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The People's Republic of China
World Bank Loan Jiangxi No. 3 Highway Project
(Ruijin to Ganzhou Expressway)

Environmental Impact Assessment Report

(Fifth version)

Public Disclosure Authorized

Entrusted by: Communications Design Institute of Jiangxi Province, P.R.China

Compiled by: Research Institute of Highway, the Ministry of Communications

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Forewords

Xiamen-Chengdu Expressway is the 16th horizontal highway in the national key highway network of 7918" under planning, which starts from Xiamen City of Fujian Province, after passing through Jiangxi Province, Hunan Province, Guangxi Province, Guizhou Province, ends at Chengdu City of Sichuan Province with a total length of 2,295 kilometers. It will organically link the developed eastern China region with the middle China region which is under vigorous economic development as well as the west China region currently under the Great West development. Construction of this key highway will play a vital role in implementing the Great West development strategy, in forming national and Jiangxi highway network, in fostering fast regional economic development alng the line, in promoting tour resource development and utilization, and in advancing the regional integration process of east, middle and west China.

The proposed project is a section of national key project the Xiamen-Chengdu Expressway in Jiangxi territory, it is a part of the 4th horizontal highway in Jiangxi Province's key road network "three verticals and four horizontals". The proposed Ruijin-Ganzhou section of Xiamen-Chengdu Expressway is approximately 116.6 kilometers long, starting from Yunshishan in Ruijin City where it links with the destination of Ailing (Jiangxi and Fujian border)-Ruijin Highway of Xiamen-Chengdu Expressway. After passing by Huichang, Yudu, Ganxian, it ends at Zhanggong District of Ganzhou City where it links with the origin (Huangjin interchange) of Ganzhou west highway of the Xiamen-Chengdu Expressway.

Entrusted by Jiangxi Provincial Communications Department, the Jiangxi Provincial Transportation Design Institute completed 《Feasibility Study Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China》. In Dec of 2004, entrusted by Jiangxi Provincial Transportation Design Institute, the Ministry of Communications Highway Research Institute undertook the environmental impact assessment for this project. Under great assistance from Jiangxi Provincial Transportation Design Institute and local governments along the route, the assessment unit has carried out field reconnaissance and investigation along he line on Dec 2004, based on which, has compiled the 《Environmental Impact

Assessment TOR for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China》 for this project. In April 2005, Ganzhou Prefectural Environmental Monitoring Station was entrusted to carry out the current environmental monitor along the project. On May 2005, on the basis of the 《Feasibility Study Report》(first revision) for this project, the assessment unit completed the 《Environmental Impact Assessment Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China》(first version). On September of 2005, based on the mid-term findings of preliminary design for this project, the assessment unit completed《Environmental Impact Assessment Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China》(second version).On October 2005, based on the adjustments in the preliminary design documents and World Bank mission's opinion on this report, we have revised and compiled the third version of the《Environmental Impact Assessment Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China》(Third version). On November 2005, based on the adjustments of alignment and World Bank mission's opinion on this report, we have revised and compiled the third version of the《Environmental Impact Assessment Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China》(Fourth version).

During the course of preparing this environmental assessment report, we have received great support from Jiangxi Provincial Communications Department, Jiangxi Provincial Transportation Design Institute, Jiangxi Provincial Environmental Protection Agency, and concerned departments of Ganzhou Prefecture, Ruijin City and each county and township along the route. Here, we would like to express our deepest gratitude!

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Chapter 1 General Overview

1.1 Assessment type

Construction of this project is a developmental activity which will produce profound influence on the society and regional economy along the route, its construction and operation will exert a very tremendous influence on the natural environment and social environment of the project directly influenced region, thus the interrelation between project implementation and environmental protection must be properly handled. According to the China National Environmental Protection Agency's requirement on environmental impact assessment classification for construction project, this project is a newly-built type A project crossing sensitive locations such as residences, thus this project shall carry out a comprehensive environmental impact assessment.

1.2 Assessment principle and objectives

1.2.1 Assessment principle

(1) Adhering to the idea that environmental impact assessment serves for project construction, serves for environment management, and promotes a coordinated development between project construction and environmental protection.

(2) Fully investigating and making best use of available material, at the same time paying attention to conducting additional monitoring and using advanced computer module to carry out simulation forecast so as to guarantee a scientific and up-to-date environmental impact assessment conclusion.

(3) As the basis for project environmental protection management and important technical documentation, the environmental assessment and report compilation shall pay attention to systematicity, advancement, utility and feasibility.

1.2.2 Assessment objectives

(1) To carry out environmental impact assessment for this project along the route so as to justify the rationality of this project construction in terms of environmental protection, to comprehensively compare and select existing local alternative line alignments in terms of environmental protection, to provide necessary scientific basis

for selecting project alignment.

⑵ To carry out investigations of social and natural environment in the assessment scope along the route so as to predict the impacts on environment caused by the design, construction and operation for this project and to put forward corresponding feasible measures and countermeasure for environmental protection and optimization.

⑶ To feedback environmental protective measure, suggestions and assessment conclusions to engineering design and construction so as to offer scientific basis for optimizing engineering design and to reduce or mitigate the negative effects on surrounding environment caused by engineering construction.

⑷ To provide information and scientific basis for decision-making in the environmental management during construction and operation stages as well as in the economic development, urban construction and environmental planning along the route.

1.3 Compilation basis

1.3.1 National laws, regulations and technical specifications

(1) "*People's Republic of China Law on Environmental Protection*" (1989.12.26);

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

(3) "*People's Republic of China Law on Prevention and Control of Ambient Noise Pollution*" (1996.10.29);

(4) "*People's Republic of China Law on the Prevention and Treatment of Water Pollution*" (1996.5.15);

(5) "*People's Republic of China Law on Air Pollution Prevention*" (2000.4.29);

(6) "*People's Republic of China Law on Solid Waste Pollution Prevention*" (1995.10.30);

(7) "*People's Republic of China Law on Water and Soil Conservation*" (1996.6.29);

(8) "*People's Republic of China Law on Land Management"* (1998.12.29);

(9) "*People's Republic of China Law on Flood Control"* (1998.1.1);

(10) "*People's Republic of China Law on Fishery"* (1986.7.1);

(11) "*People's Republic of China Law on Agriculture"* (2003.3.1);

(12) "*People's Republic of China Law on Wild Animal Protection"* (1988.11.8);

(13) “*People's Republic of China Law on Cultural Relics Protection”* (2002.10.28);

(14) “*People's Republic of China Law on Road”* (1999.10.31);

(15) “*Implementing Regulations of People's Republic of China Law on Land Management”* (1999.1.1);

(16) “*Implementing Regulations of People's Republic of China Law on Water and Soil Conservation”* (1993.8.1);

(17) “*Environmental Protection Management Rules of Construction Project”*(State Council Ordinance No. 253, 1998.11.29);

(18) “*Environmental Protection Classification Management Register for Construction Project”* （2003.1.1）；

(19) “*Regulations of Basic Farmland Protection”*(State Council Ordinance No. 257, 1999.1.1);

(20) “*Environmental Protection Management Method of Road Construction Project”* （2003.6.1）；

(21) “*Registar Namelist of Wildlife under Special State Protection”* （1989.1.13）；

(22) “*State Council Notice on Issuing National Ecological Environmental Protection Guideline”*(State Council ordinance [2000]No. 38, 2000.11.26);

(23) “*Urgent Notice on Forbidding Occupying Basic Farmland for Planting Issued by State Council”*(state [2004]No 1, 2004.3);

(24) “*Notice on Most Rigid Implementing Cultivated Land Protection in Road Construction”*(issued by the Ministry of Communications [2004]No. 164, 2004.4);

(25) “*Notice on Strengthening Environmental Impact Assessment for Construction Project loaned by International Financial Organization”*(NEPA[1993]No. 324, 1993.6.21);

(26) “*Environmental Protection Management Regulations for Construction Project in Jiangxi Province”*(*Jiangxi Provincial People's Congress Order No.* 96, 2001.6);

(27) “*Environmental Pollution Prevention Regulations in Jiangxi Province”*(*Jiangxi Provincial People's Congress Order No.* 63, 2000.12)。

1.3.2 Relevant technical specifications

(1) “*Technical Guidelines for Environmental Impact Assessment”*(HJ/T2.1～2.3-93, HJ/T2.4-1995, HJ/T19-1997, NEPA);

(2) "*Environmental Impact Assessment Specification for Road Construction Project* (tentative)"(JTJ005-96, MOC);

(3) "*Environmental Protection Design Specification of Road"*(JTJ/T006-98, MOC);

(4) World Bank Safeguard Policies, including Operational Policies(OP), Best Procedure(BP), Good practice(GP) and Operational Directives(OD). They are:

- Environmental Assessment (OP/BP/GP4.01);
- Involuntary Resettlement (OP/BP4.12);
- Cultural Property (OP4.11);
- Natural Habitats (OP/BP4.04);
- Indigenous People (OD4.20);
- Forestry (OP/GP4.36);
- Safety of Dams (OP/BP4.37);
- Pest Management (OP4.09);
- Projects in Disputed Areas (OP/BP/GP7.60);
- Projects on International Waterways (OP/BP/GP7.50).

Of the ten World Bank safeguard policies, Environmental Assessment (OP/BP/GP4.01), Involuntary Resettlement (OP/BP4.12), and Cultural Property (OP4.11) are applied in the EIA;

(5) "*Notice about Ambient Noise in Environmental Impact Assessment in Construction Projects such as Highway, Railway (Including Light Railway*)"〔environment〔2003〕No 94, 2003.5.27〕.

1.3.3 Relevant documents in the project preliminary work

(1)"Feasibility Study Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China" Jiangxi Provincial Transportation Design Institute, Sept. 2004.

(2)《*Feasibility Study Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Section of Xiamen-Chengdu National Expressway) in People's Republic of China*》 Jiangxi Provincial Transportation Design Institute, May 2005.

(3)《*Preliminary Design for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China*》 Jiangxi Provincial Transportation Design Institute, Sept. 2005.

(4) 《*Preliminary Design for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China*》 Jiangxi Provincial Transportation Design Institute, Oct. 2005.

(5) 《*Cultural Relics Assessment Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China*》 Jiangxi Provincial Archaeological Institute, Oct. 2005.

(6) 《*Water Conservation Scheme for World Bank Loan Jiangxi Road Project No. 3 Ruijin-Ganzhou Section of Xiamen-Chengdu National Expressway in People's Republic of China*》(for submission),Jiangxi Provincial Water Conservation Research Institute, Oct. 2005.

1.4 Assessment scope and time duration

1.4.1 Assessment scope

According to the environmental impact assessment characteristic and practical experience for road construction projects and by considering the natural environment characteristic of the proposed project, the scope for environmental impact assessment of this project is determined as shown in Table 1.4.1-1.

Table 1.4.1-1 Scope for environmental impact assessment of this project

No	Environmental element	Environmental investigation and assessment scope
1	Acoustic environment	Area 200m from the highway center line at both sides, properly expanded to 300m when there are special sensitive locations (school and hospital).
2	Ambient air	Area 200m from the highway center line at both sides, properly expanded to 300m when there are special sensitive locations (school and hospital).
3	Water environment	Area 200m from the highway center line at both sides, water area 200m upstream from bridge location and 1000m downstream from bridge location.
4	Ecological environment	Area 300m from the highway center line at both sides, and earth borrow pits and waste banks.
5	Social environment	Project-influenced areas

1.4.2 Assessment time duration

The assessment is conducted in the construction stage and operation stage, of which the assessment duration in construction stage is the entire construction period of the project, and the assessment duration in operation stage selects the first, seventh and fifteenth years since operation as the short-term, mid-term and long-term operation stages for prediction and assessment according to "*Environmental Impact Assessment Specification for Road Construction Project* (tentative)".

1.5 Main contents of assessment

The main contents of assessment work include: analysis of project environmental impact, assessment of social environmental impact, assessment of ecological environmental impact, assessment of acoustic environmental impact, assessment of water environmental impact, assessment of ambient air environmental impact, environmental risk analysis of pollution accident, assessment of solid waste environmental impact, public participation, alternative alignment comparison and selection, environmental protection management and environmental monitoring, environmental protection countermeasures and their technical and economic justification, profit and loss analysis of environmental impact, etc.

1.6 Assessment method and technical procedure

1.6.1 Assessment method

This assessment adopts the method of "focusing on point and representative sections to combine point with section and to feedback the whole line".

(1) Sectional assessment

Analysis and assessment are conducted according to the environmental characteristics of traffic volume, project, topography and meteorology predicted in the *Pre-FS Report* or the "*Feasibility Study Report*"(May 2005);

(2) Assessment of acoustic environment and ambient air during operation stage mainly adopt mode predicting method to calculate and analyze; assessment of ecological environment, water environment and soil erosion adopts investigation, analogical analysis and mode prediction combined method; assessment of social environment, life quality and public participation adopts investigation and analytical method.

