growth speed over 13% in the recent 6 years and GDP reached 12.533 billion yuan in 2013. It is mainly the secondary industry and the tertiary industry also develops drastically. The secondary industry mainly includes grain and oil machinery, agricultural and sideline product, metal work, textile, etc., among which grain and oil machinery accounts for 1/3 in national market share to become key industry cluster in Hubei Province; agricultural and sideline product represented by Shendan is a national agricultural industrialization leader; metal work represented by ASD is forging the largest kitchen ware production and processing base in the country.

In 2013, gross regional production was 12.533 billion yuan throughout the year, with year-on-year growth of 13.0% by comparable price. Added value of the primary industry was 3.048 billion yuan, increasing by 5.1 %; added value of the secondary industry was 4.953 billion yuan, increasing by 16.6 %; added value of the tertiary industry was 4.532 billion yuan, increasing by 14.4 %. Structure of three industries is adjusted to 24.3:39.5:36.2 from 24.4: 39.2: 36.4 last year.

General financial revenue was 787.47 million yuan throughout the year in 2013, increasing by 30.1%. General budget income was 560.04 million yuan, increasing by 34.6%; all tax revenues were 640.32 million yuan, increasing by 32.6%.

Income of urban and rural residents increased continuously. Urban per capita disposable income in the whole city was 17372 yuan, with year-on-year growth of 13.5 %. Per capita income from wages and salaries was 10248 yuan, increasing by 12.64 %; rural per capita net income was 7916 yuan, increasing by 13.7 %. Per capita net income of household management of production was 4094.74 yuan, increasing by 15.86 %, accounting for 51.73 % in all net incomes.

Anlu completed total investment in fixed assets of 12.243 billion yuan in 2013, increasing by 33.7％. As for urban and rural areas, project investment over 5 million yuan in cities and towns was 8.673 billion yuan, increasing by 35.1 %; real estate investment completed 1.155 billion yuan, increasing by 11.9%; rural project investment above 5 million yuan was 1.805 billion yuan, increasing by 55.2%; rural private investment was 611 million yuan, increasing by 12.0%.

By industry, investment of primary industry was 460 million yuan, increasing by 35% than that of last year; investment of the secondary industry was 8.804 billion yuan, increasing by 48.99%; investment of the tertiary industry was 2.282 billion yuan, increasing by -0.02%. 9 key projects such as Anneng combined heat and power generation, Youlidi LED were constructed and put into production and projects such as Zhumulangma Food commenced construction.

According to 2014 Work Report of Anlu Government, the whole city is predicted to realize gross regional domestic product of 14.1 billion yuan in 2013, with comparable growth of 12%; total investment in fixed assets was 16.28 billion yuan, increasing by 33%; fiscal revenue was 1.001

billion yuan, increasing by 27.1%; urban per capita disposable income was 19920 yuan, increasing by 15%; rural per capita net income was 9100 yuan, increasing by 15%. Industrial economy expands steadily. It is predicted that industrial added value above designated scale was 4.6 billion yuan in the whole year, increasing by 14%. “Three projects” including improvement of backbone enterprise, growth of small and medium-sized enterprises and entrepreneurial enterprise were advancing strongly and 20 industrial enterprises above designated sizes increased, with 23 enterprises with output value over 100 million.

4.2.3 Industrial structure

Grain and oil machinery industry in Anlu accounts for 1/3 in national market share, listed as key industry cluster in Hubei Province. As for agricultural and sideline product, Anlu Shendan Company is praised as “egg king” in the industry, being key leading enterprise of national agriculture industrialization. The close industry chain formed in metal work industry from raw material production to deep processing is forging the largest kitchen ware production and processing base in the country.

Table 4-2-1 Basic Conditions of Development of All Industries in Anlu in 2013 Unit: ten thousand yuan

Industry	Enterprise quantity	Industrial added value	Total industrial output value
Mining industry	6	82562	275701
Farm and sideline food processing industry	13	2219740	8595710
Food manufacturing industry	1	16504	59971
Textile industry	5	473787	1818113
Textile and garment as well as costume industry	2	31143	115478
Printing and recording media copy industry	3	26126	98870
Oil processing, coking and nuclear fuel processing industry	1	3814	24390
Chemical raw materials and chemicals manufacturing industry	2	13529	48000
Medicine manufacturing industry	2	231661	656268
Nonmetallic mineral product industry	14	345372	1101402
Non-ferrous metal metallurgy and rolling processing industry	4	198022	764039
Metal product industry	5	260632	942135
General-purpose equipment manufacturing industry	1	13209	46418
Special-purpose equipment manufacturing industry	4	279562	819283
Comprehensive utilization industry of waste resources	1	50653	168566
Power, heat, fuel gas and water production and supply industry	1	11767	31942

Data source: Anlu Statistical Yearbook 2013

In recent years, Anlu has been energetically drawing the distance between it and the Yangtze River Delta and Pearl River Delta through investment promotion. Hubei ASD Company is an enterprise of the Yangtze River Delta introduced by Anlu, specializing in producing cookers. At present, total enterprise assets of the Company are 240 million yuan, with annual production capacity exceeding 3 million sets, being “aircraft carrier” in cooker production industry in China; in addition, (Xiaolan) investment cooperation contract-signing ceremony in Anlu, Hubei was held in Xiaolan Town, Zhongshan City, Guangdong Province in July, 2013, meaning that Anlu has won the trust of enterprises in the Pearl River Delta.

4.2.4 Town development

Anlu overall planning and Urban Master Planning Summary (2013-2030) have been reviewed by expert group of Hubei Province. A batch of special plans was carried out successively. Editing and revision of overall planning of towns was launched comprehensively. 38 urban construction projects were implemented and investment was 350 million yuan. A batch of projects such as northern extension and expansion of Taibai Avenue and demolition and reconstruction of small turntable have been completed. Subsequent projects of Phase I of sewage treatment works have been completed and begin commissioning. External migration of National Highway 316, reconstruction of Nancheng Bridge and connection line, reconstruction of period line and other projects accelerate construction. Reconstruction of old town was boosted steadily. Construction of core area of Hexi new area was launched formally. Green area of 126,900 square meters has been added in the city center. Activity of ten thousand cadres entering ten thousand villages to clean ten thousand households, establishment of civilized and sanitary villages, "one line and one point" have obvious construction effect and rural garbage collection system has been set up preliminarily. Function of villages and towns has been perfected gradually. Three types of new communities, city, town and village, primary-level service platform, service organization network, service team construction have been boosted coordinately. 46 villages have been changed to communities and 150km roads to villages have been built, with 32 "villages surrounded by thousands of trees". Anlu Forestry Bureau has been rated as pioneering organization in territory greening in the whole province. Baihua Village has been rated as sanitation village in Hubei Province. Liyuan Village and Yuanfan Village have been selected as the most beautiful village in Xiaogan City.

4.2.5 Investment in transportation infrastructure

In recent years, construction and investment scale of transportation infrastructure has risen gradually in Anlu. Especially in 2013, a batch of project reconstruction such as northern extension and expansion of Taibai Avenue and demolition and reconstruction of small turntable, formal launching for construction of core area of Hexi new area have been boosted to further improve urban transportation service capacity and accessibility of road network. As planned, Anlu will energetically boost construction of "five roads and one bridge" in Chengnan new area and related supporting facilities as well as construction of Hexi new area in 2014. Construction scale of urban transportation infrastructure will achieve leapfrog development.

Table 4-2-2 Investment Conditions of Urban Transportation Infrastructure Unit: ten thousand yuan

Items	Investment conditions of urban transportation infrastructure
2010	4432
2011	5465
2012	5485
2013	10402

Data source: Anlu Finance Bureau

4.2.6 Anlu urban sewage treatment plan

Anlu urban sewage treatment plan is located in the east of Fu River in the south of Anlu downtown and the south of Fuhe Second Bridge, occupying a land of 110 Mu, overall design planning of 60 thousand tons/day. Sewage plant of Phase I with construction scale of 30 thousand tons/day and construction of sewage pipe network were completed at the end of 2008 and put into operation, serving about 160 thousand population and area of 18 square kilometers. Total investment was planned to be 100 million yuan, with investment of Phase I of about 57.27 million yuan. Anlu implemented enterprise financing, government regulation, selected excellence from excellence according to principle of "government leading, enterprise participation and market operation" to determine Guangdong Jianmin Qingzhong Environmental Protection Technology Co., Ltd. as financing operation organization, achieving reform and innovation of government public welfare establishment engineering in investment mode.

The sewage treatment plant operates with BOT mode (construction-operation-handover) and mainly constructs two biochemical tanks, two secondary sedimentation tanks, one aeration tank, plant construction and pipe network construction investment as a bundling for tendering. It adopts A/A/O nitrogen and phosphorus removal technology for sewage treatment, with effluent quality reaching national medium Level-I B standard and daily sewage treatment capacity of 30 thousand tons.

4.2.7 Education, medical treatment and public health

Educational business in Anlu developed by leaps and bounds. It integrated rural compulsory education resources, reconstructed and newly built school buildings of 557,000 square meters, completed standardization construction of equipment in 47 schools and built 7 standard schools. Anlu No.1 Senior Middle School was rated as "provincial demonstration senior high school". "Two-exemptions and one-subsidy" policy (exemption from incidental expense and textbook expense and gradually subsidize living expense of resident student) of compulsory education was implemented comprehensively. Admission rate of ten thousand students in the College Entrance Examination ranked the first in Xiaogan for 8 consecutive years. Vocational education developed rapidly and municipal secondary vocational school succeeded in establishing “national demonstration school”. Anlu City was rated as “demonstration city for standardized education charging in the whole province”.

Health undertakings accelerated development. With focus put on enhancing primary-level health, prevention and healthcare and epidemic prevention, the city improved health service system, supervision and monitoring system and healthcare system to further perfect medical treatment and public health conditions, with quality of medical service improved continuously. Municipal Pu Ai Hospital was migrated on the whole and infrastructure construction of 14 township hospitals and 45 village clinics was completed. It took the lead to implement “six-unification” village integration medicine mode in Hubei Province. At the same time, it successfully passed review of Hubei provincial hygienic city.

4.2.8 Land use status

According to the survey for land use status in editing and revision of urban master planning, urban construction land in Anlu was 18.98 square kilometers in 2012, with residential land of 804.37 hectares, accounting for 42.37%; land for public management and public service facility was 106.47 hectares, accounting for 5.61%; land for commercial service facility was 48.31 hectares, accounting for 2.55%; industrial land was 525.31 hectares, accounting for 27.67%; land for logistics and warehousing was 63.51 hectares, accounting for 3.35%; land for road and traffic facility was 286.77 hectares, accounting for 15.10%; land for public utility was 23.56 hectares, accounting for 1.24%; land for green land and square was 40.11 hectares, accounting for 2.11%.

Urban construction land use status in Anlu in 2012 is shown in Table 4-2-3.

Table 4-2-3 Balance Sheet of Anlu Urban Construction Land in 2012

Land code		Land name	Land area (hm^2)	Proportion in urban construction land (%)	Per capita land (m2/person)	Per capita land as national standard (m2/person)
Class	Division					
R		Residential land	804.37	42.37	50.91	23-36
	R2	Type-II residence	538.45	28.36	34.08	
	R3	Type-III residence	265.92	14.01	16.83	
A		Land for public management and public service facilities	106.47	5.61	6.74	≥5.5
	A1	Administration office	21.68	1.14	1.37	
	A2	Cultural facilities	0.53	0.03	0.03	

Land code: Class	Land code: Division	Land name	Land area (hm^2)	Proportion in urban construction land (%)	Per capita land (m2/person)	Per capita land as national standard (m2/person)
	A3	Education and scientific research	65.89	3.47	4.17	
	A4	Physical training	6.37	0.34	0.40	
	A5	Medical treatment and public health	10.56	0.56	0.67	
	A6	Social benefit	0.00	0.00	0.00	
	A7	Cultural relics and historic sites	0.06	0.00	0.00	
	A8	Foreign affairs	0.00	0.00	0.00	
	A9	Religion	1.36	0.07	0.09	
B		Facility of business and service industry	48.31	2.55	3.06	
	B1	Business	39.02	2.06	2.47	
	B2	Commerce	4.64	0.24	0.29	
	B3	Entertainment gymnasium	0.24	0.02	0.02	
	B4	Sales network of public utility	4.41	0.23	0.28	
M		Industrial land	525.31	27.67	33.25	
	M1	Type-I industry	105.02	5.53	6.65	
	M2	Type-II industry	302.08	15.91	19.12	
	M3	Type-III industry	133.42	6.23	8.44	
W		Land for logistics and warehousing	63.51	3.35	4.02	
	W1	Type-I logistics and warehousing	53.54	2.82	3.39	
	W3	Type-III logistics and warehousing	9.97	0.53	0.63	
S		Land for road and traffic facilities	286.77	15.10	18.15	≥12
	S1	Urban road	281.59	14.83	17.82	
	S3	Transportation junction	2.81	0.15	0.18	
	S4	Transportation terminal	1.67	0.09	0.11	
	S9	Other traffic facilities	0.70	0.03	0.04	
U		Land for public utility	23.56	1.24	1.49	

Land code		Land name	Land area (hm²)	Proportion in urban construction land (%)	Per capita land (m2/person)	Per capita land as national standard (m2/person)
Class	Division					
	U1	Supply facility	20.04	1.06	1.27	
	U2	Environmental facility	2.13	0.11	0.13	
	U3	Safety facility	1.39	0.07	0.09	
G		Land for green land and square	40.11	2.11	2.54	≥10
	G1	Park green land	39.07	2.06	2.47	
	G2	Green buffer	0.34	0.01	0.02	
	G3	Square	0.70	0.04	0.04	
H11		Urban construction land	1898.41	100.00	120.15	

Data source: Anlu Urban Master Planning (2013—2030)

On the whole, the proportion of residential land is relatively high and that of green land is relatively low. 42.37% of construction land is residential land and current per capita index value of residential land is 50.9 square meters/person, in excess of upper limit value of national standard. Current green land is 2.11% and current per capita land is 2.5 square meters/person, lower than 10% required by national standard by far and lower limit value of per capita 10 square meters/person.

4.3 Evaluation of current situation of environmental quality

4.3.1 Current situation of ambient air quality

According to *Letter of Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan – Executive Standard for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan from Anlu World Bank Loan Project Management Office of Anlu Environmental Protection Administration* (see Appendix), ambient air where the Project is located belongs to “type-II area” and Level-II standard in *Ambient Air Quality Standards* (GB3095-2012) shall be executed.

4.3.1.1 Monitoring of current situation of ambient air quality

(1) Monitoring point location

To know quality condition of ambient air in the project construction area, the environment evaluation has set up 3 atmospheric monitoring point locations within the impact scope of the Project, respectively at Anlu Environmental Monitoring Station (point A1#), public transport hub of Qili Bridge (point A2#, in the southwest at the intersection between Yinxing Avenue and Taibai Avenue), public transport hub of high speed rail station (point A3#).

Layout of monitoring point location is shown in Fig. 2 and Fig. 3 and monitoring report is shown in Appendix 7.

(2) Monitoring items: SO2, NO2, PM10, CO.

(3) Monitoring time: from July 28 to August 3, 2014.

(4) Monitoring organization: Anlu Environmental Monitoring Station.

(5) Monitoring frequency.

Monitoring was conducted for 7 consecutive days to obtain daily average value at PM10 and data of hourly average value and daily average value for SO2, NO2 and CO. Daily continuous monitoring of daily average data of individual monitoring factor is no less than 20hours and hourly monitoring time is no less than 45min.

(6) Monitoring analysis method

Status monitoring analysis method is according to related provisions and specific analysis method is shown in Table 5-3-1.

Table 4-3-1　Table of Monitoring Analysis Method of Ambient Air

No.	Monitoring items	Analysis method
1	CO	Portable infrared analyzer
2	NO2	N-ethylenediamine spectrophotometry
3	SO2	Methanal absorption-pararosaniline spectrophotometry
4	PM10	Gravimetric method

4.3.1.2 Evaluation of current situation of ambient air quality

(1) Evaluation items

Select items SO2, NO2, PM10 and CO as ambient air evaluation factor.

(2) Evaluation method

Adopt over standard rate and designation number method to evaluate current situation of ambient air quality in the proposed engineering area.

Over standard rate $\eta = \frac{\text{Number of over standard}}{\text{Number of total checkpoint}}$

Maximum occupation rate of standard value:

Pi=Ci/Si

Where: occupation rate of standard value of Pi—i type pollutant;

Ci—maximum value of status monitoring concentration value in i type pollutant (mg/m3)

Si—ambient quality evaluation standard of i type pollutant (mg/m3), namely concentration limit value of Level-II standard in GB3095-2012.

(3) Monitoring result and analysis

Status monitoring result of ambient air quality where the Project is located is shown in Table 5-3-2 and Table 5-3-3.

Table 4-3-2 Quality Monitoring Result of Ambient Air Where the Project Is Located (unit: mg/m3)

Monitoring point location	Monitoring time		Monitoring items						
			SO2		NO2		CO		PM10
			Hourly value	Daily average value	Hourly value	Daily average value	Hourly value	Daily average value	Daily average value
A1	7.28	2:00	0.028	0.032	0.026	0.027	<1.000	<1.000	0.044
		8:00	0.036		0.028		<1.000		
		14:00	0.035		0.026		<1.000		
		20:00	0.03		0.027		<1.000		
	7.29	2:00	0.033	0.036	0.026	0.029	<1.000	<1.000	0.049
		8:00	0.039		0.03		<1.000		
		14:00	0.036		0.032		<1.000		
		20:00	0.034		0.027		<1.000		
	7.3	2:00	0.035	0.034	0.029	0.028	<1.000	<1.000	0.042
		8:00	0.042		0.032		<1.000		
		14:00	0.028		0.026		<1.000		
		20:00	0.029		0.025		<1.000		
	7.31	2:00	0.032	0.031	0.025	0.025	<1.000	<1.000	0.048
		8:00	0.03		0.024		<1.000		
		14:00	0.029		0.026		<1.000		

Monitoring point location	Monitoring time		Monitoring items						
			SO2		NO2		CO		PM10
			Hourly value	Daily average value	Hourly value	Daily average value	Hourly value	Daily average value	Daily average value
		20:00	0.033		0.024		<1.000		
	8.1	2:00	0.034	0.033	0.028	0.026	<1.000	<1.000	0.049
		8:00	0.038		0.027		<1.000		
		14:00	0.03		0.025		<1.000		
		20:00	0.028		0.024		<1.000		
	8.2	2:00	0.031	0.029	0.024	0.025	<1.000	<1.000	0.047
		8:00	0.029		0.028		<1.000		
		14:00	0.028		0.024		<1.000		
		20:00	0.029		0.024		<1.000		
	8.3	2:00	0.029	0.031	0.024	0.026	<1.000	<1.000	0.046
		8:00	0.033		0.026		<1.000		
		14:00	0.029		0.026		<1.000		
		20:00	0.032		0.028		<1.000		
A2	7.28	2:00	0.029	0.031	0.025	0.026	<1.000	<1.000	0.053
		8:00	0.035		0.027		<1.000		
		14:00	0.028		0.026		<1.000		
		20:00	0.03		0.027		<1.000		
	7.29	2:00	0.033	0.033	0.028	0.028	<1.000	<1.000	0.049
		8:00	0.038		0.03		<1.000		
		14:00	0.032		0.029		<1.000		

Monitoring point location	Monitoring time		Monitoring items						
			SO2		NO2		CO		PM10
			Hourly value	Daily average value	Hourly value	Daily average value	Hourly value	Daily average value	Daily average value
		20:00	0.03		0.024		<1.000		
	7.3	2:00	0.031	0.032	0.025	0.026	<1.000	<1.000	0.048
		8:00	0.035		0.029		<1.000		
		14:00	0.031		0.025		<1.000		
		20:00	0.032		0.024		<1.000		
	7.31	2:00	0.033	0.033	0.027	0.027	<1.000	<1.000	0.041
		8:00	0.034		0.03		<1.000		
		14:00	0.031		0.025		<1.000		
		20:00	0.032		0.026		<1.000		
	8.1	2:00	0.034	0.033	0.028	0.028	<1.000	<1.000	0.048
		8:00	0.037		0.031		<1.000		
		14:00	0.03		0.027		<1.000		
		20:00	0.029		0.025		<1.000		
	8.2	2:00	0.028	0.031	0.024	0.025	<1.000	<1.000	0.044
		8:00	0.034		0.027		<1.000		
		14:00	0.032		0.025		<1.000		
		20:00	0.03		0.024		<1.000		
	8.3	2:00	0.035	0.035	0.026	0.027	<1.000	<1.000	0.045
		8:00	0.039		0.029		<1.000		
		14:00	0.034		0.026		<1.000		

Monitoring point location	Monitoring time		Monitoring items						
			SO2		NO2		CO		PM10
			Hourly value	Daily average value	Hourly value	Daily average value	Hourly value	Daily average value	Daily average value
		20:00	0.033		0.025		<1.000		
A3	7.28	2:00	0.033	0.033	0.025	0.026	<1.000	<1.000	0.048
		8:00	0.035		0.026		<1.000		
		14:00	0.03		0.024		<1.000		
		20:00	0.032		0.027		<1.000		
	7.29	2:00	0.029	0.030	0.025	0.026	<1.000	<1.000	0.045
		8:00	0.032		0.028		<1.000		
		14:00	0.03		0.026		<1.000		
		20:00	0.028		0.024		<1.000		
	7.3	2:00	0.029	0.031	0.027	0.027	<1.000	<1.000	0.047
		8:00	0.034		0.03		<1.000		
		14:00	0.03		0.026		<1.000		
		20:00	0.029		0.025		<1.000		
	7.31	2:00	0.03	0.033	0.024	0.026	<1.000	<1.000	0.042
		8:00	0.036		0.028		<1.000		
		14:00	0.034		0.027		<1.000		
		20:00	0.031		0.024		<1.000		
	8.1	2:00	0.032	0.032	0.026	0.026	<1.000	<1.000	0.046
		8:00	0.035		0.029		<1.000		
		14:00	0.03		0.025		<1.000		

Monitoring point location	Monitoring time		Monitoring items						
			SO2		NO2		CO		PM10
			Hourly value	Daily average value	Hourly value	Daily average value	Hourly value	Daily average value	Daily average value
		20:00	0.031		0.024		<1.000		
	8.2	2:00	0.033	0.034	0.026	0.026	<1.000	<1.000	0.049
		8:00	0.038		0.027		<1.000		
		14:00	0.031		0.025		<1.000		
		20:00	0.035		0.024		<1.000		
	8.3	2:00	0.033	0.032	0.025	0.027	<1.000	<1.000	0.043
		8:00	0.035		0.03		<1.000		
		14:00	0.03		0.028		<1.000		
		20:00	0.028		0.025		<1.000		
		20:00	0.028		0.025		<1.000		

Table 4-3-3 Ambient Air Evaluation Result Where the Project Is Located Unit: mg/m3

Evaluation index / Monitoring point location		SO2		NO2		CO		PM10
		Hourly value	Daily average value	Hourly value	Daily average value	Hourly value	Daily average value	Daily average value
Level-II standard value in GB3095-2012		0.5	0.15	0.2	0.08	10.00	4	0.15
A1	Maximum occupation	7.8%	24%	16%	35%	<10.0%	<25.0%	33%

	rate of standard value							
	Over standard rate	0	0	0	0	0	0	0
A2	Maximum occupation rate of standard value	7.6%	23%	15.5%	35%	<10.0%	<25.0%	35%
	Over standard rate	0	0	0	0	0	0	0
A3	Maximum occupation rate of standard value	7.6%	23%	15%	34%	<10.0%	<25.0%	33%
	Over standard rate	0	0	0	0	0	0	0

Monitoring results in Table 4-3-2 and Table 4-3-3 indicate that SO2, NO2, PM10 and CO indices in the scope of construction area of the Project can satisfy requirements of Level-II standard in *Ambient Air Quality Standards* (3095-2012). If PM2.5 is included in monitoring and evaluation scope, result may vary.

4.3.2 Current situation of environmental quality of surface water

4.3.2.1 Status monitoring of water environment quality

According to related collected data and site survey and investigation, along with Letter of Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan – Executive Standard for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan from Anlu World Bank Loan Project Management Office of Anlu Environmental Protection Administration (see Appendix), related surface water involved in the Project includes Anlu section of Fu River (Type-II water at upper reaches of Jiefang Mountain and

Type-III water at lower reaches), Chashan River, Mao River, Qili River and Huguo River (Type-III water).

To learn about current situation of water environment quality in the project area, the evaluation has collected monitoring data of Anlu Environmental Monitoring Station for section of Fu River Jiefang Mountain and Extraordinary Pavilion. The position of monitoring section is shown in Fig. 3 and monitoring report is shown in the appendix.

Table 4-3-4 Monitoring Section of Water Environment Quality

No.	Position of monitoring section	Remarks
1#	Jiefang Mountain	Routine monitoring section
2#	Extraordinary Pavilion	Routine monitoring section

(2) Monitoring items

Monitoring items include 8 items, pH value, BOD5, TP, NH3-N, petroleum, DO and permanganate index.

(3) Monitoring time, frequency and analysis method

①Monitoring time and frequency

The monitoring time is August 14, 2014.

②Monitoring analysis method

According to provisions in GB3838-2002 *Environmental Quality Standards for Surface Water*, status analysis of water quality shall be subject to related methods specified in *Standard Methods for the Examination of Water and Wastewater* (the fourth version) prepared by former State Environmental Protection Administration, as shown in Table 4-3-5.

Table 4-3-5 Water quality analysis method

No.	Monitoring item	Analysis method	Method basis	Detection lower limit
1	pH	Glass electrode method	GB/T6920-1986	0.1
2	Ammonia nitrogen	Nessler reagent spectrophotometry	HJ535-2009	0.025mg/L
3	Total phosphorus	Ammonium molybdate spectrophotometry	GB/T11893-1989	0.01mg/L
4	Biochemical oxygen demand	Rapid test method of microbial sensor	HJ/T 86-2002	--
5	Dissolved oxygen	Iodometry	GB/T7489-1987	0.2mg/L
6	Petroleum	Infrared luminosity	HJ 637-2012	0.04mg/L

7	Permanganate index	Acidity method	GB/T11892-1989	0.5 mg/L

4.3.2.2 Status evaluation of water environment

(1) Evaluation method

Single factor method is adopted to evaluate current situation of environmental quality of surface water of river and lake involved in the proposed highway.

Si, j=Ci, j/Csi

Where: Si，j-Designation number of water quality parameter i at j;

Ci, j-Status monitoring result of water quality parameter i at j;

Csi - Standard value of surface water environmental quality of water quality parameter i.

The calculation formula of designation number of pH value is:

$$S_{pH,j} = \frac{7.0 - pH_j}{7.0 - pH_{sd}}$$ **(pHj≤7.0)**

$$S_{pH,j} = \frac{pH_j - 7.0}{pH_{su} - 7.0}$$ (pHj＞7.0)

Where: pHj-pH value status monitoring result of j;

pHsd-Lower limit of pH value in surface water environmental quality standard;

pHsu- Upper limit of pH value in surface water environmental quality standard.

The calculation formula of designation number of DO (dissolved oxygen) is:

$$S_{DO,j} = \frac{|DO_f - DO_j|}{DO_f - DO_s}$$ **(DOj≥Dos)**

$$S_{DO,j} = 10 - 9 * \left(\frac{DO_j}{DO_s}\right)$$ **(DOj≤Dos)**

Where: DOf=468/(31.6+T)

DOj- Actually measured maximum concentration of dissolved oxygen (mg/L);

Dos-Standard value of environmental quality of dissolved oxygen (mg/L);

DOf-Saturated dissolved oxygen (mg/L);

T-Temperature of actually measured water body (℃).

(2) Evaluation result

Monitoring and evaluation result of current situation of water environmental quality in the water area involved in the Project is shown in Table 4-3-6.

Table 4-3-6 Monitoring and Evaluation Result of Current Situation of Surface Water Environmental Quality Unit: mg/L (pH dimensionless)

(i) M	(ii) M	(iii)	(iv) I	(v)	(vi) D	(vii)	(viii) Pe	(ix) P

onitoring section	**onitoring items**	**H value**	**H3-N**	**otal phosphorus**	**issolved oxygen**	**OD5**	**rmanganate index**	**etroleum**
(x) Ji efang Mountain	(xi) M onitoring value	(xii) .16	(xiii) .67	(xiv) .066	(xv) 7 .66	(xvi) .23	(xvii) 4.7 5	(xviii) N D
	(xix) S tandard value (Type-II)	(xx) -9	(xxi) 0.5	(xxii) 0.1	(xxiii) ≥ 6	(xxiv) 3	(xxv) ≤4	(xxvi) ≤ 0.05
	(xxvii) D esignation number	xxviii) .08	(xxix) .34	(xxx) .66	(xxxi) 0 31.	(xxxii) .11	xxxiii) 1.1 9	xxxiv) /
	(xxxv) S tandard attainment condition	**xxxvi) Over standard**						
(xxvii) E xtraordinary Pavilion	xxviii) M onitoring value	xxxix) .09	(xl) .91	(xli) .085	(xlii) 7 .93	(xliii) .41	(xliv) 5.9 6	(xlv) N D
	(xlvi) S tandard value (Type III)	(xlvii) -9	xlviii) 1.0	(xlix) 0.2	(l) ≥ 5	(li) 4	(lii) ≤6	(liii) ≤ 0.05
	(liv) D esignation number	(lv) .05	(lvi) .91	(lvii) .43	(lviii) 0 .14	(lix) .85	(lx) 0.9 9	(lxi) /
	(lxii) S tandard attainment condition	**(lxiii) Up to standard**						

Note: ND indicates not detected

We can see from Table 4-3-6 that water environment quality at the section of Fu River and Extraordinary Pavilion is in good condition and all water quality monitoring indices conform to requirements of Type-III standard limit value of *Environmental Quality Standards for Surface Water* (GB3838-2002). Among all monitoring indices at the section of Fu River and Jiefang Mountain, except dissolved oxygen reaching requirements of Type-II standard limit value of *Environmental Quality Standards for Surface Water* (GB3838-2002), other monitoring indices exceed the standard. The reason for water quality exceeding standard is mainly due to the fact that Fu River accepts a lot of domestic sewage, industrial wastewater and pollution of agricultural non-point source.

4.3.3 Monitoring and evaluation of current situation of environmental noise

Construction contents of the Project involves 7 roads, 3 public transport hubs, 1 small public transport hub, 2 public transport hubs + road passenger transport centers, etc. In which, Taibai Road, Jiefang Avenue and Yinxing Avenue are urban main roads; Biyun Road, Yinxing Avenue, Fucheng Avenue and Zhanqian Road are urban secondary main roads.

Taibai Road, Jiefang Avenue, Biyun Road and Jinqiu Avenue are located in central urban area and belong to reconstruction roads. Both sides of these roads mainly are residential and commercial lands and have more sensitive points. At the same time, places within certain range of the area are under development and have many construction projects; thus quality of acoustic environment is bad. Yinxing Avenue is located at north edge of urban area and belongs to expansion road, which has less sensitive points on both sides. Fucheng Avenue and Zhanqian Road are newly-built roads and there are several residential sensitive points along these roads; its current situation is mainly affected by noise of social activities and the quality of acoustic environment is well.

According to *Reply Letter of Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan-Executive Standard for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan of Anlu Environmental Protection Administration* (see Appendix 3), division work of sound environment function areas has not been carried out in Anlu. In principle, class-1 standards of *Environmental Quality Standard for Noise* (GB3096-2008) shall be carried out in concentration areas for residential building, medical and health care, cultural education and administrative office; class-2 standards of *Environmental Quality Standard for Noise* (GB3096-2008) shall be carried out in residential, commercial and industrial mixing zone; class-3 standards of *Environmental Quality Standard for Noise* (GB3096-2008) shall be carried out in industrial concentration district.

In order to know current situation of acoustic environment of the place where the Project is located, Anlu Environmental Monitoring Station was entrusted to monitor noise along these roads and around the station on August 14 to September 15, 2014 in this evaluation.

4.3.3.1 Monitoring of current situation of noise

1) Monitoring of sensitive building

①Monitoring method

The monitoring on current situation of environmental noise is carried out by adopting principle of points arrangement for monitoring specified in *Environmental Quality Standard for Noise* (GB3096-2008). Each monitoring point is monitored for 1 day and monitored once during daytime (6:00-22:00) and nighttime (22:00-6:00) respectively. Equivalent consecutive sound level A of each monitoring point shall be measured; in addition, Leq and L90 of each monitoring shall be recorded respectively. At the same time of monitoring, traffic flow shall be recorded and statistics shall be made according to classification of large, middle and small vehicles.

②Principle of point arrangement

Points for monitoring of current situation are located at the nearest place to proposed road and surrounding places of public transport hub, passenger transport center station with sensitive points. On the one hand, it was to reflect current situation of acoustic environment within the evaluation region; on the other hand, it was to provide basic data for forecast. In the principles of on-the-spot survey and “point-oriented” and under the comprehensive consideration of size of sensitive point, its distance to road and environmental conditions, the evaluation selected 42 representative points for monitoring. Arrangements of monitoring points for current situation of acoustic environment are shown in Table 4-3-7 and Fig.2. At the same time, monitoring and statistics for traffic flow per hour of intersecting roads along the Project were made.

Arrangement of monitoring points for current situation of noise at sensitive points along both sides of roads is shown in Table 4-3-7.

Table 4-3-7 List of Noise Monitoring Points along Roads

No.	Road name	Point location
1	Taibai Road	Taihe Villa
2		Taihe Paradise
3		Jin’s Community
4		Fengda International City
5		Anlu Secondary Vocational School
6		Pu Ai Hospital
7		Anlu Economic Development Zone of Hubei Province
8		An’er Homeland
9		Anlu Second Middle School
10		Haocheng Jiayuan Building
11		Sili Community
12		Hubei Aluminum Manufacturer Dormitory Building
13		Zhongyi Community
14	Biyun Road	Anlu Health Supervision Bureau (Center for Disease Control and Prevention)
15		Jiahe Community
16		Anlu Municipal Government
17		Fudong Community
18		Anlu Bureau of Civil Affairs
19		Shili Primary School
20		Shili Middle School
21		Dapeng Village
22	Jiefang Avenue	Yuanlin Jiayuan Building
23		Dean Garden
24		Shuanglongqiao Homeland
25		Anlu Science and Technology Bureau
26		Anlu Public Security Bureau
27		Fengda International City
28		Linyu Huadu Building
29	Jinqiu Road	Kaixuan City
30		Shangri-la City Garden
31		Jinqiu Yuyuan Building
32		Shui’an Xingcheng Building
33		Fenghai Tiancheng Building
34	Yinxing Avenue	Shitang Community

No.	Road name	Point location
35		Xugang Community
36		Shimiao Community
37		Anlu Supervision Center
38	Fucheng Avenue	Zhaohe Village
39		Lvjiafan
40		Huguo Village
41	Zhanqian Road	Linong Village
42		Jinquan Village

Note: Continuously monitor all points for 20min to record traffic flow and vehicle models comparison (namely synchronously record traffic flow on corresponding roads at monitoring period and proportion of vehicle models of large, middle and small vehicles).

Existing acoustic environment of public transport hub and passenger transport center is reflected by setting monitoring points around the site.

3 Monitoring results

Please refer to Table 4-3-8 for monitoring results of current situation of acoustic environment along roads and Table 4-3-9 for monitoring results of current situation of acoustic environment around bus stations.

Table 4-3-8 Monitoring Results of Current Situation of Acoustic Environment Quality along Roads

Unit: dB (A)

No.	Road name	Monitoring point	Monitoring period	Standard value (dB)	Monitoring value (dB)	Leq exceeding the standard	Traffic flow (vehicle/h)		Main noise source
					Leq		Middle and small vehicle	Large vehicle	
1	**Taibai Road**	**Taihe Villa**	**Daytime**	**60.0**	**57.9**	**—**	**1230**	**60**	**Traffic noise and social life noise**
			Nighttime	**50.0**	**52.7**	**2.7**	**560**	**30**	
2		**Taihe Paradise**	**Daytime**	**60.0**	**65.9**	**5.9**	**1230**	**60**	
			Nighttime	**50.0**	**53.1**	**3.1**	**560**	**30**	
3		**Jin's Community**	**Daytime**	**60.0**	**56.6**	**—**	**1260**	**66**	
			Nighttime	**50.0**	**51.8**	**1.8**	**560**	**30**	
4		**Fengda International City**	**Daytime**	**60.0**	**67.5**	**7.5**	**1350**	**66**	
			Nighttime	**50.0**	**53.8**	**3.8**	**580**	**36**	
5		**Anlu Secondary Vocational School**	**Daytime**	**60.0**	**62.6**	**2.6**	**1500**	**60**	
			Nighttime	**50.0**	**58.7**	**8.7**	**345**	**120**	

6		Pu Ai Hospital	Daytime	60.0	63.9	3.9	1890	84	
			Nighttime	50.0	58.1	8.1	312	120	
7		Anlu Economic Development Zone of Hubei Province	Daytime	60.0	67.0	7.0	1740	90	
			Nighttime	50.0	57.9	7.9	312	120	
8		An'er Homeland	Daytime	60.0	63.2	3.2	1560	120	
			Nighttime	50.0	57.8	7.8	312	120	
9		Anlu Second Middle School	Daytime	60.0	66.3	6.3	1560	120	
			Nighttime	50.0	56.0	6.0	288	120	
10		Haocheng Jiayuan Building	Daytime	60.0	73.3	13.3	1740	141	
			Nighttime	50.0	63.2	13.2	312	120	
11		Sili Community	Daytime	60.0	66.9	6.9	1140	84	
			Nighttime	50.0	58.6	8.6	180	120	
12		Hubei Aluminium Manufacturer Dormitory Building	Daytime	60.0	61.2	1.2	1140	84	
			Nighttime	50.0	57.2	7.2	180	111	
13		Zhongyi Community	Daytime	60.0	69.5	9.5	1080	120	
			Nighttime	50.0	60.5	10.5	210	96	
14	Biyun Road	Anlu Health Supervision Bureau (Center for Disease Control and Prevention)	Daytime	60.0	61.8	1.8	900	24	Traffic noise and social life noise
			Nighttime	50.0	49.7	—	126	9	
15		Jiahe Community	Daytime	60.0	64.5	4.5	1080	24	
			Nighttime	50.0	56.7	6.7	216	9	
16		Anlu Municipal	Daytime	60.0	69.0	9.0	1800	0	

		Government	Nighttime	50.0	63.5	13.5	900	6	
17		Fudong Community	Daytime	60.0	68.6	8.6	2640	24	
			Nighttime	50.0	58.1	8.1	855	6	
18		Anlu Bureau of Civil Affairs	Daytime	60.0	68.8	8.8	2010	84	
			Nighttime	50.0	63.5	13.5	828	0	
19		Shili Primary School	Daytime	60.0	57.9	—	780	36	It is mainly social life noise.
			Nighttime	50.0	49.2	—	288	6	
20		Shili Middle School	Daytime	60.0	55.8	—	750	84	
			Nighttime	50.0	49.8	—	288	6	
21		Dapeng Village	Daytime	60.0	50.2	—	0	0	
			Nighttime	50.0	47.1	—	0	0	
22	Jiefang Avenue	Yuanlin Jiayuan Building	Daytime	60.0	63.5	3.5	900	48	Traffic noise and social life noise
			Nighttime	50.0	57.7	7.7	432	36	
23		Dean Garden	Daytime	60.0	64.0	4.0	900	48	
			Nighttime	50.0	55.9	5.9	432	36	
24		Shuanglongqiao Homeland	Daytime	60.0	57.4	—	600	33	
			Nighttime	50.0	50.2	0.2	432	36	
25		Anlu Science and Technology Bureau	Daytime	60.0	60.7	0.7	1620	72	
			Nighttime	50.0	58.2	8.2	402	30	
26		Anlu Public Security Bureau	Daytime	60.0	66.1	6.1	1470	24	
			Nighttime	50.0	59.8	9.8	360	36	
27		Fengda International City	Daytime	60.0	52.6	-7.4	1200	27	
			Nighttime	50.0	56.7	6.7	402	33	

28		Linyu Huadu Building	Daytime	60.0	64.2	4.2	960	24	
			Nighttime	50.0	55.6	5.6	396	36	
29	Jinqiu Avenue	Kaixuan City	Daytime	60.0	65.5	5.5	930	15	Traffic noise and social life noise
			Nighttime	50.0	53.8	3.8	303	36	
30		Shangri-la City Garden	Daytime	60.0	63.6	3.6	870	12	
			Nighttime	50.0	55.8	5.8	432	48	
31		Jinqiu Yuyuan Building	Daytime	60.0	63.8	3.8	900	12	
			Nighttime	50.0	56.1	6.1	432	48	
32		Shui'an Xingcheng Building	Daytime	60.0	63.0	3.0	900	24	
			Nighttime	50.0	55.6	5.6	432	48	
33		Fenghai Tiancheng Building	Daytime	60.0	63.6	3.6	660	36	
			Nighttime	50.0	54.7	4.7	402	48	
34	Yinxing Avenue	Shitang Community	Daytime	60.0	71.5	11.5	570	48	Traffic noise
			Nighttime	50.0	57.8	7.8	90	60	
35		Xugang Community	Daytime	60.0	53.5	—	420	48	Traffic noise and social life noise
			Nighttime	50.0	46.3	—	150	45	
36		Shimiao Community	Daytime	60.0	58.6	—	480	60	
			Nighttime	50.0	49.5	—	162	45	
37		Anlu Supervision Center	Daytime	60.0	71.4	11.4	600	168	Traffic noise
			Nighttime	50.0	60.5	10.5	162	45	
38	Fucheng Avenue	Zhaohe Village	Daytime	60.0	49.4	—	60	0	It is mainly social life noise.
			Nighttime	50.0	45.1	—	0	0	
39		Lvjiafan	Daytime	60.0	57.1	—	60	0	

			Nighttime	**50.0**	**44.0**	**—**	**0**	**0**	
40		**Huguo Village**	**Daytime**	**60.0**	**57.2**	**—**	**66**	**0**	
			Nighttime	**50.0**	**45.2**	**—**	**0**	**0**	
41	**Zhanqian Road**	**Linong Village**	**Daytime**	**60.0**	**56.4**	**—**	**21**	**3**	**It is mainly social life noise.**
			Nighttime	**50.0**	**45.2**	**—**	**0**	**0**	
42		**Jinquan Village**	**Daytime**	**60.0**	**52.1**	**—**	**12**	**0**	
			Nighttime	**50.0**	**44.2**	**—**	**0**	**0**	

Table 4-3-9 Monitoring Results of Current Situation of Acoustic Environment Quality around Public Transport Hubs and Bus Stations Unit: dB (A)

Monitoring point No.	Name of public transport hub and bus station	Monitoring location	Daytime			Nighttime		
			Monitoring value	Standard value	Evaluation result	Monitoring value	Standard value	Evaluation result
1	Bus Transfer Hub at Passenger Transport Center Station	1m outside of east-side site	56.7	60	Up to the standard	44.5	50	Up to the standard
2		1m outside of south-side site	62.4	60	**Exceed the standard**	43.4	50	Up to the standard
3		1m outside of west-side site	70.3	70	**Exceed the standard**	56.2	55	Up to the standard
4		1m outside of west-side site	69.7	70	Up to the standard	55.8	55	**Exceed the standard**
5		1m outside of north-side site	62.4	60	**Exceed the standard**	48.3	50	Up to the standard
6	Bus Arrival-departure Hub at Train Station	1m outside of east-side site	57.8	60	Up to the standard	52.7	50	**Exceed the standard**
7		1m outside of south-side site	68.3	60	**Exceed the standard**	48.4	50	Up to the standard
8		1m outside of west-side site	66.8	60	**Exceed the standard**	47.5	50	Up to the standard
9		1m outside of north-side site	58.7	60	Up to the standard	46.1	50	Up to the standard

10	Bus Transfer Hub of Short-distance Station	1m outside of east-side site	65.7	60	**Exceed the standard**	52.0	50	**Exceed the standard**
11		1m outside of south-side site	56.2	60	Up to the standard	48.4	50	Up to the standard
12		1m outside of west-side site	61.2	60	**Exceed the standard**	47.5	50	Up to the standard
13		1m outside of north-side site	68.6	70	Up to the standard	53.3	55	Up to the standard
14	Bus Transfer Hub of Long-distance Station	1m outside of east-side site	70.4	70	**Exceed the standard**	55.8	55	**Exceed the standard**
15		1m outside of south-side site	64.1	60	**Exceed the standard**	48.1	50	Up to the standard
16		1m outside of west-side site	58.6	60	Up to the standard	46.3	50	Up to the standard
17		1m outside of north-side site	57.7	60	Up to the standard	47.6	50	Up to the standard
18	Qiliqiao Road Passenger Transport Center + Bus Transfer Hub	1m outside of east-side site	57.2	70	Up to the standard	52.7	55	Up to the standard
19		1m outside of south-side site	56.4	60	Up to the standard	46.4	50	Up to the standard
20		1m outside of west-side site	56.3	60	Up to the standard	47.2	50	Up to the standard
21		1m outside of north-side site	58.2	70	Up to the standard	50.3	55	Up to the standard
22	Road Passenger Transport Center at High-speed Railway Station + Bus Transfer Hub	Proposed site	46.2	60	Up to the standard	44.7	50	Up to the standard

2) Monitoring of attenuation cross-section

Please refer to Table 4-3-10 for details of arrangement of attenuation cross-sections

Table 4-3-10 List of Monitoring Points at Attenuation Cross-sections

No.	Point location		Remark
1	Taibai Road	North of Passenger Transport Center Station	Set noise attenuation cross-sections at west side of Taibai Road, with distances of 20m, 40m, 60m, 80m and 100m to center line of the road respectively.
2	Biyun Road	North of Shilipu	Set noise attenuation cross-sections at north side of Biyun Road, with distances of 20m, 40m, 60m, 80m and 100m to center line of the road respectively.

3	Jiefang Avenue	West of Linyu Huadu Building	Set noise attenuation cross-sections at south side of Jiefang Avenue, with distances of 20m, 40m, 60m, 80m and 100m to center line of the road respectively.
4	Jinqiu Avenue	South of Kaixuan City	Set noise attenuation cross-sections at east side of Jinqiu Avenue, with distances of 20m, 40m, 60m, 80m and 100m to center line of the road respectively.
5	Yinxing Avenue	West of Xugang Community	Set noise attenuation cross-sections at north side of Yinxing Avenue, with distances of 20m, 40m, 60m, 80m and 100m to center line of the road respectively.

Monitoring results of attenuation cross-sections are shown in Table 4-3-11.

Table 4-3-11 Noise Statistical Table of Attenuation Cross-sections Unit: dB (A)

Monitoring point			Monitoring result (dB (A))				
			20m	40m	60m	80m	100m
Taibai Road	North of Passenger Transport Center Station North of Shilipu	Daytime	69.4	63.6	58.1	52.1	45.3
		Nighttime	63.2	58.3	52.4	49.2	47.4
Biyun Road	West of Linyu Huadu Building South of Kaixuan City	Daytime	67.6	63.5	59.8	54.8	51.5
		Nighttime	58.9	54.6	50.9	48.0	43.8
Jiefang Avenue	West of Xugang Community North of Passenger Transport Center Station	Daytime	67.2	64.5	57.2	53.2	50.6
		Nighttime	58.4	54.9	51.2	47.0	43.8
Jinqiu Avenue	North of Shilipu West of Linyu Huadu Building	Daytime	65.4	62.0	57.2	54.4	54.2
		Nighttime	57.4	53.5	48.9	45.0	42.5
Yinxing Avenue	South of Kaixuan City	Daytime	63.8	63.0	61.8	60.8	59.3
		Nighttime	55.6	51.2	49.1	46.5	45.3

4.3.3.2 Evaluation and analysis of current situation of acoustic environment

It can be known from monitoring results of above table that:

①Sensitive points at both sides of Taibai Road, Biyun Road, Jiefang Avenue and Jinqiu Avenue are intensive, which are very near to existing roads and severely affected by exiting roads. Existing traffic noise of most of first-row sensitive points facing roads can meet class-4a standards in GB3096-2008 *Environmental Quality Standard for Noise* during daytime. However, the value during nighttime obviously exceeds the standard (standard scope for nighttime is 0.6~8.2dB (A). In which, the most serious point is near to Haocheng Jiayuan Building on Taibai Road.

②There are many sensitive points at both sides of Yinxing Avenue, apart from that the nearest place-residence of Shitang Community and Anlu Supervision Center have the phenomenon of exceeding standard, acoustic environment of other sensitive points can meet class-2 standards in GB3096-2008 *Environmental Quality Standard for Noise*.

③Acoustic environment of sensitive points far away from roads (Shimiao Community, Xugang Community, Shili Primary School and Shili Middle School, etc.) is slightly affected by traffic noise of roads. Its monitoring values can up to the standard and satisfy class-2 standards in GB3096-2008 *Environmental Quality Standard for Noise*.

④Monitoring results of attenuation cross-sections show that: under the condition of free of block and reflecting action of buildings on both sides of roads, acoustic environment quality during daytime and nighttime of places with distance of 60m outside of road red line of Taibai Road can basically meet class-4a standards in GB3096-2008 *Environmental Quality Standard for Noise* and acoustic environment quality during daytime and nighttime of places with distance of 80m outside of road red line can basically meet class-2 standards in GB3096-2008 *Environmental Quality Standard for Noise*; acoustic environment quality during daytime and nighttime of places with distance of 40m outside of road red line of Biyun Road can basically meet class-4a standards in GB3096-2008 *Environmental Quality Standard for Noise* and acoustic environment quality during daytime and nighttime of places with distance of 65m outside of road red line can basically meet class-2 standards in GB3096-2008 *Environmental Quality Standard for Noise*; acoustic environment quality during daytime and nighttime of places with distance of 40m outside of road red line of Jiefang Avenue can basically meet class-4a standards in GB3096-2008 *Environmental Quality Standard for Noise* and acoustic environment quality during daytime and nighttime of places with distance of 68m outside of road red line can basically meet class-2 standards in GB3096-2008 *Environmental Quality Standard for Noise*; acoustic environment quality during daytime and nighttime of places with distance of 40m outside of road red line of Jinqiu Avenue can basically meet class-4a standards in GB3096-2008 *Environmental Quality Standard for Noise* and acoustic environment quality during daytime and nighttime of places with distance of 60m outside of road red line can basically meet class-2 standards in GB3096-2008 *Environmental Quality Standard for Noise*; acoustic environment quality during daytime and nighttime of places with distance of 40m outside of road red line of Yinxing Avenue can basically meet class-4a standards in GB3096-2008 *Environmental Quality Standard for Noise* and acoustic environment quality during daytime and nighttime of places with distance of 65m outside of road red line can basically meet class-2 standards in GB3096-2008 *Environmental Quality Standard for Noise*.

⑤Public transport hub and station within urban area to be reconstructed are affected by traffic noise and passenger flow noise during daytime and there is phenomenon of exceeding the standard; however, acoustic environment during nighttime is better. Sites of Road Passenger Transport Center at High-speed Railway Station + Bus Transfer Hub to be newly built have not been developed, where there mainly are farmland with fine acoustic environment quality.

⑥Analyzed reasons for noise out of standard: residential points at both sides of existing roads within the area along the line are concentrated; overmuch of social vehicles cause traffic jam; frequent emergency brake, whistle and other situations enlarge noise; at the same time, some road sections have many vehicles for construction and muck as they are in real estate development and, thus large noise is produced. In addition, roads within the urban area are intersected vertically and horizontally and sensitive points around roads are severely affected by cumulated road noise.

In conclusion, reconstruction and expansion roads of the Project and bus stations are located at urban area and urbanization of surrounding areas is high; thus they are greatly affected by traffic noise and social life noise and partial points cannot meet corresponding provisions in GB3096-2008 *Environmental Quality Standard for Noise*. Newly built roads and proposed sites of Road Passenger Transport Center at High-speed Railway Station + Bus Transfer Hub are under small-scale development and are not affected by traffic noise of roads; these places have fine acoustic environment quality and can meet class-2 standards in GB3096-2008 *Environmental Quality Standard for Noise*.

4.4 Current situation and evaluation of eco-environmental quality

Anlu belongs to the zone of transition from mid-subtropical-broad-leaved evergreen forest to north subtropical deciduous broad-leaved forest. Areas along the project basically are farmland and urban environment, which belong to typical agro-ecological system and urban ecological system.

Plant resources within the area include cultivated plants and wild plants; in which, cultivated plants include tree species to be planted on roads of cities and towns, tree species for timber forest and crop species; wild plants include arbor, shrub and herbaceous plant.

Tree species to be planed on roads of villages mainly are camphor tree, metasequoia (artificial cultivation), osmanthus tree, weeping cypress, platanus acerifolia and so on; tree specie for timber forest mainly is masson pine; crop species include oilseed rape and paddy, etc.

Common wild tree plants are weeping willow, Chinese tallow tree, locust tree, melia azedarach and others; common suffruticosa plants are broussonetia kazinoki, vitex negundo, felon herb and others; herbaceous plants are bermuda grass, hispid arthraxon and cogon, etc.

①Natural vegetation

Wild arbors, such as weeping willow, Chinese tallow tree, locust tree and melia azedarach, etc., are widely distributed in evaluation region, but most of them are in scattered form and few of them form scale.

Cogon grasses, broussonetia kazinoki grasses and bermuda grasses and other grass grow on slope wasteland and ridges along the line.

Cogon grasses-most of them form monodominant community, with a small quantity of hispid arthraxon and cyperaceae plants.

Broussonetia kazinoki grasses-most of them form monodominant community, with a small quantity of yellow vitex chinensis mill and other shrub and herbaceous plants occasionally.

Bermuda grasses-they are in massive continuous, with a small quantity of felon herbs generally.

②Cultivated vegetation

Cultivated vegetations include masson pine, platanus acerifolia, camphor tree and crop vegetation, etc. There are crop vegetations growing on surrounding ground of regional villages, including main crop products of food crop, industrial crop and other products (vegetables and fruits). Food crop mainly includes wheat, corn, soybean, potato and others; industrial crop mainly includes rape, tea, cotton, peanut, melon and fruit, etc.

Vegetation type of the area where the Project is located mainly includes regional typical agricultural vegetation, artificially cultivated aquatic vegetation, evergreen coniferous forest and nursery of young plants; there are certain areas of lobule broussonetia papyrifera, dryland willow, humulus japonicus and other plants form into miscellaneous shrub forest and scrub grassland at both sides of roads and channels.

For vegetation type in the evaluation region, except above-mentioned small patch of forests or woods, most areas have plots of croplands. Cropland is the most typical ecosystem type in the region, which fits with the situation that the region is located at low-mountain plain, with main economic type of agriculture. Crops planted in the region are common species of Hubei Province, including more than 10 species, such as rice, wheat, cotton, rape, tea and all kinds of vegetables, melons and fruits. In recent years, owing to the drive of economy, many farmers had planted plots of economic trees, sods and flowers and pieces of artificially cultivated evergreen broad-leaved forest had been formed.

No ancient and rare tree species under protection are found in the evaluation region.

In general, vegetations of the evaluation region are much simple and coenosium species are simple. It is related to local geographical characteristics (terrain of most areas is flat and there are small quantity of small mountains) and main economic type of agriculture in the region.

(2) Animals of the region

Except animals fed by household, there are several kinds of terrestrial wildlife animals in the evaluation region. No terrestrial wild vertebrates and local endemic species under national key protection are found there.

4.5 Major environmental problems

According to monitoring and investigation results of current situation of environment, indicators of SO_2, NO_2, PM_{10} and CO within construction area of the Project can meet requirements of class-II standards in *Ambient Air Quality Standard* (3095-2012). If $PM_{2.5}$ is included in the scope of monitoring and evaluation, the results may be different. Current situation of water environment quality of Yuxiuge Section of Fu River is good and all indicators for water quality monitoring conform to limit requirements of class-III standards in *Environmental Quality Standard for Surface Water* (GB3838-2002). Among monitoring indicators of Jiefangshan Section of Fu River, apart from that dissolved oxygen is up to limit requirements of class-II standards in *Environmental Quality Standard for Surface Water* (GB3838-2002), other indicators exceed the standard; standard-exceeding of water quality is mainly related to Fu River's acceptance of large amount of domestic sewage, industrial wastewater and agricultural non-point source pollution. Reconstruction and expansion roads of the Project and bus stations are located at urban area and urbanization of surrounding areas is high; thus they are greatly affected by traffic noise and social life noise and partial points cannot meet corresponding provisions in GB3096-2008 *Environmental Quality Standard for Noise*. Newly built roads and proposed sites of Road Passenger Transport Center at High-speed Railway Station + Bus Transfer Hub are under small-scale development and are not affected by traffic noise of roads; these places have fine acoustic environment quality and can meet class-2 standards in GB3096-2008 *Environmental Quality Standard for Noise*.

5. Forecast and Evaluation of Environmental Impact

5.1 Analysis of environmental impact during construction period

According to above introduction, Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan-Urban Transport Infrastructure Subproject in Anlu, Xiaogan is divided into five sub-divisional works; in which, involved civil work and construction contents may producing environmental impact are mainly concentrated in integrated traffic corridor and road network perfecting engineering and supporting facilities engineering of public transport system. The evaluation focuses on the two aspects of sub-divisional works.

Project construction involves 7 roads, including 4.49km of expanded roads, 20.36km reconstructed roads and 4.29km of newly built roads. In which, there are four reconstructed roads. **Reconstruction engineering includes additional asphalt pavement on road surface of partial sections, additional construction of guardrail, perfection of drainage system, greening and road traffic safety facilities and so on;** there are three roads under such construction, namely Biyun Road (Yunshui Road-New G316), Jiefang Avenue (Fuhe Avenue-Jinqiu Avenue) and Jinqiu Avenue (Yinxing Avenue-Biyun Road). **Reconstruction engineering** of Taibai Road (Yinxing Avenue-Jiangxia Avenue) is construction of road traffic safety facilities.

Expanded road-Yinxing Avenue (Fucheng Avenue-New G316) is located at Hexi Outer Ring. According to future traffic demands, **the road is** expanded according to 40m of red line on the base of exiting section width and **reconstructed into urban secondary main road.**

Two newly built roads: ①Zhanqian Road (Three Bridges Connection Line-Anjin (Anlu-Beijing) Line) is located at the west of urban area and connects Anlu West Station for intercity railway from Wuhan to Shiyan (passing through Xiangyang), with total length of 2.10km and width of red line of 40m; ②Fucheng Avenue (Yinxing Avenue-Jiefang Avenue) is located at the west of Hankou-Danjiangkou Railway in the north of urban area, with total length of 2.19km and width of red line of 40m. Construction contents of new roads include road engineering, water supply and drainage engineering, traffic safety engineering, landscape engineering, illuminating engineering and other engineering but exclude ancillary works of service area and toll station.

The subproject includes construction of 6 bus transfer hubs (including 3 bus transfer hubs, 1 small bus arrival-departure hub and 2 bus transfer hub + road passenger transport center) and intellectual bus system (including bus dispatch, passenger information service and e-card system) of 194 buses.

Please refer to Section 2.2 for introduction to current situation of all roads of the Project and the evaluation will not give unnecessary details. We separately analyzed the impact of engineering to surrounding environment during construction period from aspects of atmosphere, surface water, acoustic environment, solid waste and ecology.

5.1.1 Analysis of atmospheric environmental impact

Important construction material-concrete required by proposed project is outsourcing commercial concrete and there is no concrete mixing station set in the construction area.

Air pollution sources during construction period include earth-rock excavation and backfilling, demolition of existing buildings, loading and unloading of sands and soil and flying dust generated during transportation; asphalt fume generated from road surface pavement and exhaust gas discharged by construction machinery and transport vehicles powered by fuel.

(1) Flying dust generated from earth-rock excavation and demolition of exiting buildings

In earlier stage of construction, site demolition and earth-rock excavation shall be conducted according to design requirements. These processes will damage the original earth surface and turn it into bare land. In the case of sunny day, surface water is evaporated, soil turns into dry and soft particles and then the earth surface becomes loose. When the wind is large, flying dust will be generated. A part of dust flies in the air and the other part of dust falls on nearby ground and building surface with wind. Influence of flying dust can continue 30min, thus it is the main factor to cause urban ambient air pollution.

Loose particles generated from earth-rock excavation and storage yard of sands and stones are pollution sources of flying dust; in the process of materials loading, unloading and transportation, secondary flying dust will proceed to affect ambient air quality of both sides of roads and roads. According to above factors analysis of ambient air quality, secondary flying dust generated in the process of transportation is related to degree of cleanliness of road surface and driving speed. Under the same degree of cleanliness of roads, higher driving speed will cause larger quantity of flying dust; under the same driving speed, more dirt retention on roads surface will cause larger quantity of flying dust.

Daily average concentration values of TSP in the air with different distances to down wind of construction site and concentration change of TSP after watering of construction site are shown in Table 5-1-1.

Table 5-1-1 Table of Concentration Change of TSP in the Air of Construction Site

Distance to down wind (m)	10	20	30	40	50	Standard value of daily average concentration of TSP is 0.3mg/m^3.
Concentration of TSP before watering (mg/m^3)	1.75	1.30	0.780	0.365	0.345	
Concentration of TSP after watering (mg/m^3)	0.437	0.350	0.310	0.265	0.250	

It can be seen from Table 5-1-1 that: if no any protective measures are taken, concentration of TSP at down wind of construction site is rapidly decreased when the distance is increase, and then the concentration is basically in stable value at the distance about 40m. When its scope of influence is evaluated according to class-II standards of *Ambient Air Quality Standard* (GB3095-2012) (daily average concentration of TSP is 0.3mg/m^3), the result is that it can meet the standard only at these places outside 50m.

Watering of construction site plays a very obvious role in restraining the generation of TSP at construction site. At place with distance about 35m to down wind, daily average concentration of TSP has been decreased below standard value. It shows that, suitable watering of construction site can ensure its degree of wetness and is beneficial to restrain the generation of flying dust at construction site, so as to effectively relieve the influence on surrounding environment.

(2) Secondary flying dust generated in the process of loading, unloading and transportation of construction materials

Processes of loading, unloading and transportation of construction materials almost are basic parts during the period of construction. Most of raw and auxiliary materials and outsourcing soils are transported from the nearest place, thus improper protection in the process of transportation will generate flying dust, so as to affect ambient air quality of both sides of roads and roads. Flying dust generated from vehicles travel can be divided into wind-force flying dust and power-drive flying dust according to reasons of dusting. In which, wind-force flying dust is mainly generated from floating dust on exposed road surface under the conditions of dry weather and strong wind; power-drive flying dust is mainly generated by external force in the process of loading and unloading.

In order to decrease the influence of flying dust of construction site and vehicle transportation on surrounding environment, Development Organization, Design Organization and Construction Organization shall earnestly do well at protection of air pollution during construction period according to relevant provisions and requirements.

(3) Exhaust gas generated from asphalt pavement

The project adopts commercial asphalt and asphalt fume during construction mainly comes from asphalt pavement curing. During pavement, asphalt shall be compacted by road roller and placed for 10min for natural cooling firstly. When temperature of asphalt mixture is cooled below 82℃,asphalt fume will be obviously decreased. When the asphalt is basically solidified, asphalt fume will be gone.

(4) Tail gas of construction vehicle

Exhaust gas discharged by construction machinery and transportation vehicles powered by fuel oil will increase total emission of atmospheric pollutant of local ambient air. As relevant management departments have enhanced the management degree of motor vehicles exhaust gas and Construction Organization have strengthened maintenance management of construction machinery and equipment in recent years, exhaust gas discharged by construction machinery and vehicles will not pollute surrounding environment.

5.1.2 Analysis of environmental impact on surface water

Influence on surrounding water environment during construction period of the Project mainly includes influence of construction wastewater and domestic sewage. Protection of surface water environment shall be conducted according to requirements of *Water and Soil Conservation Pla*n.

(1) Construction wastewater

Construction site of the Project has no maintenance site and machines shall be uniformly repaired at professional maintenance station. Construction wastewater mainly includes wastewater from machinery and vehicle cleaning, wastewater from road maintenance and drainage water from construction site washing.

Exit and entrance to construction site on generally roads shall be constructed with satisfactory vehicle washing and clean-keeping facilities. Vehicles going in and out of the construction site must be cleaned by washing and clean-keeping facilities before being driven away from the construction site. Vehicles carrying with mud and muck are not allowed to be driven on the road. According to actual investigation and analogy analysis, machinery and vehicles on roads to be washed each day is calculated by 100 sets per time; average water consumption for washing each vehicle is calculated by 60L per time; washing water is calculated by 80% of the drainage quantity; daily drainage quantity of wastewater for washing machinery and vehicles is about 6t. Generally, such wastewater contains SS 1000-5000mg/L of pollutant concentration, including 25mg/L of petroleum pollutant.

Partial existing roads of the Project have been constructed with rain and sewage pipe network. Wastewater for washing machinery and vehicles on these roads will be discharged into municipal sewage pipe network after treatment in oil-separating tank and neutralization sedimentation tank. Construction wastewater of other roads will be discharged into nearby water body when it reaches the standard level after treatment in oil-separating tank and neutralization sedimentation tank.

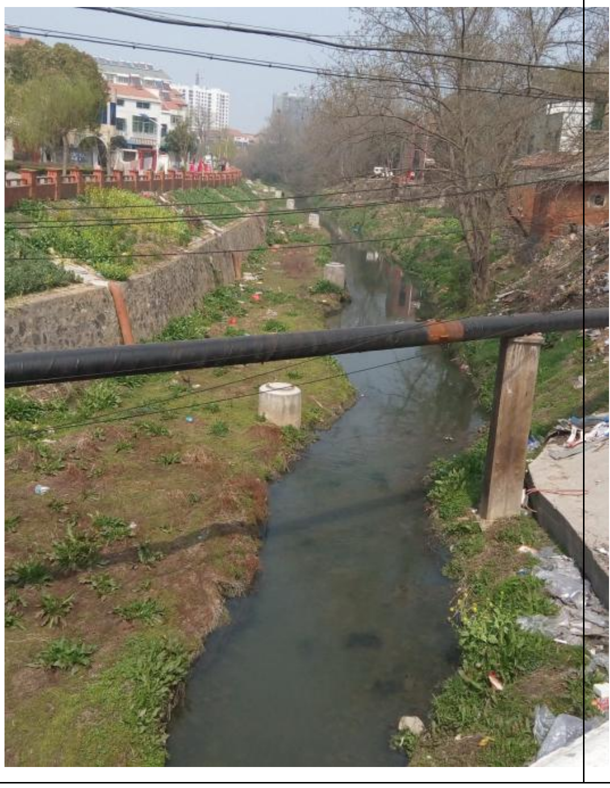
(2) Domestic wastewater

During project construction period, constructors will produce a certain quantity of domestic wastewater. According to similar engineering data, about 400 constructs will be there during construction peak period, and calculating water consumption as 120L/person per day and calculating emission factor of domestic wastewater as 0.85, maximum production of domestic wastewater is 41m^3/d, while concentration of specific pollutants in wastewater is: COD350mg/L, ammonia nitrogen 50mg/L. In combination with social environment characteristics along the line of the Project, both office-use houses and houses in living area will adopt temporary renting of surrounding existing houses and domestic wastewater so produced will be discharged through municipal pipes.

Considering that present stage is for feasibility study and that office-use houses and renting in living area remain undetermined, renting housing estate situated within the area and already established with sewage pipe network shall be taken into consideration when selecting office-use houses and living area in later period.

(3) Analysis of impact on rivers

Three wading bridges are involved in the Project (Mao River Bridge crossing Mao River on Taibai Road, **Bridge crossing Chaishanhe on Jiefang Road and** reconstruction project on Jinqiu Road crossing Mao River Bridge). Mao River and Qili River belongs to urban landscape and facilitate municipal drainage as well, which are greatly affected by urban life and manual work. They are manually reconstructed and are not natural habitats. The current situation pictures of Mao River and Qili River are as follows:



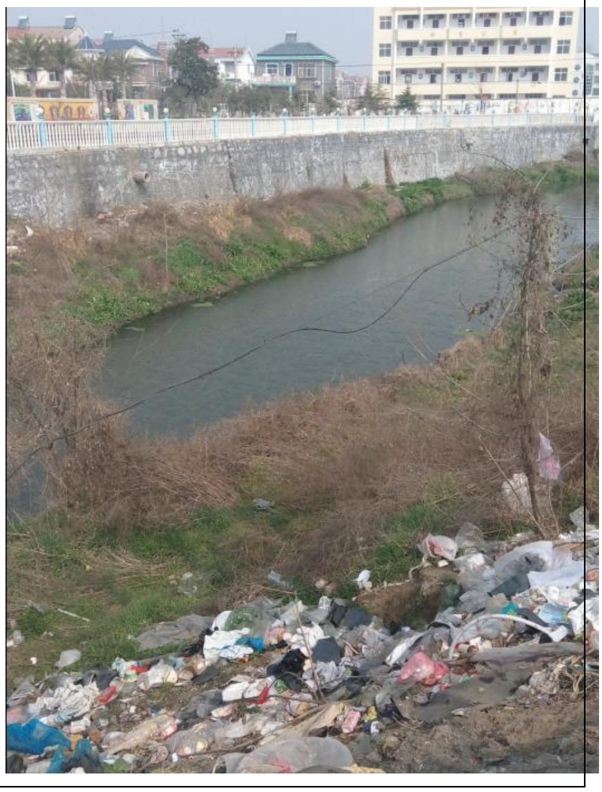


Fig 5-1-2-1 Current Situation Picture of Mao River Fig 5-1-2-2 Current Situation Picture of Qili River

To minimize the impact of bridge construction on water quality of **Qili River** (construction of Mao River Bridge crossing Mao River on Taibai road is pavement reconstruction, having no influence on Mao River). Try best to carry out pile foundation construction in dry season and to adopt circulating cast-in-situ bored pile for construction technology which makes cycle use of mud to reduce mud discharge and reduce mud to enter into water body by combination with construction technology of cofferdam. According to analysis of analogical data, cofferdam construction will be adopted and increase of SS shall not exceed 50mg/l for areas out of the scope of 50m within lower course of construction area, having no pollution on water quality of water areas out of scope within

100m of lower course. Sediment cleared through excavation of pile foundation shall be delivered to earth spoil site nearby promptly for stacking in order to prevent second time pollution on water environment caused by its arbitrary inpouring into water body.

Another main source of water quality pollution is oil running, leaking or dripping of machines which cause the increase of oils in the water; therefore, equipment shall be well maintained to eradicate pollution caused by industrial oils。

Meanwhile, in combination with water conservation scheme of the Work, reasonable measures can be adopted for adjacent places of rivers to minimize impact on surrounding rivers caused by project construction:

a. Stacking site for construction materials including pitch, oil fuel and chemicals shall be established away from rivers and water bodies.

b. During the construction process, in order to reduce the impact of engineering construction on nearby traffic and residents, PVC project enclosure with the height of not less than 2.4m shall be set up around the areas which need to be rebuilt and extended.

Fig. 5-1-2-3 Photo of Temporary Enclosure Boards for Similar Engineering

c. At road segments adjacent to rivers, it is adoptable to use waterproof cloth to cover exposed roadbed surface for rainy season in order to prevent rainfall runoff creating washout on road surface as well as to minimize the impact on rivers.

Water quality pollution caused by bridge construction is temporary and main reverse impact on water source is temporarily caused by partial elevation of suspended solids in water body. Such impact will no longer exist as the work is completed.

5.1.3 Analysis of impact on acoustic environment

5.1.3.1 Noise of construction machines

(1) Pollution source of noise of construction machines and its characteristics

There are many construction machines to be put into use for construction of proposed project as well as many transport vehicles and the construction activity will have certain influence on acoustic environment of areas along the line of the Project.

Main noise sources during road construction stage come from construction noise of construction machines and radiation noise of transport vehicles. These noises are temporary. However, construction period of the Project is long and there are many construction machineries while construction machineries are generally featured by high noise and irregularity. In combination with features of the Project, construction process is divided mainly into foundation construction, road construction and construction of transport, landscape and illumination works.

①Foundation construction: mainly including foundation treatment, foundation roadbed leveling, earthwork excavation and filling (including pipelines) and pavement compaction and other construction processes. These constructions come with a large number of material delivery vehicles arriving and leaving the construction site. Construction machinery of this stage mainly includes loaders, vibrating loaders, and earthmovers, land levelers, drilling machines, pile drivers and other construction machineries.

②Pavement construction: mainly including pitch paving on pavement or bridge floor. Construction machinery mainly includes large-scale pitch pavers.

③Construction of transport, landscape and illumination works: mainly to improve signs and marked lines on roads and to carry out road greening, road illumination construction; whereas it is unlikely to use large-scale construction machines during this stage and most of them are separately distributed, and some work is dominated by manual work, thus creating less noise impact.

Noise during construction period mainly comes from construction machines which produce most of the equipment noise along with vehicles for construction transportation, and the former mainly constitutes excavators, earthmovers, road rollers, agitators and loaders, etc.

(2) Forecast technique

Approximate noise during construction period can be calculated according to point acoustic source, and calculation formula is as follows:

$$L_{Ap} = L_{P0} - 20 \cdot \lg \frac{r}{r_0} - L_c$$ （Formula 5-1-1）

Where: L_{AP}——Sound level A of acoustic source at forecast position (r m from acoustic source), dB;

L_{p0}——Sound level A of acoustic source at forecast position (r0 m from reference source), dB;

L_c——Amendment of sound level, as confirmed in HJ2.4-2009 *Technical Guidelines for Noise Impact Assessment* and HJ/T17247.2-1998 *Acoustics—Attenuation of sound during propagation outdoors--Part 2: General method of calculation*, including decrement of air absorption and ground reflection and absorption which are detailed as follows:

$Lc=\alpha/100\cdot(r-r_0)+5\cdot\lg(r/r_0)$ (Formula 5-1-2)

A is air absorption coefficient per hectometer.

For simultaneous operation of more than one piece of equipment, sound level shall be calculated in accordance with the following formula:

$$L_{总} = 10\log\sum_{i=1}^{N} 10^{Li/10}$$ （Formula5-1-3）

Where: L_{total}——total sound level through superposition, dB;

L_i——sound level of the i sound source.

(3) Forecast result

How noise of single construction machinery or vehicle attenuates is shown in Table 5-1-2.

Table 5-1-2 Forecast Results of Main Construction Mechanical Noise Unit: dB(A)

No.	Distance from construction site / Type of machine	5	10	20	40	60	80	100	150	200	300
1	Wheel loader	90	84	78	72	69	66	65	61	58	55
2	Land leveler	90	84	78	72	69	66	65	61	58	55
3	Vibrating road roller	86	80	74	68	65	62	61	57	54	51

4	Bi-wheel bi-vibrating road roller	81	75	69	63	60	57	55	52	49	46
5	Tri-wheel road roller	81	75	69	63	60	57	55	52	49	46
6	Pneumatic tyre road roller	76	70	64	58	55	52	50	47	44	41
7	Earthmover	86	80	74	68	65	62	61	57	54	51
8	Rubber-tyred hydraulic excavator	84	76	73	71	69	61	57	54	51	49
9	Generator set (2)	84	78	72	66	63	60	59	55	52	49
10	Impact-type well drill	73	67	61	55	52	49	47	44	41	38
11	Crushing machine	100	94	87	79	75	70	67	64	60	57

Note: Noise level at the distance of 5m is actual measured value

(4) Impact analysis

Emission Standard of Environment Noise for Boundary of Construction Site shall apply for noise during construction period (GB12523-2011).

Through calculation in Table 5-1-2, when single machine operates, noise of all single machine such as earthmover, excavator and loader at 60m from sound source can be in conformity to standard as sound level no higher than 70dB(A) at boundary of construction site during day time. To achieve a sound level no higher than 55dB (A) as required for night time, construction equipment shall be 200m or more from sound source. Construction noise of crusher has the most sever impact, requiring a distance of 80m from sound source during day time and such distance should be greater than 300m from sound source to meet the requirement of 70dB(A) during day time and 55dB (A) during night time.

During actual construction process, diversified machines work together frequently and with mutual superposition of radiation from various noise sources, noise level would be higher with larger radiation scope. Rules of superposition value of multiple machinery noises at boundary of construction site are shown in Table 5-1-3.

Table 5-1-3 Rules of Superposition Value of Multiple Machinery Noises at Boundary of Construction Site

Quantity of construction machinery (set)	1	2	3	4	5	6	7	8	9	10
△LdB(A)	0	3	4.7	6	7.0	7.8	8.5	9.0	9.5	10

When 10 pieces of construction equipment operate within the site simultaneously, noise value at boundary of the site will increase by 10dB compared to such value when single construction equipment operates (A). On the one hand, mobility of construction machinery may cause distance from noise source close to boundary of construction site at some time frame; on the other hand, due to variation of mechanical equipment combination during each stage of building construction, the extent of impact by noise radiation can be different. The abovementioned situations ultimately result in the difficulty to meet requirements on limiting value *Emission Standard of Environment Noise for Boundary of Construction Site*.

Seen from field investigation, a number of sensitive spot spread intensively at both sides of the Project including residents, hospitals and schools. Daytime and nighttime construction will disturb normal life and rest for abovementioned dwelling sites, especially noise during nighttime will cause even greater interference which requires corresponding protective and management measures.

As completion of the work, impact by construction noise will no longer exists and adverse impact on environment by construction noise is temporary and short-term.

5.3.1.2 Noise of transport and traffic

During transport process of construction materials and construction spoils of the Project, noise of transport vehicles will impact noise-sensitive points along the sides of transport roads. Construction materials to be transported mainly constitute commercial concrete, steels, timbers, etc.

As indicated by analogical test, sound level at places 7.5m, 10m and 30m from loading vehicles is 82-88dB(A), 79-85dB(A) and 72-78dB(A) respectively. When transport vehicles passing by, living areas within 50m of places along the line will be effected in a larger extent.

5.1.4 Aanalysis of impact of solid waste

Solid waste during construction period of the Project mainly constitutes abandoned earthwork and household refuse of constructors.

(1) Abandoned earthwork

Earthwork of the Project constitutes temporary earthwork and permanent earthwork.

For the Project, during excavation and backfilling of water drainage works, there exists earthwork to be temporarily stacked, and earthwork of some rod line mobilization works requires to be temporarily stacked. The Project is designed with temporary earth stacking site along the road and establish such sites for all the areas where pipe network requires to be reconstructed and areas to be remolded as well as areas of rod line mobilization, and earthwork shall be stacked nearby at one side of pipelines. As the work belongs to road and station yard works, excavation of earthwork exists along the whole line, construction organization shall, during actual construction process, optimize scheme of earth stacking site setting and enforce management on reduction of impact of temporary earth stacking during construction period on surroundings:

①During the construction process, in order to reduce the impact of engineering construction on nearby traffic and residents, PVC project enclosure with the height of not less than 2.4m shall be set up around the areas which need to be rebuilt and extended. Keep construction area within these enclosures clean, and assign specific persons to take charge of clean-keeping at the construction site to make sure watering and cleaning is promptly carried out to reduce dust-raise. Stacking earth and stacking materials shall not occupy areas surrounding the red line.

②Make reasonable planning for earth stacking site according to quantity of temporary earth stacking to reduce the number of temporary earth stacking site. Try best to locate earth stacking site in the center of the enclosure where there will be less vehicles and machines pass througth during construction period to reduce disturbance on earth stacking site caused by construction machines.

③Waterproof cloth shall be adopted to creat temprary cover on the mould surface according to the duration of such mould.

According to Report of Water and Soil Conservation Scheme and according to earthwork balance of the works, total excavation quantity of the work is 933,800 m^3, and 684,200m^3 backfilling and 186,400 out-borrowed earthwork and 436,100 m^3 to be abandoned, of which 249,600 m^3 to be abandoned permanently, mainly including road excavation surplus within land occupation area and boring mud of bridge pier foundation which can be delivered to temporary earth stacking site and then be utilized for backfilling of other surrounding projects lacking earth; 186,500 to be abandoned temporarily, mainly including topsoil stripping earthwork which can be used for earthing and backfilling of green belt in later period.

According to earthwork balance, the permanent waste slag required by the Project is 249,600 m^3 in total. There are 12 waste disposal areas altogether, namely that is slope areas for waste and channel areas for waste, occupying an area of 1,409 m^2 that belongs to spare land. Refer to Fig.5-1-4-1.

Fig. 5-1-4-1 Current Situation Picture of Anlu Waste Disposal Area

Under Water and Soil Conservation Scheme of the Project, such measures as slag walls are to be first applied in the lower reaches of the waste disposal area before waste piles up on the area to prevent the loss of waste slag. Meanwhile, masonry intercepting drains are to be built on the top edge of the waste disposal area in line with the hillside to lead water catchment on the slope to the lower reaches of the waste area channel, keeping the water catchment from entering into the waste disposal area. At the same time, topsoil in the area should be stripped first before waste piling, which is to be stacked in the upper waste disposal area.

While stacking waste, first pile rocks and then earth for the soil eveness after stacking completion. In the process of waste filling, waste slag expands backwards layer by layer (0.5-0.6m thick of each layer) from the feet of earth-rataining wall. When slag reaches highest, roughly level the slag to faciliate improvement and utilization of covering soil. Because terrain relief in the Project area is not intensive, the height of slag is within 3m with side slope gradient of 1:2.

After the waste stacking completion, promptly carry out the land reclamation of the waste disposal area and recover vegetation , or conduct second ploughing according to the land use type of orignal waste disposal area.