(3) Carrying out assessment on main environmental protection objectives one by one.

1.6.2 Assessment technical procedure

The assessment technical procedure refers to Fig. 1.6.2-1.

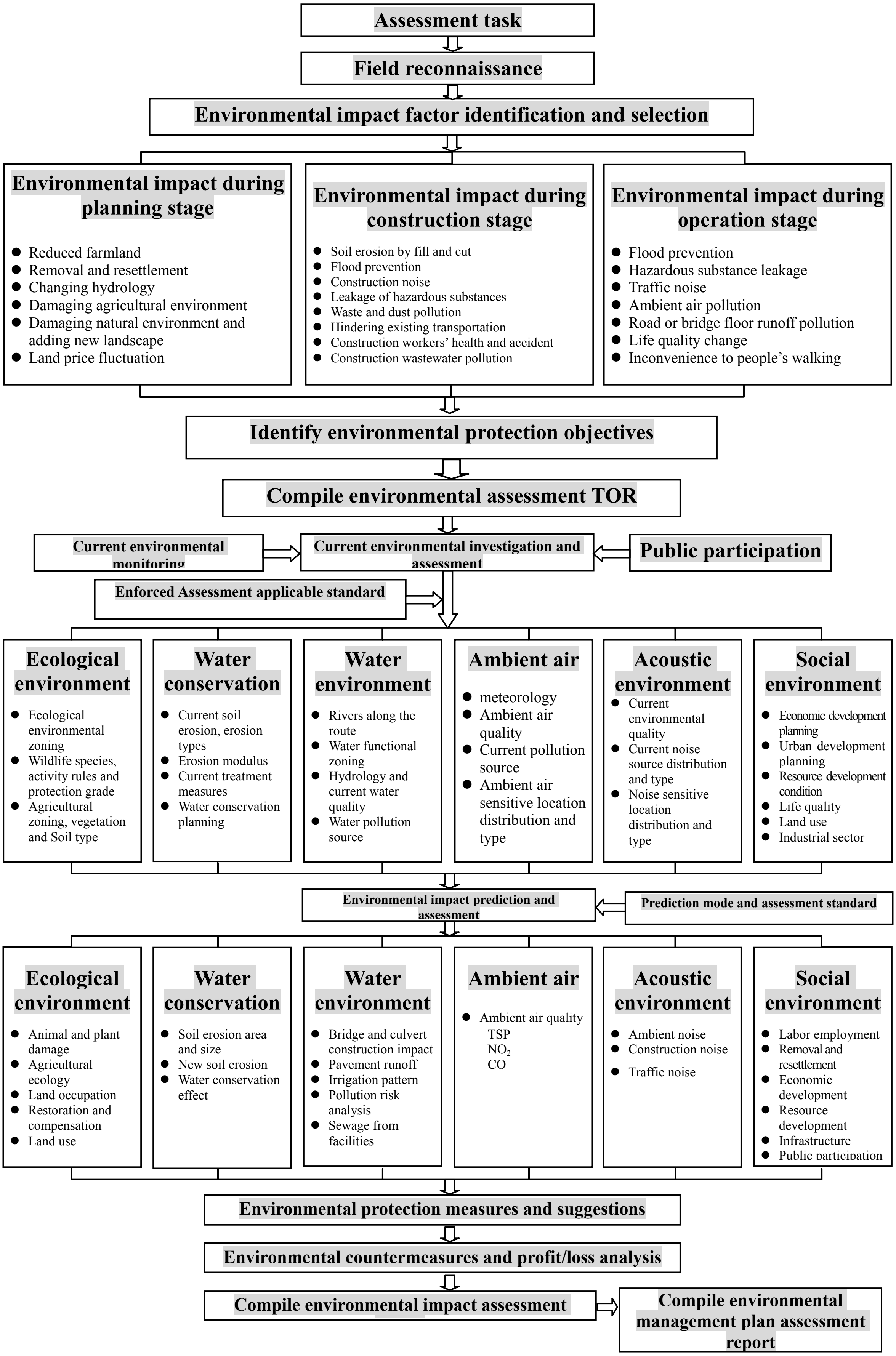


Fig. 1.6.2-1 Assessment procedure diagram

1.7 Assessment grade and focal points

1.7.1 Assessment grade

According to the "*Technical Guidelines for Environmental Impact Assessment*" (HJ/T2. 1-2.3-93, HJ/T2.4-1995, HJ/T19-1997), the assessment grade for each topic of this project is determined as shown in Table 1.7.1-1; the social environment assessment follows the "*Environmental Impact Assessment Specification for Road Construction Project (tentative)*" (JTJ005-96) .

Table 1.7.1-1 Topic assessment grade and basis

Topic	Basis	Grade
Acoustic environments	Noise level will increase significantly during and after the project is constructed	II
Ambient air	Relatively complicated landform, equiscalar discharge amount $P_i<2.5\times10^8$	III
Ecological environment	Impact scope>50km^2, biological population reduction<50%, slight impact on specie diversity, regional connectedness are worsening	II
Water environment	Small sewage discharge and simple composition, no water intake in assessment scope	III

1.7.2 Assessment focal points

The assessment focal points include assessment of ecological environmental impact (including soil erosion) during construction stage, assessment of acoustic environmental impact during operation stage, alternative alignment comparison and selection, environmental protection management and environmental monitoring, and public participation, etc.

1.8 Major environmental protection objectives

The environmental protection objectives are identified as the surface water water quality, basic farmland, vegetation, project earth borrow and waste banks, as well as village residential life quality, normal schooling, working conditions and development zone plan within the assessment scope. The concrete environmental protection objectives are listed in Table 1.8-1. The acoustic and ambient air sensitive locations for each scheme are listed in Table 1.8-2 and 1.8-3; for Daduan scheme I and Jingkeng scheme II, there is no acoustic and ambient air sensitive location.

Table 1.8-1 List of major environmental protection objectives along the route

Environmental impact factor	Environmental protection objectives	Stake No	Environmental characteristics and overview
Ecological environment	Agricultural crops	K31+012.997～K149+728	The whole route will take up cultivated fields of 3934.73 mu (Chinese acre) in size, mostly paddy fields and slope fields.
	Vegetation		The whole route will take up orchards of 377.8 mu, forestry of 6903.65mu, layout is mainly loose, does not have large-scale centralized development.
	Natural vegetation and water conservation in large fill and cut sections and tunnel cut sections	K44+935～K45+215	Dahe tunnel,280m long
		K56+885～K57+190	Zhujing tunnel,305m long
		K65+850～K66+370	Jiuling tunnel,540m long
		K67+760～K71+920	Zhonggongzhang tunnel,4160 m long
		K82+068～K83+890	Yudu tunnel,1805.5m long
		K105+093～K107+200	Xiashan tunne,2153 m long
		K109+475～K109+665	Baishan tunnel,190m long
		Earth borrow pits and waste banks	12 earth borrow pits and 24waste(slag) banks
Water environment	Jiubao river	K32+470	Jiubao river bridge,327m long
	Xijiang river	K39+150	Xijiang river bridge,187m long
	Gongjiang river	K63+010	Shangba Gongjiang River viaduct,1407m long
	Shangxi river	K94+315	Miaobei viaduct,487m long
	Gongjiang river	K100+424	Gaotan Gongjiang River bridgen,497m long
	Gongjiang river	K114+940	Jiaolin Gongjiang River super-large bridge,1087m long
	Gongjiang river	K119+220	Chenwu Gongjiang River bridge,1367m long
	Ganjiang river	K135+480	Ganjiang River super-large bridge,1337m long
	Dongfeng reservoir	K51+710	Dongfeng reservoir bridge,807m long
	JIuling reservoir	K66+735	JIuling reservoir bridge,307m long
	Maqimian reservoir	K85+593	Maqimian reservoir bridge,367m long
	Niugutang reservoir	K115+680	Niugutang reservoir bridge,127m long
	Xijiang service area	K38+500	Sewage discharge in service area,close to Xijiang river
	Yudu service area	K98+900	Sewage discharge in service area,close to Gongjiang River
Acoustic, ambient air and social environment	For details see Table 1.8-2,Table1.8-3		

Table 1.8-2 List of acoustic and ambient air sensitive locations along the recommended scheme

No	Stake No	Name of sensitive locations	Relative distance and height difference to the road(m)	Environmental features
1	K31+100~ K31+380	Taiziyuan (I)	Road north 120, height difference 7	A natural village in Yunshishan Township of Ruijin City with about 50 households, and 30 households within the assessment scope.
2	K31+370~ K31+480	Taiziyuan (II)	Road south 34,height difference 6	A natural village in Yunshishan Township of Ruijin City with about 60 households, and 45 households within the assessment scope, 2 houses to be removed, the route runs

No	Stake No	Name of sensitive locations	Relative distance and height difference to the road(m)	Environmental features
				by the village edge and the houses are distributed perpendicular to the highway.
3	K31+570~ K31+820	Yangwu (I)	Road south 32,height difference 7	A natural village in Yunshishan Township of Ruijin City with about 50 households, and 40 households within the assessment scope, 2 houses to be removed, the route runs by the village edge.
4	K31+860~ K32+320	Yangwu (II)	Road north 44, height difference 6	A natural village in Yunshishan Township of Ruijin City with about 80 households, and 70 households within the assessment scope, 8 households to be removed, the route runs by the village edge and the houses are distributed sparsely along the proposed highway.
5	K33+700~ K34+300	Loubei	Road south 54,height difference 10	A natural village in Yunshishan Township of Ruijin City with about 120 households, and 90 households within the assessment scope, the village is distributed along the south of the proposed highway in a strip form.
6	K34+500	Yanba primary school	Road south 38,height difference 10	A 2-storey teaching building, side-faces the proposed highway, there is a wall, 1~5 grades, 230 students, 6 teachers, no boarding at night.
7	K34+560~ K34+820	Zaozixia	Road south 46m, height difference 9	A natural village in Yunshishan Township of Ruijin City with about 50 households, and 40 households within the assessment scope, 1 household to be removed, and 2 households are relatively close to the proposed highway, other households are 84m from the highway.
8	K34+560~ K34+820	Chazixia	Road north 26, height difference 1	A natural village in Yunshishan Township of Ruijin City with about 40 households, 5 households to be removed, the village is distributed along a mountain foot a strip form and is 45 degrees oblique to the proposed highway.
9	K34+800~ K35+350	Lingxia	Road south 34, height difference 12	A natural village in Yunshishan Township of Ruijin City with about 45 households, 3 households to be removed, the village is distributed along a mountain foot a strip form and the route passes by cutting a hill slope, some households are sheltered by hill slope.
10	K39+220~ K39+640	Citangxia	Road north 140, height difference 6	A natural village in Xijiang Township of Huichang County with about 70households, 3 households to be removed, some households are distributed sparsely.
11	K39+380~ K39+640	Fengshuxia	Road south 44, height difference 5	A natural village in Xijiang Township of Huichang County with about 32 households, 3 households to be removed, the houses are distributed sparsely.
12	K39+640~ K39+960	Qiangong	Road south 60, height difference 4	A natural village in Xijiang Township of Huichang County with about 50 households, the households are distributed sparsely along the south side of the proposed highway.
13	K39+740~ K40+050	Xinxiaowu	Road north 34, height difference 5	A natural village in Xijiang Township of Huichang County with about 80 households.
14	K40+140~ K40+260	Jiuquping	Road north 38, height difference 7	A natural village in Xijiang Township of Huichang County with about 30 households, 6 households to be removed.
15	K40+360~ K41+100	Changjiangqiao Laozhaixia	Through the village, road south 44 and road north 30, height difference 6	A natural village in Xijiang Township of Huichang County with about 120 households, and 80 households within the assessment scope, 5 households to be removed, the village is distributed along a mountain foot and is 45 degrees oblique to the proposed highway. There are more households in the south of the highway and the proposed highway passes by cutting the hill slope, some households are sheltered by hill slope. On the east side of the village there is an old road G323, with which the new highway intersects in K40+900.
16	K41+650~	Wanjiangwan	Through the village,	A natural village in Xijiang Township of Huichang