Erosion and torrent control works of the waste disposal area are as follows:

①Engineering measures

a. Topsoil stripping and restoration

Before waste entering the area, all topsoil in the waste disposal area should be first stripped with an stripping thickness of about 30cm. The stripped topsoil are to be stacked in the upper waste disposal area with a stacking height of below 2m and a stacking side slope of 1:2. After waste slag is filled in, level the slag and restore the topsoil back.

b.Blocking works

Presssure on Earth-retaining wall generally includes its dead weight, soil pressure, water pressure and uplift pressure. To prevent permeable slag body from destroying the stablization of wall body, d=50mm plastic pipes are preburied in the wall body as round drain holes of which the shape is plum flower of 3m×2m size and outward dipping is 5%. They are 1.5m higher than the ground; surrounding the hole ports inside the wall are gravels of which the diameter is 2.5-7cm.

c. Intercepting drains

Masonry intercepting drains are applied to the waste disposal area in the Project. The side slope of intercepting drain design adpots trapezoidal cross-section of 1:0.5. Masonry is laid for the first time with a thickness of 30cm and intercepting drains are 20m safely higher. The adoption standards and the applied formula are stated as above.

②Vegetation measure

On the basis of field survey and the site conditions in the Project area, trees and grass that are suitable for the Project area are pinus massoniana, arborvitae, acacia, amorpha fruticosa, etc. in terms of trees and bermuda grass, whitetip clover, eremochloa ophiurbides, etc. in terms of grass.

③Provisional measures

These measures mainly include clearing topsoil on the waste disposal area that are to be stacked in the upper waste disposal area and adoption of soil wall and rain proof cover.

(2) Construction waste

All housing demolitions of the Project are demolitions within land used for the work; total area of buildings to be removed is 18214.33 square meters, producing 820 thousand m^3 construction wastes. Construction wastes of the Project will undergo uniform organization and distribution by Urban Management Department for regional balance, while unavailable parts will be delivered to site designated by Urban Management Department for digestion and absorption.

(3) Household waste of constructors

Maximum quantity of household wastes during construction period is approximately 0.4t/d when calculating household wastes of constructors as 1.0kg/person·d and taking the number of constructors during the peak as 400. Household wastes of constructors will be delivered to Environmental Sanitation Department for disposal after being collected and won’t have evident influence on surrounding environment.

5.1.5 Impact analysis of water and soil loss

Man-made water and soil loss is inevitable for engineering construction. Main reasons for water and soil loss during construction period are as follows:

①The Project shows characteristics of urban water and soil loss. The Project is located at urban area of Anlu City where the water and soil loss is comparatively less and urban water and soil loss does not only take place on earth’s surface but also beneath it, co-constituting three-dimensional system of urban water and soil loss. Remold of the Project basically takes place based on existing roads to improve traffic situation, therefore comprehensive pipelines beneath roadway will be influenced.

②The Project is linear and accordingly the water and soil loss will be characterized by linear distribution and improper projections will result in large quantity water and soil loss.

Prevention measures for soil and water loss is proposed in the Evaluation on the basis of *Scheme of Water and Soil Conservation*: produce system of comprehensive water and soil loss prevention measures of reasonable layout and complete functions by combining construction characteristics, construction layout and the generated water and soil loss impact and prevention targets as well as in respect of layouy of water and soil loss prevention measures, applying engineering measures and plant measures under guidance of construction measures; measures including constructing and building drainage ditch and sand basin on construction working surface and both sides of it in combination with engineering construction to reduce the scour of direct surface runoff; adopt temporary protective measures such as water drainage, cover and block for roads, water drainage works and temporary earth stacking site in order to achieve effect “line-based” control on water and soil loss. Form a “plane-based” prevention by taking measures including land reclamation and cultivation of water-conserving woods and grasses as well as landscaping for newly exposed earth surface. The goal to protect earth surface, improve ecological environment, prevent water and soil loss and realize the role of ornament and long-term effective of plant measures is so achieved through this three-dimensional comprehensive prevention system by organic integration and interaction of point-based, line-based and plane-based prevention measures.

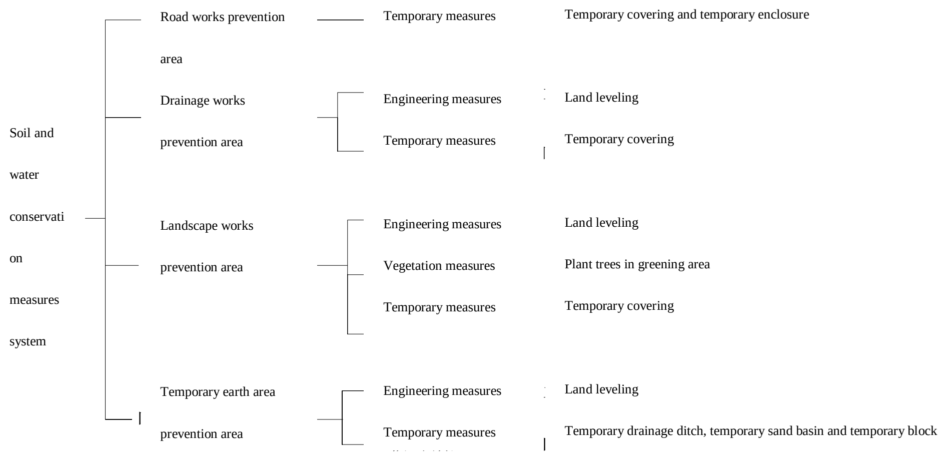


Figure 5-1-2 Overall Layout of Soil and Water Conservation Measures

1) Measure layout for road works prevention area:

The road works part of the works should be improved in accordance with primary and auxiliary separate section. Improve sidewalk at the same time and set up independent bicycle lanes. Due to insufficient consideration of main works design on temporary protective measures for road, the plan will be improved to effectively reduce soil and water loss caused by engineering construction. Specific design is as follows:

①Temporary enclosure

During the construction process, in order to reduce the impact of engineering construction on nearby traffic and residents, PVC project enclosure with the height of not less than 2.4m, with stand column made of 120*120mm PVC pipes, steel lining of 100 * 100 mm and column spacing of 3.0 m shall be set up around the areas which need to be rebuilt and extended. Fix stand column and subgrade with expansion screws. Enclosure height (excluding basic part) shall be 2.0m, made of blue PVC buckle with thickness of 22mm*200mm, PVC pipe with both ends of 50*80mm, with steel lining inside and bottom seat with the height of 500mm. Adopt bricked enclosure with total height of 2.5m. Keep construction area inside the enclosure clean. Specially-assigned person shall be responsible for clean-keeping in construction site to promptly clean by watering and reduce dust.

Mounds of earth and mounds of material shall not occupy the nearby area outside red lines. The construction proceeds in sections with recycle of enclosure.

②Temporary drainage ditch and sand basins

Build temporary drainage ditch along the outside of widened road to collect water from construction area. Sand basins shall be positioned at intervals. Section of drainage ditch shall adopt rectangular brick drainage with bottom width of 30cm and depth of 30cm according to catchment area. Effluent of sand basins of 2.0m long, 1.0m wide and 1.0m deep shall be connected to existing municipal rainwater pipe network by drainage ditch.

③Temporary covering

During road reconstruction, waterproof cloth shall be adopted to cover surface of bare subgrade in the rainy season in case of road washout caused by rainfall runoff.

Overpasses shall adopt mobile mud pools, thus the plan no longer adds new mud pools.

2) Prevention measures layout for drainage works prevention area:

Drainage system structure for rain and sewage shall basically maintain the original one this time, with focus on reconstruction and extension for existing drainage pipelines which affect road works construction, improvement for pipes for rain and sewage along the road according to the system and so on.

3) Layout of landscape works prevention area:

Part of the green belt along the road shall be dismantled and changed into bicycle lanes in landscape works of the works. Reconstruct the green belt. All these measures have the function of soil and water conservation. The plan shall only add temporary protective measures during construction period.

(1) Engineering measures

Conduct land leveling for landscape works area before unified planning for greenery landscape. Retain existing vegetation as much as possible.

(2) Temporary measures

For areas failed to be laid with turf after earth covering, cover with waterproof cloth or plastic film temporarily in case of rain.

4) Temporary layout of prevention measures for earth field prevention area

According to balance of earthwork of the works, drainage works need temporary piling up of some earthwork. It’s suggested in the plan to pile up the earthwork of drainage works directly on the pipe ditch side.

(1) Engineering measures

Site cleaning and land leveling shall be carried out for temporary earth field as designed in the plan after completion of works construction.

(2) Temporary measures

Temporary block shall be built before piling up temporary mounds of earth along drainage works. The section size of block is 0.5m high, 0.5m wide at the bottom, with inner side slope 1:0.5 and outer side slope 1:1. Temporary drainage ditch shall be built on the side away from the drain, with trapezoidal section with bottom width of 30cm, depth of 30cm and excavation slope ratio of 1:1. Sand basins of 2.0m long, 1.0m wide and 1.0m deep shall be positioned at intervals. Since mounds of earth exist for a short time, waterproof cloth shall be adopted to directly cover the mounds of earth temporarily.

5.1.6 Analysis of ecological impact

5.1.6.1 Influences on animal and plant resources

(1) Influences on animals

After field investigation, the category and quantity of wild animal resources within evaluation scope of the Project are not abundant for intensification of urban construction activities. It is found that there are no places for breeding and inhabitation of wild rare animals and other special sensitive spots and no distribution of local endemic species, therefore the engineering construction has little influence on terrestrial animals.

With construction of the Project, large number of constructors are put in and the distribution of small beasts with grinding tooth will expand and the density in area with frequent human economic activities will increase. The contact frequency with humans and living materials will be increased and thouse mouses as propagating source of natural epidemic disease may have threats on the health of local residents.

After the Project enters operation period, direct influence of construction period on wild animals will be eliminated graduallyand the influce on terrestrail animals is mainly noise pollution caused by vehicle operating, which has little influence on survival of animals and quantity of population within evaluation scope.

(2) Influences on plant resources

Landscape design philosophy of the Project is to create a "concise ecological pergola" and create beautiful and comfortable road traffic environment by combining planting design with large green quantity and environment around the site.

Green space system plays an important role in integrity and stability of urban ecological process. It can improve and strengthen anti-jamming capacity of ecological system and make structure of urban landscape more reasonable, stable, make energy flow more smooth and make environment more quiet and elegant, thus reaching efficient and harmonious state. A certain restoration measure of plants is taken in the Project to reduce the influence on ecological structure and function within evaluation scope of engineering.

In dots, lines and faces consisting urban green space system and as framework of "line" and urban green space system, banding afforestation of road is critically significant. It can combine the urban green space as an entirety and make rationality of layout and effectiveness of afforestation directly influence rationality of urban green space system. Therefore, the Project shall strictly follow relevant requirements of planning in implementation process and make the most of road space in afforestation and make road space of engineering become a real green gallery under the premise of satisfying leading function of traffic.

Acording to design requirements, part of highway section in the Project shall have a road cross-section regulation and the main and subsidiary roads shall be separated among which the position of part of treelawn will be trasferred or be changed into subsidiary road and the project construction will have a certain influence on treelawn.

Acording to design requirements, road engineering will reduce external migration of nursery stock caused by road construction by taking maximum preservation of existing trees as the principle. At the same time, take preservation of existing conditions of border trees as the principal thing and for highway section with partial deficiency or damage, plant trees by referring to tree species and specifications along the line. Vegetaion along the line after reconstruction is similar to the current condition and it can highlight effects of landscape. The construction activities are mainly in existing scope of road and it will not have great influence on animals and plants resources along the line.

①Vehetation recovery principle

The road engineering reduces external migration of nursery stock caused by road construction by taking maximum preservation of existing trees as the principle. For the road engineering needs to meet traffic function and make the existing afforested arbor be migrated outside or chopped down, it is necessary to decide together with Party A and relevant administrative departments of garden through mutual negotiation. Based on principle of ecological environmental protection, every construction organization is required to choose trees and shrubs with fine growth conditions for existing trees that influence road construction and implement transplantation for reuse so as to effectively reduce investment cost in afforestation and realize rapid reafforestation of newly-built roads.

②Tree species selection

For species of plants along the road, give priority to species of plant that grows in local place and have orbamental value. Plant trees in propert place and attention shall be paid to aspect changes of plants. Take unification of landcape of existing trees and principle of economy into consideration and confirm that main species for afforestation of this road are mainly the following varieties.

Main tree species: camphor, goldenrain tree and platanus orientails;

Backbone tree species: magnolia grandflora, gingko, clump osmanthus fragrans, moor besom, crape myrtle, red maple, prunus lannesiana, red authumnal leaves and so on;

Main shrubs and ground cover: fatsia japonica, aucuba japonica variegata, photinia serrulata, French viburrnum odoratissimum, ligustrum japonicum, gardenia with large leaves, golden-edged Chinese littleaf box, nandina domestica, floribunda Roses, ophiopogon japonicus, iris techtorum, Maynilad and so on.

5.1.6.2 Influences on land resources along the line

The road is constructed according to the method of “main line + subsidiary road” and the engineering is basically arranged along the existing road and part of highway section is being expanded and newly constructed. The Project can basically maintain original land use pattern along the line of engineering without intensifying tension degree of land resources in area along the line; at the same time, after forestation measures were taken in the engineering, green land area along the line can be added, which is helpful to beautify environment along the line and improve overall image of the city.

5.1.7 Analysis of social environment influence

5.1.7.1 Influences on transportation

Coming in and out of construction vehicles, transportation of construction materials and other construction activities will cause obstruction to occupation of existing road and bring adverse effects on going out of residents along the line.

According to field investigation, there are residents, schools, official organizations at both sides of construction road. The road construction will have a certain influence on going out of surrounding residents. The development organization shall reasonably arrange construction period and try to reduce vehicles going out at peak season in rush hours so as to reduce influence on inconvenient going out of residents. Specific measures are as follows:

(1) The construction organization shall have a good public relation with the public and residents around construction site and create a harmonious construction environment. Before commencement of work, put up necessary announcement to illustrate conditions of engineering and interference that may be caused so as to acquire understanding and support of the public.

(2) To minimize the influence of engineering construction on lives of urban residents and urban transportation, unified arrangement and planning of vehicle line of road traffic during construction period shall be conducted to prevent traffic jam; at the same time, unified arrangement for vehicle line of construction machinery and transportation vehicle of construction shall be conducted and relevant restriction regulations shall be enacted to ensure smooth and normal operation of urban traffic. And make use of broadcast, television and newspaper to make announcement to calm urban residents down in advance. Set post of duty in construction section to disperse transportation and ensure safety of pedestrian.

(3) Set clear signs in highway section of entrance and exit of the Project to remind vehicles circumambulate properly.

(4) Try to shorten construction period under the premise of ensuring construction quality and construction shall be stopped during entrance examination for secondary school, college entrance examination and the other special dates.

(5) Measures to reduce influence on transportation

①Vehicle transportation system

During the period of road construction and influenced by the construction, traffic capacity of intersection may be reduced and it is suggested that citizens bypass when they pass regional road network and avoid passing by these intersections so as to reduce time delay.

During construction period, "semi-range construction" can be adopted to ensure bi-direction access of existing road. In view that the access space is also the only access way for construction vehicles, it is feasible that construction shortcut can be implemented outside for regional transport nodes and daytime access of construction vehicles shall be prohibited to avoid morning and evening peak time.

②Strengthen traffic management vigor during construction period of engineering

a Optimize and adjust regional transportation organization to reduce traffic pressure influencing road and strengthen traffic reconciliation capacity;

b Improve regional traffic facilities, strengthen traffic management and improve operation efficiency of existing road;

c Improve signal monitoring system at relevant intersections and improve traffic capacity of highway section at intersection;

d Establish contingency plan mechanism and give prompt response in case of emergency to reduce the influence on traffic;

e Establish special traffic reconciliation group, make up defects of management in different sections, make overall and dynamic management of the whole line and conduct regular check on potential traffic danger;

f Traffic police will strengthen police force and facility along the road and reinforce traffic management.

5.1.7.2 Traffic organization scheme during construction period

During construction period of highway section, the traffic organization is implemented in different sections to ensure bi-direction lane in construction section. It is feasible that construction shortcut can be implemented outside for regional transport nodes and daytime access of construction vehicles shall be prohibited to avoid morning and evening peak time. Propaganda shall be done well to guide transit vehicles to bypass through surrounding road network.

5.1.7.3 Land requisition and demolishing

If there are function changes of land used in demolishing and requisition of engineering, there will be a certain influence on life of residents, traffic, social economy and infrastructure.

Based on an investigation, two private graves in Jinquan Villiage within the range of the Project are found necessary to be removed. According to the investigation, the graves belong to the common villagers instead of historical relics and physical cultural resources, which is of no cultural and archaeological significance.

On the influences and measures of demolishing, refer to the details in *Inhabitants Resettlement Action Plan* of the Project. The assessment quotes some contents in it as follows:

According to investigation and understanding, 20 houses of residents in all on collectively-owned land of the Project need to be demolished, including 15 houses at Zhanqian Road, 14 houses belonging to Lilong Village and 1 house belonging to Jinquan Village. There are 3 houses on Fucheng Avenue and 2 houses on Yinxing Avenue among which 1 house in Jinquan Village and 2 houses on Yinxing Avenue being influenced are not houses for residents and there are only 17 houses demolished and located on collectively-owned land needing to be resettled.

The location of these 17 houses all belong to urban planning area. According to provisions of Ministry of Land and Resources and local regular practice, house site will not be arranged and they will be allowed to construct houses by their own. Agreement is reached after repeated negotiation, Management Office of the Project will provide two resettlement methods such as currency compensation and exchange of property right and families whose houses are levied will choose of their own accord.

Aimed at demolished houses, according to the World Bank's implementation policy for resettlement of involuntary immigrants and requirements of relevant national laws and regulations, the total target of World Bank loan and urban transportation and infrastructure project in Anlu are positioned in recovering as well as improving living standard and production of people who are influenced as soon as possible.

Resettlement and recovery of people who are influenced will be conducted in two aspects such as resettlement and recovery of life and production.

Resettlement and recovery of life are mainly house demolishing and recovery of supporting facility for living and they mainly include:

● Give currency compensation or provide resettlement houses for those with demolished house to ensure their housing quality and environment is no lower than the level before demolishing.

● In the new housing environment, people who are influenced are convenient to enjoy all kinds of supporting service of living facilities.

Resettlement and recovery of production are mainly employment arrangement of labor forces and reconstruction and recovery of production facilities and they include:

● Give reasonable compensation of levied land to ensure people who are influenced will not lose income source for land requisition.

● Provide production and employment help for people who are influenced to ensure long-term living of people who are influenced will not be influenced by land requisition of the Project.

● Enterprises who are influenced can recover production and business in the original or new address and the loss from suspension caused by demolishing is reasonably compensated.

Environmental impacts generated from demolishing of old buildings are mainly dust generated in demolishing, loading and unloading of construction waste, sprinkling and flying caused in process of piling up. The dust emission generated in demolishing of old buildings is related to the demolishing method and the demolishing methods of old buildings include blasting demolishing, manual demolishing, mechanical demolishing and so on. Buildings to be demolished involved in area of the Project are self-built buildings in 3 to 5 floors which can be demolished by machine and manpower. At the time of demolishing, watering can be conducted to reduce amount of dust and 80% dust emission can be reduced. For demolishing involved in the Project, it is suggested to take the following dust prevention measures.

①Construction signboard shall be set during demolishing period of building and dust cloth shall be set outside architectural structure coordinated with pressing and watering to restrain dust.

②In demolishing of building, place for depositing rubbish and muck shall beset and the rubbish and muck shall be cleared promptly. When the rubbish and muck are carried out of demolishing site, they shall be poured into appointed disposal place of rubbish in according to approved route and time. Household rubbish on demolishing site shall be stored airtight. Promptly concentrate on sorting, recycling and clearing of household rubbish and it is forbidden to pour and unload them arbitrarily.

③In building demolishing, specially-assigned person shall be arranged to be responsible for rubbish and muck on construction site and watering equipment shall be allocated to conduct regular watering and clearing. For demolishing of building, the muck shall be hoisted and carried by means of special channel or vessel and it is forbidden to throw them into sky.

④For vehicles to transport rubbish and muck, the height to load rubbish and muck shall not exceed the upper edge of ledge of vehicle. The vehicle hopper is covered by tarpaulin or airtight vehicle hopper and washes the body and wheel of vehicle clearly.

⑤If the construction cannot be carried out immediately after demolishing work, dust screen shall be used to cover the bare floor.

⑥During construction of blasting, it is forbidden for personnel who are not conducting blasting and vehicles stay on blasting site (relevant provisions shall be strictly performed within range of blasting site) and the provisions that other people can enter the site 20 minutes after blasting shall be strictly performed; to reduce quantity of smoke generated in blasting, blasting personnel shall humidify (by using special humidizer) dumping hole at the time of dumping explosive.

Requirements for land requisition and demolishing as well as resettlement

①Policies and regulations for land requisition and demolishing as well as resettlement

ⅰ*The Law of Land Administration of the People's Republic of China*, August 2004;

ⅱ*Regulation on the Implementation of the Land Administration Law of the Peoples Republic of China*, December 1998;

ⅲ *Management Ordinance for Land Management and Demolishing of the People's Republic of China*, June 1991;

ⅳ *Regulations on the Expropriation of Houses on State-owned Land and Compensation* (implemented on January 21, 2011);

②Land requisition and demolishing organization and institution

Land requisition and demolishing is broad system engineering with tedious and complicated work and whether the work is smooth or not directly influences progress of engineering. According to previous experience of similar engineering, development organization can make up special organization or entrust other organizations to be responsible for land requisition and demolishing of the Project.

③Principle of land requisition and demolishing as well as resettlement

Under the premise of not influencing engineering quality, try to lower range of land requisition and demolishing to the minimum degree. Under unavoidable conditions of demolishing, ensure living standard of people who are unwilling to remove is not lower than that before removing. For compensation for organizations and residents who are unwilling to remove, strictly follow relevant laws and regulations as well as policies and carry out principle of prompt compensation. For problems appearing in placement of people of land requisition and demolishing, properly and promptly settle them according to relevant laws and regulations as well as policies and no future trouble shall be left.

④Target of land requisition and demolishing as well as resettlement

Target of land requisition and demolishing: the demolishing and resettlement shall be implemented by combining urban development planning, general planning scheme of transformation of old city. And layout of urban construction becomes more reasonable by resettlement, which can drive regional economic development and construction of urban area.

⑤Compensation standard

In design of next stage, refine compensation standards for house demolishing and all kinds of subsidy expenses in accordance with provisions of relevant laws and regulations.

⑥Compensation measures

For organizations and residents involved in demolishing of the Project, give compensations for different categories of buildings and different demolished area according to relevant laws and regulations as well as measures above national and local levels and by combining practical situations.

i Give prompt and reasonable compensations for objects involved in demolishing in accordance with specified standards.

ii For urban residents may be influenced in demolishing in urban area, principle of exchange of property right and "compensate one house after demolishing one" can be adopted and return the house with corresponding area for people who are influenced. If the people who are influenced do not need a new house but hope to get cash, cash can be used as compensation according to price of resettlement. Besides, the combinative method of exchange of property right and compensation as price can be adopted. The people who are influenced will decide to adopt which method of their own accord.

iii For demolishing of housing of residents, the principle is to construct and then to demolish. If demolishing comes before construction, subsidy for house renting during transition period shall be paid. Moreover, expenses for housing moving shall also be paid.

iv Improve transparency of resettlement scheme for demolishing. In process of land requisition and demolishing as well as resettlement of inhabitants, the method of negotiation shall be reflected from beginning to the end so as to make people who are influenced know compensation standard for land requisition and demolishing, resettlement position and reconstruction method of house, removing time, resettlement method of personnel and so on. In settlement and evaluation of family assets, negotiation with people who are influenced shall be reinforced and written agreement shall be signed with them.

Reasonable compensation shall be given to engineering demolishing in accordance with the *Law of Land Administration of the People's Republic of China* and standards enacted by Hubei Province, policy of land requisition and demolishing, contents of compensation, compensation standards shall be publicized and agreements shall be signed fairly and openly to prevent forced demolishing; the house demolishing shall be informed to relocated house and local village committee 3 to 4 months before commencement of engineering to ensure the agricultural population have enough time to construct new houses on approved house site. Compensation expenses for demolishing shall be promptly paid with full amount. According to provisions in Article 30 of *Law of Land Administration of the People's Republic of China*, land compensation expenses and settlement fees for requisition of farmland cannot be used for other purposes except they are used as living subsidy for surplus labor force and unemployed people caused by production development and arrangement of land requisition. Unlawful acts of any organization or any person in land requisition and demolishing are infringement of national and public interests. Therefore, in implementation process, the judicial department, banks, audit department and new media have significant meaning for supervisions of these organizations.

5.1.7.4 Influences of construction activities on life quality of residents along the line

The Project is road engineering and the coming in and out of construction vehicles and the occupation of construction period on existing road will have short-term adverse effects on going out and normal life of residents along the line. At the same time, large numbers of material transport vehicles will lower life quality of residents around and the construction noise will influence rest of residents. Sewage in construction camps and construction site as well as discharge of household rubbish and production waste will have influence on water quality of rivers along the line and the civilization degree of construction staff may have influence on daily life of local residents. This kind of influence is mainly reflected in section of the line next to residential area.

Placing of material on construction site of the Project and excavation on construction site will make the city in a mess and influence urban landscape. Excavation and other activities in process of engineering construction may bring inconvenience to residents around.

5.1.7.5 Influences of construction activities on shops along the line

Most of construction contents of road in the Project are located in downtown of Anlu and there are many shops along the line of road. Therefore, during construction period, if closed management is conducted, it may have influences on business of shops along the line of road.

Every sub-item of the Project will be constructed in accordance with period of time of construction plan and the construction time of every highway section is relatively short. After the construction of highway section is completed, the segregation board will be dismantled, therefore, its influence on every shop is limited.

Developer and construction organizations of the Project shall have positive negotiation with owners of shops to acquire understanding, avoid disputes and reduce degree of adverse effects.

5.1.8 Overlapping influences

The construction period of the Project is 60 months, which lasts for relatively long. The construction of the Project continues in different periods of time and simultaneous construction of many construction sites is not in the plan. Therefore, subprojects of the Project have few influences on each other, hence no overlapping influences during the construction period. The potential overlapping influences exerted during the construction period mainly happen to the recent large infrastructure construction projects in Anlu city. According to a survey, a larger infrastructure construction project in Anlu city, “Five Roads and One Bridge” project, will make its appearance recently, which has been included in the construction plan but of which a specific construction scheme remains to be proposed.

If “Five Roads and One Bridge” project and the Project are constructed simultaneously on the same site, overlapping influences in the same sphere area on the construction site may arise, such as on the aspects of construction noise, fugitive dust, waste slag, traffic organization. Therefore, the Construction and Management Department should promptly coordinate the construction arrangements of the Project and “Five Roads and One Bridge” project so as to take precautions in advance and properly arrange the construction time and construction period of different construction sites, avoiding causing larger overlapping influences.

5.2 Environmental impact prediction and assessment in operation period

5.2.1 Atmospheric environmental impact analysis

Factors influencing ambient air of station are mainly cooking oil fume and gas, vehicle exhaust.

There are 6 stations designed in the Project and long-distance passenger station may be equipped with caterings. But specific scheme and scale are undecided. So we will put forward principle requirements rather than analyzing it in detail this time, namely setting of catering projects shall conform to related requirement of HJ554-2010 *Specification for Environmental Protection of Catering Trade*. Cooking oil fume emission shall reach standard requirement of GB18483-2001 *Emission Standard of Cooking Fume (Trial Implementation)*. Catering organizations shall handle approval formalities for environmental impact assessment separately before construction of catering projects.

Vehicle exhaust on the station contains CO, HC, NOx, SO2, black smoke and oil mist etc. Construction scale of stations in the Project is small and the distance between each other is long, so flue gas may not generate cumulated influence. In addition, construction area of the Project is located in plains with good atmospheric diffusion condition. Vehicle exhaust on the station will not result to significant influence after natural attenuation and diffusion. This assessment will not conduct quantitative analysis.

The assessment will analyze influences of motor vehicle exhaust on atmospheric environment outside during road operation period.

Motor vehicle exhaust pollution is mainly related to traffic flow and motor vehicle quality. The assessment adopts ADMS model recommended by HJ2.2-2008 *Guideline for Environmental Impact Assessment Atmospheric Environment* to predict influences of motor vehicle exhaust on ambient air during operation period.

5.2.1.1 Prediction assessment content

(1) Prediction method

Adopt ADMS model recommended by *Guideline for Environmental Impact Assessment Atmospheric Environment* (HJ2.2-2008) to predict.

ADMS can stimulate concentration distribution of discharged pollution in short (hour average, day average) and long period (year average) such as point source, surface source, line source and body source and it is suitable for village or urban area, simple or complex terrain. The model takes building downwash, wet deposition, gravity setting, dry deposition and chemical reactions into consideration. Chemical reaction model consists of reaction among nitric oxide, nitrogen dioxide and ozone.

(2) Typical condition selection principle

①For calculation of hour average mass concentration, long-term meteorological condition shall be used to calculate hour by hour or time by time. Take hour meteorological condition with worst pollution (aimed at all calculation points) and several hour meteorological conditions which influences ambient air protection object most (decided by influence degree on ambient air sensitive area) as typical hour meteorological condition.

②For calculation of daily average mass concentration, long-term meteorological condition shall be used to calculate day by day. Take day meteorological condition with worst pollution (aimed at all calculation points) and several day meteorological conditions which influences ambient air protection object most (decided by influence degree on ambient air sensitive area) as typical day meteorological condition.

(3) Prediction content

According to features of the pollutant in the Project and requirement of atmosphere guideline, as well as meteorological features of pollution in the area, day-by-day and hour-by-hour methods shall be used to predict atmospheric environmental impact. Prediction contents are as follows:

①Maximum hour concentration distribution;

②Maximum day concentration distribution;

③Year average concentration distribution.

(4) Predictive factors

Select main pollutant discharge factors of motor vehicle exhaust as predictive factors as the Project: CO and NO_2. Discharge of NO_2 is calculated according to NO_x proportion. Q（NO_2）/Q（NO_x）=0.9

◆Prediction time bucket

Impact of the Project on atmosphere increases along enlargement of vehicle amount (tail gas discharge increases). At the same time, impact of tail gas on surrounding environment is small in initial phase during project operation according to preliminary prediction. The assessment considers environment disadvantages and set prediction time bucket in year 2030.

◆Assessment criterion

The Project is located in Anlu City. Project location and perimeter zone shall implement second standard of *Ambient Air Quality Standard* (GB3095-2012) in terms of ambient air according to Letter of Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan – Executive Standard for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan from Anlu World Bank Loan Project Management Office of Anlu Environmental Protection Administration.

Table 5-2-1 Assessment Criterion　Unit: mg/m^3

Pollutant	Average value of hour	Daily average value	Yearly average value
NO_2	0.20	0.08	0.04
CO	10	4	-

◆Prediction scope

Predict pollutant concentration within 200m at the downwind direction of road shoulder according to road air pollutant features.

◆Predictive parameters

Check source strength according to traffic flow condition in peak hour of the Project and take it as the predicted source strength. See Table 3-2-5 for details.

◆Prediction object

Predict hour and daily maximum concentration and long-term annual average concentration of pollutant grid point and environment-sensitive target within the scope. The assessment will generalize the project computation domain and divide the grid according to air prediction scope. Relative coordinates of ambient air sensitive targets can be seen in Table 5-2-2 according to generalization results of computational domain.

Table 5-2-2 Relative Coordinates of Ambient Air Sensitive Targets

No.	Name	Geographical coordinates (m)	
		X	Y
1	Taihe Villa	470757.5	463224.4
2	Jintai Community	470880.5	462647.6
3	Fengda International City	471109.3	461573.4
4	Delin Garden	471094.8	461339.2
5	Anlu Secondary Vocational School	471158.3	461275.7
6	Pu Ai Hospital	471163.3	460460.8
7	Jingang Garden	471106.4	460147.3
8	An’er Homeland	471161.9	459681.6
9	Anlu Second Middle School	471099.8	459583.7
10	Haocheng Jiayuan Building	471131.5	458957.9
11	Sili Community	470168.4	457452.5
12	Zhongyi Community	470224.0	456957.7
13	Jiahe Garden	469043.9	459874.7
14	Anlu Municipal Government	469717.3	459653.8
15	Fudong Community	470561.3	459405.1
16	Anlu Bureau of Civil Affairs	471550.9	459126.0
17	Shili Primary School	472136.9	458820.4
18	Dapeng Village	472451.8	458813.8
19	Yuanlin Jiayuan Building	469432.6	461283.6
20	De’an Garden	469980.8	461296.3
21	Shuanglongqiao Community	470255.9	461332.3
22	Anlu Science and Technology Bureau	470601.0	461395.8
23	Linyu Huadu Building	471672.0	461304.8
24	Zhongye Huafu Building	471855.6	461675.2
25	Fenghai Tiancheng Building	471751.9	460881.4

26	Jinqiu Yuyuan Building	471823.9	460815.8
27	Zhou's New Bay	471709.1	459643.7
28	Chuyue Community	471756.7	459265.9
29	Shimiao Village	470124.7	463244.2
30	Qiliqiao Middle School	470507.3	463339.4
31	Xugang Community	471978.9	463633.1
32	Shitang Community	473471.2	463899.8
33	Zhaohe Village	469467.5	463045.8
34	Lvjiafan	469618.3	462450.4
35	Huguo Village	470083.4	461701.1
36	Lilong Village	466900.5	460771.9
37	Jinquan Village	466909.0	458784.4

5.2.1.2 Prediction results and assessment

(1) Impact of pollutant on the area and environmental protection targets under typical hour meteorological conditions

①Impact of NO_2 on the area and environmental protection targets

● Maximum hour average NO_2 concentration on the ground in the area

Maximum hour average NO_2 concentration on the ground in the area happens at 6:00, March 28. Maximum hour average concentration on the ground is 0.0588 mg/m^3. It happens in (471087.2，461472.3) and the point is located in the middle part of road network, intersection between Taibai Avenue and Jiefang Avenue. Maximum hour NO_2 concentration in the area conforms to limiting value of Class II standard specified in Ambient Air Quality Standard (GB3095-2012).

●Sensitive target hour concentration

Prediction concentration of sensitive targets is described in Table 5-2-3.

Table 5-2-3 NO_2 Hour Prediction Concentration of each Sensitive Point

No.	Name of sensitive point	Predicted value (mg/m^3)	Concentration threshold (mg/m^3)	Pmax(%)	Superscale (%)
1	Taihe Villa		0.2		0
2	Jintai Community		0.2		0
3	Fengda International City		0.2		0
4	Delin Garden		0.2		0
5	Anlu Secondary Vocational School		0.2		0
6	Pu Ai Hospital		0.2		0
7	Jingang Garden		0.2		0
8	An'er Homeland		0.2		0
9	Anlu Second Middle School		0.2		0

10	Haocheng Jiayuan Building		0.2		0
11	Sili Community		0.2		0
12	Zhongyi Community		0.2		0
13	Jiahe Garden		0.2		0
14	Anlu Municipal Government		0.2		0
15	Fudong Community		0.2		0
16	Anlu Bureau of Civil Affairs		0.2		0
17	Shili Primary School		0.2		0
18	Dapeng Village		0.2		0
19	Yuanlin Jiayuan Building		0.2		0
20	De'an Garden		0.2		0
21	Shuanglongqiao Community		0.2		0
22	Anlu Science and Technology Bureau		0.2		0
23	Linyu Huadu Building		0.2		0
24	Zhongye Huafu Building		0.2		0
25	Fenghai Tiancheng Building		0.2		0
26	Jinqiu Yuyuan Building		0.2		0
27	Zhou's New Bay		0.2		0
28	Chuyue Community		0.2		0
29	Shimiao Village		0.2		0
30	Qiliqiao Middle School		0.2		0
31	Xugang Community		0.2		0
32	Shitang Community		0.2		0
33	Zhaohe Village		0.2		0
34	Lvjiafan		0.2		0
35	Huguo Village		0.2		0
36	Lilong Village		0.2		0
37	Jinquan Village		0.2		0

The table shows that maximum hour NO_2 concentration of each sensitive point is lower than 0.2mg/m^3, limiting value for second standard of Ambient Air Quality Standard (GB3095-2012).

Intersection between Taibai Avenue and Jiefang Avenue has the maximum hour NO_2 concentration according to the prediction. High concentration exhaust gas of the Project is mainly near road axis. Concentration of sensitive point is only within 10.1% of standard value. As traffic flow change is not huge before and after reconstruction of the Project, hour concentration of NO_2 in the area will remain the present status after reconstruction.

②Impact of CO on the area and environmental protection targets

●Maximum hour average CO concentration on the ground in the area

Maximum hour average CO concentration on the ground in the area happens at 6:00, March 28. Maximum hour average concentration on the ground is 0.3185 mg/m^3. It happens in (471087.2，461472.3) and the point is located in the middle part of road network, intersection between Taibai Avenue and Jiefang Avenue. Maximum hour CO concentration in the area conforms to limiting value of Class II standard specified in Ambient Air Quality Standard (GB3095-2012).

● Hour concentration of sensitive target

Sensitive target prediction concentration is described in Table 5-2-4.

Table 5-2-4 CO Hour Prediction Concentration of each Sensitive Point

No.	Name of sensitive point	Predicted value (mg/m^3)	Concentration threshold (mg/m^3)	Pmax (%)	Superscale (%)
1	Taihe Villa		10		0
2	Jintai Community		10		0
3	Fengda International City		10		0
4	Delin Garden		10		0
5	Anlu Secondary Vocational School		10		0
6	Pu Ai Hospital		10		0
7	Jingang Garden		10		0
8	An’er Homeland		10		0
9	Anlu Second Middle School		10		0
10	Haocheng Jiayuan Building		10		0
11	Sili Community		10		0
12	Zhongyi Community		10		0
13	Jiahe Garden		10		0
14	Anlu Municipal Government		10		0
15	Fudong Community		10		0
16	AnluBureau of Civil Affairs		10		0
17	Shili Primary School		10		0
18	Dapeng Village		10		0
19	Yuanlin Jiayuan Building		10		0
20	De’an Garden		10		0
21	Shuanglongqiao Community		10		0
22	Anlu Science and Technology Bureau		10		0
23	Linyu Huadu Building		10		0
24	Zhongye Huafu Building		10		0
25	Fenghai Tiancheng Building		10		0
26	Jinqiu Yuyuan Building		10		0
27	Zhou’s New Bay		10		0
28	Chuyue Community		10		0

29	Shimiao Village		10		0
30	Qiliqiao Middle School		10		0
31	Xugang Community		10		0
32	Shitang Community		10		0
33	Zhaohe Village		10		0
34	Lvjiafan		10		0
35	Huguo Village		10		0
36	Lilong Village		10		0
37	Jinquan Village		10		0

The table shows that maximum hour CO concentration of each sensitive point is lower than 10mg/m^3, limiting value for second standard of Ambient Air Quality Standard (GB3095-2012).

(2) Impact of pollutant on the area and environmental protection targets under typical daily meteorological conditions

①Impact of NO_2 on the area and environmental protection targets

●Maximum daily average NO_2 concentration on the ground in the area

Maximum daily average NO_2 concentration on the ground in the area happens on October 20. Maximum hour average concentration on the ground is 0.0564 mg/m^3. It happens in (471087.2，461472.3) and the point is located in middle part of road network, intersection between Taibai Avenue and Jiefang Avenue.

● Daily average concentration of sensitive target

Sensitive target prediction concentration is described in Table 5-2-5.

Table 5-2-5 Daily Average Prediction NO_2 Concentration of each Sensitive Point

No.	Name of sensitive point	Predicted value (mg/m^3)	Concentration threshold (mg/m^3)	Pmax (%)	Superscale (%)
1	Taihe Villa		0.08		0
2	Jintai Community		0.08		0
3	Fengda International City		0.08		0
4	Delin Garden		0.08		0
5	Anlu Secondary Vocational School		0.08		0
6	Pu Ai Hospital		0.08		0
7	Jingang Garden		0.08		0
8	An’er Homeland		0.08		0
9	Anlu Second Middle School		0.08		0
10	Haocheng Jiayuan Building		0.08		0
11	Sili Community		0.08		0
12	Zhongyi Community		0.08		0

13	Jiahe Garden		0.08		0
14	Anlu Municipal Government		0.08		0
15	Fudong Community		0.08		0
16	Anlu Bureau of Civil Affairs		0.08		0
17	Shili Primary School		0.08		0
18	Dapeng Village		0.08		0
19	Yuanlin Jiayuan Building		0.08		0
20	De’an Garden		0.08		0
21	Shuanglongqiao Community		0.08		0
22	Anlu Science and Technology Bureau		0.08		0
23	Linyu Huadu Building		0.08		0
24	Zhongye Huafu Building		0.08		0
25	Fenghai Tiancheng Building		0.08		0
26	Jinqiu Yuyuan Building		0.08		0
27	Zhou’s New Bay		0.08		0
28	Chuyue Community		0.08		0
29	Shimiao Village		0.08		0
30	Qiliqiao Middle School		0.08		0
31	Xugang Community		0.08		0
32	Shitang Community		0.08		0
33	Zhaohe Village		0.08		0
34	Lvjiafan		0.08		0
35	Huguo Village		0.08		0
36	Lilong Village		0.08		0
37	Jinquan Village		0.08		0

The table shows that maximum daily NO_2 concentration of each sensitive point is lower than 0.08mg/m^3, limiting value for second standard of Ambient Air Quality Standard (GB3095-2012).