No	Stake No	Name of sensitive locations	Relative distance and height difference to the road(m)	Environmental features
	K41+800		road south 44 and road north 56, height difference 12	County with about 50 households, 5 households to be removed, more households along the north side of the proposed highway.
17	K42+300~ K42+540	Jiaojiangtou	Road north 25, height difference 6	A natural village in Xijiang Township of Huichang County with about 30 households, 10 households to be removed.
18	K42+600~ K42+800	Tangtouxia	Road north 80, height difference 7	A natural village in Xijiang Township of Huichang County with about 50 households.
19	K42+550	Datian primary school	Road south 180, height difference 7	Located in Hetang village, there is a 2-storey office building, one 1-storey teaching building, one 1-stoery old house used as canteen, there is a wall, 1~5 grades, 300 students, 14 teachers.
20	K42+500~ K42+700	Hetang	Road south 80, height difference 7	A natural village in Xijiang Township of Huichang County with about 30 households.
21	K42+900~ K43+100	Qiuqiu	Road south 34, height difference 3	A natural village in Xijiang Township of Huichang County with about 40 households, 1 household to be removed.
22	K43+900	Huoxing primary school	Road south 110, height difference 7	Three 1-storey houses, one for classroom, one for teachers' dormitory and offices, 1~5 grades, 290 students, 10 teachers, no boarding at night.. the school lies in a hill foot where the highway passes by cutting the hill top. Due to the sheltering of road slope, vehicle traffic noise does not have big impact on the school..
23	K48+500	Xijiang Township sanatorium	Road north 174, height difference 0	The sanatorium is close to national roadG323, only 20m;there is a wall, the yard is spacious with one 2-storey building, two rows of 1-stoery houses. There are 20 old persons each sharing one room. The sanatorium is separated from the highway by a hillock, so the impact from the highway is not large.
24	K48+900~ K49+460	Shanshupai	Road north 30, height difference 10	A natural village in Xiaomi Township of Huichang County with about 200 households, 7 household to be removed. The households are distributed collectively along the north side of the highway, the old road G323 passes through the village and the proposed highway is about 120m to the old road in the shortest distance.
25	K49+580~ K49+740	Shanbei	Through the village, road south 32 and road north 38, height difference 15	A natural village in Xiaomi Township of Huichang County with about 80 households, and 11 households to be removed, the village is distributed perpendicular to the proposed highway in a strip form.
26	K53+700~ K54+150	Yuyang	Road north 40, height difference 2	A natural village in Huanglin Township of Yudu County with about 70 households and 7 households to be removed, the village is distributed sparsely along the north side of the proposed highway.
27	K56+120~ K57+060	Heliaoxia	Through the village, road south 32 and road north 28, height difference 6	A natural village in Huanglin Township of Yudu County with about 80 households and 7 households to be removed, most households are is distributed collectively in a hill slope in the south side of the proposed highway, a few households are distributed sparsely in the north of the highway, the proposed highway passes by cutting the hill top.
28	K71+950~ K72+330	Shijing	Road south 110, height difference 15	A natural village in Hefeng Township of Yudu County with about 35 households within the assessment scope, the households are distributed perpendicular to the proposed highway, close to the exit of Zhonggongzhang tunnel.
29	K73+550~ K73+800	Shangduan	Road south 26, height difference 10	A natural village in Huanglin Township of Yudu County with about 30 households distributed sparsely along a mountain foot, the route passes by cutting a slope.

No	Stake No	Name of sensitive locations	Relative distance and height difference to the road(m)	Environmental features
30	K74~ K74+280	Huangtian	Road north 42, height difference 1	A natural village in Huanglin Township of Yudu County with about 30 households.
31	K75+050~ K75+570	Shihuiling	Through the village, height difference 4	About 100 households, the village is distributed in strip form and is 30 degrees oblique to the proposed highway. Most households are distributed in the south side of the route.
32	K76+175~ K76+400	Tudi	Road north 100, height difference 4	About 30 households, centered distribution.
33	K76+435～ K76+825	Youliaobei	Through the village, height difference 2	About 60 households, the village is distributed in strip form along a mountain foot and the household centered place is 120m from the route, some scattered households are close to the route.
34	K76+445～ K77+160	Tangmianshang	Through the village, height difference 3	About 50 households, the village is sparsely distributed along a mountain foot, there are more households on the north side of the highway.
35	K77+680~ K77+900	Daping	Road south 140, height difference 3	About 40 households, 10 households within the assessment scope, centered distribution.
36	K78+350~ K78+480	Hantang	Road north 50, height difference 2	About 20 households, relatively centered households.
37	K79+850~ K80+130	Chiyu	Road south 90, height difference 13	About 40 households, 20 households within the assessment scope, most households are 130m away from the proposed highway.
38	K99+170~ K99+560	Hongtang	Road north 30, height difference 2	About 50 households, 30 households within the assessment scope, sparse distribution.
39	K99+610~ K99+910	Xinwu	Road north 80, height difference 4	About 60 households, 30 households within the assessment scope, centered distribution.
40	K101+980~ K102+520	Pengwu	Through the village, height difference 4	About 60 households, 38 households within the assessment scope, the village is distributed along hill foot, the route passes by cutting a hill slope.
41	K102+700~ K102+910	Tianzigang	Road north 160, height difference 5	About 30 households, 15 households within the assessment scope.
42	K102+880~ K103+080	Shuiduan	Road north 30, height difference 6	About 30 households, distributed collectively, and is adjacent to Tianzigang.
43	K103+490~ K103+840	Xiamaoping	Through the village, height difference 10	About 35 households, about 26 households within the assessment scope, the households are sparsely distributed along the road, most perpendicular to the road, this is a viaduct section.
44	K103+790~ K104+300	Maoping	Through the village, height difference 10	About 80 households, about 60 households within the assessment scope, the households are collectively distributed along the north side of the proposed highway with some households scattered along the south side; on the east side of the village there is a railway, this place is a viaduct section.
45	K104+940~ K105+050	Zhaijiaoxia	Road north 28, height difference 18	About 30 households, the village is distributed along hill foot, and close to the portal of Xiashan tunnel.
46	K114+530~ K114+850	Xiaba	Road south 90, height difference 16	A natural village in Jiaolin village of Jiangkou Township of Ganxian County with about 48 households and about 30 households within the assessment scope, distributed along river banks of Gongshui River.
47	K119+600～ K119+860	Pingzigao	Road south 20, height difference 14	About 40 households, sparse distribution., this is a viaduct section.
48	K119+580～ K120	Xiaomenkou	Road north 20, height difference 15	About 30 households, sparse distribution., this is a viaduct section.
49	K124+650~ K124+880	Laohupai	Road south 30, height difference 4	About 30 households, 19 households within the assessment scope.
50	K126+710~	Wansong	Road north 110,	The school is located in a mountain foot, the route passes

No	Stake No	Name of sensitive locations	Relative distance and height difference to the road(m)	Environmental features
	K126+740	primary school	height difference 15	by cutting the hill top. The school is a new Hope primary school built in 2002 with a total of 6 classes, 200 or more students, and 6 teachers; the teaching building is a 2-storey building.
51	K132+260~ K132+400	Zouwu	Road north 30, height difference 7	About 20 households distributed along a hill foot, this is a viaduct section.
52	K132+340~ K132+670	Shizishuxia	Road south 30, height difference 3	About 30 households distributed along a hill foot, the highway passes by cutting the hill top, most households are sheltered by the hill slope, is a viaduct section.
53	K132+500~ K132+570	Tianxin primary school	Road south 40, height difference 0	newly-built in 2003, two 2-storey buildings, one right-faces the south direction and back-faces the highway, one right-faces the west direction; 1~5 grades, 200 students and 10 teachers.
54	K132+680~ K132+850	Hechangbei	Road north 30, height difference 9	About 40 households, centered distribution., this is a viaduct section.
55	K141+200~ K141+400	Paishang	Through the village, height difference 10	About 40 households, the village is distributed in a long strip form and is 60 degrees oblique to the proposed highway. This place is a viaduct section.
56	K141+570~ K141+800	Shanbiantoushang	Road north 90, height difference 7	About 60 households, about 40 within the assessment scope, centered distribution., this is a viaduct section.
57	K142+290~ K142+430	Gangbianpai	Road south 20, height difference －2	About 20 households, distributed in a hill slope.
58	K142+340~ K142+400	Gangbian primary school	Road south 160, height difference 6	Located in Gangbianpai village, one 1-storey buildings for classroom and offices, 1~3 grades, 90 students, 7 teachers, no boarding at night.
59	K142+310~ K142+450	Tengshuwo	Road north 50, height difference 5	About 30 households, about 20 within the assessment scope, the village is distributed in the hill slope north of the proposed highway, this is a viaduct section.
60	K144+340~ K144+640	Yongquanganggshang	Road north 20, height difference 6	About 25 households, relatively-centered distribution.
61	K147+230~ K147+350	Cangxia	Road north 30, height difference 4	About 20 households, centered distribution.
62	K147+200~ K147+250	Yeshan primary school	Road north 80, height difference 4	Two 1-storey buildings, 1~2 grades, 30 students, 3 teachers, no boarding at night.
63	Hhefeng interchang linking-up road K0+620～K0+880	Zhongduan	Road west 80, height difference 1	About 20 households within the assessment scope, centered distribution.
64	l Hhefeng interchang linking-up road K1+800～K2+200	Fengshu	Road east 20, height difference 5	About 25 households within the assessment scope, the village is distributed along a mountain foot a strip form
65	Hhefeng interchang linking-up road K1+900～K1+950	Xiabao sanatorium	Road west 140, height difference 1	
66	Yudu interchang	Aonao	Road west 20, height difference 6	About 40 households within the assessment scope, relatively-centered distribution.

No	Stake No	Name of sensitive locations	Relative distance and height difference to the road(m)	Environmental features
	linking-up road K2+400～K2+600			
67	Yudu interchang linking-up road K5+150～K5+300	Shuibei	Road west 80, height difference 2	About 30 households within the assessment scope, relatively-centered distribution.

Table 1.8-3 List of acoustic and ambient air sensitive locations along the Sanmen section's scheme II

No	Stake No	Name of sensitive locations	Relative distance and height difference to the road(m)	Environmental features
1	K102+275~K102+525	Pengwu	Through the village, road south and road north each 40,height difference 3	About 30 households within the assessment scope, the village is distributed along a hill slope in a strip form, the highway passes by cutting the hill.
2	K103+575~K103+790	Sanmen	Through the village, height difference 8	About 30 households, the village is distributed in a strip form and is 60 degrees oblique to the proposed highway; the old road G323 passes through the village, and the proposed highway overrides the old road.
3	K104+010~K104+110	Sanmen middle school	Road south 40, height difference 2	Built in 1966, there is a wall, one 3-storey teaching building built in 2003, two rows of 1-storey houses for classrooms and student dormitory, one 3-storey building for classroom and student dormitory; 400 students, 26 teachers, about 100 students live in the school..

1.9 Assessment applicable standard

According to the environmental survey along the route, and the requirements of "*Technical Guidelines for Environmental Impact Assessment*", "*Technical Guidelines for Environmental Impact Assessment: Non-pollution Ecological Impact*", "*Technical Guidelines for Environmental Impact Assessment: Acoustic Impact*", "*Environmental Impact Assessment Specification for Road Construction Project* (tentative)"and "*World Bank Operational Policies and Guidelines* OP/BP/GP 4.01", the following standards are applied for the assessment.

1.9.1 Water environment

Surface water quality assessment along the route enforces the class III and IV criteria of the《*Surface Water Environmental Quality Standard*》 (GB3838-2002), of which the Ganjiang River bridge section enforce class IV criteria and other water bodies all enforce class III criteria；irrigation water enforces class Ⅰ criteria of 《*Farmland Irrigation Water Quality Standard*》 (GB5084-92)； Sewage discharge from management and service facilities along the route enforces class Ⅰ criteria of 《*Sewage Comprehensive Discharge Standard*》 (GB8978-1996). Specific indexes refer to Table 1.9.1-1.

Table 1.9.1-1 Water quality assessment standards (excerpt)

Assessment standards		pH	Hypermanganate index(mg/L)	SS (mg/L)	Petroleum (mg/L)
GB3838-2002 "*Surface Water Environmental Quality Standard*"	Class Ⅳ	6~9	≤10	≤30*	≤0.5
GB3838-2002 "*Surface Water Environmental Quality Standard*"	Class III	6~9	≤6	≤30*	≤0.05
GB5084-92 "*Farmland Irrigation Water Quality Standard*"	Class Ⅰ	5.5~8.5	≤200#	≤150	≤5.0
"*Sewage Comprehensive Discharge Standard*" (GB8978－1996)	Class Ⅰ	6~9	≤100#	≤70	≤5.0

Note：" "means that the figure is class Ⅲ criteria of SL63-94《Surface Water Quality Standard》; "#"means that the figure is the COD index of related standard.*

1.9.2 Acoustic environment

According to investigation, the road mostly runs through rural areas which is not classified in acoustic environmental functional zoning, the current acoustic environmental assessment enforces the class 1 criteria of《*Urban Ambient Noise Standard*》（GB3096-93）; for areas at both sides of National Road 323, the area within 50m from road boundary enforces class 4 criteria and area 50m from road boundary enforces class 1 criteria. During construction stage, it is to enforce the 《*Construction Boundary Noise Level Limit*》 (GB12523-90) (see Table 1.9.2-1); and during operation stage, it is to enforce the《*Notice about Ambient Noise in Environmental Impact Assessment in Construction Projects such as Highway, Railway (Including Light Railway)*)》〔environment〔2003〕No 94〕, that is, for the sensitive locations within the assessment scope: areas 50m within the line of right-of-way enforce class 4 criteria, areas 50m from the line of right-of-way enforce class 1 criteria; schools and hospitals (sanatorium, sanatorium) and other sensitive buildings within assessment scope enforce class 1 criteria.

The standard values are shown in Table 1.9.2-2.

Table 1.9.2-1 Construction Boundary Noise Level Limit(GB12523-90)(excerpt) unit: dB

Construction stage	Main noise source	Noise limit value	
		Daytime	Nighttime
Earth/stone works	Bulldozer, excavator, loader, etc	75	55
Piling	Various pilers	85	forbidden
Structure	Concrete mixer, vibrator and electric saw, etc	70	55
Decoration	Crane and elevator, etc	65	55

Table 1.9.2-2 Acoustic environmental assessment standard value during operation stage unit: dB

Class or sensitive objective		Daytime	Nighttime
GB3096-93 "*Urban Ambient Noise Standard*"	Class 1	55	45
	Class 4	70	55

1.9.3 Ambient air

(1) Ambient air quality standard

Ambient air quality enforces class Ⅱ criteria of "*Ambient Air Quality Standard*" (GB3095-1996) (see Table 1.9.3-1 in which NO_2 value is modified according to Environmental Document [2000] No. 1).

(2) Pollutant discharge standard

Bituminous smoke enforces "*Air Pollutant Comprehensive Discharge Standard*" (GB16297-1996), see Table 1.9.3-2.

Table 1.9.3-1 Ambient Air Quality Standard(GB3095-1996)(excerpt) unit: mg/m^3

Pollutant name		NO_2	TSP	CO
Class Ⅱ limit values of GB3095-1996 "*Ambient Air Quality Standard*"	Daily average	0.12	0.30	4.0
	1 hour average	0.24	—	10.0

Table 1.9.3-2 Bituminous smoke (new pollution source) discharge standard (excerpt) unit: mg/m^3

Pollutant name	Standard value
"*Air Pollutant Comprehensive Discharge Standard*" (GB16297-1996)	Bituminous smoke maximal allowable discharge concentration Construction mixing:75, melting, dipping:40

1.9.4 Other standards

The soil erosion assessment standards adopt the many years' average soil erosion volume in areas the route passes as the reference, and classified according to Table 1.9.4-1.

Table 1.9.4-1 Soil erosion strength classification index

CLASS	EROSION MODULUS [$t/(km^2 \cdot a)$]
Ⅰ tiny erosion(no obvious erosion)	<200, 500, 1000
Ⅱ slight erosion	(200, 500, 1,000)~2,500
Ⅲ median erosion	2,500~5,000
Ⅳ intense erosion	5,000~8,000
Ⅴ very intense erosion	8,000~15,000
Ⅵ violent erosion	> 15,000

Chapter 2 Project Overview

2.1 Project's geographical location and construction significance

2.1.1 Project's geographical location

This project runs through Ruijin City, Huichang County, Yudu County, Ganxian County, Zhanggong District, Ganzhou City, all subordinate in Ganzhou City. Ganzhou City is located in the upstream Ganjiang River and in the south Jiangxi Province, it is situated between east longitude 113°54' ~ 116°38' and north latitude 24°29' ~ 27°09', which is 295km long from north to south and 219km wide from east to west. It neighbors Fujian Province in the east, adjoins Guangdong Province in the south, meets Hunan Province in the west, and connects Ji'an and Fuzhou of this province in the north. For details see Fig. 2.1.1-1 and Fig.2.1.1-2.

2.1.2 Project's construction significance

⑴ Construction of this project is necessary to build national expressway network and Jiangxi road skeleton.

⑵ Construction of this project is necessary to the implementation of the West Development and to the promotion of region economy.

⑶ Construction of this project is necessary to Jiangxi's economic development and takeoff of the middle area.

⑷ Construction of this project is necessary to speed up the tourism resources development and utilization.

⑸ Construction of this project is necessary to improve traveling conditions and to adapt to the rapid traffic volume growth.

2.2 Setting-up of route alternative schemes

The overall route alignment identified in the preliminary design stage for this project is basically consistent with that identified in the recommended scheme in the "*Feasibility Study Report*" submitted in May 2005. During this stage, optimization and comparison among alternative schemes were conducted in accordance with the landform, topography, urban planning, road network layout, engineering construction conditions, and mileage in this region, and in accordance with the findings of field reconnaissance and the solicited opinions from transportation, railroad, and water conservation departments as well as local governments so as to adjust and optimize partial schemes in the "*Feasibility Study Report*".

In the preliminary design documents in Sept of 2005, the whole route has set up: Yuyang-Hefeng comparison section (K53+316.870~K74+178.981), Daduan comparison section (K53+316.870~K60+854.987), Yudu tunnel comparison section (K81+204.569~K89+267.512), Sanmen comparison section (K102+275~K109+198.327), and Gongjiang River comparison section (K81+204.569~K121+932.334), a total of five comparison sections for partial route alternative schemes. The scheme setting-up is shown in Table 2.2-1.

Table 2.2-1 List of alternative route scheme setting-up during preliminary design（Sept. 2005）

Route alternative scheme		OD stake No	Route length	Scheme selection
Yuyang-Hefeng comparison section	Scheme I	K53+316.87~ K75+050.890	21.734km	
	Scheme II	K53+316.87~ K73+719.454	20.403km	
	Scheme III	K53+316.87~K74+178.981	20.862km	Recommended
Daduan comparison section	Scheme I	K53+316.870～K60+854.987	7.538km	Recommended
	Scheme II	K53+316.870～K60+564.947	7.248km	
Yudu tunnel comparison section	Scheme I	K81+197.553～K89+702.931	8.375km	
	Scheme II	K81+204.569～K89+267.512	8.063km	Recommended
Sanmen comparison section	Scheme I	K102+275～K109+198.327	6.923km	Recommended
	Scheme II	K102+275～K107+171.490	6.896km	
Gongjiang River comparison section	Scheme I	K81+204.569～K121+932.334	40.292km	Recommended
	Scheme II	K81+204.569～K120+987.740	39.783km	

Note: See Figure 7.5.1-1.

After comparison and justification, scheme III of Yuyang-Hefeng comparison section, scheme II of Yudu tunnel comparison section and scheme I of Gongjiang River comparison section are selected as the recommended schemes.

In the preliminary design documents of October 2005, the route schemes of Daduan comparison section and Sanmen comparison section are further compared and justified, and the Jingkeng comparison section (scheme I and scheme II) was newly added in section K83+455.138～K93+226.5 for comparison and justification. The scheme setting-up is shown in Table 2.2-2.

Table 2.2-2 List of alternative route scheme setting-up during preliminary design（Oct. 2005）

Route alternative scheme		OD stake No	Route length	Scheme selection
Daduan comparison section	Scheme I	K53+316.870～K60+854.987	7.538km	
	Scheme II	K53+316.870～K60+564.947	7.248km	Recommended

Route alternative scheme		OD stake No	Route length	Scheme selection
Jingkeng comparison section	Scheme I	K85+445.138～K93+226.5	7.771km	Recommended
	Scheme II	K85+455.138～K94+136.205	8.246km	
Sanmen comparison section	Scheme I	K102+275～K109+198.327	6.923km	Recommended
	Scheme II	K102+275～K107+171.490	6.896km	

Note: See Figure 7.5.1-1.

2.3 Traffic volume estimate

The traffic volume estimates for the whole line is listed in Table 2.3-1.

Table 2.3-1 Traffic volume estimates

Section \ Year	2009	2015	2020	2025	2029
Yunshishan～Huichang (K31+012.977～K50+248)	9396	14880	19911	25898	32050
Huichang～Hefeng (K50+248～K78+181)	10261	16160	21422	27731	33638
Hefeng～Yudu (K78+181～K90+225)	10571	16648	22069	28298	34326
Yudu～Luo'ao (K90+225～K101+230)	11172	17594	23322	29906	36276
Luo'ao～Ganxian (K101+230～K124+244)	12308	19063	24914	31645	37950
Ganxian～Ganzhou north (K124+244～K139+377)	13620	20746	26858	33791	40215
Ganzhou north～Huangjin interchange (K139+377～K149+728)	14373	21892	28342	35658	42438
Average of whole new road	11139	17413	22981	29457	35684
Average of whole old road	4619	6552	8321	10073	11338

Note：New road traffic volume is calculated at pcu/d, old road traffic volume is calculated at mte/d.

2.4 Description of recommended alignment

2.4.1 route alignment (strike) of recommended alignment

2.4.1.1 OD of recommended alignment

The origin（K31+012.977＝A section K30+818.5）of Xiamen-Chengdu National Expressway Ruijin-Ganzhou Highway in Jiangxi Province starts from the destination of Ailing-Ruijin Highway. Starting from Beixia village of Yunshishan Township of Ruijin City, the route passes by Xijiang Township and Xiaomi Township of Huichang County, Huanglin Township, Bai'e Township of Huichang County, Hefeng Township, Licun Township, Gongjiang Township, Xinbei Township, Luojiang Township and Luo'ao Township of Yudu County, and enters into Ganxian County territory; after passing by Jiangkou Township, Maodian Township and Chutan township of Ganxian county, it runs through Shuixi Township and Hubian Township of Zhanggong District and ends at

Xietang village of Panlong Township within Huangjin Development Zone of Ganzhou City to link with the Ganzhou west section of the Xiamen-Chengdu Expressway with the destination stake number of K149+728 and total length of 116.637 km. The locations of origin and destination of the route are consistent with that of the "Feasibility Study Report".

2.4.1.2 Major controlling points of recommended alignment

This route aligns in an east-to-west direction with its origin (K31+012.977) locating in the east side of Huangzhubei of Yunshishan Township in Ruijin City where it links with the destination of Ailing (Jiangxi and Fujian border)-Ruijin Highway of Xiamen-Chengdu Expressway. The route runs through Shabei, Heba, Shixiawan, and Gaowei, and enters within the boundaries of Huichang County in Pengwu. The route runs by Fushan, Qiangong, and crosses National Road 323 near Laozhaixia (K40+911.5); the route crosses Gan-Long railroad nearby Maogan (K41+520); after running by Huoxing and Beikeng, it crosses Huichang-Shanshupai road（provincial road 223）nearby Shanshupai, where Huichang north interchange is established to link with. After running by Huangtiankeng, it crosses the Dongfeng reservoir; after running by Shibei, Yuyang, Shebei, Daduan and Longtanmian, it crosses the Gongjiang River nearby Laowu village (K62+960); after Bai'e, Wuxianpai, Luyuting, it passes from the northern side of Jiuling reservoir, and passes through Zhonggongzhang mountain peak in Huichang and Yudu border in a tunnel nearby Qigong village to enter within the boundaries of Yudu County.

Zhonggongzhang tunnel exit lies nearby Shijing village within the boundaries of Yudu County, after running by Huangzhutou, Shihuiling, Tangmianxia and Dakengtian, it sets up Hefeng interchange near Caoqitang（K78+181）to link with nearby villages and townships such as Hefeng, Licun and Tieshanlong; after running by Xiataiping, Chezhu, Shibei, Xiawan, Zhangkeng, Xiawu, Luopuyuan and Shixia, it crosses Yudu- Pangushan road near Pizhuwan（K88+100）; after Guanzhaixiacun, Liuwu and Changkeng, it sets up Yudu interchange and Yudu linking-up road near Pingling （K92+250）to link with Yudu County town. After running by Yanxia, it crosses Shangxi River near Laohuxing; after running by Yangkou, Likeng, and Hongtang, it crosses the Gongjiang River nearby Gaotan （K100+450）; it sets up Luo'ao interchange near Dakeng (K101+728) to link with National Road 323 as well as townships such as Luo'ao. After running by Pengwu and Xiuduan, it crosses National Road 323 near Xiamaoping (K103+570) it and crosses Gan-Long railroad near Shitoutang（K104+310）; after running by Zhaijiaoxia, Longkeng, Dingwu, Wanzibei, it enters within the boundaries of Ganxian County.