NO_2 concentration at sensitive point is only within 18% of standard value according to the prediction. As traffic flow change is not huge before and after reconstruction of the Project, daily average concentration of NO_2 in the area will remain the present status after reconstruction.

②Impact of CO on the area and environmental protection targets

●Maximum daily average CO concentration on the ground in the area

Maximum daily average CO concentration on the ground in the area happens on October 20. Maximum daily average concentration on the ground is 0.3061 mg/m^3. The position is in (471087.2，461472.3) and the point is located in the middle part of road network, intersection between Taibai Avenue and Jiefang Avenue . Maximum daily CO concentration in the area conforms to limiting value of Class II standard specified in Ambient Air Quality Standard (GB3095-2012).

● Daily average concentration of sensitive target

Predicted concentration of sensitive point is described in Table 5-2-6.

Table 5-2-6 Daily Average Predicted CO Concentration of each Sensitive Point

No.	Name of sensitive point	Predicted value (mg/m^3)	Concentration threshold (mg/m^3)	Pmax(%)	Superscale (%)
1	Taihe Villa		4		0
2	Jintai Community		4		0
3	Fengda International City		4		0
4	Delin Garden		4		0
5	Anlu Secondary Vocational School		4		0
6	Pu Ai Hospital		4		0
7	Jingang Garden		4		0
8	An’er Homeland		4		0
9	Anlu Second Middle School		4		0
10	Haocheng Jiayuan Building		4		0
11	Sili Community		4		0
12	Zhongyi Community		4		0
13	Jiahe Garden		4		0
14	Anlu Municipal Government		4		0
15	Fudong Community		4		0
16	Anlu Bureau of Civil Affairs		4		0
17	Shili Primary School		4		0
18	Dapeng Village		4		0
19	Yuanlin Jiayuan Building		4		0
20	De’an Garden		4		0
21	Shuanglongqiao Community		4		0
22	Anlu Science and Technology Bureau		4		0
23	Linyu Huadu Building		4		0
24	Zhongye Huafu Building		4		0
25	Fenghai Tiancheng Building		4		0
26	Jinqiu Yuyuan Building		4		0
27	Zhou’s New Bay		4		0
28	Chuyue Community		4		0
29	Shimiao Village		4		0
30	Qiliqiao Middle School		4		0
31	Xugang Community		4		0
32	Shitang Community		4		0

33	Zhaohe Village		4		0
34	Lvjiafan		4		0
35	Huguo Village		4		0
36	Lilong Village		4		0
37	Jinquan Village		4		0

The table shows that CO concentration of each sensitive point is lower than 4mg/m^3, limiting value for second standard of Ambient Air Quality Standard (GB3095-2012).

(3) Impact of pollutant on the environment under long-term meteorological conditions

①Impact of NO_2 on the area and environmental protection targets

●Maximum annual average concentration on the ground

Maximum annual average concentration for NO_2 on the ground is 0.0286mg/m^3 and it appears in (471087.2, 461472.3). The point is located in the intersection between Taibai Avenue and Jiefang Avenue.

● Annual average concentration of sensitive target

Predicted concentration of sensitive target is described in Table 5-2-7.

Table 5-2-7 Annual Average Predicted NO_2 Concentration of each Sensitive Point

No.	Name of sensitive point	Predicted value (mg/m^3)	Concentration threshold (mg/m^3)	Pmax(%)	Superscale (%)
1	Taihe Villa		0.04		0
2	Jintai Community		0.04		0
3	Fengda International City		0.04		0
4	Delin Garden		0.04		0
5	Anlu Secondary Vocational School		0.04		0
6	Pu Ai Hospital		0.04		0
7	Jingang Garden		0.04		0
8	An’er Homeland		0.04		0
9	Anlu Second Middle School		0.04		0
10	Haocheng Jiayuan Building		0.04		0
11	Sili Community		0.04		0
12	Zhongyi Community		0.04		0
13	Jiahe Garden		0.04		0
14	Anlu Municipal Government		0.04		0
15	Fudong Community		0.04		0
16	Anlu Bureau of Civil Affairs		0.04		0
17	Shili Primary School		0.04		0
18	Dapeng Village		0.04		0
19	Yuanlin Jiayuan Building		0.04		0

20	De’an Garden		0.04		0
21	Shuanglongqiao Community		0.04		0
22	Anlu Science and Technology Bureau		0.04		0
23	Linyu Huadu Building		0.04		0
24	Zhongye Huafu Building		0.04		0
25	Fenghai Tiancheng		0.04		0
26	Jinqiu Yuyuan Building		0.04		0
27	Zhou’s New Bay		0.04		0
28	Chuyue Community		0.04		0
29	Shimiao Village		0.04		0
30	Qiliqiao Middle School		0.04		0
31	Xugang Community		0.04		0
32	Shitang Community		0.04		0
33	Zhaohe Village		0.04		0
34	Lvjiafan		0.04		0
35	Huguo Village		0.04		0
36	Lilong Village		0.04		0
37	Jinquan Village		0.04		0

The table shows that annual average NO_2 concentration of each sensitive point is lower than 0.04mg/m^3, limiting value for second standard of Ambient Air Quality Standard (GB3095-2012).

②Impact of CO on the area and environmental protection targets

●Maximum annual average CO concentration on the ground in the area

Maximum annual average concentration for CO on the ground is 0.1552mg/m^3 and it appears in (471087.2, 461472.3). The point is located in the middle of road network, intersection between Taibai Avenue and Jiefang Avenue.

● Annual average concentration of sensitive target

Predicted concentration of sensitive target is described in Table 5-2-8.

Table 5-2-8 Annual Average Predicted CO Concentration of each Sensitive Point

No.	Name of sensitive point	Predicted value (mg/m^3)
1	Taihe Villa	
2	Jintai Community	
3	Fengda International City	
4	Delin Garden	
5	Anlu Secondary Vocational School	
6	Pu Ai Hospital	
7	Jingang Garden	
8	An’er Homeland	

9	Anlu Second Middle School	
10	Haocheng Jiayuan Building	
11	Sili Community	
12	Zhongyi Community	
13	Jiahe Garden	
14	Anlu Municipal Government	
15	Fudong Community	
16	Anlu Bureau of Civil Affairs	
17	Shili Primary School	
18	Dapeng Village	
19	Yuanlin Jiayuan Building	
20	De’an Garden	
21	Shuanglongqiao Community	
22	Anlu Science and Technology Bureau	
23	Linyu Huadu Building	
24	Zhongye Huafu Building	
25	Fenghai Tiancheng Building	
26	Jinqiu Yuyuan Building	
27	Zhou’s New Bay	
28	Chuyue Community	
29	Shimiao Village	
30	Qiliqiao Middle School	
31	Xugang Community	
32	Shitang Community	
33	Zhaohe Village	
34	Lvjiafan	
35	Huguo Village	
36	Lilong Village	
37	Jinquan Village	

(5) Brief summary of prediction results

The assessment predicts impact of vehicle exhaust on ambient air during operation period of the Project (year 2030) through ADMS model recommended by *Guideline for Environmental Impact Assessment-Atmospheric Environment* (HT2.2-2008). It predicts impact of road pollutant on the area and environmental protection target under typical hour, daily and long-term meteorological conditions.

Prediction results show that high concentration exhaust gas of the Project is mainly near road axis. Concentration contribution value on sensitive points is lower than the corresponding standard value. As traffic flow change is not huge before and after reconstruction of the Project, exhaust gas concentration in the area will remain the present status after reconstruction.

To sum up, increment of maximum concentration of CO and NO_2 in the area is small during operation period of the Project and it also has small impact on ambient air quality along the line. With improvement of environmental protection laws and regulations and development of automobile industry, motor vehicle exhaust pollutant discharge will decrease. Therefore, impact of exhaust gas discharge on surrounding environmental during operation period of the Project is superior to above results.

5.2.2 Acoustic environmental impact analysis

Construction content of the Project contains 6 stations. Noises in station operation period are mainly traffic noises of passenger cars in passenger station or public traffic vehicles and noises of social activities (such as catering equipment and station broadcasting etc.). Strength of main noise source in the station during project operation period is 70~80 dB(A), which can reach requirement on acoustic environment functional zone according to noise of passenger transport (public transport) station field. Therefore, noise of project station has a small impact on the outside. **The assessment will analyse influences of road traffic noise on sensitive points along the line.**

5.2.2.1 Road traffic noise assessment method

Highway (road) traffic noise prediction mode in Appendix A of Technical Guidelines for Noise Impact Assessment (HJ 2.4-2009) is adopted.

5.2.2.2 Road traffic noise prediction mode

(1) Prediction mode

① Prediction mode for equivalent sound level of Class i vehicle

$$L_{eq}(h)_i = \overline{(L_{0E})}_i + 10\lg(\frac{N_i}{V_i T}) + 10\lg(\frac{7.5}{r}) + 10\lg[\frac{\psi_1+\psi_2}{\pi}] + \Delta L - 16$$

Where:

$L_{eq}(h)_i$ -Hour equivalent sound level of Class i vehicle. dB(A);

$\left(\overline{L_{0E}}\right)_i$ -Speed of Class i vehicle is V_i, km/h; Energy with horizontal distance of 7.5m is sound level A, dB(A);

N_i-Hour average traffic flow for Class i vehicle which passes certain prediction point in daytime and nighttime, vehicle/h;

r-distance between road axis to prediction point, m; It is applicable to noise prediction with r＞7.5m.

V_i -Average velocity speed of Class i vehicle, km/h;

T -Time for calculation of equivalent sound level, 1h;

Ψ_1、Ψ_2-Field angle and radian from prediction point to both ends of limited road section, as shown in Fig. 5-2-1.

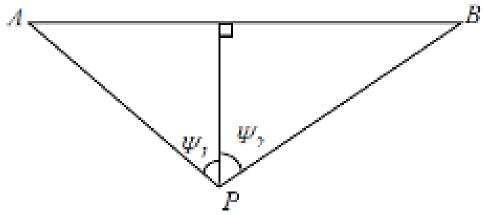


Fig. 5-2-1 Modified Function of Limited Road Section. A-B is Road Section and P is Prediction Point.

ΔL-correction due to other factors, dB(A); It can be calculated according to the following formula:

$\Delta L=\Delta L_1-\Delta L_2+\Delta L_3$

$\Delta L_1=\Delta L_{slope}+\Delta L_{pavement}$

$\Delta L_2=A_{atm}+A_{gr}+A_{bar}+A_{misc}$

Where:

ΔL_1-Correction due to line factors, dB(A);

ΔL_{slope}-Correction of highway longitudinal slope, dB(A);

$\Delta L_{pavement}$-Correction due to pavement material, dB(A);

ΔL_2-Attenuation in route of sound wave transmission, dB(A);

ΔL_3- correction due to reflection, dB(A)

②Equivalent sound level of total traffic flow is:

$$L_{eq}(T)=10\lg\left(10^{0.1L_{eq}(h)_{\mathrm{H}}}+10^{0.1L_{eq}(h)_{\mathrm{M}}}10^{0.1L_{eq}(h)_{\mathrm{L}}}\right)$$

If certain prediction point is influenced by traffic noise of several lines (for example, prediction point near viaduct is influenced by many lanes on and under the bridge. High-rise building prediction point is influenced by many lanes on the ground), sound level of each lane on the prediction point shall be calculated respectively and then the results shall be added to gain the contribution value.

Where:

$L_{eq}(T)$-Hour equivalent sound level of total traffic flow, dB(A);

$L_{eq}(h)_H$、$L_{eq}(h)_M$、$L_{eq}(h)_L$ -Hour equivalent sound level of large, middle and small vehicles, dB(A).

(2) Calculation parameter

①Speed of motor vehicle:

Design speed for the principal line is 40-60km/h and for auxiliary road is 30-40km/h according to feasibility study report of the Project.

②Radiation noise level of single vehicle L_{oi}

Average radiation noise level (dB) L_{oi} of vehicles on reference point (at position of 7.5m) is calculated according to the following formula:

Small vehicle $L_{OS}=12.6+34.73LgVs+\Delta L_{pavement}$

Middle vehicle $L_{OM}=8.8+40.48lgV_M+\Delta L_{longitudinal\ slope}$

Large vehicle $L_{OL}=22.0+36.32lgV_L+\Delta L_{longitudinal\ slope}$

Where: label S, M, L on the lower right corner refers to small, middle and large vehicle.

V_i- average running speed of this type of vehicle, km/h

③Calculation of correction and attenuation

a) Correction (ΔL_1) due to line factors

◆Longitudinal slope correction (ΔL_{slope})

Traffic noise source strength correction △L longitudinal slope due to road longitudinal slope shall refer to values of Table 5-2-9.

Table 5-2-9 Corrected Value for Noise Level of Pavement Longitudinal Slope

Longitudinal slope β (%)	≤3	4-5	6-7	＞7
Corrected value [dB(A)]	0	+1	+3	+5

Notes: the table only corrects large and middle vehicles rather than small vehicles.

◆Pavement correction ($\Delta L_{pavement}$)

Noise correction for different pavements is described in Table 5-2-10.

Table 5-2-10 Noise Correction for Common Pavement

Pavement	$\Delta L_{pavement}$
Asphalt concrete pavement	0
Cement concrete pavement	+1~2

Notes: the table only corrects large and middle vehicles rather than small vehicles.

b) Attenuation in route of sound wave transmission (ΔL_2)

◆Barrier attenuation A_{bar}

i) Sound barrier attenuation (A_{bar})

Unlimited sound barrier can be calculated according to the following formula:

$$\mathrm{Abar} = \begin{cases} 10\times\lg\left(\dfrac{3\times\pi\times\sqrt{(1-t^2)}}{4\times\tan^{-1}\sqrt{\dfrac{(1-t)}{(1+t)}}}\right) & t=\dfrac{40f\delta}{3\mathrm{c}}\le 1 \quad dB \\ 10\times\lg\left(\dfrac{3\times\pi\times\sqrt{(t^2-1)}}{2\times\ln(t+\sqrt{(t^2-1)})}\right) & t=\dfrac{40f\delta}{3\mathrm{c}}>1 \quad dB \end{cases}$$

Where:

f-frequency of sound wave, HZ;

δ-sound path difference, m;

c-sound speed, m/s.

Calculation of limited sound barrier:

A_{bar} is still calculated according to unlimited sound barrier attenuation formula and then it shall be corrected according to Fig. 5-2-2. Corrected A_{bar} depends on defilade angle β/θ.

Projection and reflection correction of sound barrier can be calculated according to HJ/T90.

Limited barrier

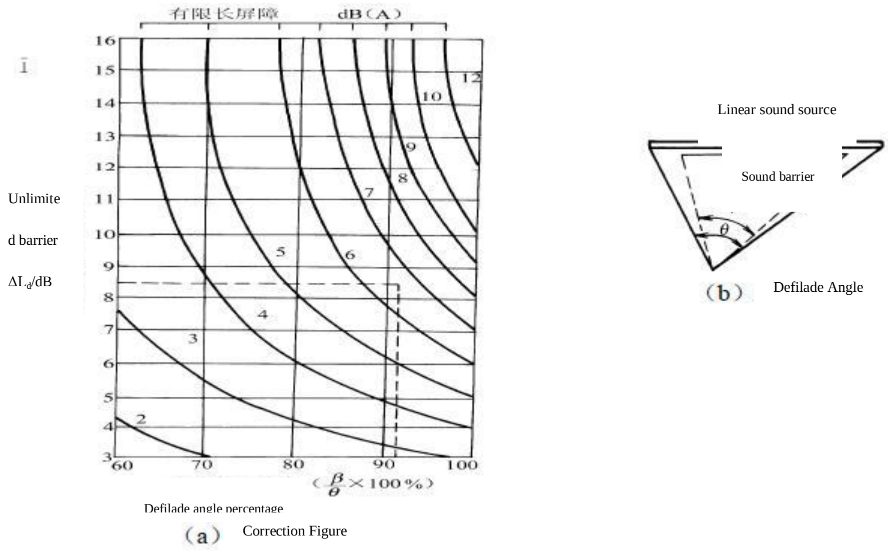


Fig. 5-2-2 Sound Barrier with Limited Length and Correction of Linear Sound Source

ii) Attenuation calculation for sound shadow area beside high embankment or low cutting

Sound shadow area attenuation A_{bar} beside high embankment or low cutting is the additional attenuation incurred by prediction point in sound shadow area beside high embankment or low cutting.

When prediction point is located in sound emission area, A_{bar}=0

When prediction point is located in sound shadow area, A_{bar} is decided by sound path difference δ.

Calculate sound path difference δ (δ=a+b-c) according to Fig. 5-2-3, then calculate Fresnel number N_{mx}. Then calculate A_{bar} according to above formula.

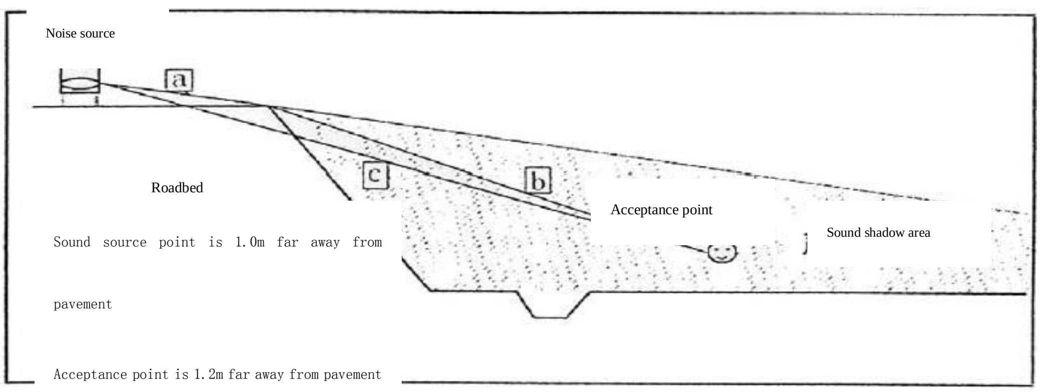


Fig. 5-2-3 Schematic Diagram for Sound Path Difference Calculation

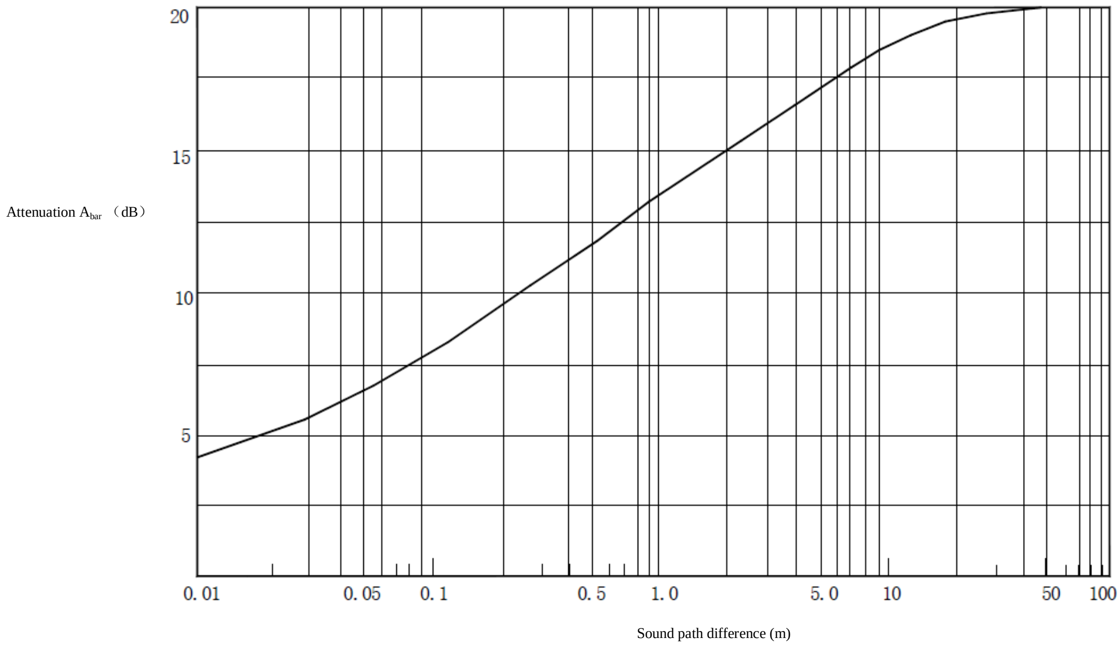
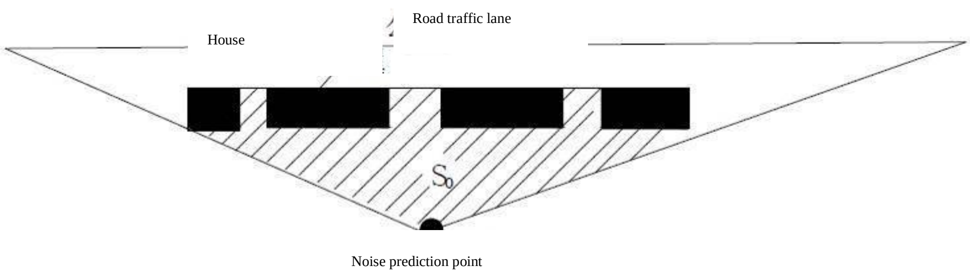


Fig. 5-2-4 Relation Curve between Noise Attenuation A_{bar} and Sound Path Difference δ (f=500Hz)

iii) Additional attenuation prediction of rural house

Rural house attenuation can be calculated according to Appendix A, GB/T17247.2. approximate calculation can refer to values in Fig. 5-2-5 and Table 5-2-17 within sound shadow area scope for first row of houses along highway.



S is the area sum of first row of houses. S_0 is area of dash area (including floor area)

Fig. 5-2-5 Schematic Diagram for Rural House Noise Reduction Prediction

Table 5-2-11 Estimation for Additional Attenuation of Rural House Noise

S/S0	Abar
40-60%	3dB(A)

70-90%	5dB(A)
Once a row of house is added	1.5dB(A) Maximum attenuation ≤10dB (A)

iv) Green belt noise attenuation calculation

Additional attenuation of green belt is related to varieties of trees, belt structure and density. Green belt near sound source or near prediction point or both above conditions can reduce sound wave, as shown in Fig. 5-2-6.

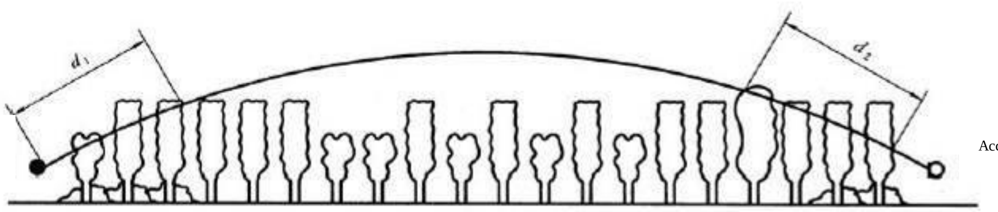


Fig. 5-2-6 Noise Attenuation Diagram through Trees and Shrubs

Attenuation of noise which transmits through leaf increases along increase of leaf transmission distance. $d_f=d_1+d_2$. In order to calculate d_1 and d_2, radius of curve path can be supposed to be 5km.

First line in Table 5-2-18 shows attenuation due to dense leaves when the noise goes through the dense leaves with total length between 10m and 20m. The second line shows attenuation coefficient when the noise goes through the dense leaves with total length between 20m and 200m. When dense leave path length is over 200m, attenuation value for 200m can be used.

Table 5-2-12 Attenuation When Octave Frequency Band Noise Goes Through Dense Leaves

Item	Transmission distance (m)	Central frequency of octave frequency band (Hz)							
		63	125	250	500	1000	2000	4000	8000
Attenuation (dB)	10≤df＜20	0	0	1	1	1	1	2	3
Attenuation coefficient (dB/m)	20≤df＜200	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.12

◆Attenuation due to air absorption (A_{atm})

Attenuation due to air absorption is calculated according to the following formula:

$A_{atm}=a(r-r_0)/1000$

Where: a is function of temperature, humidity and frequency of sound wave. Corresponding air absorption coefficient is selected according to average temperature and humidity of the area where construction project is located in prediction calculation. See Table 5-2-13.

Table 5-2-13 Air Absorption Attenuation Coefficient α of Octave Frequency Band Noise

Temperature ℃	Relative humidity %	Air absorption attenuation coefficient α							
		Central frequency of octave frequency band Hz							
		63	125	250	500	1000	2000	4000	8000
10	70	0.1	0.4	1.0	1.9	3.7	9.7	32.8	117.0
20	70	0.1	0.3	1.1	2.8	5.0	9.0	22.9	76.6
30	70	0.1	0.3	1.0	3.1	7.4	12.7	23.1	59.3
15	20	0.3	0.6	1.2	2.7	8.2	28.2	28.8	202.0
15	50	0.1	0.5	1.2	2.2	4.2	10.8	36.2	129.0
15	80	0.1	0.3	1.1	2.4	4.1	8.3	23.7	82.8

◆Ground effect attenuation (A_{gr})

Ground type can be divided into:

i) Firm ground, including paved road surface, water surface, ice surface and punning road.

ii) Loose ground, including ground covered by grass or other plants and ground suitable for growth of plants such as farmland.

iii) Mixture ground which is made up of firm ground and loose ground.

When sound wave is transmitted across the ground, or most of the ground is mixture ground with loose ground, under the premise that only A sound level is calculated in prediction point, octave frequency band attenuation due to ground effect can be calculated according to the following formula:

$$A_{gr} = 4.8 - \left(\frac{2h_m}{r}\right)\left[17 + \frac{300}{r}\right]$$

Where:

r-distance between sound source and prediction point, m;

h_m-average terrain clearance of travel path, m; it can be calculated according to Fig. 5-2-7, h_m=F/r;

F: area, m^2; r, m.

If negative value appears in A_{gr} calculation, A_{gr} can be replaced by “0”.

For other conditions, calculation can refer to GB/T17247.2.

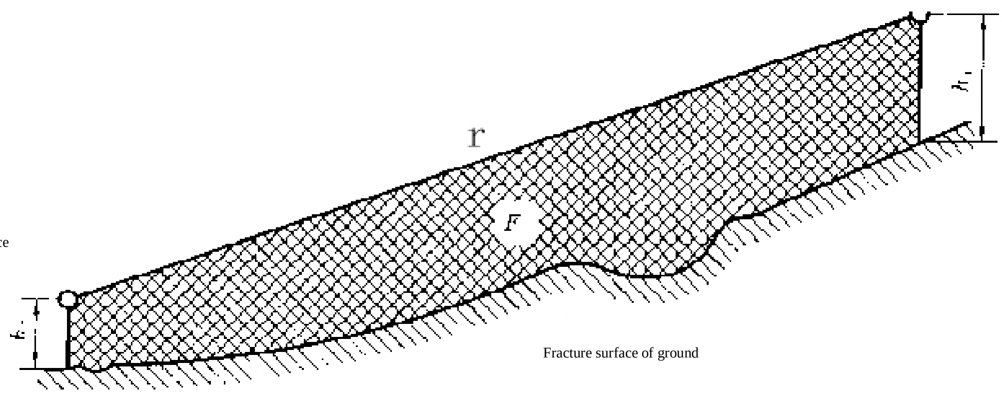


Fig. 5-2-7 Method to Estimate Average Height h_m

◆Attenuation due to other reasons

Attenuation due to natural condition (such as wind, temperature gradient, mist) change will not be taken into consideration generally.

c) Correction due to reflection (ΔL_3)

◆Urban crossroad noise (impact) correction

Noise correction (additional value) of crossroad is in Table 5-2-14.

Table 5-2-14 Noise Addition in Crossroad

Distance between point influenced by noise and intersection of nearest fast traffic lane axis	Crossroad (dB)
≤40	3
40＜D≤70	2
70＜D≤100	1
＞100	0

◆Reflection correction of buildings on both sides

Reflection of landform and buildings on both sides of sound source influences correction of factors. When distance between both sides of line is less than 30% of total calculation height, the reflection correction is:

When buildings on both sides are reflectors: $\Delta L_{reflection}=4H_b/w \leq 3.2dB$

When buildings on both sides are general absorptive surface: $\Delta L_{reflection}=2H_b/w \leq 1.6dB$

When buildings on both sides are total absorptive surface: $\Delta L_{reflection}\approx 0$

Where:

w-distance between reflection surface of buildings on both sides of line, m

H_b-average height h of structures. Average value of the lower height on both sides shall be used in the calculation, m.

④Traffic flow and day-night ratio

Different traffic volume and day-night ratio results of different road sections in each prediction year are in Table 2-2-3.

⑤Vehicle type ratio

Vehicle classification (large, middle, small vehicle). Method is in Table 5-2-15.

Table 5-2-15 Vehicle Classification Standard

Vehicle type	Gross vehicle mass
Small vehicle (S)	Below 3.5t
Middle vehicle (M)	3.5t to 12t
Large vehicle (L)	Over 12t

Note: small vehicle includes light truck, saloon car and estate car with less than 7 seats (including 7 seats) generally.

Large vehicle includes container car, articulated vehicle, engineering vehicle, passenger bus (more than 40 seats) and heavy trucks generally.

Middle vehicle includes middle truck, middle passenger bus (7 to 40 seats), 3-wheel and 4-wheel vehicles for agriculture application.

Vehicle type ratio is in Table 2-7-1 according to feasibility report of the Project and vehicle classification method.

5.2.2.3 Ambient noise level calculation mode

Calculation formula for ambient noise prediction $(LAeq)_{prediction}$ at calculation prediction point is:

$$(LAeq)_{prediction} = 10lg[10^{0.1(LAeq)traffic}+10^{0.1(LAeq)background}]$$

Where: $(LAeq)_{prediction}$-ambient noise prediction of prediction point, dB(A);

$(LAeq)_{traffic}$-road traffic noise of prediction point, dB(A);

$(LAeq)_{background}$-ambient noise background value of prediction point, dB(A).

5.2.2.4 Noise prediction scheme

(1) Determination of calculation point location and scheme

①Typical section prediction

The assessment makes prediction according to long-term traffic flow and typical roadbed section rather than shield of buildings, terrain and cross with other roads.

②Sensitive point prediction

There are many sensitive points near both sides of road in the project such as residence, school, hospital and office. The assessment only selects several typical sensitive points and predicts noise impact during operation period.

(2) Assessment criterion

4a-type area standard of Environmental Quality Standard for Noise (GB3096-2008) shall be implemented in the first row of houses near road (the first row of house is higher than 3 stories) or in the area within the scope 35m far from road border line (the first row of house is lower than 3 stories). 2-type area standard of Environmental Quality Standard for Noise (GB3096-2008) shall be implemented in other areas.

According to Notice of Ambient Noise issues in Environmental Impact Assessment of Construction Project such as Highway and Railway (including light rail) (HF[2003]No.94 document) by the former State Environmental Protection Administration, in terms of special sensitive buildings such as school (including teaching and scientific research) within the assessment scope, outdoor standard shall be 60dB (A) in daytime and 50dB(A) in nighttime.

(3) Determination of prediction parameters

Table 5-2-16 Road Prediction Parameter List

Operation time	Road name	Origin/terminal station	Design speed (km/h)	Daytime	Nighttime	车型比（大：中：小）（%）
2020年	Taibai Avenue	Yinxing Avenue-Jiefang Avenue	50	873	216	4：7：89
		Jiefang Avenue- Biyun Road		1247	308	
		Biyun Road-Anwei Bridge		1234	305	

		Anwei Bridge-Jiangxia Avenue		831	205
	Biyun Road	Binhe Avenue-Handan Road	40	457	113
		Handan Road-Taibai Avenue		715	177
		Taibai Avenue-Jingqiu Avenue		631	156
		Jingqiu Avenue-New National Highway316		397	98
	Jiefang Avenue	Binhe Avenue-Taibai Avenue	50	746	184
		Taibai Avenue-Jinqiu Avenue		627	155
	Jinqiu Avenue	Yinxing Avenue-Jiefang Avenue	40	393	97
		Jiefang Avenue-Biyun Road		448	111
	Yinxing Avenue	Fucheng Avenue-Taibai Avenue	50	397	98
		Taibai Avenue- New National Highway316		329	81
	Zhanqian Road	Connecting Line of Three Bridges-Anjing Line	40	299	74
	Fucheng Avenue	Jiefang Avenue-De’an North Road	40	290	72
		De’an North Road-Yinxing Avenue		303	75
2030年	Taibai Avenue	Yinxing Avenue-Jiefang Avenue	50	1323	327
		Jiefang Avenue-Biyun Road		1444	357
		Biyun Road –Anwei Bridge		1577	390
		Anwei Bridge –Jiangxia Avenue		1154	285
	Biyun Road	Binhe Avenue-Handan Road	40	653	161
		Handan Road-Taibai Avenue		829	205

		Taibai Avenue-Jingqiu Avenue		887	219
		Jingqiu Avenue-New National Highway316		760	188
	Jiefang Avenue	Binhe Avenue-Taibai Avenue	50	953	235
		Taibai Avenue-Jinqiu Avenue		840	208
	Jinqiu Avenue	Yinxing Avenue-Jiefang Avenue	40	765	189
		Jiefang Avenue-Biyun Road		826	204
	Yinxing Avenue	Fucheng Avenue-Taibai Avenue	50	846	209
		Taibai Avenue- New National Highway316		777	192
	Zhanqian Road	Connecting Line of Three Bridges-Anjing Line	40	714	177
	Fucheng Avenue	Jiefang Avenue-De'an North Road	40	743	184
		De'an North Road-Yinxing Avenue		803	199

5.2.2.5 Noise prediction results analysis

The assessment conducts prediction and assessment of mid-long term road operation (year 2030).

1) Road traffic noise prediction

The assessment adopts representative section for road traffic noise prediction analysis. It divides the prediction according to cross section layout and different traffic flow. It mainly predicts noises of different positions away from road axis without considering obstructing and reflection effects of buildings on both sides of road on road traffic noise of the Project. Height of prediction point is 1.2m. Road sound level line during operation period is in the attached figure. Prediction results are in Table 5-2-17.

Table 5-2-17 Traffic Noise Prediction Results List of Typical Sections during Project Operation Period Unit: dB(A)

Road name	Prediction year	Time	Distance from road axis (m)							
			30	40	60	80	100	120	150	200
Taibai Avenue	Year 2020	Daytime	62.3	59.9	57.5	55.9	54.6	53.6	52.4	50.7
		Nighttime	56.3	53.8	51.4	49.8	48.6	47.5	46.3	44.6
Biyun Road		Daytime	55.6	53.9	51.9	50.4	49.3	48.4	47.1	45.5
		Nighttime	49.8	48.2	46.4	45.1	44.1	43.4	42.3	41.0
Jiefang Avenue		Daytime	59.5	57.5	55.3	53.4	52.1	50.9	49.5	47.7
		Nighttime	53.4	51.4	49.2	47.3	46.0	44.9	43.4	41.6
Jinqiu Avenue		Daytime	57.3	53.4	51.3	49.6	48.2	47.2	45.9	44.1
		Nighttime	51.2	47.3	45.2	43.5	42.2	41.1	39.8	38.1
Yinxing Avenue		Daytime	57.1	54.8	52.2	50.4	49.0	47.7	46.2	44.0
		Nighttime	51.0	48.7	46.1	44.3	42.9	41.6	40.1	38.0
Fucheng Avenue		Daytime	54.1	52.2	49.9	48.2	47.1	46.1	44.7	43.0
		Nighttime	48.0	46.1	43.8	42.1	41.0	40.0	38.7	36.9
Zhanqian Road		Daytime	54.0	52.0	49.7	47.9	46.6	45.5	44.2	42.3
		Nighttime	47.9	45.9	43.6	41.9	40.6	39.5	38.1	36.3
Taibai Avenue	Year 2030	Daytime	63.0	60.5	58.1	56.5	55.3	54.2	53.0	51.4
		Nighttime	56.9	54.4	52.1	50.5	49.2	48.2	46.9	45.3
Biyun Road		Daytime	58.1	56.3	54.0	52.4	51.2	50.2	49.0	47.3
		Nighttime	52.0	50.2	47.9	46.4	45.1	44.2	42.9	41.3
Jiefang Avenue		Daytime	60.6	58.5	56.3	54.4	53.1	52.0	50.6	48.7
		Nighttime	54.5	52.5	50.2	48.3	47.1	45.9	44.5	42.7
Jinqiu Avenue		Daytime	60.2	56.3	54.2	52.5	51.1	50.1	48.8	47.0
		Nighttime	54.1	50.2	48.1	46.4	45.1	44.0	42.7	41.0
Yinxing Avenue		Daytime	60.8	58.5	55.9	54.1	52.7	51.5	50.0	47.8
		Nighttime	54.7	52.4	49.9	48.0	46.6	45.4	43.9	41.7
Fucheng Avenue		Daytime	58.3	56.3	54.0	52.3	51.1	50.1	48.7	46.9
		Nighttime	52.2	50.3	47.9	46.2	45.1	44.0	42.7	40.9

Zhanqian Road		Daytime	57.7	55.8	53.4	51.7	50.4	49.3	47.9	46.1
		Nighttime	51.7	49.7	47.4	45.7	44.4	43.3	41.9	40.0

Above table shows that without shield of building during operation period, standard distance results of noise prediction in typical sections are as follows:

Table 5-2-18 List for Distance between Road Prediction Standard and Road Axis in Typical Sections

Time (year)	Section	To the center line of road		To the red line of road	
		Standard distance in 4a-type area (m)（m）	Standard distance in 2-type area (m)	Standard distance in 4a-type area (m)	Standard distance in 2-type area (m)
2020	Taibai Avenue	40	80	10	50
	Biyun Avenue	30	30	18/17.5/4/10	18/17.5/4/10
	Jiefang Avenue	30	60	8.5/3.5	38.5/33.5
	Jinqiu Avenue	30	40	0	10
	Yinxing Avenue	30	60	10	40
	Fucheng Avenue	30	30	10	10
	Zhanqian Road	30	30	10	10
2030	Taibai Avenue	40	100	10	70
	Biyun Avenue	30	60	18/17.5/4/10	48/47.5/34/40
	Jiefang Avenue	30	80	8.5/3.5	58.5/53.5
	Jinqiu Avenue	30	60	0	30
	Yinxing Avenue	30	60	10	40
	Fucheng Avenue	30	60	10	40
	Zhanqian Road	30	40	10	20

2) Noise prediction on sensitive point

(1) Noise implementation standard on sensitive point along the line

There are many sensitive points along the line of the Project according to field investigation and they are mainly residence, school, office and hospital. Within the scope 35m far from both sides of road boundary lines determined by the assessment, the area where the first row of building faces to the road shall implement 4a-type standard and other areas shall implement 2-type standard of Environmental Quality Standard for Noise (GB3096-2008). Acoustic environment standard of schools (including teaching and scientific research) shall be 60dB(A) in daytime and 50dB(A) in nighttime.

(2) Prediction results of each sensitive point

Noise prediction results at sensitive points during mid-long term of road operation are in Table 5-2-19 and 5-2-20.

According to monitored data of present status and analysis tables of prediction results, after opreration of the Project, acoustic environments on both sides of the sensitve points worsen to some degree after the operation of newly-built roads, and noise values of some sensitve points on the both sides increase to a certain extent while noise values of other sensitve points improve compared with their existing conditions after operation of the reconstructed roads.

(3) Indication of prediction result analysis

i. Prediction results show that predicted values of part sensitive points will be superior to the existing values during late period of road operation period. Reasons may contain the following aspects:

①Though road traffic flow increases during operation period of the Project, influenced by change of trip mode in the area, proportion of small vehicle increases gradually and that of large and middle vehicles decreases. Impact of traffic noise on sensitive points will be stable gradually in late period. Therefore, part predicted values may be superior to existing values during late period of project operation.

②Some sensitive points are located on both sides of intersected road, they are influenced by roads of the Project as well as traffic noise of the crossroad. Roads of the Project have small contribution to overall noise value of sensitive points and noise value on sensitive points can remain the present status.

③According to on-site investigation, some sensitive points within assessment scope are influenced by noise of real estate project under construction significantly. They are near existing roads, where traffic flow is huge and vehicles are mainly heavy trucks and slag cars. Noise in the area due to construction vehicles is continuous. Monitored existing noise cannot reflect acoustic environment condition before construction of the Project objectively and monitored existing noise value is bigger than actual value.

ii. Predicted values of some sensitive points in nighttime do not exceed present status but values in daytime exceed present status. This is due to:

Municipal road traffic flow concentrates mainly in daytime during operation period. Traffic flow day-night ratio is about 8:1, namely flow in daytime (6:00-22:00) accounts for 89% of flow of whole day and flow in nighttime (22:00 to 6:00 of next day) accounts for 11% of flow of whole day. Traffic flow concentrates mainly in daytime, which leads to that noise contribution value in nighttime is much smaller than that in daytime during operation period. Traffic flow day-night ratio is about 4:1 according to monitoring of present status. So, traffic flow in nighttime may be lower than present status during operation period and predicted value of noise in nighttime is superior to the existing values slightly.

Table 5-2-19Acoustic Environment Prediction Results of Representative Sensitive Point at Height of 1.2m on both Sides of Line during Road Operation Period (Year 2020)

NO.	Name of sensitive points	Closest distance with road (m)		Prediction value/dB(A)		Standard value//dB(A)		Superscale vaule /dB(A)		Existing value/dB(A)		Increment compared with present status/dB(A)status/dB(A)	
		Distance with	Distance	Day	Nigh	Day	Nigh	Day	Nigh	Day	Nigh	Daytime	Nightti
1	Taihe Villa	45	15	60.8	54.8	60	50	0.8	4.8	57.9	52.7	2.9	2.1
2	Jintai Community	60	30	56.3	50.2	60	50	0	0.2	56.6	51.8	-0.3	-1.6
3	Fengda International City	31	1	59.4	53.3	60	50	0	3.3	67.5	57.9	-8.1	-4.6
4	An’er Homeland	33	3	63.3	57.2	60	50	3.3	7.2	63.2	57.8	0.1	-0.6
5	Anlu Second Middle School	32	2	62.4	56.3	60	50	2.4	6.3	66.3	56	-3.9	0.3
6	Haocheng Jiayuan Building	32	2	62.5	56.5	60	50	2.5	6.5	73.3	63.2	-10.8	-6.7
7	Sili Community	35	5	57.7	51.6	60	50	0	1.6	66.9	58.6	-9.2	-7.0
8	Hubei Aluminum Manufacturer Dormitory Building	55	25	59.2	53.1	60	50	0	3.1	61.2	57.2	-2.0	-4.1
9	Zhongyi Community	35	5	59.9	53.8	60	50	0	3.8	69.5	60.5	-9.6	-6.7
10	Jiahe Community	29	21	56.4	50.4	60	50	0	0.4	64.5	56.7	-8.1	-6.3
11	Fudong Community	31	6	61.4	55.3	60	50	1.4	5.3	68.6	58.1	-7.2	-2.8
12	Anlu Bureau of Civil Affairs	27	1	59.3	57.2	60	50	0	7.2	68.8	63.5	-9.5	-6.3
1	Dapeng Village	35	15	55.0	48.9	60	50	0	0	50.2	47.1	4.8	1.8

3													
14	Yuanlin Jiayuan Building	38	13	58.9	52.8	60	50	0	2.8	63.5	57.7	-4.6	-4.9
15	De’an Garden	30	5	59.8	53.8	60	50	0	3.8	64	55.9	-4.2	-2.1
16	Shuanglongqiao Homeland	30	5	59.8	53.7	60	50	0	3.7	57.4	50.2	2.4	3.5
17	Anlu Science and Technology Bureau	33	8	59.2	53.1	60	50	0	3.1	60.7	58.2	-1.5	-5.1
18	Criminal Police Team of Anlu Public Security Bureau	35	10	59.7	53.6	60	50	0	3.6	66.1	59.8	-6.4	-6.2
19	Fengda International City	26	0	58.5	52.4	60	50	0	2.4	56.7	52.6	1.8	-0.2
20	Linyu Huadu Building	31	5	60.8	54.8	60	50	0.8	4.8	64.2	55.6	-3.4	-0.8
21	Kaixuan City	31	1	54.3	48.3	60	50	0	0	65.5	53.8	-11.2	-5.5
22	Shangri-la City Garden	31	1	55.4	49.3	60	50	0	0	63.6	55.8	-8.2	-6.5
23	Jinqiu Yuyuan Building	33	3	54.0	47.9	60	50	0	0	63.8	56.1	-9.8	-8.2
24	Shui’an Xingcheng Building	38	8	55.9	49.8	60	50	0	0	63	54.7	-7.1	-4.9
2	Shitang Community	22	2	59.4	53.3	60	50	0	3.3	71.5	57.8	-12.1	-4.5

5													
26	Xugang Community	55	35	52.5	46.5	60	50	0	0	53.5	46.3	-1.0	0.2
27	Shimiao Community	100	80	52.7	46.6	60	50	0	0	58.6	49.5	-5.9	-2.9
28	Zhaohe Village	22	2	60.9	54.9	60	50	0.9	4.9	49.4	45.1	11.5	9.8
29	Lvjiafan	25	5	58.4	52.3	60	50	0	2.3	57.1	44	1.3	8.3
30	Huguo Village	20	0	54.5	48.5	60	50	0	0	57.2	45.2	-2.7	3.3
31	Lilong Village	20	0	57.7	51.6	60	50	0	1.6	56.4	45.2	1.3	6.4
32	Jinquan Village	20	0	58.0	52.0	60	50	0	2	52.1	44.2	5.9	7.8

Table 5-2-20 Acoustic Environment Prediction Results of Representative Sensitive Point at Height of 1.2m on both Sides of Line during Road Operation Period (Year 2030)

No.	Name of sensitive points	Closest distance with road (m)		Prediction value/dB(A)		Standard value//dB(A)		Superscale vaule /dB(A)		Existing value/dB(A)		Increment compared with present status/dB(A)	
		Distance with axis	Distance with red line	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
1	Taihe Villa	45	15	62.6	56.5	60.0	50.0	2.6	6.5	57.9	52.7	4.7	3.8
2	Jintai	60	30	58.0	52.0	60.0	50.0	0	2.0	56.6	51.8	1.4	0.2

	Community												
3	**Fengda International City**	**31**	**1**	**61.1**	**55.1**	**60.0**	**50.0**	**1.1**	**5.1**	**67.5**	**57.9**	**-6.4**	**-2.8**
4	**An'er Homeland**	**33**	**3**	**63.9**	**57.9**	**60.0**	**50.0**	**3.9**	**7.9**	**63.2**	**57.8**	**0.7**	**0.1**
5	**Anlu Second Middle School**	**32**	**2**	**63.0**	**57.0**	**60.0**	**50.0**	**3.0**	**7.0**	**66.3**	**56.0**	**-3.3**	**1.0**
6	**Haocheng Jiayuan Building**	**32**	**2**	**63.2**	**57.1**	**60.0**	**50.0**	**3.2**	**7.1**	**73.3**	**63.2**	**-10.1**	**-6.1**
7	**Sili Community**	**35**	**5**	**58.9**	**52.8**	**60.0**	**50.0**	**0**	**2.8**	**66.9**	**58.6**	**-8.0**	**-5.8**
8	**Hubei Aluminum Manufacturer Dormitory Building**	**55**	**25**	**60.6**	**54.6**	**60.0**	**50.0**	**0.6**	**4.6**	**61.2**	**57.2**	**-0.6**	**-2.6**
9	**Zhongyi Community**	**35**	**5**	**61.3**	**55.2**	**60.0**	**50.0**	**1.3**	**5.2**	**69.5**	**60.5**	**-8.2**	**-5.3**
10	**Jiahe Community**	**29**	**21**	**57.9**	**51.6**	**60.0**	**50.0**	**0**	**1.6**	**64.5**	**56.7**	**-6.6**	**-5.1**
11	**Fudong Community**	**31**	**6**	**61.5**	**55.5**	**60.0**	**50.0**	**1.5**	**5.5**	**68.6**	**58.1**	**-7.1**	**-2.6**
12	**Anlu Bureau of Civil**	**27**	**1**	**60.7**	**54.6**	**60.0**	**50.0**	**0.7**	**4.6**	**68.8**	**63.5**	**-8.1**	**-8.9**

	Affairs												
13	**Dapeng Village**	**35**	**15**	**57.8**	**51.8**	**60.0**	**50.0**	**0**	**1.8**	**50.2**	**47.1**	**7.6**	**4.7**
14	**Yuanlin Jiayuan Building**	**38**	**13**	**60.0**	**53.9**	**60.0**	**50.0**	**0**	**3.9**	**63.5**	**57.7**	**-3.5**	**-3.8**
15	**De’an Garden**	**30**	**5**	**60.9**	**54.8**	**60.0**	**50.0**	**0.9**	**4.8**	**64.0**	**55.9**	**-3.1**	**-1.1**
16	**Shuanglong qiao Homeland**	**30**	**5**	**60.8**	**54.8**	**60.0**	**50.0**	**0.8**	**4.8**	**57.4**	**50.2**	**3.4**	**4.6**
17	**Anlu Science and Technology Bureau**	**33**	**8**	**60.3**	**54.2**	**60.0**	**50.0**	**0.3**	**4.2**	**60.7**	**58.2**	**-0.4**	**-4.0**
18	**Criminal Police Team of Anlu Public Security Bureau**	**35**	**10**	**60.7**	**54.6**	**60.0**	**50.0**	**0.7**	**4.6**	**66.1**	**59.8**	**-5.4**	**-5.2**
19	**Fengda International City**	**26**	**0**	**59.7**	**53.7**	**60.0**	**50.0**	**0**	**3.7**	**56.7**	**52.6**	**3.0**	**1.1**
20	**Linyu Huadu Building**	**31**	**5**	**62.1**	**56.0**	**60.0**	**50.0**	**2.1**	**6.0**	**64.2**	**55.6**	**-2.1**	**0.4**
21	**Kaixuan City**	**31**	**1**	**57.0**	**50.9**	**60.0**	**50.0**	**0**	**0.9**	**65.5**	**53.8**	**-8.5**	**-2.9**
22	**Shangri-la City Garden**	**31**	**1**	**58.0**	**51.9**	**60.0**	**50.0**	**0**	**1.9**	**63.6**	**55.8**	**-5.6**	**-3.9**

23	**Jinqiu Yuyuan Building**	**33**	**3**	**56.7**	**50.6**	**60.0**	**50.0**	**0**	**0.6**	**63.8**	**56.1**	**-7.1**	**-5.5**
24	**Shui'an Xingcheng Building**	**38**	**8**	**58.5**	**52.5**	**60.0**	**50.0**	**0**	**2.5**	**63.0**	**54.7**	**-4.5**	**-2.2**
25	**Shitang Community**	**22**	**2**	**63.1**	**57.0**	**60.0**	**50.0**	**3.1**	**7.0**	**71.5**	**57.8**	**-8.4**	**-0.8**
26	**Xugang Community**	**55**	**35**	**56.3**	**50.2**	**60.0**	**50.0**	**0**	**0.2**	**53.5**	**46.3**	**2.8**	**3.9**
27	**Shimiao Community**	**100**	**80**	**56.0**	**49.9**	**60.0**	**50.0**	**0**	**0**	**58.6**	**49.5**	**-2.6**	**0.4**
28	**Zhaohe Village**	**22**	**2**	**61.1**	**55.1**	**60.0**	**50.0**	**1.1**	**5.1**	**49.4**	**45.1**	**11.7**	**10.0**
29	**Lvjiafan**	**25**	**5**	**62.5**	**56.4**	**60.0**	**50.0**	**2.5**	**6.4**	**57.1**	**44.0**	**5.4**	**12.4**
30	**Huguo Village**	**20**	**0**	**58.6**	**52.5**	**60.0**	**50.0**	**0**	**2.5**	**57.2**	**45.2**	**1.4**	**7.3**
31	**Lilong Village**	**20**	**0**	**61.5**	**55.4**	**60.0**	**50.0**	**1.5**	**5.4**	**56.4**	**45.2**	**5.1**	**10.2**
32	**Jinquan Village**	**20**	**0**	**61.8**	**55.7**	**60.0**	**50.0**	**1.8**	**5.7**	**52.1**	**44.2**	**9.7**	**11.5**

In addition, some other factors may also influence monitored value:

①Existing road network structure of some sections in the area is not complete and traffic jams and congestion are worse. Existing bituminous pavement is damaged seriously and vehicles are detained on the road frequently. All these reduce noise source strength and predicted value of existing noise;

②Influenced by fluctuation of traffic flow and change of monitor time, certain error will be generated during monitoring.

To sum up, predicted value of each point will be stable with improvement of road network during operation period.

3) Sensitive point protection requirement

According to on-site investigation, housing estate near the road is concentrated and is mainly located on both sides of the road. In order to protect acoustic environment in the area, sensitive buildings shall be protected from noise. Therefore, if present status of sensitive points exceeds the standard, the assessment advises that environmental noise shall remain present status after operation of project; if present status of sensitive points reaches the standard, environmental noise shall reach corresponding noise standard for functional zone.

According to on-site investigation, planned roads are mainly located in interior of Anlu urban area and noise sensitive points such as residence, school, hospital and office are concentrated along the line. The Project consists of reconstruction and extension of existing roads and construction of new roads. Acoustic environment protection in the area can protect sensitive buildings from noise actively through reducing its own traffic noise. As vehicles passing through the area in operation period are small vehicles and there is no protection measures on the road such as sound barrier, the assessment advises that low noise pavement shall be set in whole section to reduce impact of traffic noise further as well as reduce impact of road traffic noise on sensitive points along the line.

According to Ground Traffic Noise Pollution Prevention Technique Policy (HF[2010]No.7), if outdoor environment noise of noise sensitive buildings exceeds standard due to construction or operation of ground traffic facility and outdoor technological means are infeasible, passive protection measures shall be taken on noise sensitive buildings (such as sound insulation door and window, ventilating and noise elimination window) and indoor acoustic environment quality shall be protected reasonably. The environmental quality shall meet requirement of *Code for Design of Sound Insulation of Civil Buildings* (GB50118-2010).

5.2.3 Water environment impact analysis

5.2.3.1 Water environment impact analysis in stations

Waste water generated in stations of the Project mainly includes: staffs' office and domestic wastewater and passengers' domestic wastewater etc. catering wastewater will go to septic-tank with other domestic wastewater after being handled in oil separator. They will be discharged into sewage pipe. They will be handled in sewage treatment plant and will be discharged into Fu River after reaching emission standard.

According to above-mentioned analysis, the biggest passenger flow rate in the 6 stations (construction scheme and construction scale for some stations are still undecided) constructed in the Project is about 2200 person/d (small size public transit hub in railway station). Maximum water consumption for single station is about 31m^3/d, drainage coefficient is 0.85 and output of domestic wastewater is about 26.4m^3/d.

According to the survey, in the 6 stations of the Project, 5 stations other than highway passenger transportation center and public transportation transfer hub of high speed rail station have already been equipped with sewage pipe network. Domestic sewage can be handled in Anlu Urban Sewage Treatment Plant. According to project construction and development plan, highway passenger transportation center and public transportation transfer hub of high speed rail station will be constructed in 2019 and will be finished in 2020. If sewage pipe network is constructed at that place at that time, sewage from highway passenger transportation center and public transportation transfer hub of high speed rail station will be treated in the sewage treatment plant. If the sewage pipe network is not constructed, construction organization shall construct sewage treatment facility on its own, treat domestic sewage and discharge it after primary standard of *Integrated Wastewater Discharge Standard* (GB8978-1996) is reached. For sewage treatment facility, the assessment recommends buried power integration sewage treatment facility with treatment scale of more than 30m^3/d.

To sum up, waste water on stations of the Project will not influence water environment significantly.

5.2.3.2 Road runoff impact analysis

Road of the Project will not generate wastewater and wastewater is mainly rainwater. Initial rainwater contains much pollutant. It will take 30 minutes from formation of surface runoff to rainfall during initial stage of rain according to related document literature. Concentration of suspended solids (SS) and oils in rainwater is high and it will decrease along duration of rainfall half an hour later. Decrease speed of biochemical oxygen demand (BOD_5) in rainwater along duration of rainfall is slower than the former and that of pH value is relatively stable. Obviously, road surface is washed out basically after 40 minutes of rainfall. In terms of initial rainwater pollutant on road, SS is about 221mg/l, COD is about 107mg/l, BOD is about 20mg/l and petroleum is about 7 mg/l according to related actual measurement and document literature about road rainwater of Hubei. Road surface runoff takes a small proportion of ground runoff volume and it is scattered along whole line. When road rainwater is transported in surface water channel or rainwater pipe network, suspended solids and silt in the water will be attenuated, sedimented or degraded and pollutant concentration in the water will be reduced. Influence on receiving water of rainwater is relatively small.

But gasoline may be leaked and engine oil may pollute road when motor maintenance condition is poor, motor is in failure and accident happens. Rainwater will flow into water area nearby along with road edge, which will result to petroleum and COD pollution. Traffic management measures shall be taken to prevent similar accidents.

5.2.3.2 Feasibility analysis on outlet of rainwater and sewage along the line after completion of project

According to above-mentioned engineering analysis, existing rainwater and sewage pipe network of each road line in the Project is not complete. Rainwater and sewage pipe network will be constructed to form rainwater and sewage separate system according to requirement of plan after reconstruction of the Project.

Taibai Avenue: Yinxing Avenue- Jiefang Avenue section will go to Jiefang Avenue rainwater pipeline from north to south, and then into Fu River. Section in the south of Jiefang Avenue will go into Fu River through Jiefang Avenue rainwater pipeline and Biyun Road rainwater pipeline separately.

Biyun Road: go into Fu River from east to west.

Jiefang Avenue: go into Fu River from east to west.

Jinqiu Avenue: go into Fu River through arterial pipe of Jiefang Avenue and Biyun Road separately.

Yinxing Avenue: go into Fu River from east to west.

Fucheng Avenue: rainwater goes into Fu River through Jiefang Avenue.

Zhanqian Road: rainwater is discharged into water body nearby.

5.2.4 Solid waste impact analysis

Solid wastes during road operation period are mainly carriers of transport vehicles, stowage scattered from traffic accident vehicles and passengers' litters etc. Environmental sanitation department shall strengthen management and clean.

Passenger stations of the Project are not equipped with vehicle maintenance and washing functions. Solid wastes generated in public transportation and passenger stations are mainly domestic garbage from staffs and passengers. In terms of there domestic garbage, environmental sanitation department shall arrange special environmental sanitation personnel to clean the road regularly, collect and handle garbage on the road.

Final emission load of the Project is zero. It has no huge influence on outside environment.

5.2.5 Ecological impact analysis

5.2.5.1 Analysis of impact on animals and plants

After the Project is completed and comes into operation, impact on animal and plant resources due to construction will fade away. Ecological environment of assessment district will not change too much before and after construction of the Project. Natural animal and plant resources are rare. Impact on animals and plants due to construction will fade away or disappear after operation of the Project. In the area where the Project goes through, birds are basically frequent species in urban communities. Their activity scope is limited and operation of the Project will not influence their distribution and will not result to decrease or disappearance of bird species and quantity.

5.2.5.2 Analysis of impact on urban ecological landscape environment

Urban landscape is made up of several ecological systems with interaction relationship between human and environment as core. Urban landscape has a weak ecological structure and its self adjusting capacity is low. So, it relies on input and output of ecological flow such as material flow and energy flow to maintain its stability. Access gallery is the only way which must be passed by energy flow, material flow, information flow and population flow of urban ecosystem. Smooth of access gallery can guarantee complete and smooth of urban functions. With recovery of landscape conditions destroyed during construction period, gallery function effects will increase, material circulation will be accelerated, landscape heterogeneity will increase and function such as landscape flow will recover in a certain degree.

Landscape consists of two levels: visual landscape and ecology landscape. Visual landscape is people's visual population such as observation of surrounding environment. Urban visual landscape is integration of urban natural landscape, building landscape and culture landscape. Ecology landscape is integration of different ecosystems and it is made up of model land, section and gallery. Urban ecology landscape refers to all special scales of city or space structure and appearance of city layout.

Both sides of road appear typical urban ecology landscape. Functional structures such as residence zone, transportation junction, enterprise and public institution are distributed along the line. Dense population along line and impeded surrounding gallery restrict migration of population flow, material flow, energy and information among each structure, which influences stability of landscape ecological system along the line. Green construction of urban transport infrastructure subproject in Anlu, Xiaogan emphasizes landscape design and local cultural features and it will not influence landscape basically after completion. Existing green plants grow well along the line of the Project. Construction method shall be selected reasonably in next design and construction process and effective measures shall be taken to reserve existing street trees. Transplant and protection for existing plants shall be implemented for recycle later. In general, construction of the Project has little influence on surrounding landscapes. Recovery and transplant of existing plants on the road after construction can reduce interference of project construction on landscapes.

After operation of the Project, as artificial gallery, basic functions of city such as residence zone, commercial zone, transportation junction and enterprise and public institution along the line will be combined as a more integrated structural system. Road construction improves accessibility of function section landscapes along the line, makes input and output of ecological flow smooth, ensures efficient functioning of city, improves stability of urban ecology landscape system and ensures healthy development of the city. At the same time, the Project is constructed along the existing road, which reduces division of function section along the line and will not increase crumbliness of line landscapes.

5.2.5.3 Analysis of impact on visual landscape

(1) Green planting design

①Street trees

Existing street trees shall be reserved. If trees are missing in some sections or road is damaged, trees shall be added and tree species shall refer to the species and specification along the line. Plant pit comb shall be added in the pit and loess shall not be exposed.

②Greening of greenbelt which divides vehicle on both sides

It shall be mainly defoliation megaphanerophyte such as goldenrain tree with dungarunga which has various flowering phase and color phase changing under it such as crape myrtle and photinia fraseri. Shrub shall have clear color phase and texture such as golden edge boxwood, nandina domestica thunb and dragon juniper which can form an effect of curve and improve spatial continuity of road greening.

③Greening of channelization island and split belt

Plants in the channelization island shall be concise and shall not influence sight safety requirement. It shall be hedge shrub such as photinia fraseri and golden edge boxwood which can form simple curve.

Ends of split belt shall notice control of safety driving sight distance. Dungarunga which blooms or has various color phase changing such as crape myrtle, prunus cerasifera and red leaves prunus persica shall be planted in the upper layer. Shrub such as nandina domestica thunb, cuckoo and radix ophiopogonis shall be planted in the bottom layer.

Landscape design philosophy of the Project is to forge a “simple ecological green gallery” and build beautiful and comfortable road traffic environment combined with a large number of green planting designs and environment near the field. Conception of “environmental protection, safety, nature, ecology” is introduced in the design, which enriches space and layer and makes whole road a green gallery in the area. Fully grasp location advantages of natural and human resources near the road, adjust measures to local conditions and integrate with surrounding environment. Whole road shall reflect features of accord development.

5.2.6 Social environment impact analysis

The Project is municipal construction project with public welfare, which will have positive benefits on society and economy and will have certain influence on living quality of residents at the same time.

5.2.6.1 Impact on local economic development

Construction of the Project will improve traffic conditions along the line significantly and increase traffic volume of the area. With development of social economic intercourse, a series of industrial belt will be formed in highway gallery, which will bring positive effect to social development, industrial structure and social labor ratio along the line. It will also help the Project in successful realization of national economy and social development planning goal in the area.

Construction of the Project will enhance economic leading role of Anlu to surrounding new cities, improve economic development condition of existing areas, improve investment environment and promote urbanization of suburban area.

5.2.6.2 Analysis of impact on urban traffic

In order to realize traffic environment which is “convenient for people’s travel, convenient for vehicle and for material flow”, corresponding modern urban traffic system must be constructed. Construction of the Project will improve traffic relation convenience of Anlu and enrich road network distribution.

5.2.7 Environmental accident risk analysis

The Project is an important constituent part of Anlu traffic framework road network and it takes dual functions: regional transportation and local service. As main passage of the area, potential environmental risks of the Project are environmental influence and control due to accident risks. The chapter will analyze dangerous goods transportation environmental risks on the road.

The Project is located in Anlu City, Xiaogan. Parts of the sections are located in suburb. Both sides of the road are mainly offices and residences. There is also crossing bridge.

In consideration of environmental sensitivity of the section as well as environmental risk influence of dangerous goods transportation, according to Regulations on the Control Over Safety of Dangerous Chemicals, "transport vehicle shall try to drive in the suburb in order to avoid risk accidents happening in urban center or communities with dense population", the assessment thinks that urban section road of the Project shall forbid dangerous chemicals transportation and obvious warning marks shall be posted in both ends of the bridge to prevent environmental risk accidents due to traffic accidents.

6. Environmental Protection Measures and Technical and Economic Verification

6.1 Environmental protection requirement in design period

Combine with social environment, natural environment along the line and features of planning conditions, implement environmental awareness and design philosophy of “pay high attention, overall and careful, economical and practical, convenient for management” in whole process of project engineering design. Consider requirement of environmental protection and landscape fully. Take ecological greening as background, pay attention to ecological protection especially social impact of land acquisition on the area influenced by the project and improve sustainable development of society and economy.

(1) Vegetation protection and recovery

When construction is completed, requirement of local ecological planning shall be combined to restore bare lands due to temporary occupation which have vegetation recovery condition but cannot be used as second plough. This can reduce artificial destruction of environment and harm of newly added water and soil loss. Greening design shall combine arbor, shrub and grass.

(2) Strength design of special section

Distribution of pipe network in project construction area is complicated. Development organization shall communicate with related department further, verify relationship between related municipal works with the Project, strengthen design of related special sections and take the scheme approved by related department as the final scheme.

(3) When next phase is designed, longitudinal slope, cross slope, elevation of related crossing roads and drainage pipeline direction shall be verified to ensure good connection between intersection along the line of the Project and drainage pipelines.

(4) Consider construction requirement of all kinds of pipelines fully. Lay and reconstruct all kinds of pipelines in one time according to the construction principle of “underground first,

over-ground second".

6.2 Related requirement of construction bidding and tendering

(1) Tender phase

①Preparation of tender document shall reflect environmental impact assessment result of the Project, specify environmental protection goal in each bidding section and specify engineering contractor's responsibility and obligation on ecological environmental protection, conservation of water and soil, population health and environment improvement.

②Put forward specific environmental protection requirement on construction organization plan in each bidding section. Environmental protection implementation plan shall be prepared and corresponding environmental improvement personnel and environmental protection facility shall be equipped.

③Standardize preparation and audit of pretender; Ensure engineering contractor's reasonable profit and make it able to implement environmental protection plan.

(2) Bidding phase

①Bidding documents must conform to environmental protection requirement of bidding documents and shall specify construction organization plan and implementation measures which conform to environmental protection requirement. Corresponding environmental protection management personnel and facility shall also be equipped.

②Bidding document offer shall specify investment cost budget for implementation of environmental protection management and measures according to specific environmental protection requirement of each bidding section.

Contractors of the Project shall implement responsibility and obligation of environmental protection. They shall not subcontract works to others or extract management fee. They shall accept supervision of development organization and local environmental protection organization voluntarily.

(3) Bid evaluation phase

①Establish high-quality bid evaluation expert team and invite high-quality environmental protection experts to participate in the evaluation.

②Review content of construction organization scheme related to environmental protection and civil construction carefully. Especially strengthen review of environmental protection conditions. Prevent engineering contractors who aim at winning the bidding and lowering environmental protection input from winning.

6.3 Pollution control measures during construction period

6.3.1 Air environmental pollution control measures

(1) Hardness fence with height of no less than 2.4m shall be set in construction site and the site shall be kept clean. Specially-assigned person shall be in charge of cleaning work on construction site. He shall water and clean the site to reduce dust. One person shall be arranged in each construction section to water the site and reduce rise of dust regularly. Watering frequency shall be determined by weather situation. Watering shall be conducted in rush hours such as morning (7:30-8:30), noon (12:00-13:00) and night (17:30-19:00) according to general principle. Watering shall be conducted every 2 hours in fine days of summer with wind speed exceeding grade 3.

(2) Watering and spraying shall be conducted before removal of existing buildings to control the dust. In terms of removal of buildings, vertical transport equipment or chute shall be set. Removed objects shall not be thrown from high altitude or pushed over in large scale. Barbaric construction operation is forbidden.

(3) Special spray vehicle shall be used for watering to control the dust during removal of existing buildings. Building removal operation shall be stopped in case of gale weather exceeding grade 4.

(4) Vehicles carrying building materials and building rubbish shall conform to related regulations. Construction muck clear and transportation qualification management shall be implemented strictly. Vehicles carrying construction muck must transport according to the route and time specified by city management department. Clean-keeping measures shall be implemented in construction site and digestion yard strictly. Hardening measures shall be taken and washing

facility shall be equipped in entrances and exits of digestion yard and construction site where construction muck is to be discharged. Vehicles in and out of construction site and digestion yard shall keep clean. There shall be no mud on the running vehicles. Vehicles carrying construction muck must be equipped with waterproof cloth or sealed transport vehicle shall be used to reduce scattering of muck. Otherwise, the vehicle shall not be used for construction muck transport.

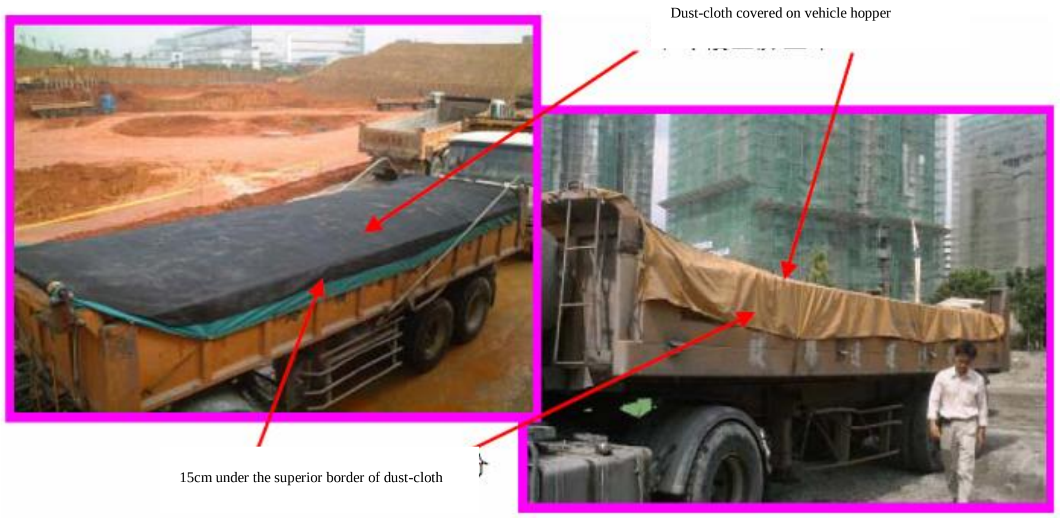


Fig.6-1-2 Sketch Map of Dust-cloth on Vehicle Hopper

(5) Professional environmental protection management personnel shall be assigned during each construction phase. Their responsibilities are guiding and managing discarded earth of project, construction rubbish, disposition, clean, transportation and pile of building materials, site recovery and hardening. They shall also clean dirt and discarded material on construction site roads and dirt on vehicle wheels to prevent secondary flowing dust pollution.

(6) Reasonably arrange the construction and transportation, and try to avoid the rush hour to ease the traffic pressure for transportation of large-scale members and large quantity of materials and spoil. Meanwhile, The Construction Organization shall coordinate with the Traffic Administrative Department to adopt responsive measures and ease traffic on the construction site with a view to avoid traffic jam and control vehicle exhaust emission to the maximum.

(7) Special persons shall be assigned to the construction area to realize scientific management and civilized construction. During foundation construction, measures to enhance the construction progress shall be adopted as far as possible, and earthwork shall be promptly transported to the designated place to shorten the hazard circle of stacking earthwork.

(8) The gravel, building materials, etc. can't be loaded fully during transportation, and meanwhile the corresponding covering and sealing measures (for instance with tarpaulin) shall be adopted. The accidentally dropped sand and building materials on the ground shall be cleared.

(9) Adequately watering the operating plane and temporary mound to keep a certain extent of humidity to reduce dust emission; if the construction site is close to all vulnerable spots, the watering quantity and frequency shall be raised and measures to reduce dust emission and influence on the surrounding vulnerable spots shall be adopted; the construction roads shall be tamped and hardened, and the in and out vehicles shall pass though the water pool to reduce dust emission.

(10) The garbage truck for construction shall be covered with tarpaulin or transport the garbage with enclosed truck, and the open truck is strictly forbidden to transport the construction garbage. The illegal behaviors of superelevation, overload and dropping along the road are forbidden.

(11) Adopt commercial concrete for construction concrete and spot mixed concrete is forbidden to avoid dust pollution during mixing of concrete.

6.3.2 Water environment protection measures

Measures adopted during construction period are mainly as follows:

(1) Strengthen construction management and supervision, and regularly check the construction machinery to avoid leakage of oil to flow into municipal pipe network;

(2) Temporary covering canvas shall be prepared for construction materials such as asphalt, oil and chemicals; necessary measures shall be adopted to prevent earth and scattered construction materials from blocking existing municipal pipe network;

(3) Build simple drainage facility before construction of roadbed slope, and dig trapezoidal drainage ditch outside slope angle of embankment;

(4) Build interception and drainage ditch around stock ground of construction site, and set desilting basin and silt fence at the exit to drain rainwater, mud with silt to municipal sewage pipe network after precipitation through desilting basin;

(5) Build oil separator and precipitation facilities for construction sewage; build mud purification pond to precipitate mud drained into the purification pond, and the supernatant will be used to water the construction pavement and to rinse the machinery and trucks, etc. and the rest will be drained to municipal pipe network through silt fence.

(6) The stacking sites of construction materials such as asphalt, oil and chemicals shall be far away from rivers;

(7) During the construction process, in order to reduce the impact of engineering construction on nearby traffic and residents, PVC project enclosure with the height of not less than 2.4m shall be set up around the areas which need to be rebuilt and extended.

(8) The exposed roadbed surface of road section close to rivers shall be covered with waterproof cloth in rainy days to avoid erosion to road surface caused by rainfall runoff and to reduce influence on the rivers.

6.3.3 Acoustic environment protection measures

According to Article 27, 28, 29 and 30 of *Law of the People's Republic of China on Environmental Noise Pollution Prevention*, the Project shall conform to emission standard of environmental noise on the construction site specified by the state during construction period; report the project name, construction site and duration, possible environmental noise value and the adopted noise pollution prevention measures to the administrative department in charge of environment protection of the construction site five days before commencement of the engineering. The following countermeasures and suggestions are put forth for influence of noise environment during construction period:

(1) During construction, receive the supervision and inspection of the Urban Management Department and take effective measures for vibration and noise reduction without disturbing the residents;

(2) The sensitive spots of residential area, hospital, school, etc are densely and evenly distributed at the both side of the Project. The day and night construction will disturb normal life, rest of the above residents, and the influence of night noise is even worse, so all the night construction shall be forbidden; if there is really a need for night construction due to the

construction technology, it is necessary to go through formalities for review and approval of Night Construction Permit according to the relevant provisions and publicize the complaint hotline for night construction noise; the use of high-noise mechanical equipment at night is restricted within 7:00-12:00 and 14:00-22:00, and if there is a need for continuous construction for special reason, the approval of the environment protection department must be obtained in advance;

(3) Try to use low-noise machinery, and all the construction machinery shall be receive noise measurement under normal operation in advance and the nonconforming machinery shall be prohibited from mobilization. The machinery shall be regularly maintained during construction to avoid noise enhancement due to poor performance of the equipment; the high-noise machinery such electric generator, air compressor shall be located at the remote place which is far from the sensitive spots such as residential area, and shall be regularly maintained strictly in conformity with operation procedure, and build 2.4m high fence near the residential area;

(4) Use the commercial concrete, and there is no concrete mixer in the construction site;

(5) Organize the construction trucks. The transportation trucks shall pass the construction site through the side far away from the sensitive spots, and shall slow down and avoid honking when passing through;

(6) Stop construction during special days such as on the dates of senior high school entrance examination and national college entrance examination, etc.

It is expected that after the adoption of the above measures, the environmental influence of construction noise will be reduced and the noise doesn’t much affect the surrounding environment when the night construction is avoided. But when there is a need for night construction for special reasons and the requirement of Emission Standard of Environment Noise for Boundary of Construction Site (GB12523-2011) is hard to meet, the Development Organization and the Construction Organization shall strengthen the operation and management of construction period and take the advice of surrounding residents to heart to obtain their understanding and support.

6.3.4 Measures for solid waste

The solid waste during construction period of the Project mainly includes discarded earthwork and domestic refuse of constructors.

According to the investigation and materials provided by the Development Organization, environmental protection measures to be adopted for solid waste include:

①PVC project enclosure with the height of not less than 2m shall be set up around the areas which need to be rebuilt and extended. Keep the construction area within the enclosure clear, and special people shall be assigned to be responsible for cleaning of the construction site by promptly watering and sweeping to reduce raised dust. The mound and windrow shall not be within the nearby area outside the red line.

②Reasonabely arrange the mound areas according to temporary quantity of the piled soil to reduce the quantity of temporary mound areas. Try to arrange the mound areas in the middle of the enclosure where the trucks and machnery barely pass through during construction to reduce the disturbance of construction machinery on the mound areas.

③Directly use waterproof cloth to temporarily cover the mound area due to short time existence of the mound.

④The discarded earthwork of the Project mainly includes brick slag, construction waste caused by pavement break, boring slag of pedestrian overcrossing, road, clay residue caused by excavated drainage engineering, etc. The discarded earthwork of the Project is uniformly organized and allocated by the Urban Administrative Department for regional balance, and those which can't be utilized shall be transported to designated place for treatment by the Urban Administrative Department.

⑤The domestic garbage shall be handled by the Sanitation Department after separate collection.

6.3.5 Ecological protection measures

(1) Flowers, plants and trees in the middle part of the road and by the sides of the road shall be transplanted without the need of replanting after being totally removed, and it is suitable to fill up the vacant field through transplanting by design. During the construction, pay attention

to protect vegetation of trees and green space in neighboring area. It is required for the transplanted vegetation that:

①Vegetation restoration principle

The road engineering shall be based on the principle of preserving existing trees to avoid migration of seedlings caused by road construction. When it is necessary to migrate or fell existing green trees to satisfy the need of traffic function, the decision shall be made after common consultation together with Party A and the relevant garden administrative departments. Based on the principl of eco-environment protection, it is required for all the construction organizations that the well grown arbors and shrubs of existing trees which affect the road construction shall be selected to be reused to effectivley reduce the cost of greening investment and realize rapid vegetation restoration of the newly built road.

②Tree species selection

Give priority to locally grown species with ornamental value for plants along the sides of the road, match species with the site and stress seasonal change of the plants. Considering landscape uniformity of the existing species and the principle of economy, the following main species are selected for greening of the road.

Key species: cinnamomum camphora, koelreuteria paniculata, platanus;

Dominant species: southern magnolia, gingko, cluster osmanthus, photinia serrulata, crape myrtle, red maple, prunus lannesiana, red leaves prunus persica, etc.

Main shrubs and ground cover: fatsia japonica, aucuba japonica variegate, photiniaxfraseri, France holly, ligustrum, big leaf gardenia, phnum penh buxus sinica, nandina domestica, floribunda roses, ophiopogon japonicus, iris tectorum maxim., manilagrass, etc.

(2) During construction, try to construct the road outside the red line, and the mound and windrow shall be kept away from the neighboring area.

(3) During construction, the large area of garbage caused by pavement break shall be handled in order, and then build enclosure and clear and transport the waste slag to avoid disordered landscape along the road sides.

(4) Reasonably allocate the earth excavation and filling, and take protective measures in the temporary piling spots of spoil to avoid earth excavation and filling in rainy days, and water and soil erosion caused by rain wash, polluted water and blockade in drainage pipeline.

Tamp the spoil surface, temporarily obstruct with bagged soil around it and meanwhile cover the spoil with cloth. Set drainage ditch around the temporary spoil spots, and the rainwater shall be precipitated in the desilting basin after flowing through the drainage ditch, and then be discharged into the municipal pipe network.

(5) To the satisfaction of requirements of the engineering construction, try to save the occupied land and reasonably arrange the construction progress. Clear the construction site instantly after the completion of the Project, withdraw from the occupied site and restore the original road and greening.

6.3.6 Mitigation measures of social environment influence

Occupation of the existing road by construction activities such as in and out of construction trucks, transportation of the construction materials will cause traffic jam and bring adverse effect on resident trip along the road.

According to the site investigation, there are residents, school, research institute, etc. along the both sides of construction roads. Road construction will bring adverse effect on the trip of surrounding residents. The Development Organization shall reasonably arrange the construction period, and try to reduce the quantity of traveling trucks during rush hours to reduce the adverse influence of the construction on resident trip. The specific measures are as follows:

(1) The Construction Organization shall foster good relations with the public and the surrounding residents around construction site to create a harmonious construction environment. Before commencement of construction, post the necessary notice to describe the engineering condition and the possible disturbance to obtain understanding and support of the public.

(2) To reduce the influence of adverse effect of engineering construction on urban resident life and traffic to the minimum, the vehicle routes during construction shall be uniformly shunted and arranged to avoid traffic jam; meanwhile, the routes of construction machinery and construction transport vehicles shall be uniformly arranged, either, and relevant restriction provisions shall be issued to ensure smooth and normal running of the urban traffic with advance notice by means of broadcast, television and newspaper. People shall be arranged on duty in the construction section to disperse traffic and ensure pedestrian safety.