The route runs by Wangwu and Xinanqian, and crosses National Road 323 nearby Xiewupai (K113+920), crosses the Gongjiang River nearby Xiaba (K115+050); after Niugutang reservoir, Dakeng and Changkengzi, it crosses Gongjiang River near Chenwu (K118+950); crosses Yangtang reservoir near Huangniupo（K121+220） and crosses the Beijing-Kowlon Railway, Gan-Long Railway and National Road 323 altogether near Huangnixia (K123+100); after running by Fengshukeng, it establishes Ganxian interchange near Huangnipai (K124+244) to link with Ganxian County and National Road 323. After running by Laohupai, Xiaobeitou, Hepingtou, Wansongshan, Taiyangping, Kuxia, Chenkeng, Aoshang, Shirenqian, Zouwu, Hechangbei and Heshukeng, the route crosses Ganjiang River nearby Lilaosan (K135+800), and enters within the boundaries of Zhanggong District.

After the route crosses Ganjiang River, it runs by Lingbei and Xiashanlong and crosses National Road 105 near Wenjia (K138+320) and sets up Ganzhou north interchange near Qiaotou (K139+377) to link with National Road 105; after running by Paishang, Gangbian, Zhoujia, Lizitang, Zhougongkeng, Yeshan, Doufuwo, Changkengzi, the route ends at Xietang village to link with the Ganzhou west section of the Xiamen-Chengdu Expressway, which is already completed.

The recommended route is 116.637km long, passing through 5 counties (cities) and 17 townships such as Yunshishan of Ruijin City, Xijiang, Xiaomi, Bai’e of Huichang County, Huanglin, Hefeng, Licun, Gongjiang, Luojiang and Luo’ao of Yudu County, Jiangkou, Maodian and Chutan of Ganxian County, Shuixi, Hubian and Panlong of Zhanggong District.

2.4.2 Construction scale, standard and main technical indicators of the recommended alignment

2.4.2.1 Technical indicators

The main technical indicators for the proposed project are listed in Table 2.4.2.1-1.

Table 2.4.2.1-1 Main technical indicators

Indicator name	Unit	Adopted indicator
Road grade	—	Expressway
Design speed	km/h	100

Indicator name	Unit	Adopted indicator
Subgrade width	m	26.0
Carriageway width	m	2×7.5
Hard shoulder width	m	3.0
Bridge and culvert width	m	2×12.5
Automobile loading grade	—	Auto—I
Design flood frequency for super-large bridge	—	1/300
Design flood frequency for bridge and culvert and subgrade	—	1/100
Maximum longitudinal gradient	%	4%
Minimal stopping sight distance	m	160
Pavement form	—	Bituminous concrete
Interchange ramp design speed	km/h	60～30

Data resource: "Preliminary Design for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China " (Oct. 2005).

2.4.2.2 Major works volume (construction scale)

The major works volumes for the recommended alignment are listed in Table 2.4.2.2-1.

Table 2.4.2.2-1 Main technical and economic indicators

No	Item name	Unit	Quantity	Remark
1	Road grade	grade	Expressway	Two-way 4-lane
2	Design driving speed	Km/h	100	
3	Design traffic volume (2029)	pcu/d	35684	2029 long-term traffic volume
4	Land occupation	mu	12535.42	
5	Land rental	mu	1731.2	
6	Building removal	m^2	274370	
7	Power and telecom line relocation	100 m	1127.14	
8	Total road length	km	116.815	
9	Route growth factor		1.11	
10	Maximum longitudinal gradient	%	3.8	
11	Minimum radius of horizontal curve	m	900	
12	Subgrade earth/stone works volume	1,000 m^3	23513.573	
	(1) Earth works	1,000 m^3	11851.695	
	(2) Stone works	1,000 m^3	11826.858	
13	Earth/stone works volume/km	1,000 m^3	201.289	
	(1) Earth works	1,000 m^3	101.457	
	(2) Stone works	1,000 m^3	101.244	
14	Protection works			
	(1) Retaining wall	m^3	2200.69	
	(2) Concrete protection works for road embankment and cutting	m^3	59132.63	
	(3) Planting grass and shrub	m^2	3462415	
15	Drainage works			
	(1) Side ditch(blind pipe ditch)	m	77951	
	(2) Drainage ditch	m^3	126599.15	
	(3) Berm ditch and chute	m^3	27861.568	

No	Item name	Unit	Quantity	Remark
	(4) Cutoff trench	m^3	2145.756	
16	Pavement			
	(1) Bituminous concrete	1,000 m^2	2672.245	
	(2) Cement concrete	1,000 m^2	7.24	
17	Bridge	m/place	19182/76	
	(1) Super-large bridge	m/place	5198/4	
	(2) Large bridge	m/place	12234/44	
	(3) Median bridge	m/place	1675/25	
	(4) Small bridge	m/place	75/3	
18	Culvert	place	170	Excluding those used for both underpass and culvert
19	Underpass (passageway)	place	203	Including those used for both underpass and culvert
20	Tunnel	m/place	9548.5/7	
	(1) Super-long tunnel	m/place	4160/1	
	(2) Long tunnel	m/place	3958.5/2	
	(3) Median tunnel	m/place	540/1	
	(4) Short tunnel	m/place	890/3	
21	Interchange	place	6	
22	Grade separation	m/place	2715.5/49	
	(1) Main line overpass	m/place	1966.5/38	
	(2) Main line underpass	m/place	749/11	

Data resource: "Preliminary Design for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China" (Oct. 2005).

2.4.3 Project works of the recommended alignment

2.4.3.1 Subgrade

(1) Subgrade cross-sectional profile

① Integrated subgrade cross-section：subgrade width is 26.0m, its cross-section arrangement is: 0.75m(shoulder)+3.0m(hard shoulder)+2×3.75m(carriageway)+0.75m(marginal strip)+2.0m(median separator)+0.75m(marginal strip)+2×3.75m(carriageway)+3.0m(hard shoulder) +0.75m(shoulder).

② Separated subgrade cross-section：separated cross-sectional width is 13m, its cross-section arrangement is: 0.75m(shoulder)+1.0m(left hard shoulder)+2× 3.75m(carriageway) +3.0m(right hard shoulder)+0.75m(shoulder).

(2) Subgrade design principle

The subgrade design elevation is determined in accordance with the requirements for bridge and subgrade flood frequency, grade-separated junction and passageway clearance as well as subgrade stability condition, and various factors such as terrain, geology, underground water level, surface ponding as well as climate.

The subgrade of up-link and down-up independent tunnel adopts separated forms, linked continuously and smoothly with integrated-type subgrade. The strip between the separated subgrade will be treated according to different situations, and will be drained water and planted.

Filling slope generally adopts 1:1.5, when it is higher than 8m, it is 1:1.75 below 8m; when the filling height is bigger than 12m but smaller than 20m, the filling platform width is 1.5m; regarding high-fill subgrade, 2.0m wide filling platform will be set up every 8m, its slope ratio is 1:1.5, 1:1.75, 1:2.0 respectively, taking 8 meters as boundary limit; outside the toe of slope, 1.5m berm will be set.

The cut road section slope is determined according to the geological data by adopting slower slope stipulated by subgrade design code, generally within 1:0.75 ~ 1:2.0. When the cut height is higher than 8m, 2.0m wide platform will be set up in place 8m high in the cutting, and inside it a platform ditch will be set up; outside the subgrade ditch, a 1.5m wide stage for heaping soil and broken rock will be set.

⑶ Subgrade in pond, reservoir and canal sections

According to water immersing situation, cofferdam is used to drain water and clear silt or stone is used to clear silt and fill subgrade, immersed subgrade slope uses mortar pitching protection.

⑷ Unfavorable geological section

The unfavorable geology of the entire road section is mainly slope instability, silt, shallow layer weak subgrade and so on. The silt and shallow layer weak subgrade can adopt earth filling, stone filling to clear silt and sand mat according to different situations. When facing soft soil subgrade with large thickness of weak layer, geotextile grill reinforcement, crushed stone columns and DJM pile can be used to solidify subgrade. The slope instability can be specially treated by designing drainage system, slowing the slope, using crib anchoring rod, anti-skid column, retaining wall and pre-stressed anchor rod according to the geology and hydrology.

⑸ Subgrade compaction standard

Before filling subgrade, the humus and extraneous matters should be removed, and tamping shall be done before filling, subgrade shall be filled in layers and compacted with each layer 30cm thick, heavy-duty compaction standard shall be adopted.

⑹ Subgrade and pavement drainage

① Subgrade drainage

Side ditch: subgrade cutting section generally sets up 0.8m (bottom width) ×1.2m (depth) rectangle cross-sectional concrete side ditch; ramp and linking-up road cutting sections adopt 0.8m (bottom width) ×0.8m (depth) rectangle cross-sectional concrete side ditch.

Intercepting trench and platform ditch: for cutting sections, when surface water flows into subgrade side slope and the catchment area is relatively large, 0.8m (bottom width) ×0.5m (depth) rectangle mortar pitching intercepting trench will be set up in slope mouth larger than 5.0m. When cutting slope is relatively higher, cut platform ditch will be set up in the platform.

Drainage ditch: in sections with relatively concentrated rainfall or in sections with long paddy fields, drainage ditches are considered to be set up for irrigation and floodwater drainage. Generally the main line proeject adopts 0.6m (bottom width) ×0.8m (depth) rectangle mortar pitching drainage ditch; ramp and linking-up road adopt 0.6m (bottom width) ×0.6m (depth) rectangle mortar pitching drainage ditch.

② Pavement drainage

The pavement drainage is in loose drainage form. The superelevated highway section adopts collecting well, horizontal drainage pipe, and chute to form concentrated drainage system.

③ Median separator drainage

In bottom of median separator, it is to set up a geotextile cloth water sealing layer with two clothes and one mold, vertical and horizontal drainage pipes and collecting well shall be adopted to form the drainage system for median separator.

⑺ Protection works

To prevent and cure subgrade disease, to guarantee subgrade stability stabilize and to improve environmental landscape, protection forms such as planting, crib, slope protection, retaining wall, and facing wall will be adopted according to different geological situation and slope height.

Fill section: when fill section side slope height is under 4.0m, to adopt full sodding, when the slope height is greater than 4.0m, to adopt herringbone mortar pitching skeleton bank protection with seed spraying in the skeleton; for immersing slopes, the slope face below 0.5m above the water level shall be protected by mortar pitching slope protection.

Cutting sections: According to the geology, height, gradient and stability of the slope, different protection forms will be adopted; this project intends to adopt seed spraying, "herringbone" skeleton, arch skeleton, mortar pitching facing wall, facing wall and retaining wall or facing wall combined with skeleton which is paved with geotextile grid and sprayed with to plant grasses after backfilling earthwork. In high slopes with bad geological conditions, crib anchoring bolt, anti-skid pile, retaining wall, and prestressed anchor bolt can be used for special protection.

2.4.3.2 Pavement

This section's pavement structure is: 4cm thick fine-grained bituminous concrete antiskid surface course+5cm median-grained bituminous concrete middle surface course+7cm thick coarse-grained bituminous concrete bottom surface course+ 20cm thick cement stabilizing macadam base course +18cm thick cement stabilizing macadam top base course +20cm thick graded macadam bottom base course+earth course.

The pavement of marginal strip, hard shoulder and acceleration/deceleration lane is the same as that of carriageway.

The tunnel adopts cement concrete pavement: 26cm cement concrete +20cm cement stabilizing macadam base course +10cm poor concrete.

2.4.3.3 Bridge and culvert

The recommended schema will set up 4 super-large bridges, 45 large bridges (including 1 of linking road), 25 median bridges and 170 culverts with a total bridge length of 19182m accounting for 16.4% in the total length of the route, and with an average number of culvert per each km of 1.47. The setting-up of super-large and large bridges along the route is listed in Table 2.4.3.3-1.

Table 2.4.3.3-1 List of super-large and large bridges

No	Central stake No	Bridge name	opening number and span (opening-m)	Bridge length (m)	Structural type	Navigation standard
1	K32+470	Jiubao river bridge	14--20	327	prestressed concrete continuous box beam	
2	K34+485	Yanba bridge	5-30	157	30m T-beam	
3	K38+385	Yantanba bridge	5-40	207	40m T-beam	
4	K39+150	Xijiang river bridge	6-30	187	30m T-beam	
5	K44+530	Yewu bridge	8-30	247	30m T-beam	
6	K45+940	Huoxing viaduct	8-40	327	40m T-beam	
7	K47+685	Beikeng bridge	5-40	207	40m T-beam	

No	Central stake No	Bridge name	opening number and span (opening-m)	Bridge length (m)	Structural type	Navigation standard
8	K51+710	Dongfeng reservoir bridge	20-40	807	40m T-beam	
9	K59+450	Daduankeng viaduct	9-30	277	30m T-beam	
10	K59+935	Longtanmian viaduct1	10-30	307	30m T-beam	
11	K59+935	Longtanmian viaduct2	7-40	287	40m T-beam	
12	K61+130	Magong viaduct	9-40	367	40m T-beam	
13	K63+025	Shangba Gongshui river viaduct	4×50+40×30	1407	30m T-beam+50m uniform cross-sectional continuous box beam	Ⅵ-2
14	K64+770	Xiaojuan viaduct	9-40	367	40m T-beam	
15	K65+460	Jiuling viaduct 1	8-40	327	40m T-beam	
16	K65+765	Jiuling viaduct 2	5-30	157	30m T-beam	
17	K66+735	Jiuling reservoir bridge	10-30	307	30m T-beam	
18	K67+660	Qigong bridge (left line)	4--30	127	30m T-beam	
		Qigong bridge (right line)	4-30	127	30m T-beam	
19	K84+485	Yikeng viaduct (left line)	11-40	447	40m prestressed concrete continuous T-beam	
	K84+532	Yikeng viaduct (right line)	10-40	407	40m prestressed concrete continuous T-beam	
20	K85+593	Maqimian viaduct	9-40	367	40m prestressed concrete continuous T-beam	
21	K86+500	Jingkou viaduct	4-30	127	30m prestressed concrete continuous T-beam	
22	K87+695	Bankeng viaduct	4-40	167	40m prestressed concrete continuous T-beam	
23	K94+315	Miaobei viaduct	16-30	487	30m prestressed concrete continuous T-beam	
24	K100+424	Gaotan Gongjiang River bridge	8×30+5×50	497	prestressed concrete continuous combination box beam	Ⅴ-2
25	K104+630	Shitoukeng viaduct left line	18-40	727	40m prestressed concrete continuous T-beam	
	K104+635	Shitoukeng viaduct right line	19-40	767	40m prestressed concrete continuous T-beam	
26	K107+863	Longkeng viaduct left line	5-30	157	30m prestressed concrete continuous T-beam	
	K107+916	Longkeng viaduct right line	6-30	187	30m prestressed concrete continuous T-beam	
27	K108+637	Dingwu viaduct left line	17-40	687	40m prestressed concrete continuous T-beam	
	K108+666	Dingwu viaduct right line	17-40	687	40m prestressed concrete continuous T-beam	
28	K110+548	Dayun viaduct	11-30	337	30m prestressed concrete continuous T-beam	
29	K111+880	Chenwu viaduct	5-40	207	40m prestressed concrete continuous T-beam	
30	K112+285	Xin'anqian viaduct	6-30	187	30m prestressed concrete continuous T-beam	
31	K114+920	Jiaolin Gongjiang River super-large bridge	14×40+4×50+8×40	1087	T-beam+ uniform cross-sectional continuous box beam	Ⅴ-2
32	K115+680	Niugutang reservoir viaduct	4-30	127	40m prestressed concrete continuous T-beam	
33	K116+991	Dakeng viaduct	8-30	167	30m prestressed concrete continuous T-beam	
34	K119+220	Chenwu Gongjiang River	19×40+4×50+9×	1367	prestressed concrete	Ⅴ-2

No	Central stake No	Bridge name	opening number and span (opening-m)	Bridge length (m)	Structural type	Navigatio nstandard
		large bridge	40		continuous combination box beam	
35	K121+055	Yangtang reservoir viaduct	5-30	287	30m prestressed concrete continuous T-beam	
36	K122+740	Duimen viaduct	6-30	217	30m prestressed concrete continuous T-beam	
37	K123+165	Viaduct overcrossing G323	6-40	247	40m prestressed concrete continuous T-beam	
38	K125+620	Xiaobeitou viaduct	17-30	517	30m prestressed concrete continuous T-beam	
39	K126+488	Xikeng viaduct	6-40	247	40m prestressed concrete continuous T-beam	
40	K131+483	Anziqian bridge	5-30	157	30m prestressed concrete continuous T-beam	
41	K132+763	Hechangbei viaduct	7-30	217	30m prestressed concrete continuous T-beam	
42	K134+080	Huangzhupai bridge	5-30	157	30m prestressed concrete continuous T-beam	
43	K135+492	Ganjiang super-large bridge	28×30+40+4×80 +40+3×30	1337	extradosed PSC bridge with continuous rigid frame	III—3
44	K136+422	Lingbei viaduct	5-40	207	40m prestressed concrete continuous T-beam	
45	K138+430	Huangsha'ao viaduct	8-40	327	40m prestressed concrete continuous T-beam	
46	K139+962	Tongtianyan (I) viaduct	5-40	207	40m prestressed concrete continuous T-beam	
47	K140+314	Tongtianyan (II) viaduct	4-40	167	40m prestressed concrete continuous T-beam	
48	K143+640	Zhoujia viaduct	6-40	247	40m prestressed concrete continuous T-beam	
49	K1+552	Xiabao river bridge (Hefeng interchange linking-up road)	8-20	165	prestressed concrete hollow unit	

2.4.3.4 Tunnel

The recommended scheme of this project will set up 7 tunnels, namely Dahe, Zhujing, Jiuling, Zhonggong, Yudu, Xiashan and Baishan, with a total double-arch tunnel length of 9548.5 m, see Table 2.4.3.4-1 for details.

Table 2.4.3.4-1 List of tunnels

No	Tunnel name	Entrance stake No	Exit stake No	Tunnel length（m）	Tunnel structure
1	Dahe tunnel	K44+935	K45+215	280	Multiple arch tunnel
2	Heliaoxia tunnel	K57+510	K57+930	420	Multiple arch tunnel
3	Jiuling tunnel	K65+850	K66+390	540	Multiple arch tunnel
4	Zhonggong tunnel left line	K67+760	K71+920	4160	separated tunnel
	Zhonggong tunnel right line	K67+760	K71+920	4160	
5	Yudu tunnel left line	K82+068	K83+890	1822	separated tunnel
	Yudu tunnel right line	K82+111	K83+900	1789	

6	Xiashan tunnel left line	K105+093	K107+200	2107	separated tunnel
	Xiashan tunnel right line	K105+091	K107+290	2199	
7	Baishan tunnel	K109+475	K109+665	190	Multiple arch tunnel

2.4.3.5 Intersection works

(1) Interchange

Interchanges all adopt single trumpet form, a total of 6. The interchanges along the route are shown in Table 2.4.3.5-1.

Table 2.4.3.5-1 List of interchanges

No	Name of interchange	Central stake No	County or city belonged to	Ramp (inking-up road)length（km）	Intersected road	Intersection method	Spacing（km）
1	Huichang interchange	K50+248	Huichang County	3.226	Provincial road 223	Main line overpassing	
2	Hefeng interchange	K78+181	Yudu County	4.911	Yu-Pan road	Main line overpassing	27.933
3	Yudu interchange	K90+225	Yudu County	9.135	Jingsan road in Yudu development zone	Main line overpassing	12.074
4	Luo'ao interchange	K101+230	Yudu County	3.108	National road 323	Main line underpassing	11.475
5	Ganxian interchange	K124+244	Ganxian County	2.817	National road 323	Main line overpassing	22.514
6	Ganzhou north interchange	K139+377	Zhanggong District	3.616	National road 105	Main line overpassing	15.133

(2) Grade separation

Separated overpasses will be set up in places of the highway intersecting with classified roads, local roads and railways, there are a total of 49 overpasses/2715.5m.

(3) Passageway

According to the distribution of residential areas and needs of farmland cultivation, the whole highway will set up 203 passageways for providing access to residents, agricultural vehicles and tractors.Some passageways also have the function of water overflow at the same time. All passageways adopt steel reinforced concrete slabs; the passageway pavement is 18cm cement concrete face course +22cm macadam (gravel) base course.

⑷ Intersections with pipelines

The whole route mainly crosses with telecommunication cables, electricity transmission high-voltage lines and telecommunication lines. As for the crossing of overhead photoelectric cable, electricity transmission line, and telecom line with the route, when the pole space and the electric wire vertical height satisfy the proposed highway undercrossing requirement, removal is not allowed. Otherwise, removal or electric wire heightening shall be taken. When the route transversely crosses over the photoelectric cable, slab culverts shall be built along the cable so to protect the photoelectric cable. If the crossing angle is too small, and it is difficult to build culvert to protect the cable, then removal can be taken.

2.4.3.6 Traffic engineering and service facilities along the route

It is intended to set up 2 service areas, 3 park lots, 1 maintenance division, 1 highway management center, 1 highway monitoring and telecom sub-center, 3 management stations, 1 tunnel management station, 6 interchange tollgates. See Table 2.4.3.6-1 for their locations and sizes.

Table 2.4.3.6-1 List of facilities along the route

No	Name	Location	Distance （km）	Land occupied (mu)	Remarks
I	Service area and parking lot				
1	Xijiang service area	K38+500	67 km from Changting service area	120	Within territory of Huichang County
2	Yuyang parking lot	K58+700		15	Within territory of Huichang County
3	Hefeng parking lot	K79+950		15	Within territory of Yudu County
4	Yudu service area	K98+900	59 km from Xijiang service area	120	Within territory of Yudu County
5	Ganxian parking lot	K122+100		15	Within territory of Ganxian County
II	Management center and station, etc				
1	Huichang north interchange tollgate	On the right side of the main line K50+24, Huichang north interchange ramp FK0+100	2 entrances and 2 exits	15	
2	Huichang north management station			20	
3	Huichang tunnel management station			15	To manage groups of short tunnels
4	Zhonggongzhang tunnel management station	On the right side of K78+300, Hefeng interchange ramp K0+500		20	To set up tunnel power distribution house and watch-out house in the entrance (or exit) of Zhonggongzhang and Yudu tunnels
5	Hefeng interchange tollgate		2 entrances and 2 exits	15	

No	Name	Location	Distance （km）	Land occupied (mu)	Remarks
6	Yudu interchange tollgate	On the right side of K92+200, Yudu interchange ramp K0+300	2 entrances and 3 exits	15	
7	Yudu management station			20	
8	Luo'ao interchange tollgate	On the right side of K101+700, on the right of K0+800 of Luo'ao interchange ramp A	2 entrances and 2 exits	15	
9	Xiashan tunnel management station			15	To set up tunnel power distribution house and watch-out house in the entrance (or exit) of Xiashan tunnel
10	Ruijin-Ganzhou maintenance center			60	
11	Ganxian interchange tollgate	On the left side of K124+000, Ganxian interchange ramp K0+300	2 entrances and 3 exits	15	
12	Ganxian management station			20	
13	Ganzhou north interchange tollgate	On the left side of K139+400, Ganxian north interchange ramp K0+200	3 entrances and 5 exits	18	
14	Ruijin-Ganzhou Highway management center			25	
15	Ruijin-Ganzhou Highway monitoring and telecom center			25	

2.4.3.7 Earth/stone works volume

The total cut volume for subgrade in the recommended scheme of this project is $23513.6\times10^3m^3$, of which earth cut volume is$11851.7\times10^3m^3$ stone volume is $11826.9\times10^3m^3$. The quantities of earth and stone works for this project are listed in Table 2.4.3.7-1 and 2.4.3.7-2 respectively.

2.4.3.8 Proposal of earth borrowing and waste disposal

Because this project lies in mountainous and hilly terrain, involving relatively large volume of fill and cut, and there will be earth borrow and waste disposal in partial sections. The earth works are mainly settled by longitudinal transit and by using cut as fill. The cutting works（including earth and stone works）shall be used as subgrade filling material as much as possible and the extra earth works shall be disposed of nearby; at the same time the subgrade cross-section can be specially designed so to make full use of waste earth and to dispose of waste earth outside the filling and in the middle of separated subgrade. The setting up of waste bank shall not block river course, shall not form source of mudflow, and shall not occupy good farmlands, so as to minimize impact on surrounding natural environment. In some sections that need earth borrowing to fill subgrade, earth borrow pits shall be set up.

The recommended scheme of this project will set up 12 earth borrow pits and 24 waste (slag) banks, as listed in Table 2.4.3.8-1 and 2.4.3.8-2.