(3) Set clear signs at the entrance and exit section of the Project to remind detour.

(4) Try to shorten the construction period on the premise of ensuring the construction quality, and stop construction during special periods such as in the periods of senior high school entrance examination and national college entrance examination.

(5) Measures to mitigate influence on the traffic

During road construction, the traffic capacity of the intersection will be reduced under the influence of the construction, so it is suggested that citizens shall detour through the regional road network to avoid passing through the affected intersections and reduce the delayed time.

Strengthen the traffic management during engineering construction

a Optimize and adjust regional transportation organization to minimize the traffic pressure of the main affected roads and improve the traffic evacuation capacity in the district;

b Improve the regional means of transportation, strengthen transportation management and raise the running efficiency of existing roads;

c Perfect the signal monitoring system at the crossroad and improve the traffic capacity of the crossroad;

d Establish a contingency plan to promptly respond to the emergency and reduce the adverse influence on the traffic;

e Set up a specialized traffic evacuation group to fill the gaps of sectional management, dynamically manage the whole line as a whole and regularly inspect the potential traffic danger;

f The Traffic Police Department shall arrange more police along the side of the roads and strengthen the traffic management.

6.4 Pollution prevention measures during operation period

6.4.1 Atmospheric environmental pollution prevention measures

In specific respect to road system, It is recommended in the report that the following measures should be taken for the purpose to further reduce the impact of exhaust gas produced during operation of the Project on surrounding environment.

(1) No thoroughfare for motor vehicles with over-proof emission of off-gas pollutant

In order to reduce emission of off-gas pollutant of motor vehicles, inspection on vehicle emission shall be carried out by Urban Traffic Management Department; prohibit over-proof motor vehicles to pass through; limit vehicles with over-proof off-gas emission to drive on the road.

(2) Enforcement on detection and maintenance of motor vehicles

Emission load of off-gas pollutant of motor vehicles is closely associated with its technical conditions. Frequent over-proof exhaust of in-use vehicle is mainly caused by low level maintenance, deterioration of engine technology, etc. After application of unleaded gasoline and installation of off-gas cleaning cartridge on motor vehicle, inspection and maintenance become even more important for such motor vehicle. Therefore, I t is necessary to enforce the inspection and maintenance on the vehicle and keep in-use vehicle always in good conditions in order to reduce emission of off-gas pollutant.

(3) Keep roads clean and carry out watering promptly in order to reduce dust particles on road surface

As dust raised on road comes from dust particles settled on road surface, reducing these dust particles means reducing source of pollution.

(4) Utilize plant cover to purify the air

It is proved by tests that broad-leaf arbors on both sides of the road are equipped with certain dust prevention and purification effect on pollutant, therefore, it is recommended for construction organization to carry out landscaping on both sides of the road for the purpose to make full use of purification effect of plant cover on environment and air.

(5) Enforce environmental management and establish organization of environmental management for Road Management Department; entrust Environmental Protection Department to carry out regular ambient air monitoring at monitoring points specified in the Evaluation.

In specific respect to station yard, it is recommended in the report that the following measures should be taken to further reduce the impact of exhaust gas produced during operation of the Project on surrounding environment.

(1) For catering setting, catering project setting shall be in conformity with relevant requirements by HJ554-2010 Specification For Environmental Protection of Catering Trade and emission of cooking fume shall be in conformity with GB18483-2001 Emission Standard of Cooking Fume (trial implementation); in addition, prior to establishment of catering project, catering organization shall handle environmental impact assessment submitting and approval procedures separately.

(2) Enforcement on interior ventilation of the station yard.

(3) Reasonable planning of overall layout of station yard and scientific management on vehicles entering and leaving the site.

6.4.2 Prevention measures for acoustic environmental impact

During operation period of the Project, a series of measures are necessary for ensuring a good acoustic environmental quality of both sides of the road, including intrinsic control and prevention measures of the work, planning control requirements on construction along the road as well as later period intrinsic noise prevention measures for environmental sensitive spots.

6.4.2.1 Intrinsic control measures of the work

(1) Enforcement of management on road operation. For instance: No honking for certain areas; speed limit for vehicles within the area; drive through road sections with more dwelling districts and carry out limit or time limit for nighttime thoroughfare of heavy-duty trucks and large-scale heavy-duty trucks passing the boarder; adjust traffic signals to smooth the traffic and make vehicles free from frequent stopping and starting in order to reduce source of noise; enforce road operation maintenance, and repair damaged road promptly; keep road surface

level and smooth in order to prevent increase of traffic noise resulted from vehicles unable to drive normally.

(2) Carry out landscaping along the road planned to be constructed, and in respect of tree species, aiphyllium with large crown and leaf area shall be selected, and plant short shrubs of proper amount at places surrounding arbors, in order to reduce traffic noise effectively. According to relevant study, greening lowering noise is mainly the reflection and absorption effect of plants on sound wave. Plant cover itself is cellular material equipped with certain sound absorption function which can reduce energy of sound wave thus making noise reduce. Equipped with qualified conditions, artificial geographic scenery spot may be constructed for the Project to reduce noise. Adopt multi-layer plantation structure as arbors-shrubs-grasses for tree species selected in order to achieve good sound insulation and noise reduction effect.

6.4.2.2 Strengthening the reasonable planning and building layout along the roads.

Most of the regions along roads of the Project have been planned to be class 2 residential lands, administrative lands, school lands, hospital lands, commercial facility lands, retail commerce lands, green lands of parks, green lands for environmental protection, etc. Therefore, class 2 residential lands, administrative lands, lands of institutions of higher learning, primary school lands, hospital lands, etc. are the acoustic environmental sensitive areas of the Project.

According to the forecast, the roads will exert severe impacts on the surrounding acoustic environment in the operation period. In the later phase, the Planning Department should adopt an optimal design, avoid infrared rays and adjust the building layout to alleviate the influences of traffic noise on the surrounding environment.

6.4.2.3 Noise prevention scheme for sensitive spots

(1) Noise prevention principles of sensitive spots

The Work is included in the urban road reconstruction projects. The quality of existing acoustic environment along the roads is relatively poor and practical situation of the Work needed to be considered to achieve the protection of the sensitive spot of the Project. If the noise of the sensitive spot exceeds the standard and the existing level after the completion of the Work, relevant noise preventive measures are needed to be taken to make the environmental noise of the sensitive spot reach the corresponding standard limiting value.

According to the field survey, sensitive spots of noise concentrate in dwellings, schools, hospitals, institutions, etc. along the roads of the Project. Because the Work is the road reconstruction, regional acoustic environmental protection may be realized by lowering the traffic noise value itself (e.g. set up the pavement of low noise) to actively protect the buildings along the roads sensitive to noise and lower the influences of traffic noise on the surrounding areas.

Besides, according to *Policies of Noise Pollution Prevention Techniques for Ground Transportation* (HF [2010] No.7), when the construction or operation of the ground means of transportation causes the environmental noise outside of the sensitive buildings to exceed the standard and the out-door techniques of meeting the standard adopted are infeasible, passive protection measures (such as doors and windows for sound insulation, and ventilation windows for noise elimination) can be made allowances for to buildings sensitive to noise to properly protect the quality of indoor acoustic environment.

(2) Analysis of current main noise reduction measures

Currently the noise preventive measures of urban road traffic mainly include the setting of sound barrier, control of vehicle speed, forbiddance of whistles, etc. Directed at the objects exceeding the standard, such measures as relocation, adjustment of roadside functional zones of the protected targets, and the setting of sound proof windows are taken. Here is the comparison of several noise reduction measures as follows to rationally determine the measures suitable to the sensitive spots that exceed the standard. See Table 6-4-1 in details.

Table 6-4-1 Comparison Table of Common Measures of Noise Prevention

Measures of noise reduction	Applicable	Noise reduction effect	Estimated cost	Advantages	Disadvantages
Relocation	Severely exceeding the standard and not easily solved through other measures; based	No noise influences	Related to the practical situation	Thorough noise reduction and complete	Relatively high cost; limited applicability and having certain impacts on residents' life.

	on residents' will			elimination of noise influences	
Forests for noise reductio n	Noise slightly exceeding the standard; centralized residential areas, schools or hospitals with afforestation conditions	20m wide green belt can reduce noise by 2~3dB(A)	200~500yuan/m	Noise reduction, air purification, road beautification and ecology improvement	Occupying large land areas; taking relatively long time to achieve the noise reduction effect; remarkable seasonal changes of noise reduction and the limited applicability
Low noise paveme nt	Severely exceeding the standard; scattered distribution; residential areas, schools, and hospitals that are far away from the roads.	3~7dB(A)	30~50yuan/m^2	Good noise reduction effect; widely applied	Hard to maintain; noise effect decreasing with time going by
Erect type of sound barrier	Severely exceeding the standard; centralized sensitive spots relatively close to the roads	5~12dB(A)	Unequal among 500-2000yuan/ m^2 based on forms and structures	Widely applied and easy to be implemented	Some forms of sound barrier having influences on landscape.
Whole sealing sound barrier	Severely exceeding the standard; relatively close to the roads and centralized in the sensitive spots on both sides	20~30dB(A)	Unequal among 1200~1400yuan/m^2 based on forms and structures	Good noise reduction effect	High construction cost; having certain influences on the landscape along roads; potential safety hazard
Sound proof window of double-l ayer hollow	Severely exceeding the standard; scattered distribution; residential areas, schools or hospitals relatively far away from the roads	27~34 dB(A)	800~1000 元/ m^2 800~1000yuan/ m^2	Good effect; proper cost; good applicability; having few influences on residents' life	Hard to implement compared with such noise reduction measures as sound barrier

(3)Combined selection of noise preventive measures of the Project

Based on the analysis of noise forecast in the previous chapter, the mid-long-term noise value of most sensitive spots after the operation of the Project will increase to a relatively great degree compared with the current situation, especially the appearance of diverse degrees of exceeding the standard along near the roads with the biggest standard-exceeding value of 10.4dB (A), the highest increase of 6.0dB(A) compared with the current situation. Some of the sensitive spots cannot satisfy the corresponding quality standards of acoustic environment which worsens to some extent after operation.

On the basis of the field investigation, residential areas near the roads are relatively intensive, so the sensitive buildings need protection from noise in order to protect the regional acoustic environment. So the evaluation suggests that noise preventive measures should be taken for the sensitive spots of which environmental noise exceeds the standard and the current situation after the operation of the Work to make the environmental noise at sensitive spots reach the corresponding environmental standard or better than that of the current situation.

Based on the comprehensive consideration of such factors as features, road characteristics, noise reduction effect needed and the application conditions of different noise reduction measures of all the sensitive spots along the roads of the Project and in the principles of technical feasibility, economy and rationality, and fair, low noise pavement will be adopted. The reasons for the adoption are as follows:

①Of all the noise reduction measures, the effect through relocation is the best. However, because relocation needs cooperation from such related departments as the government, it’s hard to implement. Only such sensitive spots as far exceed the standards and are scattered with poor house structures are dealt with the measure. The evaluation is without environmentally-friendly relocation measures.

②Forests for greening and noise reduction not only can reduce noise but beautify environment and purify air. But considering that the Project is located in the urban built-up areas where the land resources are precious and few lands for greening can be used, forests for greening to reduce noise will occupy land resources with limited effect. Hence, the evaluation doses not adopt the measure.

③Combined with the characteristics of the Work, there are no conditions for setting the sound barrier for the Work is about the road surface. Consequently, the evaluation doses not adopt the measure.

Because the Work is located in the central urban area, medium-and large vehicles moving on the roads account for a low percentage which tends to decrease with time going by. Therefore, **low noise pavement** can be adopted to further reduce the impacts of traffic noise on the surroundings.

Additionally, for those sensitive spots which do not reach the standard after the adoption of the above active measures of noise prevention, passive preventative measures(e.g. sound proof doors and windows, ventilation windows for noise elimination, etc.) can be taken into account to deal with the sensitive buildings to properly protect the quality of indoor acoustic environments.

The evaluation further analyzes the feasibility of the above related measures and the details are as follows:

Analysis of noise reduction effect of low noise pavement

The traffic noise is mainly comprised of the vehicle power noise and the vehicle tire noise, and the low noise pavement realizes the noise reduction effect by reducing the vehicle tire noise. On the ordinary asphalt road, cement road or other road structure are painted mixed materials with a high porosity (porosity usually at 15%-25%), forming the low noise pavement which reduces noise through the interflowing hole network on the surface.

The low noise pavement can be divided into the bituminous concrete and the cement concrete and the low noise pavement of bituminous concrete is most studied currently. Bituminous pavement of low noise generally refers to the pavement that can reduce noise, relative to common dense bituminous concrete pavement. So far, the bituminous pavement found that can reduce noise are: porous bituminous pavement, rubber bituminous pavement, SMA pavement, ultra-thin bituminous pavement, porous elastic road surface, etc. See Table 6-4-2 in detail about the techno-economic analysis of all types of low noise pavements.

Table 6-4-2 Techno-economic Comparison of Diverse Low Noise Pavements

Low noise pavement	Noise-reduction principle	Applicability analysis
Porous bituminous pavement	There are many small connected holes on the porous bituminous pavement with the porosity of 15%-20% and even more than 20%. When the tire rolls, the compressed air can pierce into the holes on the road surface freely instead of volleying into the surroundings, hence a reduction of air pumping noise of tread pattern. This road surface structure is characterized with such features as anti-noise, anti-tracks, anti-slide performance improvement in rainy days, splash and hydroplaning reduction, visibility enhancement of road signs and transportation safety improvement.	The pavement can achieve anti-noise and anti-tracks; meanwhile it is featured by anti-slide performance improvement in rainy days, splash and hydroplaning reduction, etc. But the pavement durability is relatively poor due to the high porosity.
Rubber	About the mechanism of rubber bituminous pavement, it is largely	Not widely applied currently.

Low noise pavement	Noise-reduction principle	Applicability analysis
bituminous pavement	because of the high elasticity of rubber powder or rubber crumbs that the pavement produces the effect of the absorption of tire vibration and shock. Meanwhile, the rubber asphalt mixture is a kind of polymer composites with relatively strong internal damping, which can greatly reduce tire vibration, therefore lowering the vibration noise of tire/road surface largely.	
SMA pavement	Noise from the tire contacting the road surface is closely linked with texture property of the road surface. According to the study, the addition of macroscopic structure (0-0.5mm road aggregate surface in the horizontal direction, 0-0.2mm tiny structure in the vertical direction and 0.5-50mm of wave length) quantity can reduce the air pumping noise of the tire. Much coarse aggregate of SMA mixture, building stones used of high quality and the road surface structure of great depth make SMA pavement armed with good macroscopic structure, bestowing the property of absorbing and weakening the tire rolling noise on SMA pavement.	The noise reduction property of the road surface and applicability of the relative perdurability are popular with many countries and the noise reduction pavement is relatively widely applied in our country's urban roads currently.
ultra-thin bituminous pavement	The size of the biggest aggregate particle in the ultra-thin bituminous mixture is small with its surface even, guaranteeing the condition for smooth driving. Thanks to the developed negative texture (surface structure quantity in the unit area) on the road surface, the noise of tire contacting the road surface is absorbed via the structure depth and the interspaces of the pavement to emit air pumping noise on one hand, and the noise energy is weakened and consumed through the multiple reflections of road surface texture on the other hand.	Relatively thin asphalt structure, relatively high construction cost and relatively poor pavement durability of the pavement.
（PERS） porous elastic road surface (PERS)	According to acoustics, PERS is a kind of porous sound absorption materials with porous sound absorption and resonance sound absorption; from vibration, one of the important components of PERS is rubber particle which makes the mixture material equipped with the effects of damping and vibration and noise reduction.	Due to the complicated construction techniques of PERS and the high construction cost, it is still in the test and research phase at present.

To sum up, based on the analysis of noise reduction, durability and economy, the rubber bituminous pavement and porous elastic pavement are still in the test and research stage and haven't been widely applied. The durability of Ultra-thin bituminous concrete pavement and porous bituminous pavement is relatively poor while SMA pavement can reduce noise to some extent and can endure relatively well with low cost and has been widely used in urban roads. So the entire length of the reconstruction roads of the Work is suggested to adopt **SMA low noise pavement.**

(4)Reviews over noise prevention measures to be taken in the Project

According to the analysis of above noise preventive measures and aimed at the Work's features, active preventive measures of traffic noise should be vigorously applied to the sensitive spots of the Work exceeding the standard. The evaluation suggests the active preventive measures of noise, namely setting SMA low noise pavement along the whole line.

6.4.3 Measures of water pollution prevention

(1)To protect the surrounding water body such as river, water pollution and hidden accidents resulting from vehicle oil leak and cargo dropping should be prevented and treated. The bulk materials which can easily produce dust like coal, lime and cement should covered when they are loaded to keep them from dropping, forming runoff that affects water quality.

（2）Rainwater drainage system should be regularly checked and cleared to ensure it is unblocked and maintains in a good condition. Maintain well and take good care of the facilities along the line.

(3)Emergency response team for carriage of hazardous articles is established to deal with all the potential significant contamination accidents; the hazardous article vehicles shall be specially managed with a special sign set.

(4) Domestic wastewater of all stations is preprocessed and then drained into the municipal sewage pipe network, followed by the discharge with standard level after the disposal by sewage treatment plants; if the high-speed railway station, the road passenger transportation center and the bus transfer junction haven't been connected to the sewage pipe network when they have been constructed, the Developer should build sewage treatment facilities by itself and only when the domestic wastewater complies with the Class A of *Integrated Wastewater Discharge Standard* (GB8978-1996), can it be discharged. For the sewage treatment facility constructed all by the Developer, the evaluation recommends and suggests the dynamic buried sewage treatment integration facilities with the treatment scale of more than 30 m^3/d.

6.4.4 Solid waste disposal

Trash cans are set along the line to collect solid wastes. Intensify sweeping and regularly send them to the urban garbage disposal plant for disposal.

6.5 Transportation management of hazardous article and emergency measures

The Project is a significant component of Anlu road network, undertaking dual functions of regional transportation's rush through and local service. As the regional main thoroughfare, it is mainly workplaces and residences flanked the road.

Take environmental sensitivity of the road's section and impact of hazardous article transportation's environmental risk into consideration, the assessment presents that the section of road shall forbid transportation of dangerous chemical according to specification that "to avoid risks and accidents happen in urban center or communities with dense personnel, transport vehicles shall try to pick route in suburb with sparse population" in *Safety Management Regulations of Dangerous Chemical.* If it truly needs to transport dangerous chemical in this section of road for special circumstances, the following measures shall be taken:

①It shall be reported to local departments such as Public Security and Environmental Protection Department in advance and risk pre-arranged planning of hazardous article transportation shall be put forward.

②Running time and time interval of passing the section of road shall be appointed by Public Security Department, and Public Security Department can implement traffic control when it is necessary.

③Transport vehicles must strictly enforce relevant specifications in *Transportation of Dangerous Goods Code* (TT3130).

6.6 Environmental protection acceptance inspection after construction completion

According to No. 13 document of *Acceptance Management Method of Environmental Protection after completion of Construction Project* (published on Dec. 27, 2001, implemented on Feb. 1, 2002) issued by State Environmental Protection Administration and requirements in No. 5 document of *Management Method of Environmental Protection in Transportation Construction Project* issued by Ministry of Communications in 2003, project construction and environmental protection shall implement "three at the same time" system and apply for acceptance inspection of environmental protection facilities within three months after it is brought into service.

Summary sheet of "three at the same time" system of environmental protection in the Project and environmental protection acceptance check of construction completion can be seen in Form 6-6-1.

Form 6-6-1 Summary Sheet of Environmental Protection Acceptance Check of Construction Completion

No.	Items	Main content of acceptance check	Remark
I	Organizations and institutions setting	Relevant Environmental-Impact Assessment Organization is established according to EIA report and management requirements	Provided by the Owner of the Project when the acceptance check application report is submitted
II	Bidding documents	Specification clause about environmental protection shall exist in engineering construction and facility purchasing contract	
III	Dynamic monitoring material	Environmental monitoring report in construction period	
IV	Effect test of environmental protection facilities	Inspection report of environmental protection facilities' effect in trial operation period	
V	A list of environmental protection facilities	Environmental protection facilities determined by engineering design and EIA	

V	Details of measures			Quantity	Amount (ten thousand yuan)	Expected effect	Remark
Ecological protection and restoration	Ecological restoration and conservation of water and soil			/	1870	Reduce the effect to surrounding ecological environment	Greening investment is not counted
Prevention of noise	Construction period	Noise reduction facilities such as temporary noise barrier shall be set		/	30	Meet the demand in GB12523-2011 *Emission Standard of Environmental Noise in Construction Field*	Analogical estimated column
	Operation period	Noise control in operation period	Set low noise road		1650	Predicted value of sensitive sites' acoustic environment can satisfy standard threshold requirements of GB3096-2008 *Quality Standard of Acoustic Environment* and standard of *Civil Architecture Sound Insulation Design Code* or be not beyond current situation level	/
Prevention of water pollution	Construction period	Industrial wastewater of construction camps shall be disposed through oil removal and sedimentation basin. Temporary waste slag site, drains in disposal site, pipelines and		/	30	Reduce the effect of water environment	Estimated column, adjustment shall be made in accordance with the number of construction camps

		blocking equipment.				
Pollution prevention of atmospheric environment	Construction period	Watering to reduce dust around environmental sensitive sites, construction camps and construction roads	60 months	20	Meet secondary standard in the form *Ambient Air Quality Standard* (GB3095-2012)	Analogical estimation
Collection of solid waste	Disposal of construction waste in construction period		/	50,000/year	Zero release	Analogical estimation

7 Public Involvement

7.1 Purpose and function of public involvement

Public participation is a kind of two-way communication between Construction Organization of the Project and the public in the place that the Project is located through EIA work, with the purpose of making the public fully understand the Project and know content and meaning of construction. In this way, the public’s support and coordination for the Project can be acquired.

Public involvement is an important part of environmental impact assessment. Implement public involvement is necessary and its function locates in:

(1) In the process of public involvement, inform the public of relevant environmental problems which may be caused by the Project. It can make the public understand the Project and obtain the public’s understanding and support, which acquires full recognition of the public and increases the public’s environmental protection awareness at the same time.

(2) Feelings of the public, especially the public who suffer direct effect of the Project for environmental problems related to the Project and relevant environmental effect are direct and sensitive. They can often be aware of some significant environmental problems and environmental effect and propose helpful opinions to feasibility of environmental protection measures, which can make for the process of EIA.

(3) Various opinions and suggestions of the public for the Project can be acquired through public involvement, providing basis for safeguarding vital interests of the public. Fully adopt feasible suggestions in the process of EIA, and reduce worries of the public caused by the shortage of communication between both sides. Lower the negative effect on public interests as far as possible.

(4) Assessment work after EIA mainly depends on the function of public supervision. The public’s positive participation is a significant component of environmental management mechanism, which is in favor of protecting the ecological environment, enhancing

environmental benefit and economic benefit of the Project, improving environmental quality and ensuring the implementation of sustainable development strategy.

7.2 Principle, pattern and content of public investigation

7.2.1 Investigation principle

The public being engaged in investigation follows the principle of publicity, equality, wide range and convenience and strives to achieve scientific, objective, fair and comprehensive standard.

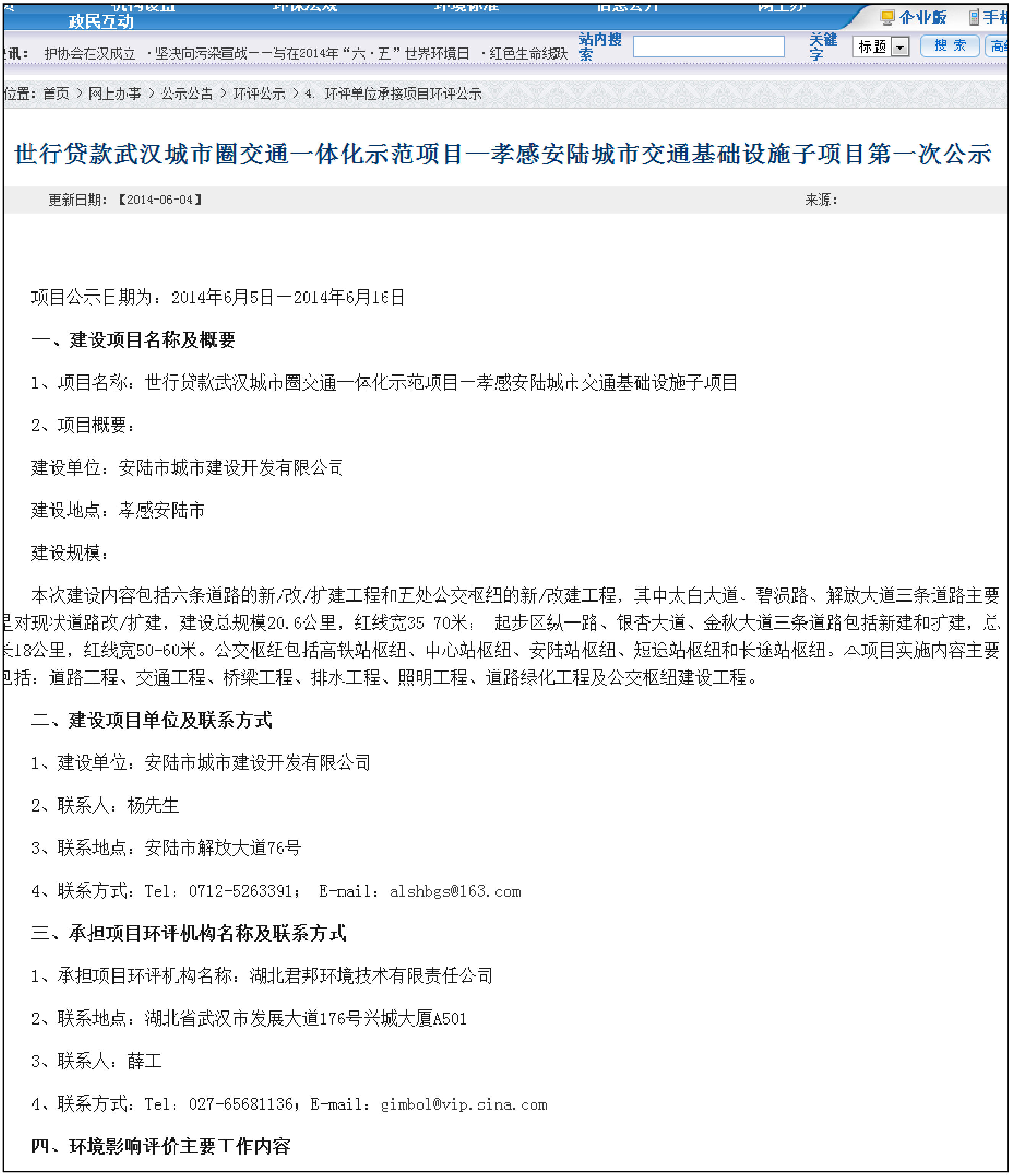
7.2.2 Investigation pattern

The public involvement of EIA adopts the following methods in accordance with requirements in *The Public involvement's Interim Procedures of EIA*:

1) Internet survey

Our Company successively released the first publicity and abridged edition publicity of the Project's basic information on website of Hubei Environmental Protection Bureau (http://www.hbepb.gov.cn) and EIA outline publicity of the Project and abridged edition publicity on website of Government Affairs Gazette in China Anlu(http://www.anlu.gov.cn) on June 5, 2014 and December 25 after the acceptance of engagement;

The screenshots of publicity are as follows:



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讯： 护协会在汉成立 ·坚决向污染宣战——写在2014年“六·五”世界环境日 ·红色生命线跃 站内搜索 关键字 标题 搜 索

位置：首页 > 网上办事 > 公示公告 > 环评公示 > 4. 环评单位承接项目环评公示

世行贷款武汉城市圈交通一体化示范项目—孝感安陆城市交通基础设施子项目第一次公示

更新日期：【2014-06-04】 来源：

项目公示日期为：2014年6月5日—2014年6月16日

一、建设项目名称及概要

1、项目名称：世行贷款武汉城市圈交通一体化示范项目—孝感安陆城市交通基础设施子项目

2、项目概要：

建设单位：安陆市城市建设开发有限公司

建设地点：孝感安陆市

建设规模：

本次建设内容包括六条道路的新/改/扩建工程和五处公交枢纽的新/改建工程，其中太白大道、碧涢路、解放大道三条道路主要是对现状道路改/扩建，建设总规模20.6公里，红线宽35-70米； 起步区纵一路、银杏大道、金秋大道三条道路包括新建和扩建，总长18公里，红线宽50-60米。公交枢纽包括高铁站枢纽、中心站枢纽、安陆站枢纽、短途站枢纽和长途站枢纽。本项目实施内容主要包括：道路工程、交通工程、桥梁工程、排水工程、照明工程、道路绿化工程及公交枢纽建设工程。

二、建设项目单位及联系方式

1、建设单位：安陆市城市建设开发有限公司

2、联系人：杨先生

3、联系地点：安陆市解放大道76号

4、联系方式：Tel：0712-5263391； E-mail：alshbgs@163.com

三、承担项目环评机构名称及联系方式

1、承担项目环评机构名称：湖北君邦环境技术有限责任公司

2、联系地点：湖北省武汉市发展大道176号兴城大厦A501

3、联系人：薛工

4、联系方式：Tel：027-65681136；E-mail：gimbol@vip.sina.com

四、环境影响评价主要工作内容

Fig. 7-2-1 the First EIA Information Publicity's Screenshot on Website of Hubei Environmental Protection Bureau

Fig. 7-2-2 Publicity Screenshot of EIA Outline on Website of Government Affairs Gazette in China Anlu

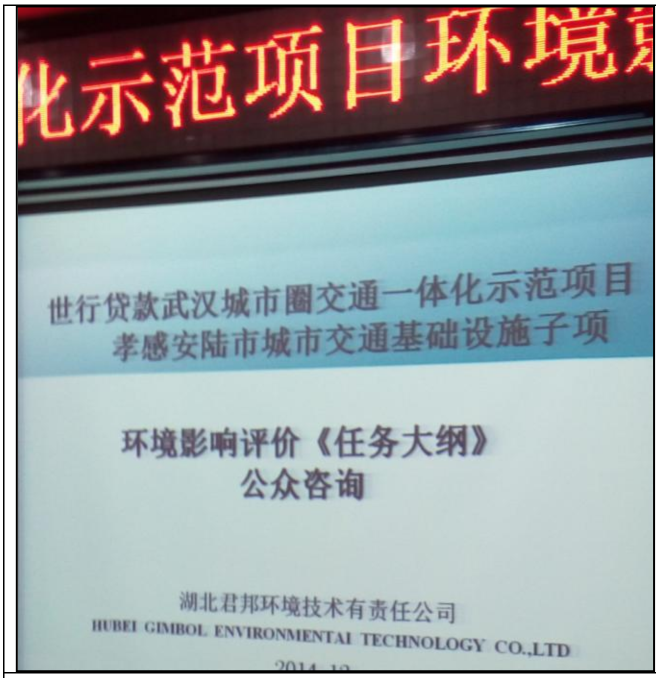
Fig. 7-2-3 Publicity Screenshot of EIA Abridged Edition on Website of Hubei Environmental Protection Bureau

Fig. 7-2-4 Publicity Screenshot of EIA Abridged Edition on Website of Government Affairs Gazette in Anlu, China

After the first publicity and abridged edition publicity of the Project on the Internet, the Representative Office of the World Bank in Anlu received many consultative calls. Except a part of calls for contacting business, the main content of those calls is concerning whether construction of the Project will affect daily life and transportation. Workers in the Representative Office of World Bank replied the question patiently, and they told the consultants that the Project is proceeded in special time divisions and appointed sections of roads, which will fundamentally not affect normal transportation and traveling.

2) The public's participation in the hearing

Anlu Yunan Asset Management Co., Ltd. respectively held two hearings participated by the public in Anlu on October 23, 2014 and December 23, 2014. Pictures taken from meeting can be seen in Fig. 7-2-5.



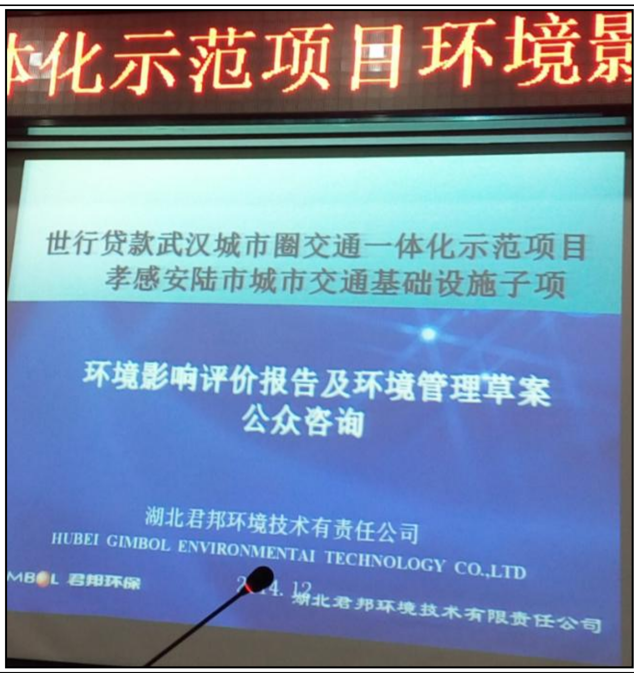


Figure 7-2-5 The Hearing Attended by the Public pictures of Xiaogan Anlu Urban Transportation Infrastructure Subitem

(1) The first public consultation

Time: 9 o'clock in the morning on October 23, 2014 (Thursday).

Address: the fifth floor of Development and Reform Bureau in Anlu City.

Contents of public consultation: EIA *Terms of Reference* of the Project.

Moderator: Wen Jiawei, Deputy Director of World Bank's Representative Offices in Anlu City

Participants: they are mainly resident representatives who may be influenced by construction and who are around construction road and stations, representatives of public institutions (45 people in all), including:

①EIA Organizations, Project Office of World Bank in Anlu, Development Organizations and so on;

②Representatives of Public Institutions: Government Office of Anlu, Anlu Health Inspection Bureau, Municipal Government of Anlu, Anlu Civil Affairs Bureau, Anlu Supervision Center, Anlu Science and Technology Bureau, Anlu Public Security Bureau, Secondary Vocational and Technical School in Anlu, Anlu Pu Ai Hospital, economic development zone in Anlu, No. 2 Middle School in Anlu, Roads and Traffic Authority in Anlu, Anlu Internal Revenue Commission, No. 1 Middle School in Anlu and organization representatives.

③Resident representatives: administration committee of the development zone in Anlu, Fucheng Office, Nancheng Office, Yandian Town, Tangdi Town, principal of environmental protection in branch of Hexi New District and Jiahe Community, Fudong Community, Shili Primary School, Shili Middle School, Zhoujiaxin Village, Kaixuan City, Shangri-La City Garden, Jinqiu Imperial Garden, Shui’an Xingcheng Building, Xugang Community, Shitang Community, Shimiao Community, Zhaohe Village, Lvjiafan, Huguo Village, Lilong Village, Jinquan Village, Yuanlin Garden, De’an Garden, Shuanglongqiao Homeland, Fengda International City, Linyu Fortant, Taihe Villa, Luojia Village, Taihe Paradise, Jinjia Yard, Delin Garden, Jinbang Well-known City, Jingang Garden, An’er Homeland, Haocheng Garden, Sili Community, Zhongyi Community and other resident representatives.

Process of conference:

a. The moderator introduces tropics for discussion and main participants of conference;

b. Representatives of EIA organizations introduce main construction content and key points of EIA of the Project;

c. In discussion stage of conference, representatives of different fields present at the conference will put forward their doubts, opinions and suggestions as regards to questions of the Project’s construction content, scope and implementation time. Each representative of relevant government departments, Project Department of all levels and owners will give on-site explanation for the questions proposed by representatives of all fields. EIA Organization will assist in answering questions with technical contents.

d. The moderator makes a conclusion of the conference.

Conference conclusion:

Representatives present in the meeting thoroughly understood the content and implementation time of the Project and thought that the advantages of the Project are greater than disadvantages as a whole. The Project can improve city image of Anlu as well as living standard of residents, and it is safer for residents’ traveling after the traffic flow is divided. Personnel in the meeting also advised to establish underground passage at Bixia Road and platform bridges in the exits of three schools (No. 1 Middle School in Anlu, No.2 Middle School in Anlu, High Vocational and Technical School in Anlu) on Taibai Road.

After the detailed introduction to the public, the Owner explained that the establishment of overpass had been considered in earlier-stage plan, but the current plan was to establish traffic light and designate pedestrian crossings on the students-concentrated roads. Because the establishment of overpass only makes pedestrian to avoid vehicles, but the purpose of reducing vehicles' speed cannot be obtained. The optimization of road traffic aims at the harmony between traffic and pedestrian. Improve current traffic safety facilities on roads, and make urban vehicles strictly follow traffic rules. Meanwhile, owners also demonstrated that suggestions on the consultative meeting would be further discussed with the Design Department.

(2) The second public consultation

Time: 9 o'clock in the morning on December 23, 2014 (Tuesday).

Address: the fifth floor of Development and Reform Bureau in Anlu City.

Contents of public consultation: abridged edition of EIA of the Project and plan draft of environmental management.

Moderator: Wen Jiawei, Deputy Director of World Bank in Anlu City.

Participants: they are mainly resident representatives who may be influenced by construction and who are around construction road and stations, representatives of public institutions (48 people in all), including:

①EIA Organization, Project Office of World Bank in Anlu, Development Organizations and so on;

②Representatives of Public Institutions: Government Office of Anlu, Anlu Health Inspection Bureau, Municipal Government of Anlu, Anlu Civil Affairs Bureau, Anlu Supervision Center, Anlu Science and Technology Bureau, Anlu Public Security Bureau, Secondary Vocational and Technical School in Anlu, Anlu Pu Ai Hospital, economic development zone in Anlu, No. 2 Middle School in Anlu, Roads and Traffic Authority in Anlu, Anlu Internal Revenue Commission, No. 1 Middle School in Anlu and organization representatives.

③Resident representatives: administration committee of the development zone in Anlu, Fucheng Office, Nancheng Office, Yandian Town, Tangdi Town, principal of environmental protection in branch of Hexi New District and Jiahe Community, Fudong Community, Shili Primary School, Shili Middle School, Zhoujiaxin Village, Kaixuan City, Shangri-La City Garden, Jinqiu Imperial Garden, Shui'an Xingcheng Building, Xugang Community, Shitang Community, Shimiao Community, Zhaohe Village, Lvjiafan, Huguo Village, Lilong Village, Jinquan Village, Yuanlin Garden, De’an Garden, Shuanglongqiao Homeland, Fengda International City, Linyu Fortant, Taihe Villa, Luojia Village, Taihe Paradise, Jinjia Yard, Delin Garden, Jinbang Well-known City, Jingang Garden, An’er Homeland, Haocheng Garden, Sili Community, Zhongyi Community and other resident representatives.

Process of conference:

a. The moderator introduces purpose, process as well as main participants of conference;

b. Representatives of EIA organizations introduce main environmental impacts and improvement measures of the Project;

c. In discussion stage of conference, representatives of different fields present at the conference will put forward their opinions, doubts or suggestions as regards to environmental impacts caused by project construction. Each representative of relevant government departments, Project Department of all levels and the employer in location of project construction will put forward their suggestions and doubts which will be solved on site. EIA organization will assist in answering questions with technical contents.

d. The moderator makes a conclusion of the conference.

Conference conclusion:

After representatives present at the conference hear EIA organization’s analysis of environmental impacts in construction and operation period of the Project as well as introduction to environmental protection measures, all representatives show their acceptable attitudes toward environmental impacts generated from the Project and support construction of the Project. But they also put forward some opinions including “reconstruction engineering of road shall ensure smoothness of water, gas, electricity and network”, “safety of places around school and point with dense residents shall be ensured during the construction period”. “Try to avoid construction period in time quantum of entrance examination for secondary school and college entrance examination”, “how to ensure profits of residents and organizations involved in demolishing” and so on.

The employer gives reply to above-mentioned questions: the road will pay attention to protection of municipal supporting facilities at two sides of the road in design and construction; in construction period, construction mark and protective screening will be set outside construction range and other measures will be made to reduce influences of construction on sensitive points around to the greatest extent; in sections around the school, avoid construction during entrance examination for secondary school and college entrance examination; Resettlement Plan of Inhabitants is being prepared in the Project and reasonable arrangement and compensation will be made for organizations and residents involved in demolishing.

3) Issue questionnaire participated by the public

The Engineering goes through urban center and many people are under direct influence and there are many people around the line and the environment condition is complex and sensitive. After this abridged edition is announced, based on the principle of publicity, equality, wide range and convenience and overall consideration of region, occupation, background of specialized knowledge, ability of expression, degree of being influenced and other factors, technical staff have asked for public opinions by means of random questionnaire survey, interview of special organizations and concentrated survey along the line from December 23, 2014 to January 13, 2015.