Table 2.4.3.7-1 Works volumes of earth and stone for the project（K31+012.977～K74+178.981）

Route section	Cut （m^3）（natural）							Fill（m^3）（compacted）						waste（m^3）（compacted）		
	Total volume			Earth	Stone			Total fill volume	Used for this stake		Used for long hauling		Borrow			
	Earth	Stone	Tunnel mucking	III	IV	V	Tunnel stone works	Total volume	Earth	Stone	Earth	Stone	Earth	Earth	Stone	Tunnel slag disposal
Total of shared section 1 K31+012.977～K53+316.87	1185463	2280473	66059	1185463	1730256	550217	66059	3876838	121695	99194	967376	2617873	70700	37762	126109	71804
Total of shared section 2 K60+854.987～K74+178.981	782645	895926	960939	782645	680693	215233	960939	2116152	51290	43670	654672	1233463	133059			753261
Total of Daduan scheme I K53+316.87～K60+854.978	643926	1467555	56000	643926	1263096	204459	56000	2508620	68941	73359	561870	1509756	294694			32870
Total of Daduan scheme II K53+316.87～K60+564.947	853903	1035413	96000	853903	483192	552221	96000	1217803	47715	22244	610320	480653	56871	114749	633165	104348
Total of interchange	148047	838269		148047	641620	196649		535452	20609	9101	156719	349023			107964	
Recommended scheme= shared section 1+ shared section 2+Daduan scheme II +interchange	2970058	5050081	1122998	2970058	3935761	1114320	1122998	7746245	241309	174209	2389087	4681012	260630	152511	867238	929413
Equilibrium formula for the recommended scheme	Cut:(2970058/1.09+5050081/0.92+ tunnel mucking:1122998/0.92)+borrow:260630=fill:7746245+waste:(152511+867238)+ tunnel slag disposal:929413															

Note：CBR of the recommended scheme and earth borrow pits do not meet requirement, and should be added with lime by a rate of 8% for improvement, the added lime quantity if 10390m^3.

Table 2.4.3.7-2 Works volumes of earth and stone for the project（K75+050～K149+728）

No	OD stake No	Cut(m^3)(natural)				Fill (compacted)			Used for this stake (compacted)		Used for long hauling (compacted)		Borrow (natural)	Waste (natural)		Remark
		Total volume	Earth	Stone		Total volume	Earth (m^3)	Stone (m^3)	Earth (m^3)	Stone (m^3)	Earth (m^3)	Stone (m^3)	Earth (m^3)	Earth (m^3)	Stone (m^3)	
			Hard earth	Soft stone	Secondary hard stone											
I	Recommended scheme (K75+050~K149+728)															
1	K75+050~K81+197.553	771111	569856	178167	23088	1322967	1104212	218755	23205	6651	499600	212104	633734			Including the quantity of Hefeng interchange
2	K81+204.57~K85+455.138	457386	126396	219981	111009	990086	525313	464773	27714	34259	167679	430514	359612			Utilizing slag from Yudou tunnel of 79434 for earth and 105000 for stone
3	Jingkeng section scheme Ⅰ K85+455.138~K93+226.5	1798560	632488	1025883	140189	2221438	1016022	1205416	81889	97170	498375	1108246	474976		57091	Including the quantity of Yudu interchange, linking road
4	K94+136.205~K102+275	1887548	1088502	743058	55988	1550733	859389	691344	272798	81286	586591	610058		151769	163009	Including the quantity of Luoao interchange
5	Sanmen section scheme I K102+275~K109+198.327	863817	191582	449989	222246	1001590	600822	400768	10767	37430	185080	363338	441422	16190	499152	Utilizing slag from Xiashan tunnel of 34936 for earth and 123112 for stone
6	K109+198.327~ K149+728	6353080	1897944	3914875	540261	6844516	2671180	4173336	226104	408246	1507545	3765090	1021908	10379	630955	Utilizing the quantity of Ganxian interchange,Ganzhou north interchange and slag from Baishan tunnel of 1938 for earth and 16618 for stone
7	K116+314.528～K123+431.509	1101767	200585	783572	117610	1099249	242145	857103	29965	69162	154058	787942	63354		112646	
8	K123+253.382～K149+728	3932446	1291577	2505261	135608	4677386	1944866	2732520	130188	155449	1054747	2577071	828326		126951	
	Total of the recommended scheme for the whole route	11987237	4562313	6349043	1075880	14034767	6886217	7148550	640326	523734	3498179	6624816	2995007	178122	1073411	Utilizing slag from tunnel of 116308 for earth and 244730 for stone
Equilibrium formula for the recommended scheme		Cut:Hard earth:4562313+sone:7424923+brrow earth:2995007=Fill:Earth:6886217×1.09-(tunnel slag disposal earth:116308×1.09)+Stone:7148550×0.92-(ttunnel slag disposal g stone:244730×0.92)+waste earth:178122+waste stone:1073411=计价方 14982244														

Table 2.4.3.8-1 Setting-up of earth borrow pits and waste (slag) banks of the recommended scheme（K31+012.977～K74+178.981）

Name	Location of earth borrow pit or waste bank		Earth borrow pits						Waste earth (slag) bank			Remarks
	Route left or right	Stake number to road	Thickness of usable layer (m)	Max cutting depth (m)	Volume available (m^3)	Planned use volume (m^3)	Size of occupied land (mu)	Units the land belongs to	Earth and stone volume (m^3)	Hauling distance (km)	Size of occupied land (mu)	
	I. earth borrow pits											
1# earth borrow pit	Left	K32+300	10	13	90000	70700	13	Yunshishan Township				Earth borrow pit in Changtiaoshan mountain
2# earth borrow pit	Right	K54+600	11	12	80000	59170	11	Huanglin Township				Earth borrow pit in Yuyang village
	II. Waste earth (slag) bank											
1# waste bank	Right	K46+700							707	0.25	1	Mountain ridge right of K45+600
2# waste bank	Right	K51+500							76544	0.45	14	Mountain ridge and paddy fields right of K51+500
3# waste bank	Left	K57+400							157322	0.29	16	Mountain ridge and paddy fields left of 57+400
4# waste bank	Left and right	K58+100							367127	0.5	43	Mountain ridge and paddy fields left of K58+100
5# waste bank	Left and right	K59+000							368633	0.48	45	Mountain ridge and paddy fields right of K59+000
Dahe tunnel waste slag bank	Left	K44+800							32959		8.9	Mountain ridge left of K44+800
Zhujing tunnel waste slag bank	Left	K56+820							35902		10.66	Mountain ridge left of K56+820
Jiuling tunnel waste slag bank	Right	K66+300							63564		14.35	Mountain ridge and paddy fields right of K66+300
Zhonggong tunnel entrance waste slag bank	Left	K67+600							226000		29	Mountain ridge and paddy fields left of K67+600
Zhonggong tunnel exit waste slag bank	Right	K71+800							226000		57	Mountain ridge and paddy fields right of K71+800

Table 2.4.3.8-2 Setting-up of earth borrow pits and waste (slag) banks of the recommended scheme（K75+050～K149+728）

No	Name of earth borrow pit and waste bank	OD stake number of embankment with earth use (waste disposal)	Place of earth borrow pit and waste bank				Earth borrow pit					Waste (slag)bank	Land occupied	
			Distance to road(m)		To-road stake No	Length of hauling road (m)	Name of soil	Thickness of usable layer (m)	Max. possible cutting depth (m)	Available quantity 10,000m^3	Planned quantity for use 10,000m^3	Waste quantity 10,000/m^3	Size of occupied land (m)	Land owning unit
			Left	Right										
I	Earth borrow pit													
1	1# earth borrow pit K75+580	K76+000~K82+000	600		K75+580	900	Yellow clayey	15	18	120	100.0		100.0	Hefeng Township of Yudu County
2	2# earth borrow pit K87+900	K84+175~K86+500		150	K87+900	600	Red earth	13	15	50	32.0		50.0	LicunTownship of Yudu County
3	3# earth borrow pit K92+400	K90+000~K93+000	50		K92+400	300	Red earth	8	10	40	30.0		60.0	Xinbei Township of Yudu County
4	4# earth borrow pit K98+600	K100+000~K105+000	20		K98+600	400	Red earth	10	15	60	55.0		60.0	Luojiang Township of Yudu County
5	5# earth borrow pit K113+700	K109+700~K111+000	20		K113+700	500	Red earth	12	15	40	25.0		40.0	Jiangkou Township of Ganxian County
6	6# earth borrow pit K123+320	K123+300~K133+000	20		K123+320	800	Red earth	10	12	20	10.0		25.0	Maodian Township of Ganxian County
7	7# earth borrow pit K139+800	K136+164~K138+700		100	K139+800	200	Red earth	10	12	20	10.0		25.0	Jiangkou Township of Ganxian County
8	8# earth borrow pit K139+900	K136+164~K138+700		40	K139+900	160	Red earth	10	12	20	10.0		25.0	Shuixi Township of Ganxian County
9	9# earth borrow pit K143+900	K141+000~K144+000		20	K143+900	180	Yellow clayey	12	14	18.6	10.0		23.0	Hubian Township of Ganxian County
10	10# earth borrow pit K144+200	K144+000~K149+720	20	20	K144+200	200	Yellow clayey	11	14	45	35.0		50.0	Hubian Township of Ganxian County
II	Waste (slag) bank													
1	1# waste bank K101+400	K100+700~K105+000		20	K101+400	200						34.0	43.5	Luo'ao Township of Yudu County
2	2# waste bank K107+400	K107+300~K109+500		20	K107+400	200						51.0	50.0	Luo'ao Township of Yudu County
3	3# waste bank K113+250	K110+000~K114+400		20	K113+250	60						1.3	26.0	Jiangkou Township of Ganxian County

No	Name of earth borrow pit and waste bank	OD stake number of embankment with earth use (waste disposal)	Place of earth borrow pit and waste bank				Earth borrow pit					Waste (slag)bank	Land occupied	
			Distance to road(m)		To-road stake No	Length of hauling road (m)	Name of soil	Thickness of usable layer (m)	Max. possible cutting depth (m)	Available quantity 10,000m^3	Planned quantity for use 10,000m^3	Waste quantity 10,000/m^3	Size of occupied land (m)	Land owning unit
			Left	Right										
4	4# waste bank K116+180	K115+463~K118+319	40		K116+180	150						15.0	21.5	Jiangkou Township of Ganxian County
5	4-1# waste bank K116+570	K115+463~K118+319	30		K116+570	300						35.0	80.0	Jiangkou Township of Ganxian County
6	5# waste bank K121+900	K122+000~K123+300		30	K121+900	200						22.0	42.0	Maodian Township of Ganxian County
7	5-1# waste bank K133+750	133+000~K135+000		30	K133+750	100						9.0	23.0	Shuixi Township of Ganxian County
8	6# waste bank K136+740	K136+000~K137+000	80		K136+740	120						5.0	18.2	Shuixi Township of Ganxian County
9	7# Ganxian north interchange waste bank	Ground leveling for tollgate and management station		0	In the back of monitoring center	300						3.0	16.0	Shuixi Township of Ganxian County
10	K82+070 waste slag bank	Slag disposal for Yudu tunnel		20	K82+070	60						9.5	16.4	Hefeng Township of Yudu County
11	K84+050 waste slag bank	Slag disposal for Yudu tunnel		20	K84+050	100						8.5	12.8	Licun Township of Yudu County
12	K105+050 waste slag bank	Slag disposal for Xiashan tunnel	240	100	K105+050	400						12.0	38.8	Luo'ao Township of Yudu County
13	K107+240 waste slag bank	Slag disposal for Xiashan tunnel	50	20	K107+240	120						14.5	27.3	Luo'ao Township of Yudu County
14	K109+800 waste slag bank	Slag disposal for Baishan tunnel		20	109+800	50						3.0	8.6	Jiangkou Township of Ganxian County

2.4.3.9 Distribution of construction sites and detour roads

The distribution of construction sites for this project is listed in Table 2.4.3.9-1 and the distribution of detour roads are listed in Table 2.4.3.9-2.