In particular, aimed at the fact that the public and groups of residential area around the road to be constructed, school, hospital, official organizations and others may be under direct or indirect influence of pollution source of the Project, general situation of engineering to be constructed, engineering construction, influence degree and range on environment after engineering construction and commissioning, as well as main adverse effects and positive effects are introduced to local public to have an in-depth knowledge of the public's knowledge of meaning of engineering construction and their attitudes and suggestions in environmental impact. See detailed contents of questionnaire in Table 7-2-1.

Table 7-2-1 Personal Opinion Survey for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan

The Project was situated in Anlu, Xiaogan. The current engineering construction content includes integration traffic corridor and road network improvement engineering, public traffic system supporting facility engineering, road safety engineering (including command center equipment and system construction, urban area signal control system, traffic video monitoring system, electronic police system, public transportation safety publicity and education), slow traffic system (including the slow traffic improvement of old town existing road. The scope includes Handan railway, Jiefang Avenue and Fuhe Avenue enclosed area) and so on. Road engineering (including Taibai Road, Biyun Road, Jiefang Avenue, Jinqiu Avenue, Yinxing Avenue, Zhanqian Road and Fuhe Avenue) counts up to 30.50 kilometers including reconstruction of 20.36

kilometers, extension of 4.49 kilometers and new construction of 4.29 kilometers, It mainly involved 7 road and ancillary engineering such as supporting constructive traffic engineering, plumbing engineering, electric engineering, landscape engineering and so on. Public traffic system supporting facility engineering mainly constructed 6 public transportation hub (including 3 public transportation hub, 1 small departure transportation hub, 2 public transportation hub add highway passenger transportation).

The total investment of the Projection is about 1101365500 Yuan. The Project was preliminary planned to be constructed in 2015 and total finished in 5 years. The plan was performed according to the urgency and priority of every project.

The Project construction period will produce construction noise, raise dust and will impact the trips of residents around, ecological environment and urban landscape; The impacts towards along environment are noise and vehicle exhaust mainly after accomplish of the Project. According to the primary analysis conclusion of environmental evaluation, the Project will produce certain impact on project surroundings during construction period, but the impact time of construction period is short and the accomplishment of the Project will play an important part on local economic development, suburban travel environment and local environment in the longer term.

According to the relevant national requirements towards construction project environment management, the construction project needs to consult suburban and unit around selected site about opinions and suggestions about project construction. Therefore, Anlu City World Bank project office cooperates with Hubei Gimbol Environment Technology Co., Ltd will carry out public involvement work to gather the opinions and suggestions of residents and units about the Project. They will provide reference for the environmental management work of the government department concerned and try best to control pollution impact to the lowest limit. Please provide precious opinions and suggestions for the company to well accomplished environmental protection work and protect surrounding environment. Thanks for your cooperation!

Respondent information	
Name:	Telephone:
Age:	Occupation:
Sex:	Degree of culture:
Address:	
ID card No.:	The relationship with the Project: □Relocation household □Others______

1. Do you know Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan Urban Transport Infrastructure Subproject in Anlu, Xiaogan?	
□Yes, I know □Know little □No, I don’t know	
2. Do you satisfied with current residence or work place?	
□Very satisfied □Satisfied □Not satisfied	
3. What do you think is the major impact on you made by current transportation?	
□Vehicle exhaust □Noise □Ecological influence □Others___________	
4. What do you think is the biggest impact on you or your most concerned environmental problem during the Project construction period?	
□Vehicle exhaust □Noise □Land demolition □Ecological influence □Others___________	
5. What do you think is the biggest impact on you or your most concerned environmental problem during the Project operation period?	
□Vehicle exhaust □Noise □Ecological influence □Others___________	
6. What kind of resolve way do you want to get if the Project construction brings about impact on your living environment?	
□Request the management reaches standards □Economic compensation □Remove □Doesn’t matter	
7. What do you think is the function of the Project towards local?	
□Improve transportation condition □Promote the economic development □Improve the standard of living □No big effect	
8. Do you agree that the Project be constructed locally?	
□Agree □Acceptable □Disapprove (reason)	
9. What is your reason from environmental protection point of view to **disapprove** the Project? (The disapproval will be invalid if you do not fill in your reason)	
10. What are your opinions and suggestions on the environmental problems that may be brought by the Project and precautionary measures?	
11. What are your opinions and suggestions on the Project approval and engineering Construction Organization?	
Investigator：	Investigation time：

The major contents of public involvement for this time are as follows:

The public understand degree towards proposed project;

The public satisfaction condition of local present environment quality condition and the major environmental problem existed in local area;

The environmental problem on proposed project concerned by the public;

The beneficial function made by the public for the Project construction;

The support degree of the public towards proposed project;

The specific opinions and suggestions of the public about proposed project.

7.3 Survey result of public involvement

The questionnaire survey provides 75 questionnaires to the public and recycles 60 actually (Typical public involvement can be seen from Appendix 6).

The basic information of respondent staff can be seen from Table 7-3-1.

Table 7-3-1 the detail information list of respondents

No.	Name	Unit address or home address	Contact information	Attitude
1	Xu Zuwen	Lilong Village	13871876370	Agree
2	Li Zhengyue	Jinqiu Avenue No.77	13972696340	Agree
3	Xu Yiqiong	Jiefang Community	13396185503	Agree
4	Ms. Chen	Jiefang Community	15871266618	Agree
5	Song Yan	Fucheng Office	13687128738	Agree
6	Wang Sanhua	Shuanglongqiao Community	15335764111	Agree
7	Li Shaoan	Nancheng Street	13986490868	Agree
8	Hu Xiangming	Jiefang Avenue No. 20	13886355965	Agree
9	Wu Gang	Fuhe Community	13476514328	Agree
10	Mr Lu	Jiefang Community	13871907070	Agree
11	Hu Youying	Supervision Center	18995705366	Agree
12	Mr Liu	Shui’an Xingcheng	18771726388	Agree
13	Qin Daqiang	Jintai Community	13907296792	Agree
14	Gao Huayan	Yuantong Temple Community	13871866151	Agree
15	Zhang Aiping	Along Jiefang Avenue	13797180100	Acceptable
16	Jiang Yafeng	Handan Road No. 442	13871876763	Acceptable
17	Guo Ziyang	Untold	15271868081	Acceptable
18	Sun Shilu	Jinqiu Avenue No.76	13797125525	Agree
19	Ding Yunbing	Shimiao Community	Untold	Acceptable
20	Yao Xiaojun	Xugang Community	15171318261	Agree
21	Mr Zhang	Anlu Police Statiom	18995705368	Agree
22	Shang Liang	Pu’ai Hospital	13617235929	Agree
23	Zhang Yan	Biyun Road No.15	13886375756	Agree
24	Fu Zhongbo	Anlu 2nd Middle School	13972696770	Agree
25	Jian Dehua	Anlu 1st Middle School	13972646775	Agree
26	Chai Ancheng	Anlu Educatiom Department	13476526340	Agree
27	Li Shuping	Xicheng New Community	13507297288	Agree
28	Guo Jinping	Nancheng Jiayuan	13545456681	Agree
29	Huang Zhiyong	Tangdi Town Government	13733460163	Agree

30	Sun Chunfeng	Taibai Avenue No.67	13789950088	Agree
31	Wang Yunguo	Taihe Fairyland	13789986788	Agree
32	Cai Jiade	Shili Middle School	15171285697	Agree
33	Mr Wei	Jinquan Village	13995855626	Agree
34	Mr Cheng	Handan Road Around	13397270085	Agree
35	Mr Ma	Jiefang Avenue Around	15897724209	Agree
36	T u Wei	Caomiao Village	13797114633	Agree
37	Mr Liang	Zhao River Community	15972336381	Agree
38	Liu Yaming	Sili Community	13995865529	Agree
39	He Wenjun	Shitang Community	13581456438	Agree
40	Yu Jianhua	Anlu Australian Prudential	18507296191	Agree
41	Li Shiqiang	Fudong Community	15971238450	Agree
42	Xiao Ganxue	Tobacconist Government Office	15971263202	Agree
43	Li Wenzhi	Zhao River Community	15072107924	Agree
44	Zhuo Shouai	Fudong Community	15327574320	Agree
45	Zhang Yao	Anlu IRS	13657122355	Agree
46	Zhou Biao	Zhao River Community	15972343792	Agree
47	Mr Li	Da Feng International City	18672297198	Agree
48	Lu Xiulan	Linyu Haudu	15072658363	Agree
49	Yan Wentao	South Community	18671250708	Acceptable
50	Hu Wenwen	South Community	13669021667	Acceptable
51	Fei Xiong	Around Jiefang Avenue	13986456929	Acceptable
52	Fu Xiaoqing	Jianshe Street No. 10, Jiefang Avenue	15971278886	Acceptable
53	Mr Zou	Chuyue 2nd Street	13986480436	Agree
54	Zhang Xiaowen	Country Protection Village	13972686235	Agree
55	Li Xiaoming	Lv Farmland	18727525721	Agree
56	Mr Lu	Deling Garden	13871907070	Agree
57	Luo Wenwen	Demian Domitory	13789995819	Acceptable
58	Liao Jing	Zhongshan Community	18007296345	Acceptable
59	Liu Chuanhui	Jindun Street, Tobacconist Town	0712-5228026	Agree
60	Ai Junqiang	Power Supply Village	15337326623	Agree

The basic composition of respondent staff is shown in Table 7-3-2

Table 7-3-2 Respondent Staff Composition List

Items	Investigation information	Number of people (people)	percentage%
Gender	Male	45	75
	Female	15	25
Standard of culture	Senior high school, technical secondary school and above	49	82
	Lower than Senior high school and technical secondary school	6	10
	Untold	5	8
Age	Above 30	42	70
	30 and less than 30	18	30

The research result is shown in Table 7-3-3.

Table 7-3-3 Investigation Statistics Result Table of Public Involvement

No.	Question	Option	Selection people (people)	Percentage（%）
1	Do you know Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan Urban Transport Infrastructure Subproject in Anlu, Xiaogan?	Yes, I know	37	62
		Know little	21	35
		No, I don't know	2	3
2	Do you satisfied with current residence or work place?	Very satisfied	1	2
		Satisfied	45	75
		Not satisfied	14	24
3	What do you think is the major impact on you made by current transportation?	Vehicle exhaust	38	63
		Noise	42	70
		Ecological influence	34	57
		Others	6	10
4	What do you think is the biggest impact on you or your most concerned environmental problem during the Project construction period?	Vehicle exhaust	38	63
		Noise	50	83
		Land demolition	36	60
		Ecological influence	42	70
		Others	3	5
5	What do you think is the biggest impact on you or your most concerned environmental problem during the Project operation period?	Vehicle exhaust	38	63
		Noise	41	68
		Ecological influence	27	45
		Others	4	7
6	What kind of resolve way do you want to get if the Project construction brings about impact on your living environment?	Request the management reaches standards	52	87
		Economic compensation	12	2
		Remove	1	2
		Doesn't matter	2	3
7	What do you think is the function of the Project towards local place?	Improve transportation condition	50	83
		Promote the economic development	44	73
		Improve the standard of living	38	63

		No big effect	0	0
8	Do you agree that the Project be constructed locally?	Agree	50	83
		Acceptable	10	17
		Disapprove	0	0

7.4 Collection of public's participation inquiry opinion

(1) Personal opinion survey

The questionnaire survey provides 75 questionnaires for the public and recycles 60 actually so the recovery rate is 80% which shows those publics are very concern about the construction of the Project and they are willing to publish their opinions by this opportunity. The survey results combined written form and oral form shows that 83% of the investigators agree the Project and 17% are acceptable with the establishment of the Project. The central collection of the opinions and suggestions of the investigators are as follows:

①Short-term construction environmental problem is accepted, and the Project is of great help for local construction and development and residents' traveling after the completion. Relevant organizations shall supervise the Project, and the time limit for the Project is not allowed to be delayed or even put aside;

②The construction shall avoid the period of senior high school entrance examination and college entrance examination as far as possible. Environmental Protection Administration shall enhance supervision of construction's effect on examinees;

③Increase greening rate, and ensure that the planned routes and stations won't be changed in 50 years after the completion;

④Take it into overall consideration that traffic integration's effect on convenience and safety problem of students' going to school, and night construction shall be reduced at the same time;

⑤Scientific planning and safety construction are required. We hope that regulators and constructors can be carefully for the good Project and do well in the Project;

⑥In the period of road pipe network reconstruction, normal operation of power supply, water supply, gas supply, Internet and others shall be ensured. Guarantee smooth traffic in construction roads as far as possible;

⑦Do well in environmental influence treatment measures in the early stage, middle stage and later stage of construction strictly in accordance with requirements in EIA report, and make great efforts in management and implementation. Reduce the effect of emission of exhaust gas and waste water and solid waste to the lowest degree;

⑧Construction vehicles and machines shall decrease the chance to pass through residential area as far as possible and reduce noise pollution and it shall also promptly clear up garbage produced during construction period;

⑨Well balance interests and appeals of each party.

(2)Group opinion survey

The EIA handed out 12 questionnaires to surrounding communities, schools, hospitals, Organs and other groups and received 12 questionnaires in practical. Corresponding relations of respondents and sensitive protected objects are as follows in Table 7-4-1.

Table 7-4-1 Corresponding Relation Table of Respondents and Sensitive Protected Objects of the Project

No.	Name of communities	The covered sensitive protected object
1	Jiefang Community Residents Committee	Lvjiafan, De'an Garden, Shuanglongqiao Homeland etc.
2	Zhaohe Community Residents Committee	Zhaohe Village, Zhaojia River, Lijia Taizi, etc.
3	Fudong Community Residents Committee	Jingang Garden, etc.
4	Jintai Community Residents Committee	Taihe Villa, Taihe Paradise, Luojia Village, Jinjia Yard, etc.
5	Xiaotai Community Residents Committee	Delin Garden, Jinbang Well-known City, etc.
6	Huguo Community Residents Committee	Huguo Village, Yuanlin Garden, etc.
7	Shili Community Residents Committee	Shili Village, Yangpeng Settlement, etc.
8	Fuhe Community Residents Committee	Jiahe Community, Fuhe Community, Zijin Garden, etc.
9	Nancheng Sub-district office	Sili Village, Caomiao Village, Zhongyi Community, etc.
10	Chuyue Community Residents Committee	Zhoujiaxin Village, Kaixuan City, Fengda International City, etc.
11	Chengdong Community Residents Committee	Jinqiu Imperial Garden, Shui'an Xingcheng Building, Shangri-La City Garden, Linyu Fortant, etc.
12	Tangdi Town People's Government	Lilong Village, Jinquan Village

The surveyed organizations were all in favor of the Project and made request verbally that noise, raised dust shall be controlled in construction period, moreover, residents' safe traveling and civilized construction shall also be guaranteed, and the Project's effect on surrounding environment shall be reduced to the greatest extent.

(3) Internet survey

There is no feedback in the period of survey.

7.5 Adoptions of typical public opinions

Although the majority of respondents favored construction of the Project, they were still concerned about environmental problems caused by the Project's construction. To dispel their worries about the Project's construction, aiming at these problems, adoptions of public opinion by the Constructor can be seen in Table 7-5-1.

Table 7-5-1 Public opinions and Adoptions Table

No.	Opinions and suggestions	Explanation of adoptions
1	Relevant organizations are advised to supervise the Project; the time limit of the Project shall not be delayed or even put aside.	Strict management and supervision system of the Project has been installed to ensure that the Project can progress in accordance with time limit and quality standard.
2	Construction shall avoid the period of senior high school entrance examination and college entrance examination as far as possible. Take it into overall consideration that traffic integration's effect on convenience and safety problem of students' going to school, and night construction shall be reduced at the same time	Avoid duration of senior high school entrance examination and college entrance examination, and rationally arrange construction time. Avoid night construction as far as possible. If the work shall be done at night, announcement shall be put up to inform surrounding residents and organizations after acquiring permission of construction.
3	Environmental Protection Administration shall enhance supervision.	The Construction Organization will entrust qualified Supervision Organization to monitor water, gas, noise and waste in construction period and operation period on a regular basis, which shall be supervised by Environmental Protection Administration.
4	Increase greening rate, and ensure that the planned routes and stations won't be changed in 50 years after the completion.	Plant osmanthus fragrans, loropetalum chinense, Hybrida Vicary Privet in central lane separator green belt, pittosporum tobira in lane separator green belt on two sides, and cinnamomum camphora on avenue. Increase greening rate on the basis of safeguarding transportation safety; Plan of the Project accords with *Anlu Urban Master Planning* (2013-2030).
5	In the period of road pipe network reconstruction, normal operation of power supply, water supply, gas supply, Internet and others shall be ensured. Guarantee smooth traffic in construction roads as far as possible.	On the basis of ensuring normal water, gas, electricity and network in the transformation road, conduct semi-closed construction, and guarantee smooth traffic in the section of road.

6	Do well in environmental influence treatment measures in the early stage, middle stage and later stage of construction strictly in accordance with requirements in EIA report, and make great efforts in management and implementation. Reduce the effect of emission of exhaust gas and waste water and solid waste to the lowest degree	The implementation conditions of the Project's measures in EIA are supervised by environmental supervision organization to guarantee the smallest effect on surrounding environment of the Project.
7	Construction vehicles and machines shall decrease the chance to pass through residential area as far as possible and reduce noise pollution and it shall also promptly clear up garbage produced during construction period	Routes of construction vehicles will be rationally planned in construction period. Reduce the effect on residential areas as far as possible, and enhance management. Forbid to whistle around densely populated place, school and hospital. Entrust Muck Management Department to promptly dispose and clear up solid waste produced in construction period.
8	Well balance interests and appeals of each party.	Special management organizations will be established in the construction period of the Project.

7.6 Conclusion of public involvement

As the survey demonstrates, the majority of respondents understand and favor the Project. In their opinion, the Project will bring positive effect to social economy, but rational environmental safeguarding procedures and work of traffic dispersion shall be taken by Construction Organization in construction period. Meanwhile, they are still concerned about the effect of noise and dust may caused by the Project in construction and operation period.

EIA thinks that Construction Organization shall further strengthen environmental pollution control measures in construction period as well as work of traffic dispersion. On the premise that measures adopted in EIA and relevant requirements are effectively implemented, the Project's effect on surrounding environment can be controlled within the scope that the nation allows, and the worsening of surrounding living environment won't be caused. In this way, environmental effects that the public were once worried about all can be alleviated or eliminated, and the public can stand construction of the Project.

Moreover, Construction Organization shall further enhance communication with the public, and publicize the Project, enterprise conditions, enterprise administrators as well as commitment for environmental protection through news media, bulletin board and other methods, which can make the public understand content of the Project and give play to better environmental and social benefit.

8. Environmental management and monitoring plan

In order to protect the Project's environment along the line and ensure effective control and mitigation of all kinds of adverse environmental impact of the Project, stringent and scientific track management shall be conducted and environmental management as well as environmental monitoring shall be implemented in whole execution of the Project.

8.1 Environmental management

Considering the significant difference in the contents and working time limits of construction period and operation period of the Project, separate organizations shall be set up and environmental management of the proposed project shall be phased. Corresponding regulatory agencies generally include supervision and enforcement agency and monitoring agency. The Plan is used for organization and implementation of environmental impact mitigation measures put forward in the Report. The Responsible Party has been pointed out and the operation scheme and monitoring project have been developed in the Plan.

The primary purposes of environmental protection and management are: to make the construction and operation of the Project conform to "Three Synchronous Principles" which include synchronized planning, synchronous development and synchronous implementation and to provide basis for implementation and supervision of environmental protection measures, approval of the Project's environmental protection and completion acceptance of environmental protection. By carrying out the Plan, adverse impact the Project has on the environment has been reduced to the minimum; harmonious development of economic benefit and environmental benefit of the Project has been realized.

8.1.1 Environmental management and supervisory organization

See the composition of environmental protection and management organization and supervision organization in each period of project construction and operation in Figure 8-1-1.

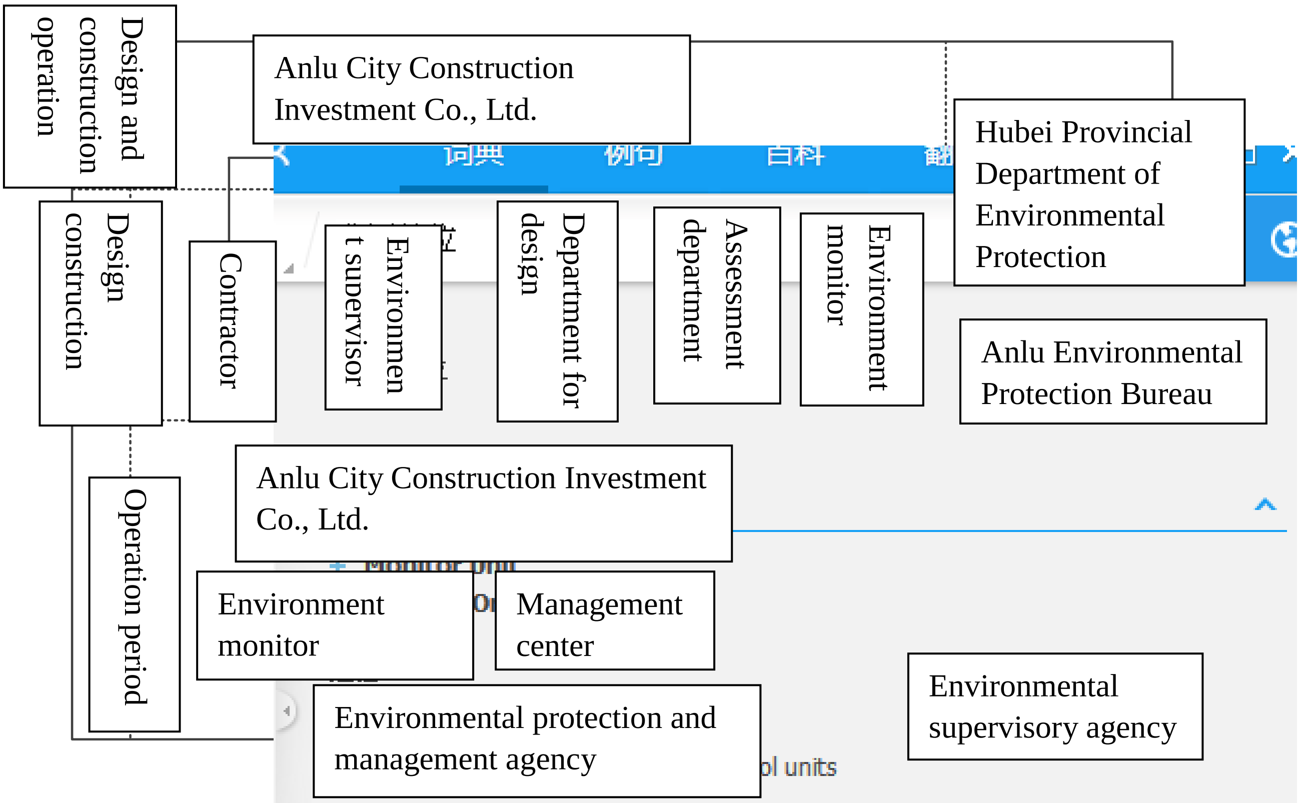


Figure 8-1-1 Schema

8.1.2 Environmental management plan

See environmental management plan in implementation process of proposed road project in Table 8-1-1.

Table 8-1-1 Management Plan of Project Environment

Stage	Implementation	Measures	Implementing Agency	Responsible organization	Supervisory agency

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Construction period	Noise pollution prevention and cure	①Reasonably arrange construction time. Those who must work at night shall obtain construction permit and post a notice; ②Maximize the use of low-noise machinery and prohibit the machinery exceeding the national standard from entering the construction site for construction; ③Noisy machinery shall be taken away from sensitive acoustic environment such as residential areas; regular maintenance and stringent operation regulations shall be adopted; and 2.4m fence shall be set up around residential areas; ④Ready-mixed concrete shall be used and no concrete mixer shall be set up on construction site; ⑤Organization work of construction vehicles shall be well done; the transport vehicles shall slow down and avoid honking when passing by the sensitive points; ⑥Stop construction in special days such as senior high school entrance examination and college entrance examination	Contractor	Anlu Construction &Development Investment Co., Ltd., Anlu City Urban and Rural Construction Bureau, Anlu City Transportation Bureau, Brigade for Public Security and Traffic Police	Department of Environmental Protection in Hubei Province
	Air pollution control	①Specially-assigned person shall be appointed to be responsible for cleaning the construction site; timely watering and cleaning shall be ensured to reduce dusts; ②Watering and spraying shall be ensured to prevent the dust from flying about before removing the existing buildings. Vertical transportation equipment and discharge groove shall be set up when tearing down the buildings. It is prohibited to throw the demolitions at high altitudes or tear down them over large areas and barbaric construction work is prohibited. ③Spraying by special vehicle and watering shall be ensured to prevent the dust from flying about when tearing down the existing buildings. In the event of wind above Level 4, stop tearing down the buildings. ④Muck shall be cleared timely, otherwise, it is necessary to cover or solidify muck which could not be cleared and shall be piled up centrally and temporarily; ⑤Enclosure shall be set up around materials such as gravel which is easy to produce flowing dust pollution on construction site, and it shall be covered with dense screen and other materials for covering; ⑥Quality management of clearing construction muck shall be stringently implemented. Closed capping device shall be set up in vehicles for transporting construction muck, otherwise, they are forbidden to be involved in the business of construction muck transportation; ⑦Specially-assigned person shall be appointed to be responsible for construction area, trying to ensure scientific management and civilized construction. In foundation construction period, measures shall be taken to improve the process of the Project as much as possible. And earthwork shall be transported to designated locations to reduce cycle of harm of piling up. ⑧The construction site and strictly forbid shall be reasonably arranged and it is prohibited to set the location for piling up materials and earthwork temporarily on one side of sensitive points. Meanwhile, transit route of project engineering vehicles shall be adjusted and they are prohibited to passing through residential areas.			

	Prevention and control of water pollution	①Enhance the work of construction management and supervision during construction and check the construction machinery regularly; ②Materials of construction such as pitch, oil, chemicals shall not be piled up near municipal pipe network and canvas for temporary sheltering shall be prepared; ③Simple drainage facilities shall be built before filling embankment slope and trapezoidal drains shall be excavated outside slope angle of embankment; ④Intercepting gutter shall be built around the stockyard on construction site; grit chamber and net for blocking sands shall be set up on exit; rainwater and mud containing sediment shall be discharged into municipal sewage pipe network after sedimentation treatment in grit chamber, etc; ⑤Oil removal and sediment facilities shall be set up to deal with construction wastewater; mud purifying pond for precipitation of sludge shall be set up and supernatant could be recycled for watering, cleaning of machinery and vehicles on pavement of construction section, while the rest shall be discharged into municipal pipe network through the net for blocking sands; ⑥Locations for piling up materials of construction such as pitch, oil and chemicals shall be away from lake water; ⑦During the construction process, in order to reduce the impact of engineering construction on nearby traffic and residents, PVC project enclosure with the height of not less than 2.4m shall be set up around the areas which need to be rebuilt and extended. ⑧In section near the lake, in the event of rainy season, waterproof cloth may be used to cover the surface of bare roadbed in case any erosion rainfall runoff might do to pavement and to reduce the impact on lake.			
	Pollution prevention of solid waste	①First of all, PVC project enclosure with the height of not less than 2.4m shall be set up around the areas which need to be rebuilt and extended to keep construction region within the enclosure clean; and special-assigned person shall be appointed to be responsible for cleaning the construction site; timely watering and cleaning shall be ensured to reduce dusts. Mound and windrow shall not occupy the region near red line. ②Reasonably plan the field of mound and reduce the number of it according to the amount of temporary mound. Try to arrange the field of mound in the middle of enclosure; ensure that vehicles and machinery pass fewer sections to reduce the impact of construction machinery on the field of mound. ③Temporarily cover the mound with waterproof cloth according to the time of mound. ④Abandoned earthwork of the Project mainly includes brick slag of houses removed, construction waste of breaching the pavement, drilling residue of footbridge, the rest of soil excavated in road and drainage works, etc. The abandoned earthwork of the Project shall be deployed by in unified organization by City Management Department for regional balance. The part which could not be utilized shall be absorbed and disposed in places designated by City Management Department. ⑤Domestic garbage shall be disposed by sanitation departments after being separately collected.			

	Water and soil conservation	It shall be implemented according to water and soil conservation measures in *Report of Water and Soil Conservation Scheme*, mainly including engineering measures(land leveling and removing of hardened layer), vegetation measures(sowing the seeds of white clover) and interim measures(building gutter, grit chamber, block and sealing, etc.).		
Operation period	Noise pollution prevention and cure	①Corresponding administrative regulations on traffic noise shall be formulated combining the characteristics of different regions; ②Low-noise pavement shall be set up on the whole line;	Anlu City Transportation Bureau	Anlu City Transportation Bureau
	Air pollution control	①Prohibit the passage of motor vehicles which discharge excessive exhaust pollutants; ②Strengthen the overhaul of motor vehicles; ③Keep the pavement clean and water it timely to reduce dust particles on it; ④Purity the air by utilizing vegetation; ⑤Strengthen environmental management efforts and set environmental management agencies for road management departments. Meanwhile, entrust environmental protection bureau to carry out ambient air monitoring regularly on specified monitoring points in the assessment.		
	Prevention measures for risk accidents	①Reinforce safety inspection and road management of vehicles transporting chemical hazard; ②They shall be incorporated into local emergency incident management system; equipment and apparatus for an emergency shall be equipped.		
	Environmental monitoring	It shall be carried out in accordance with National Technical Specifications for Environmental Monitoring.		Qualified Monitoring Station

8.2 Environmental monitoring Plan

8.2.1 Monitoring purposes

Environmental monitoring of the Project mainly includes the impact of construction and operation on environment of both sides of the road. The purposes are to ensure the implementation of all measures and suggestions about environmental protection in Environmental Impact Report and limit the environmental impact caused by engineering construction to national laws, regulations and standards.

8.2.2 Content and requirement of environmental monitoring in construction period

（1）Content of environmental monitoring in construction period

①Impact of dusts of construction field and transport vehicles on sensitive points such as residential areas nearby;

②Impact of construction noise on sensitive points such as residential areas nearby;

(2) Monitoring plan

See environmental monitoring plan in construction period in Table 8-2-1, where monitoring of environmental noise mainly focuses on foundation construction of pavement and air quality monitoring mainly focuses on earthwork phase; monitoring of solid waste is conducted through the whole construction period. Monitoring points could be selected according to the actual situation such as transport routes in construction period; monitoring points of atmosphere and noise are mainly set up along the sensitive points of line. While monitoring points of solid waste could be set in regions such as field for piling up surface soil and interim field for piling up mound.

Table 8-2-1 Table of Environmental Monitoring Plan in Construction Period

Monitoring program	Monitoring sites	Monitoring frequency		Monitoring duration	Implementing agency	Supervisory organization
TSP	Exit and entrance of transport vehicle at construction site	Monitor once at sensitive point in construction period		12 consecutive hours each time	Qualified monitor entrusted by the Owner	Anlu Environmental Protection Administration
L_{Aeq}	Sensitive points along Project line	Once a season	One day	Once both in the day and at night		
COD、BOD_5、SS	Waste water point for washing vehicles	Monitor twice in construction period	/	Every two days		
Solid waste	Near the field for piling up surface soil and temporarily piling up mound					

（3）Monitoring requirements

Developer must make content and requirements of environmental monitoring in construction period clear in construction contract and entrust construction organizations to organize implementation in construction period. Meanwhile, organizations with corresponding qualifications shall be entrusted to undertake environmental monitoring; all the monitoring reports shall be kept on file as data for acceptance of environmental protection of completed construction project.

8.2.3 Content and requirements of environmental monitoring ability in operation period

（1）Content of environmental monitoring in operation period

Monitoring in operation period mainly includes traffic noise along the road and impact of automobile exhaust.

（2）Monitoring plan

See environmental monitoring plan in Table 8-2-2.

Table 8-2-2 Environmental Monitoring Scheme

Monitoring elements	Stage	Monitoring point	Testing parameters	Monitoring frequency	Implementing agency	Supervisory agency
Environmental noise	Operation period	Sensitive points near the road	Equivalent A sound-level	Monitoring scheme prepared by organizations for environmental acceptance shall prevail in trial operation period and opinions of Examination and Approval Department shall prevail after environmental acceptance.	Entrust qualified monitors	Hubei Provincial Department of Environmental Protection
Air quality	Operation period	Sensitive points near the road	NO_2、CO			

（3）Monitoring requirements

In the first year after the Project is completed and put into operation, organizations with corresponding quality shall be entrusted by Road Management Department to undertake environmental monitoring and all monitoring reports shall be kept on file for reference.

8.3 Environmental supervision

Environmental supervision of construction projects (hereinafter referred to as environmental supervision) refers to implementing specialized environmental protection consultation and technical services for construction project and assisting as well as guiding Developer to comprehensively implement all measures for environmental protection of construction projects according to laws and regulations about environmental protection, Environmental Impact Assessment for Construction Project and its approval documents as well as environmental supervision contract, etc.

As a supplementary means of environmental impact assessment and “Three Simultaneousness” acceptance and supervision, environmental supervision can achieve the change of environment management of environment protection administration institution from after-management to whole process management and from single administrative supervision of environment protection to the combination of administrative supervision and the third party supervision, playing a positive role in strengthening whole process management of construction projects and upgrading effectiveness and completeness of environmental impact assessment.

To guarantee various environment protection problems (including potential problems) existing in construction process of construction projects can be promptly found, effectively prevented and properly coped with and that construction projects meet the requirements of national and local environment protection policies, laws and regulations, technical specifications and standards and acceptance of completion environment protection, in accordance with the requirements of [2012]No.5 *Notice on Further Promoting Experimental Work of Construction Projects Environment Supervision* of Environmental Protection Office under General Office of Ministry of Environmental Protection, environmental supervision shall be carried out in the Project.

8.3.1 Work targets of environmental supervision

Environmental supervision is in accordance with relevant laws, legislations, policies, technical standards formulated and issued by the nation and relevant departments in charge, approved design documents, bidding documents and supervision/construction contract signed by law. According to the scope and content of environmental supervision service, it performs the duties of environmental supervision, independently, impartially, scientifically and effectively serves the works, implements all-around environmental supervision and makes the works meet the requirements of environment protection in design, construction, operation and other aspects.

8.3.2 Basic principles of environmental supervision

The law-abiding, honest, impartial and scientific criteria shall be complied with when engaging in environmental supervision of works construction; the principle that environmental supervision is “the third party” shall be confirmed; environmental supervision shall have strict distinction to environment management of the Owner and law enforcement of environmental supervision by governmental departments, serving environment management of the Employer and governmental departments.

Environmental supervision, of which position cannot be weakened, shall be included in works supervision and management system. The relationship in supervision work among the Owner, the Builder, the Works Supervisor, the Environment Supervisor, the Environment Monitor and governmental environment administration departments in charge shall be smoothed and coordinated, which creates favorable conditions for doing environmental supervision work well.

The supervisor shall, in accordance with works features, formulate standardized supervision system corresponding with actual situation of works, making supervision work carry out in order.

8.3.3 General work procedures of environmental supervision

The supervision work shall, in accordance with basic principles project environment supervision work shall comply with, be carried out as per listed procedures in the following figure 8-3-1.

(1) Signing and recording of environmental supervision contract

The Developer and the Environment Supervisor of construction projects shall sign environmental supervision contract and submit it to local environment departments in charge; the Environment Supervisor shall carry out supervision as per work scope specified in the contract.

(2) Environmental supervision in design stage

The Developer shall entrust and start environmental supervision work in design stage; environmental supervision in design stage calls for responding to the consistency of environment protection requirements mentioned in works design, specialized design of environment protection, environment impact assessment and official reply and preparing compliance supervision report for design documents; that part shall be included in working scheme compiling of environmental supervision.

(3) Carrying out environmental supervision

Environmental protection supervision engineers shall submit environment protection works construction progress, quality control, works quantity and other report forms, completion and inspection reports to the Owner;

Promptly irregularly report and submit various sudden environment issues in construction and their disposal situation to the Owner;

Promptly consult with the Works Construction Supervisor when dealing with environment issues related civil works;

Respectively report and submit it to the Owner, the Design Institute, the Builder and the Works Supervisor as per change category and procedure provisions when environment protection works needs changing its design because of omissions and errors in design;

Promptly deal with issues of environment and water protection arising from law enforcement inspection by the Owner, industry departments in charge and local departments in charge.

(4) Preparation and submission of environmental supervision plan

To guarantee the implementation effects of environmental supervision work, the Supervisor shall prepare environmental supervision plan before environmental supervision work is carried out.

According to project features, the plan shall include compliance supervision report for design documents and environmental supervision work plan during construction period.

The Environment Supervisor shall finish technology assessment work after general report for environmental supervision is finished, complete environmental supervision report as per technology assessment opinions and submit it to the Developer together with technology assessment opinions; then the Developer shall report and submit it to local environment departments in charge.

(5) Transferring of materials and achievements

The sign for finishing environmental supervision work is that general report for environmental supervision is reported and submitted to local environment departments in charge; the Environment Supervisor shall submit general report for construction projects environmental supervision to the Project Developer as basis of environment protection acceptance for construction projects completion and transfer all archives and information of environmental supervision to the Developer.

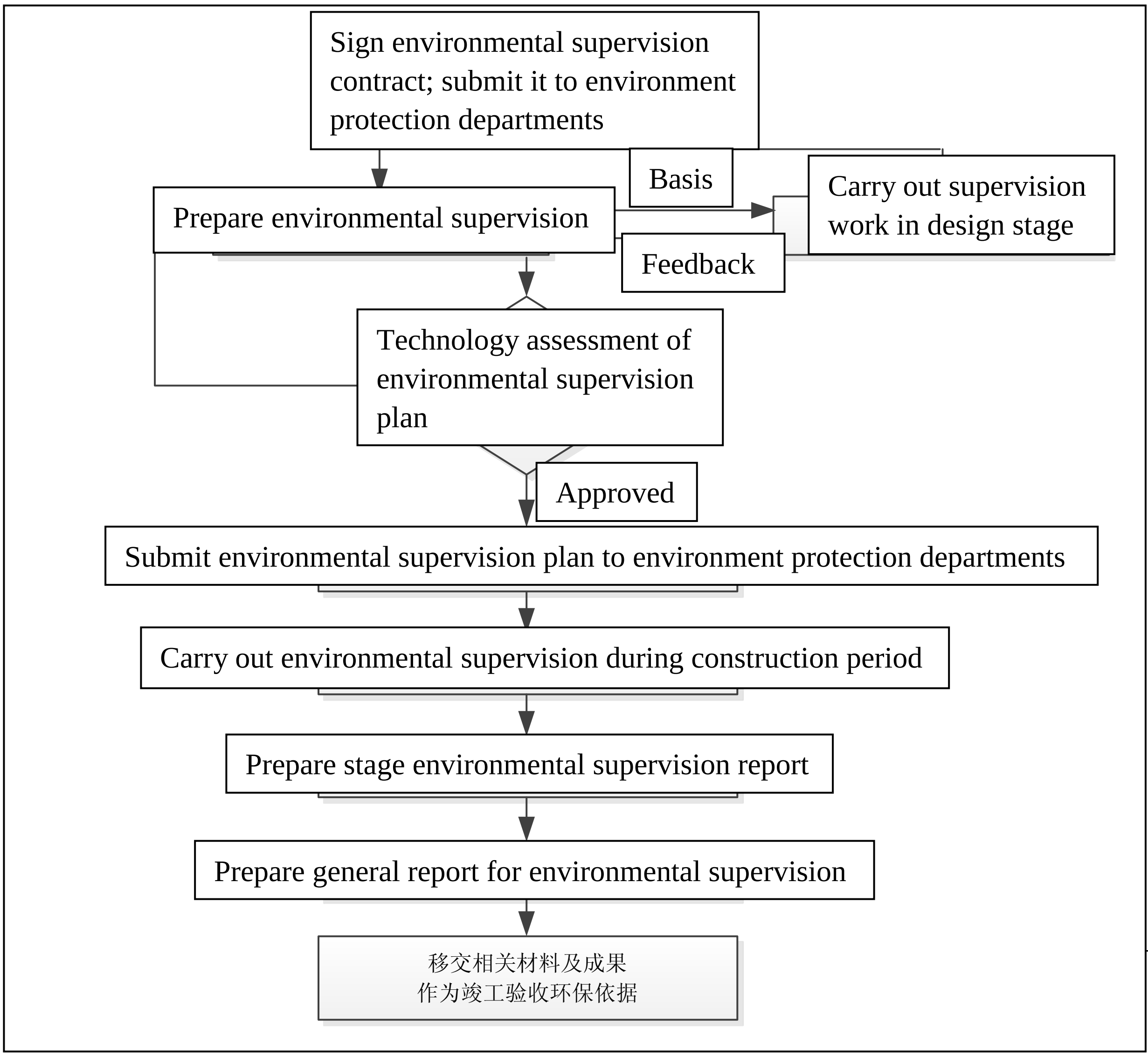

Figure 8-3-1 Work procedures for proposed works environment supervision

8.3.4 Main content of environmental supervision

8.3.4.1 Scope of environmental supervision

Scope of environmental supervision refers to the area the Project is located and influences, including road, construction site of temporary project, field for temporarily piling up mound (slag) and local existing roads undertaking a lot of engineering transportation. Content of supervision includes ecological protection, water and soil conservation, afforestation, pollutant prevention and cure as well as all aspects of environmental protection work.

See details of the Project's scope and content of environmental supervision in Table 8-3-1.

Table 8-3-1 Scope and content of environmental supervision of the Project

Content	Ecology	Water and soil conservation	Acoustic environment	Water environment	Ambient air	Social environment
Road engineering	√	√	√	√	√	√
Construction road (export-road)	√	√	√		√	√
Construction site	√	√	√	√	√	√
Temporary field of piling up mound	√	√			√	√

8.3.4.2 Key points of environmental supervision

This section specifies key points of the Project's environmental supervision. It is worth noting that besides carrying out the work according to key points of the supervision, the environmental supervisory engineer shall adopt corresponding provisional measures according to the actual situation of engineering construction.

Table 8-3-2 Key Points of the Project's Environmental Supervision

Construction activities	Key points of supervision	Supervision methods	Principal means
Construction bidding and tendering mode	Prepare work plan for the Project's environmental supervision		
	Re-check clauses of environmental protection in construction contract	Document re-check	On-spot record
	Re-check environmentally sensitive points and protection targets on site of construction section	Make an inspection tour	

		Review environmental protection measures in construction organization and design of Contractor	Document review	
		Examine and approve Contractor's environmental management plan in construction period	Document review	
		Review construction scheme and corresponding environmental protection measures in application for initiating sub-projects	Document review	
Preparation before construction		Examine and approve Contractor's environmental management plan of subgrade project in construction period	Document review	
		Check the control line of construction survey and set clear boundary markers of scope of subgrade and land acquisition		Spot check
		Review the Contractor's newly increased plan for temporary land use and supervise the Contractor's to go through relevant procedures for land acquisition	Document review and spot check	Field measurements of area of temporary site
During the construction period	Site clearing	Examine and clear boundary line of fieldwork and determine plant and structure which needs to be reserved	Make an inspection tour	
		Check the earth's surface clear-up operation and prohibit working across the red line	Make an inspection tour	
		Check to see whether stripping topsoil has been sent to designated point for central stacking and drainage facilities are prepared and whether covering and restoration measures for temporary vegetation are adopted after the designed stacking height is reached.	Make an inspection tour	
	Road engineering	The Contractor shall be supervised to strictly control the excavation of working face to avoid excessive breaking.	Make an inspection tour	
		Check to see whether the construction site and field for temporarily piling up mound for the Project are far away from nearby water body.	Document review, make an inspection tour	Field measurements of area of temporary site
		For restoration of temporary land used for construction such as field for temporarily piling up mound and construction road, key monitoring shall be adopted for indexes such as soil preparation, vegetation coverage, survival rate of plant, thickness of covering soil.	Make an inspection tour, on-site	Field measurements of area of temporary site
		Check the temporary drainage facilities in subgrade construction and make sure that running water of construction site shall not be discharged into nearby water body; and siltation, obstruction and erosion of pipe network along the line shall not be given rise to;	Make an inspection tour, check and evaluate	Check and assess project quality of temporary drainage facilities
		The Contractor shall be supervised to give timing watering for construction site and road in dry season during construction.	Make an inspection tour, fixed-point monitoring	Inspect watering and environmental monitoring station will monitor at fixed point
		The Contractor shall be supervised to adopt measures for noise reduction and prohibit night construction of mechanical equipment with high noise.	Make an inspection tour、spot check	Adopt acoustic meter for monitoring
		Supervise to see whether construction earthwork has been dispatched according to balance sheet of it and whether slag has been discarded at designated place.	Make an inspection tour	
		Check to see whether temporary sedimentation tank, drainage ditch and catchwater have been set during subgrade excavation at the place of surface runoff of rain.	Make an inspection tour	
		Check to see whether timely dust protection measures have been taken after subgrade excavation is completed.	Make an inspection tour	
		Check to see whether covering measures have been taken for	Make an inspection	

		transporting and piling up powered materials used on road such as cement.	tour	
		Check to see whether domestic sewage in construction period has lived up to the discharge requirements of GB8978-96 three-level standard; prohibit direct flowing of construction waste water and road runoff into nearby pipe network and water system.	Make an inspection tour、 spot check	Inspect on-site where sewage is discharged; environmental monitoring stations will coordinate with environmental supervisory engineer in monitoring
		Supervise and inspect protective measures of builders in the process of asphalt pavement.	Make an inspection tour	
		If any cultural relics during subgrade excavation and construction are found, the Contractor shall be supervised to report it to local department of cultural relics for disposal.	Make an inspection tour, on-site	On-site supervision after finding any cultural relics
	Drainage and other ancillary works	Move and modify municipal facilities along the line	On-site	
		Other projects such as traffic facilities, signs and markings, etc.	Make an inspection tour	
		Construction layout of Green Project, quality control of material specification and working procedures, project quality inspection and evaluation, etc.	Make an inspection tour	
	Public involvement	Learn opinions and suggestions of residents and organizations within the scope of construction influence on environmental protection in construction period and handle complaints of the masses.	Questionnaire or forum	
Shakedown period		Mainly includes supervising restoration measures for temporary land use such as construction site and field for piling up mound, pre-acceptance of environmental supervision, putting file in order, preparing a final report and assisting the Owner in preparing the work of completing the Project and acceptance of environmental protection, etc.	Document review, make an inspection tour	
		Application for pilot run of the Project	Make an inspection tour, spot check	Environmental monitoring stations will coordinate with environmental supervisory engineer in monitoring

8.3.4.3 Concrete working methods of environment protection supervision

(1) Check to see whether environment protection measures mentioned in project preliminary design and construction drawing design are implemented in accordance with approved environmental impact report;

(2) Assist the Employer in organizing project construction, design and environment protection training of administrative staff;

(3) Audit relevant environment protection provisions in bidding documents and project contract;

(4) Supervise measures of protecting ecology, water, air and sound environment and reducing project environment impacts in construction process and construction quality of environment protection project; and carry out stage acceptance and sign signature in accordance with standards;

(5) Systematically record impacts on project construction environment, effects of environment protection measures and construction quality of environment protection project;

(6) Promptly report unexpected problems of environment protection design and construction to Environment Supervision Leadership Team; and bring forward the solution suggestions;

(7) Be responsible for drafting work plan and conclusion of project environment supervision.

8.3.5 Working system for environment supervision

Working system shall be established for environment supervision, including work records, personnel training, reports, correspondence, regular meeting and so on.

(1) Work records system

As an important source of environment supervision information collection, environment supervision records are basic data for environment supervision engineers to make an action judgment. Environment supervision engineers shall, in accordance with work records of project construction and environment supervision, put emphasis on describing inspection and supervision situation of on-site environment protection of project, describe main environmental issues discovered then and the responsible unit of issues arising, analyze main causes of issues and bring forward treatment suggestions. Recorded data mainly consist of the side reporting, witnessing records, inspection records, relevant image data and so on.

(2) Document auditing system

Document auditing system refers to the provision that the Environment Supervisor audits environment protection measures and construction organization design of environment protection installation, which are related to construction project and prepared by the Project Builder.

The Environment Supervisor shall audit construction organization design and environment protection measures in construction measures plan prepared by the Construction Project Builder, special environment protection program, construction plan of environment protection installation and so on. Auditing opinion of the Environment Supervisor for the above documents is one of basic condition for the Construction Project Supervisor to approve the above documents.

(3) Meeting system

Meeting system refers to the provision that various meetings, confirmed by the Environment Supervisor, shall be participated in or organized.

The Environment Supervision Institution shall establish environment protection meeting system, including the first site meeting for environment protection, regular meeting and thematic meeting for environment supervision. For regular meeting for environment supervision, when and where the meeting is held, main participants and general meeting agenda shall be clear. During the meeting, the Builder retrospectively summarizes recent environment protection work; environment supervision engineers make full review of environment protection work in this stage, assent to the achievement in the work and raise the existed problems and rectification requirements. Meeting summary shall be made in every meeting. If the major accident occurs, the meeting can be held at any time.

(4) Emergency report and processing system

The Environment Supervisor shall, in accordance with Environmental Impact Assessment Document and approval requirements, supervise whether the Developer and the Builder develop environment risk emergency preplan and implement risk-warding measures for environment risks which may occur with the scope of environment supervision. When the environment emergency event happens on site, the Environment Supervisor shall urge the Developer and the Builder to take emergency measures, directly report it to relevant departments and bring forward processing requirements.

(5) Work reporting system

The environment supervision report is an important part of environment protection work in project construction. Work reporting system refers to the provision that the Environment Supervisor makes regular report for on-site environment supervision situation; report forms include the environment supervision program, monthly report, semi-annual report, and yearly report, thematic report for environment supervision and environment supervision report during construction period and general report for environment supervision. The Environment Supervisor shall, in accordance with requirements of the Developer and responsible administration environment protection departments with the duty of approvals, present the needed report.

For major environmental issues occur during the construction process of construction project, the Environment Supervisor shall, on the basis of investigation and study, coordinate with the Developer and the Builder to prepare thematic report for environment supervision together.

(6) Correspondence system

The environmental issues, discovered by environment supervision engineers during the process of on-site inspection, shall be issued in the form of Environment Supervision Notice to inform the Builder of correction or treatment measures needed to be taken; some provisions and requirements of the Builder in some aspects shall be informed in writing. When oral notice is needed in an emergency, it shall be confirmed in written letter subsequently. Similarly, environment supervision engineers shall be sent a letter for the response of the Builder for environmental issues treatment and problems in other aspects.

(7) Inspection and recognition system

Inspection and recognition system refers to the provision that the inspection and recognition of major environment protection measures and environmental issues treatment results during the construction process of construction project.

The Construction Project Builder shall report to the Environment Supervisor for inspection and recognition after implementing major environment protection measures. Environment supervision engineers shall make follow-up inspections. If environmental issues, which the Builder is required to process in limit of time, are processed conformingly, it shall be recognized; if they are not processed or not processed conformingly, further environment supervision measures shall be taken, such as issuing an order of stopping work and reporting to environment protection departments.

8.3.6 Establishment of environment supervision institution

Environment monitoring during the construction period is carried out by the Developer (Anlu City Construction Investment Co., Ltd) entrusting the organization with project supervision qualification trained by environment protection affairs to carry out project environment supervision for the implementation of environment protection measures in design documents. To guarantee the execution of supervision plans, the Developer shall sign environment supervision contract for construction period with the Supervisor prior to construction.

According to construction organization experience of road works, taking into account that mileage of the Project is comparatively short, one Environment Monitoring Resident Office shall be directly set up. The Resident Office shall be estimated as per two part-time environment supervision engineers; so there is one professional environment supervision engineer for the proposed road, two part-time environment supervision engineers and three people in all.

8.3.7 Environment supervision training plan

To implement the Item smoothly and effectively, all employees shall be trained with knowledge and skill of environment protection; the training can be carried out by the Works Project alone or together with other environment protection trainings of municipal road works project. In addition to explaining importance and implementation significance of the works to all employees, there shall be targeted trainings with different focuses for the employees in different posts; concrete training plan can be seen in Table 8-3-3.

Table 8-3-3 Training Plan

Trainees	Training content	The number	Training time (day)
Environmental protection supervision engineers and environmental administrator	Environmental protection legislations, construction planning, criterion and specifications for environment supervision	10-15	4
	Environmental air monitoring and control technology, environmental noise monitoring and control technology and water environment monitoring and control technology	**3-4**	**4**

8.3.8 Requirements for environment supervision effects

Reinforce the environment supervision for the Builder to standardize the construction behavior, make landscape environment damage and pollutants emission during the construction process be controlled effectively and facilitate environment protection supervision and administration of environment protection departments during the construction process.

Be responsible for relevant environment protection measures related to main project quality; fulfill the functions of supplement, supervision and guidance for construction supervision work.

Carry out and implement relevant national, provincial and municipal environment protection policies and legislations together with responsible environment protection departments; fully fulfill the function of supervision as the third party.

9. Environmental Economic Cost-benefit Analysis

9.1 Environmental protection investment estimation

9.1.1 Initial investment of environment protection

Initial investment of environment protection includes the fees of environment protection facilities, equipment, environmental monitoring and other fees, which shall be included in the budget of proposed project. Initial investment can be seen in Table 9-1-1.

Table 9-1-1 Direct investment estimation of environmental protection measures

No.	Environmental protection measures		Unit	Total price (ten thousand yuan)	Quantity	Remark
Part Ⅰ Environment monitoring					/	/
1	Environment monitoring during construction period		Item	1	10	The construction period is 60 months
2	Completion acceptance environment monitoring		Item	1	10	/
Part ⅡEnvironmental protection measures					/	/
1	Ecological protection measures	Ecological restoration and soil and water conservation	Item	1		1
2	Water pollution control	Set septic tank on construction camp; production wastewater is disposed by oil separation and sedimentation tank. Temporary waste slag place, disposal field drain, pipeline and shelter devices	/	/	30	2
3	Air environment pollution prevention	Water and suppress dust around environment hypersensitive points, on construction camp and construction sidewalk.	Item	1	10	3
4	Noise pollution	Set temporary insulation board and other noise reduction facilities during	Item	1	50	4

	prevention	construction period;					
		Noise control during operation period	Low-noise road surface	m^2			
5	Solid waste collection	Construction waste disposal during construction period		Item	1	20	5
6	Heath protection costs of construction personnel			Item	1	10	Disease prevention and safety protection
7	Reservation environmental protection funds			Item	1	100	
Part Ⅲ Environment management							
1	Training for environment management personnel			Item	1	20	
Part Ⅳ Independent fees							
Ⅰ	Environment management fee			Item	1		4.0% of sum of Ⅰ～Ⅲ
Ⅱ	Environment works design fee			Item	1		5.0% of sum of Ⅰ～Ⅲ
Ⅲ	Environment supervision fee			Item	1		
Ⅳ	Project quality supervision fee			Item	1		0.25% of sum of Ⅰ～Ⅲ
	Sum of Part Ⅰ～Ⅳ						
	Basic reserve funds						6.0% of sum of Ⅰ～Ⅳ
	Total environmental protection investment						/

9.1.2 Proportion of environmental protection investment and total project construction

As a comprehensive regulation project of urban environment, municipal supporting projects belong to environment improvement project works; total investment in such projects reaches to 1598280.66 thousand yuan.

To achieve harmony and unity between economic construction and environmental protection, a series of effective protection measures shall be taken for environment in works; preliminary estimate of direct environmental protection investment in works projects is 55840.75 thousand yuan, accounting for 3.5% of works investment ratio.

9.2 Environment losses rising from projects

Environment losses rising from projects mainly show in the change of land resource utilization form and environment impacts occurring during construction period and operation period.

(1) Change of land resource utilization form

The Project covers permanent land occupation of 22.04hm^2, of which road land occupation covers 17.16hm^2 and site land occupation covers 4.88 hm^2; the main land occupation types includes the highway land, urban residential land and etc. The project construction will definitely cause the change of land resource utilization form; such change, from a perspective of environmental protection, will lead to incision and destruction of original ecology environment.

However, after the Project is established, road construction will definitely occupy land resource; after the proposed road in the Project is put into operation, regional economic development will definitely be strengthened; partial and temporary environment losses will result in the appreciation of land resource occupied by road construction.

Environment impacts arising during construction and operation period

There will be impacts on ambient air and sound environment during the works construction period; but the time is comparatively short and it can be relieved by taking effective environmental protection measures. The impacts on air and sound environment, arising during operation period, can be relieved by taking effective environmental protection measures.

9.3 Social benefits analysis

The construction of project, in accordance with requirements of *General Planning of Wuhan City Circle* (2006～2020), urban general planning of Anlu City, "Scientific Outlook on Development" and "Two-oriented Society", generates huge social benefits; so its national economic benefits will definitely be high.

The following analysis based on combining economic and social direct/indirect benefits:

(1) Urban construction of Anlu City can be accelerated.

(2) Traffic order in Anlu City will be improved; the constant travel need in people's lives will be met.

(3) The city appearance and investment environment will be improved; the city image and solicitation will be promoted.

(4)Macro environment quality of Anlu City will be improved because of works implementation.

(5) The transit time of cargo will be saved, which can generate corresponding benefits.

(6) Traffic accidents will be reduced, which can generate corresponding benefits.

(7) Land appreciation benefits: the construction of project can change traffic conditions and living and working conditions of residents along the line, improve urban investment environment, rationally exploit and utilize limited land resources, enhance land utilization degree and bring huge appreciation benefits of land resource for further upgrading land use value.

(8) Traffic problems can be solved better and road service level can be enhanced better, which create better conditions for serving project surrounding area; without doubt, the Project will bring new development chances and greater economic benefits for Wuhan City, especially project surrounding area.

In summary, the construction of project, in accordance with urban general planning, can properly increase road area, improve urban environment, advance urban functions, promote city image and investment environment, play a role in boosting economic development of Anlu City, make surrounding resources be fully exploited and utilized, spur land exploitation and utilization and economic construction of the area along the line and bring a series of economic and social benefits.

9.4 Summary

There will be impacts on ambient air and sound environment during the works construction period; but the time is comparatively short and it can be relieved by taking effective environmental protection measures. The impacts on air and sound environment, arising during operation period, can be relieved by taking effective environmental protection measures. Preliminary estimate of direct environmental protection investment in works projects is 55840.75 thousand yuan, accounting for 3.5% of works investment ratio.

The implementation of works enhances road service level, meets the demand of traffic needs, further optimizes urban road transportation network; does favors in speeding up regional construction and development and fully playing the role of city in project under construction and constructed project.

In summary, the construction of the Works will make city functions more rational and generate better social and environmental benefits.

10. Conclusions

10.1 Project overview

With the development of Anlu City, external urban traffic volume of Anlu keeps a sustained growth; further regional integration of Anlu, Wuhan, Xiaogan and Yunmeng puts forward higher requirements for regional traffic integration. Public facilities of Anlu are gathered in Old Town Core Area while the population is mainly distributed in east of the Core Area; road network infrastructure supply in Core Area cannot meet the traffic demand; access passages in Old Town Core Area are severely congested at peak hours; inadequate public traffic supporting facilities, imperfect public traffic service system and low-level urban public traffic service in Anlu cannot meet the needs of residents production and life; illegal passenger traffic affects the normal order of urban passenger traffic and jeopardize traffic participants; in addition, there is not special public parking lot in Anlu City at present; it is mainly parking inside driveway; delimited parking berth in roads in Old Town Core Area leads to the reduction of road capacity; traffic congestion is easy to be arouse at peak hours; on the other hand, parking inside driveway occupies the space of non-motorized vehicle lane and traffic of vehicle lane and non-motorized vehicle lane are severely mixed, which diminishes road traffic safety.

Anlu City is equipped with the preconditions of sustainable development; but incomplete road network, lacking road traffic facilities, low-level public traffic system development, backward road safety management facilities and other traffic problems exist there. Therefore, Urban Transport Infrastructure Subproject in Anlu, Xiaogan is proposed to start with completing road network in urban area, improving the integration of existed main traffic corridor, enhancing public traffic service ability and upgrading the level of road safety management facilities, relieve current traffic problems and pay a demonstrative role in establishing future transport infrastructure at the same time.

Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan- Urban Transport Infrastructure Subproject in Anlu, Xiaogan is a subproject of Traffic Integration

Demonstration Project of Wuhan City Circle Supported by World Bank Loan, of which total investment is 1.125 billion yuan.

The project includes five subprojects: improvement project of integrated traffic corridor and road network, supporting facilities works of public traffic system, road safety works, slow traffic system improvement and institution construction and technical assistance; relevant content of subentry construction is as follows:

Integration of traffic corridor works consists of 4.49km road to be extended, 20.36km road to be reconstructed, 4.29km road to be newly built; supporting facilities works of public traffic system consists of 3 public transport hubs, 1 small public transport hub, 2 public transport hubs+highway passenger transportation center, one card system for public traffic, intelligent public traffic system and a batch of public traffic vehicles purchase;

Road safety works consists of the construction of command center equipment and system, self-adaptive traffic signal control system, traffic video monitoring system, electronic police system and propaganda and education of the public traffic safety;

Slow traffic system improvement mainly improves slow traffic of Wuhan-Danjiang Railway in Old Town, Jiefang Avenue and enclosed area in Fuhe Avenue; this project will make improvements for slow traffic facilities of existed branch road and public passage in Old Town District; the construction mainly includes alteration of slow special passage/special road, perfection of slow traffic signs marking system, establishment of parking facilities for non-motorized vehicle and improvement of slow passages across railways.

10.2 Current situation of environmental quality

10.2.1 Ambient air

In accordance with *Letter of Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan –Executive Standard for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan from Anlu World Bank Loan Project Management Office of Anlu Environmental Protection Administration* (see in Appendix), the ambient air within project area, which belongs to “Area II”, shall execute secondary standard of *Ambient Air Quality Standard* (GB3095-2012).

The current situation monitoring result of atmospheric environment shows SO_2, NO_2, PM_{10} and CO index within construction area of the Project meet the requirements of secondary standard of *Ambient Air Quality Standard* (3095-2012); if $PM_{2.5}$ is included in the scope of monitoring and assessment, the result may be different.

10.2.2 Surface water

In accordance with relevant collected information and reconnaissance survey on site, combined with *Letter of Traffic Integration Demonstration Project of Wuhan City Circle Supported by World Bank Loan –Executive Standard for Environmental Impact Assessment of Urban Transport Infrastructure Subproject in Anlu, Xiaogan from Anlu World Bank Loan Project Management Office of Anlu Environmental Protection Administration* (see in Appendix), relevant surface waters involved in the Project are Anlu reach of Fuhe River (upstream in Jiefang Mountain belongs to Water Ⅱ; downstream belongs to Water Ⅲ), Zhashan River, Mao River, Qili River and Huguo River (Water Ⅲ).

It can be known on the basis of current situation monitoring data analysis of water environment that water environment quality current situation of Yuxiuge section of Fuhe River is comparatively good; all various water quality monitoring indexes meet the requirements of standard limits Ⅲ of *Surface Water Environment Quality Standard* (GB3838-2002); as for various monitoring indexes of section at Jiefang Mountain of Fuhe River, apart from that dissolved oxygen meet the requirements of standard limits Ⅱ of *Surface Water Environment Quality Standard* (GB3838-2002), other monitoring indexes are beyond the standard; the overproof causes of water quality are mainly related to the acceptance of a large amount of domestic sewage, industrial wastewater and agricultural non-point source pollution in Fuhe River.

10.2.3 Sound environment

Reconstructed and extended road and terminal yard in the project are located in urban area; surrounding urbanization is comparatively high; partial monitoring sites are greatly affected by traffic noises and social living noises; partial sites cannot meet corresponding GB3096-2008 *Sound Environment Quality Standard*; the proposed sites development scope of newly-built road and passenger transportation center of highway and railway station+traffic transport transfer hub is small, not impacted by road traffic noises; sound environment quality is fine and can meet requirements of Class II standard of GB3096-2008 *Sound Environment Quality Standard*.

10.2.4 Ecological environment

Project area, which mainly belongs to urban built-up area, dominated by human activity, with row upon row of tall buildings, shops and residential buildings, is an artificial ecological system based on urban structure; plant resource within the area includes cultivated plants and wild plants, of which cultivated plants include tree species for town ways, timber forest tree species and crop species and wild plants include arbor, shrub and herb plant. Tree species for village way mainly include camphor tree, metasequoia (artificial cultivation), osmanthus fragrans, cypress, platanus acerifolia and other species; timber forest tree species mainly include masson pine; crop includes rape, rice, etc.

There is no big wild animal within project area; existing plants and animals mainly are, under control of human, species reserved and developed for meeting human's needs.

Ecological system within assessment scope is equipped with relative stability and functional integrity; the system can obtain comparatively stable maintenance and development and be equipped with certain anti-interference ability because of artificial effective management and energy supply.

10.3 Environmental impact and measures in construction period

10.3.1 Atmospheric environment

Air pollution source in construction period includes dust produced in excavation, embankment and loading, unloading and transportation of sand and lime; asphalt fume produced on asphalt pavement and exhaust gas discharged by fuel-powered construction machinery and haulage vehicles.

Build enclosure or simple folding screen for boundary of the field to block the exhaust gas produced in construction period of the Project; adequately water during excavation of dry soil's surface to maintain certain humidity of working face; timely clear the muck; enclosure shall be set around materials which are easy to produce dust such as gravel on construction site, and they shall be covered with dense screen or other materials for covering. Impact the construction has on ambient air of surroundings and residents is not so significant.

10.3.2 Water environment

Impact of construction on nearby water environment mainly includes that of construction wastewater and domestic sewage.

（1）Construction management and supervision shall be enhanced and construction machinery shall be checked regularly to prevent oil leaked from flowing into municipal pipe network;

（2）Canvas for temporary sheltering shall be prepared for materials of construction such as asphalt, oil, chemicals; necessary measures shall be taken to prevent soil and granular construction materials from blocking municipal pipe network;

（3）Simple drainage facilities shall be built before filling embankment slope and trapezoidal drains shall be excavated outside slope angle of embankment;

（4）Intercepting gutter shall be built around the stockyard on construction site; grit chamber and net for blocking sands shall be set up on exit; rainwater and mud containing sediment shall be discharged into municipal sewage pipe network after sedimentation treatment in grit chamber, etc;

（5）Oil removal and sediment facilities shall be set up to deal with construction wastewater; mud purifying pond for precipitation of sludge shall be set up and supernatant could be recycled for watering, cleaning of machinery and vehicles on pavement of construction section, while the rest shall be discharged into municipal pipe network through the net for blocking sands;

（6）Locations for piling up materials of construction such as pitch, oil and chemicals shall be away from lake water;

（7）During the construction process, in order to reduce the impact of engineering construction on nearby traffic and residents, PVC project enclosure with the height of no less than 2.4m shall be set up around the areas which need to be rebuilt and extended.

（8）In section near the lake, in the event of rainy season, waterproof cloth may be used to cover the surface of bare roadbed in case any erosion rainfall runoff might do to pavement and to reduce the impact on rivers.

10.3.3 Acoustic environment

Noise in construction period mainly comes from haulage vehicles for construction machinery, among which most of the noise comes from that of construction machinery including excavators, bulldozers, rollers, agitators, loaders, etc.

According to actual situation of the Project, the following measures and suggestions are put forward for the impact construction noise has on surrounding:

（1）Accept supervision and inspection of Urban Management Department and adopt vibration and noise reduction measures according to relevant requirements. It is not allowed to disturb the residents.

（2）Many sensitive points such as residence, hospitals, schools are intensively and uniformly distributed around both sides of the Project, so construction day and night would disturb normal life and rest of above residential areas, especially noise at night. Therefore, construction at night shall be prohibited on the whole line. If construction technology does need nighttime construction, complaint telephone of night construction's noise and disturbance shall be announced after examination and approval of handling *Nighttime Construction Permit* according to relevant regulations; use of mechanical equipment with high noise shall be limited to 7:00～12:00、14:00～22:00. If there is any need to continuously construct, it shall be approved by Environmental Protection Administration in advance.

（3）Maximize the use of low-noise machinery and all construction machinery and equipment shall receive noise measurement for its normal working conditions. Prohibit the machinery exceeding the national standard from entering the construction site for construction. In construction period, frequent maintenance shall be given to equipment to avoid enhance the noise due to poor equipment performance. Noisy machinery shall be taken away from sensitive acoustic environment such as residential areas; regular maintenance and stringent operation regulations shall be adopted; and 2.4m fence shall be set up around residential areas.

（4）Ready-mixed concrete shall be used and no concrete mixer shall be set up on construction site;

（5）Construction vehicles shall be well organized; the haulage vehicles shall slow down and avoid honking when passing by the sensitive points;

（6）Stop construction in special days such as senior high school entrance examination and college entrance examination。

It is predicted that after adopting the measures mentioned above, the impact construction noise has on surroundings will be alleviated and less significant if nighttime construction is avoided. But if there is any need to construct at night and requirement of *Emission Standard of Environment Noise for Boundary of Construction Site* is met, Developer and organizations shall reinforce operation and management in construction period and carefully listen to opinions and suggestions of residents nearby and obtain their understanding and support.

10.3.4 Solid wastes

Solid wastes produced in construction period of the Project are mainly earthwork abandoned and domestic sewage of builders. According to survey and data provided by the Developer, the proposed environmental protection measures for solid wastes are as follows:

（1）First of all, PVC project enclosure with the height of not less than 2.4m shall be set up around the areas which need to be rebuilt and extended to keep construction region within the enclosure clean; and special-assigned person shall be appointed to be responsible for cleaning the construction site; timely watering and cleaning shall be ensured to reduce dusts. Mound and windrow shall not occupy the region near red line.

（2）Reasonably plan the field of mound and reduce the number of it according to the amount of temporary mound. Try to arrange the field of mound in the middle of enclosure; ensure that vehicles and machinery pass fewer sections to reduce the impact of construction machinery on the field of mound.

（3）Temporarily cover the mound with waterproof cloth according to the time of mound.

（4）Abandoned earthwork of the Project mainly includes brick slag of houses removed, construction waste of breaching the pavement, drilling residue of footbridge, the rest of soil excavated in road and drainage works, etc. The abandoned earthwork of the Project shall be deployed by in unified organization by City Management Department for regional balance. The part which could not be utilized shall be absorbed and disposed in places designated by City Management Department.

（5）Domestic garbage shall be disposed by sanitation departments after being separately collected.

10.3.5 Impact of water and soil loss

Job types in construction period are varied including land requisition, foundation earth and rock engineering, facilities, materials, transportation of earthwork, track and house construction, etc. These construction activities will give rise to different degrees of surface disturbance, destruction of vegetation and erosion of soil; especially in rainy days, they will inevitably result in water and soil loss within scope of the Project. In operation period, with all kinds of protective engineering implemented and completed, water and soil loss will be alleviated and the surroundings will be restored or partly be better than it used to be.

10.3.6 Ecological environment

Existing road layout is utilized in most of the Project. Construction activities are within the scope of road without causing any major impact on flora and fauna along the line.

The road is built in the way of "main line +side roads" and existing road layout is utilized in the Project. Original land use pattern along the line of the Project is overall maintained without exacerbating the tensions of land in areas along the line. Meanwhile, after greening measures are taken for the Project, the green area along the line is increased, which will help beautify the environment and improve overall image of the city.

10.3.7 Social environment impact assessment

Vehicles moving in and out of construction site and occupying the existing roads will cause a short-term adverse effect on travel and normal life of residents along the line of existing road. Meanwhile, haulage vehicles carrying a large quantity of materials may cause traffic jam of some section. Dusts of construction vehicles will lower living quality of residents nearby and construction noise will influence the rest of residents. Discharge of sewage, household garbage, wastes produced by production on construction camps and sites will cause an impact on water quality of rivers along the line; even level of civilization of constructors will influence daily life of local residents. And such kind of impact is mainly on the section of residence near the line.

Vehicles moving in and out of construction site and construction activities such as transportation of construction materials will occupy the existing roads, resulting in traffic jam and thus causing a short-term adverse effect on travel of residents along the line. According to field investigation, since there are residents, schools, offices and organizations, road construction will cause a short-term adverse effect on travel of residents nearby. Removal and land requisition of the Project will change the using function of land thus having certain influence on life, transportation, social economy and infrastructure of residence. Placing of materials and excavation on construction site will make the city in a mess influencing landscape of the city. Activities such as excavation in construction period may cause a short-term adverse effect on travel of residents nearby. Considering that most road construction of the Project is conducted in urban area of Anlu and there are many shops along the road, closed-off management is adopted in construction period, which may has certain impact on business of the shops along the line.

10.4 Environmental impact assessment in operation period

10.4.1 Ambient air

Under average meteorological conditions of typical hour, day and year, the result of predicting impact pollutants of road have on regions and environmentally sensitive points indicates that pollutants mainly center on centerline of the road; and in operation period of the Project, the increments of maximum concentration of CO and NO_2 in this area are small, which means the impact on quality of ambient air along the line is not so significant.

10.4.2 Acoustic environment

It is predicted that traffic noise produced on major roads will be higher with the increase of service time and traffic flow. And the roads to be built will lower the quality of acoustic environment of regions along the line and that of some residential areas along the line will be even worse to varying degrees. The quality of acoustic environment along the line of some improved roads or in local region is greatly improved.

Considering the deviation of result prediction which may be caused by prediction mode error and project design alteration and alteration that may result from adjustment of land use planning along the line, tracking and monitoring of acoustic environment in trial operation period and initial operation period shall be reinforced after road construction is completed. While taking all kinds of noise control measures put forward in the assessment, Developer shall adequately adjust and perfect acoustic environment protective measures by combining the result of tracking and monitoring to avoid any dispute over environment after transport service is provided.

After all kinds of noise control measures put forward in the assessment are implemented, the total sound level of environmental noise at environmentally sensitive points designed by the Project meets the requirements of standard limit or is above current level.

10.4.3 Water environment

No wastewater is produced on roads of the Project and it is mainly rainwater collected, among which initial rainwater's content of pollutants is higher. During transportation of road rainwater in surface drainage or storm sewer, pollutant concentration in water is greatly reduced after dilution, sedimentation or degradation of suspended solids and sediment in water. Therefore, it will not have any adverse impact on relevant receiving water. But if the vehicle is not well maintained or it breaks down or gets into any accident, gasoline and engine oil leaked may pollute the road. What's worse, after rain, water containing oil will flow into nearby water area thus causing pollution of petroleum and COD. As a consequence, measures shall be taken to prevent the occurrence of such accidents. Wastewater produced in the field of the Project mainly includes: domestic sewage of staff and passengers, etc. After disposed by oil separator, restaurant wastewater of the Project with other domestic sewage will be disposed in septic tank and then discharged into sewage pipe. At last, it will be discharged into Fuhe River after it is dealt with in sewage treatment plant and reaches the standard.

Among six proposed stations of the Project, except road passenger transportation center+public traffic transfer hub of High Speed Station, the others are all connected to sewage pipe network. Therefore, domestic sewage could be centrally disposed in Anlu municipal sewage plant. According to construction plan of the Project, road passenger transportation center+public traffic transfer hub of High Speed Station will be initiated in 2019 and completed in 2020. At that time, if sewage pipe network there is built and connected, wastewater in road passenger transportation center+public traffic transfer hub of High Speed Station will be centrally disposed in sewage treatment plant; otherwise, Developer shall build sewage treatment facilities themselves and domestic sewage shall be discharged after it reaches primary standard of *Integrated Wastewater Standard* (GB8978-1996).

Therefore, the impact on water environment in operation period of the Project is not so significant.

10.4.4 Ecological impact analysis

During project construction, haulage vehicles and stock ground will have certain adverse influence on appearance and landscape environment of part of the city. However, such kind of influence is short-lived and will disappear on termination of construction. After completion of the Project, proportion of afforestation will be increased and rational allocation will be reinforced to make integrated environmental benefits, for example, protecting the road surface, reducing water and soil loss, lowering traffic dust and noise, adjusting and improving road microclimate. In this way, landscape environment along the line will be improved, which may beautify the appearance of road.

10.4.5 Social environment impact analysis

The project construction is non-profitable municipal construction project, which provides positive benefits for society and economy. The construction of the Project not only provides convenient traffic conditions and complete set of municipal facilities for residents and organizations along the line but also improves regional investment environment, playing an important role in promoting the sustainable, healthy and rapid development of economy of surroundings.

10.4.6 Accident risk impact analysis

After construction project is put into operation, the risks mainly come from haulage vehicles carrying dangerous goods. There are accident risks of leakage, fire and explosion in vehicles carrying dangerous materials which are inflammable, explosive, toxic, corrosive and radioactive.

In operation period, safety check and management of haulage vehicles carrying dangerous chemicals on road shall be reinforced; detailed emergency plans shall be developed to prevent diffusion of pollutants and dangerous goods.

10.5 Conformance analysis of industrial policy and planning

In Traffic Integrated Demonstration Project in Wuhan City Cycle of World Bank-Xiaogan Anlu Urban Transport Infrastructure Subproject, seven integrated traffic corridors and road network improvement project, three public transit hubs, one small public transit hub, two public transit hubs+road passenger transport center, bus card system, intelligent public transport system, a batch of public transport purchase, a batch of road safety projects, slow traffic system in old city, a batch of institutional construction and technical assistance are built.

According to order No.9 of *Catalogue for Guiding industry Restructuring (2011 Version)* and order No.21 of *Decisions of National Development and Reform Commission about Modification of Relevant Clauses of Catalogue for Guiding industry Restructuring (2011 Version)* of National Development and Reform Commission, the Project belongs to “Encouraged” category, namely “24.highway and road transport (including urban passenger transport)” and “22.urban infrastructure”, thus it is in accordance with national industrial policy.

Anlu City is located at cluster development axis of modern manufacturing industry in Xiaogan City and is the extension of development axis of both Xiaogan and Wuhan’s manufacturing industry. Moreover, it is a primary zone for cluster development of modern industry in Xiaogan City. And it will be turned into an important place for industries integrating logistics, modern manufacturing and high and new technology in Wuhan city cycle. Located at the development zone of Wuhan and

Shiyan, Anlu City is one part of key zones for development in Wuhan city cycle. As municipal infrastructure construction, the Project is in accordance with the requirements of *Master Plan of Wuhan City Cycle* and *Urban Master Plan of Xiaogan City*.

The Project includes integrated traffic corridors and road network improvement project, ancillary facilities for public traffic system and so on. While serving both Hedong and Hexi areas of Anlu City, the Project also gives consideration to all areas in the east, south, west and north of the city and it makes it convenient for villages and towns to get in contact with city area, thus reinforcing Anlu's communication with Xiaogan and Wuhan and greatly promoting residence and development of the city. Therefore, it is in accordance with requirements of *Urban Master Plan of Anlu City*.

The Project's construction of public transport hub and passenger stations makes it convenient for citizens to change bus and save time for transit time; construction of integrated traffic corridors and road network improvement project can further improve municipal road network of Anlu City and raise the residents' happiness index. Overall planning and construction of public transport hub could effectively integrate systematic resources; constitute a service network for public transportation infrastructure with reasonable allocation and perfect functions. Besides, it could realize reasonable allocation of resources and reduce occupation of resources which is important for improving municipal environment of Anlu City, guiding balanced development between regions and achieve sustainable development of traffic. Therefore, the Project's construction is in accordance with *Anlu City Comprehensive Transportation System Plan.*

10.6 Public involvement and analysis

The environmental assessment is available to the public with information about environment published via network. Many methods are adopted for the public to take a part in it, for example, handing out a survey, visiting departments, the public's attending the hearing. The public along the line took an active part in the assessment and they considered the Project's construction would help improve traffic conditions, promote economic development and raise the living standard. Meanwhile, requirements and suggestions about environmental protection and pollution abatement were put forward. Department for evaluation came up with corresponding measures and advices about environmental protection according to these suggestions. 100% of the public who were surveyed were in favor of or took an acceptable attitude towards the Project's construction and no one opposed to it.

It is surveyed that most respondents had a clear idea about the Project and a supportive attitude towards it. They thought the Project would have a positive influence on social economy but they also thought Developer should adopt reasonable environmental protection measures and conduct traffic dispersion. Meanwhile, they were also concerned with noise and dust which may possibly exist in construction period and operation period of the Project.

The assessment found that Developer should further strengthen environmental pollution control measures and traffic disperse during construction. Under the circumstances that relevant requirements and measures in the assessment are practically implemented, the impact of the Project on its surroundings could be controlled within the scope of national standards and would not lead to the deterioration of environmental quality of the surroundings. Therefore, what the public are concerned with could be alleviated or eliminated. In short, the Project is acceptable to the public.

Developer shall further enhance its communication with the public. By methods such as news media and billboards, the Project, basic situation of the enterprise, the commitment enterprise managers have made to environmental protection could be publicized so that the public could have a better understanding of what the Project includes. Besides, environmental and social benefits could be maximized.

10.7 General conclusion of environment assessment

Traffic Integrated Demonstration Project in Wuhan City Cycle of World Bank-Xiaogan Anlu Urban Transport Infrastructure Subproject is in accordance with industrial policies and local planning, and it is also very important for improving infrastructure construction of Anlu City and enhancing urban functions. The areas where the Project and its construction are located are well coordinated and could produce good social and economic benefits.

Project construction and operation will have adverse impact on ecological, acoustic and ambient environment of the region the Project is located. Therefore, while ensuring investment for environmental protection and stringent execution of "Three Simultaneousness" and all kinds of environmental protection measures stipulated in *Report* after submission for approval, Developer shall effectively control and alleviate possible environmental impact of project construction. Considered from the perspective of environmental protection, the Project is practicable.