Table 2.4.3.9-1 list of construction sites

No	Name of works	Stake No	County and township belonged to	Temporary land use (mu)					
				Paddy fields	Dry lands	Waste lands	Forestl ands	Cash forest	Total
1	Jiubao River large bridge	K32+465	Yunshishan Township of Ruijin City	20					20
2	Luanshi median bridge	K33+180	Yunshishan Township of Ruijin City				6		6
3	Yanba large bridge	K34+485	Yunshishan Township of Ruijin City	20					20
4	Hongxing grade separation 1	K36+205	Xijiang Township of Huichang County				6		6
5	Hongxing grade separation2	K36+840							
6	Yanbatan large bridge	K38+385	Xijiang Township of Huichang County	9.5			10.5		20
7	Lantian grade separation	K38+950	Xijiang Township of Huichang County				6		6
8	Xijiang River large bridge	K39+150	Xijiang Township of Huichang County	20					20
9	Jiuquping median bridge	K40+407	Xijiang Township of Huichang County	6					6
10	323 sub-line overpassing	K40+911.5	Xijiang Township of Huichang County				6		6
11	Railway-crossing grade separation	K41+520	Xijiang Township of Huichang County				6		6
12	Jiaojiangtou grade separation	K42+520	Xijiang Township of Huichang County	6					6
13	Shangdulishuxia median bridge	K43+180	Xijiang Township of Huichang County	6					6
14	Yewu large bridge	K44+540	Xijiang Township of Huichang County				20		20
15	Dahe tunnel	K44+935	Xijiang Township of Huichang County				15		15
16	Huoxing viaduct	K45+940	Xijiang Township of Huichang County				20		20
17	Beikeng large bridge	K47+685	Xiaomi Township of Huichang County				20		20
18	Shanshupai grade separation	K49+140	Xiaomi Township of Huichang County				6		6
19	Interchange overpassing the bridge	K50+248	Xiaomi Township of Huichang County				6		6
20	Dongfeng reservoir large bridge	K51+710	Xiaomi Township of Huichang County				20		20
21	Shibei median bridge	K53+180	Xiaomi Township of Huichang County				6		6
22	Baizhan, Heizhan	K48+500	Xiaomi Township of Huichang County	18.8		12.6	48.6		80

No	Name of works	Stake No	County and township belonged to	Temporary land use (mu)					
				Paddy fields	Dry lands	Waste lands	Forestlands	Cash forest	Total
23	1#earth borrow pit	Left of K32+300	Yunshishan Township of Ruijin City					13	13
24	1＃waste bank	Mountain ridge right of K46+700	Xijiang Township of Huichang County					1	1.0
25	2＃waste bank	Mountain ridge left and right of K51+100	Xiaomi Township of Huichang County	13.6				0.4	14
26	Zhuangqian grade separation	K55+300	Huanglin Township of Yudu County						6
27	Heliao tunnel	K57+510	Huanglin Township of Yudu County	6					19.3
28	Daduankeng median bridge	K58+795	Huanglin Township of Yudu County				6		6
29	Daduankeng viaduct	K59+445	Huanglin Township of Yudu County	1.1			18.9		20
30	Longtanmian viaduct 1	K59+870	Huanglin Township of Yudu County				20		20
31	Longtanmian viaduct 2	K60+300	Bai'e Township of Huichang County				20		20
32	3＃waste bank	Mountain ridge right of K57+400	Huanglin Township of Yudu County	11.5			4.5		16
33	4＃waste bank	Mountain ridge left and right of K58+100	Huanglin Township of Yudu County	36.6			6.4		43
34	5＃waste bank	Mountain ridge left and right of K59+000	Huanglin Township of Yudu County	40.2			4.8		45
35	Magong viaduct	K61+130	Bai'e Township of Huichang County				20		20
36	Dawujia grade separation	K62+140	Bai'e Township of Huichang County				6		6
37	Shangba Gongshui River viaduct	K63+010	Bai'e Township of Huichang County				20		20
38	Wuxian viaduct	K64+300							
39	Xiaojun viaduct	K64+700	Bai'e Township of Huichang County				20		20
40	Jiuling viaduct 1	K65+460	Bai'e Township of Huichang County				20		20
41	Jiuling viaduct 2	K65+765	Bai'e Township of Huichang County				20		20
42	Jiuling tunnel	K65+850	Bai'e Township of Huichang County				20		20
43	Jiuling reservoir large bridge	K66+735	Bai'e Township of Huichang County				20		20
44	Qigong large bridge	K67+660	Bai'e Township of Huichang County				20		40
45	Zhonggong tunnel	K67+780	Bai'e Township of Huichang County, Hefeng Township of Yudu County	13			27		40
46	Duimengang grade separation	K72+700	Hefeng Township of Yudu County						12
47	Huangnilong grade	K73+380	Hefeng Township of	7.8			4.2		12

No	Name of works	Stake No	County and township belonged to	Temporary land use (mu)					
				Paddy fields	Dry lands	Waste lands	Forestlands	Cash forest	Total
	separation		Yudu County						
48	1# earth borrow pit	K75+580	Hefeng Township of Yudu County				100		100
49	2 # earth borrow pit	K87+900	Licun Township of Yudu County				50		50
50	Yikeng viaduct	Right of K84+650	Licun Township of Yudu County					10	10
51	Maqimian viaduct	Right of K85+300	Licun Township of Yudu County			11			11
52	Jingkou viaduct	Right of K86+500	Licun Township of Yudu County	6					6
53	Bankeng viaduct	Right of K87+530	Licun Township of Yudu County	5					5
54	Baiyashi viaduct	Right of K88+340	Licun Township of Yudu County	5					5
55	3 # earth borrow pit	K92+400	Xinbei Township of Yudu County				60		60
56	4 # earth borrow pit	K98+600	Luojiang Township of Yudu County				60		60
57	Baotang viaduct	Left of K90+020	Xinbei Township of Yudu County	5					5
58	Yanxia viaduct	Right of K93+150	Gongjiang Township of Yudu County	4					4
59	Miaobei viaduct	Left of K94+250	Xinbei Township of Yudu County	12					12
60	Gaotan Gongjiang River large bridge	Left of K100+300	Xinbei Township of Yudu County	20					20
61	Shitoukeng viaduct left line	Right of K104+750	Jiangkou Township of Ganxian County				18		18
62	Longkeng viaduct left line	Right of K107+950	Luo'ao Township of Yudu County				5		5
63	Dingwu viaduct left line	Right of K108+700	Luo'ao Township of Yudu County				15		15
64	5 # earth borrow pit	K113+700	Jiangkou Township of Ganxian County					40	40
65	Dayun viaduct	Right of K110+550	Jiangkou Township of Ganxian County				9		9
66	Chenwu viaduct	Left of K111+850	Jiangkou Township of Ganxian County	5					5
67	Xin'anqian viaduct	Right of K112+260	Jiangkou Township of Ganxian County	5					5
68	Jiaolin Gongjiang River super-large bridge	Left of K115+400	Jiangkou Township of Ganxian County	20					20
69	Niugutang viaduct	Right of K115+725	Jiangkou Township of Ganxian County			4			4
70	Dakeng viaduct	Right of K117+000	Jiangkou Township of Ganxian County	5					5
71	Chenwu Gongjiang River large bridge	Right of K119+400	Maodian Township of Ganxian County	20					20

No	Name of works	Stake No	County and township belonged to	Temporary land use (mu)					
				Paddy fields	Dry lands	Waste lands	Forestlands	Cash forest	Total
72	Yangtang reservoir viaduct	Right of K121+330	Maodian Township of Ganxian County				4		4
73	6＃earth borrow pit	K123+320	Maodian Township of Ganxian County				25		25
74	7＃earth borrow pit	K139+640	Shuixi Township of Zhanggong District				25		25
75	8＃earth borrow pit	K139+640	Shuixi Township of Zhanggong District				25		25
76	9＃earth borrow pit	K143+900	Hubian Township of Zhanggong District				20		20
77	10＃earth borrow pit	K144+200	Panlong Township of Huangjin Development Zone	10			40		40
78	Duimen viaduct	Right of K122+590	Maodian Township of Ganxian County	5					5
79	G323-crossing viaduct	Right of K123+210	Maodian Township of Ganxian County	5					5
80	Xiaobeitou viaduct	Left of K215+500	Maodian Township of Ganxian County	11					11
81	Xikeng viaduct	Right of K126+460	Maodian Township of Ganxian County	5					5
82	Anziqian viaduct	Left of K131+450	Chutan Township of Ganxian County	4					4
83	Hechangbei viaduct	Right of K132+720	Chutan Township of Ganxian County	5					5
84	Huangzhupai viaduct	Right of K134+780	Chutan Township of Ganxian County	5					5
85	Ganjiang River super-large bridge	Right of K135+100	Chutan Township of Ganxian County		20				20
86	Lingbei viaduct	Left of K136+450	Shuixi Township of Zhanggong District	5					5
87	Huangsha’ao viaduct	Left of K138+400	Shuixi Township of Zhanggong District	9					9
88	Tongtianyan (II) viaduct	Left of K140+300	Shuixi Township of Zhanggong District	5					5
89	Shuikou large bridge	Left of K141+095	Hubian Township of Zhanggong District	3					3
90	Zhoujia viaduct	Right of K143+640	Hubian Township of Zhanggong District	5					5

Table 2.4.3.9-2 List of detour roads

No	Name of works	Location or stake number of detour roads	Road length (m)	Subgrade width (m)
1	To use local road for hauling materials	Yun-Wan Road	2	4.5
2	To use local road for hauling materials	Yun-Jiu Road	1	4.5
3	To use local road for hauling materials	323-Hongxing village road	1.5	3.5
4	To use local road for hauling materials	Hui-Shan road	0.5	8
5	To use local road for hauling materials	Shanshupai-Dongfeng reservoir	3.5	4.5

No	Name of works	Location or stake number of detour roads	Road length (m)	Subgrade width (m)
6	To use local road for hauling materials	323-Yuyang village road	2.5	4.5
7	To use local road for hauling materials	Zhuang-Bai road	2.4	4.5
8	To use local road for hauling materials	Yu-Pan Road	15	4.5
9	To use local road for hauling materials	Hefeng-Kuxin village road	2	4.5
10	Jiubao River large bridge	K32+465	0.1	4.5
11	Luanshi median bridge	K33+180	0.68	4.5
12	Yanba large bridge	K34+485	0.1	4.5
13	Hongxing grade separation 1	K36+205	0.05	4.5
14	Yanbatan large bridge	K38+385	0.3	4.5
15	Xijiang River large bridge	K39+150	0.2	4.5
16	Jiuquping median bridge	K40+407	0.2	4.5
17	Railway-crossing grade separation	K41+520	0.16	4.5
18	Shangdulishuxia median bridge	K43+180	0.3	4.5
19	Yewu large bridge	K44+540	0.2	4.5
20	Dahe tunnel	K44+935	0.6	4.5
21	Beikeng large bridge	K47+685	0.05	4.5
22	Overpassing bridge of interchange	K50+248	0.2	4.5
23	Dongfeng reservoir large bridge	K51+710	0.3	4.5
24	Shibei median bridge	K53+180	0.4	4.5
25	Baizhan, Heizhan	K48+500	0.16	4.5
26	1#earth borrow pit	Left of K32+300	0.8	4.5
27	1＃waste bank	Mountain ridge right of K46+700	0.32	4.5
28	2＃waste bank	Mountain ridge left and right of K51+100	0.1	4.5
29	Zhuangqian grade separation	K55+300	0.1	4.5
30	Heliao tunnel	K57+510	0.3	
31	Daduankeng median bridge	K58+795	0.1	
32	Daduankeng viaduct	K59+445	0.6	
33	Longtanmian viaduct 1	K59+870	0.5	
34	Longtanmian viaduct 2	K60+300	0.9	
35	2＃earth borrow pit	Right of K54+600	0.2	4.5
36	3＃waste bank	Mountain ridge right of K57+400	0.3	
37	4＃waste bank	Mountain ridge left and right of K58+100	0.5	
38	5＃waste bank	Mountain ridge left and right of K59+000	0.6	
39	Magong viaduct	K61+130	1.3	4.5
40	Shangba Gongshui River viaduct	K63+010	1.1	4.5
41	Wuxian viaduct	K64+300	0.5	4.5
42	Xiaojun viaduct	K64+700	0.6	4.5
43	Jiuling viaduct 1	K65+460	0.3	4.5

No	Name of works	Location or stake number of detour roads	Road length (m)	Subgrade width (m)
44	Jiuling viaduct 2	K65+765	0.4	4.5
45	Jiuling tunnel	K65+850	0.6	4.5
46	Jiuling reservoir large bridge	K66+735	0.4	4.5
47	Qigong large bridge	K67+660	0.8	4.5
48	Zhonggong tunnel	K67+780	2.1	4.5
49	1# earth borrow pit	K75+580	0.7	
50	2＃earth borrow pit	K87+900	0.8	
51	Yikeng viaduct	Right of K84+650	0.3	
52	Maqimian viaduct	Right of K85+300	0.3	
53	Jingkou viaduct	Right of K86+500	0.25	
54	Bankeng viaduct	Right of K87+530	0.3	
55	Baiyashi viaduct	Right of K88+340	0.7	
56	3＃earth borrow pit	K92+400	0.2	
57	4＃earth borrow pit	K98+600	0.4	
58	Baotang viaduct	Left of K90+020	0.25	
59	Yanxia viaduct	Right of K93+150	1.1	
60	Miaobei viaduct	Left of K94+250	0.2	
61	Gaotan Gongjiang River large bridge	Left of K100+300	0.9	
62	Shitoukeng viaduct left line	Right of K104+750	0.2	
63	Longkeng viaduct left line	Right of K107+950	0.3	
64	Dingwu viaduct left line	Right of K108+700	0.2	
65	5＃earth borrow pit	K113+700	0.5	
66	Dayun viaduct	Right of K110+550	0.1	
67	Chenwu viaduct	Left of K111+850	0.2	
68	Xin’anqian viaduct	Right of K112+260	0.5	
69	Jiaolin Gongjiang River super-large bridge	Left of K115+400	0.9	
70	Niugutang viaduct	Right of K115+725	0.5	
71	Dakeng viaduct	Right of K117+000	0.2	
72	Chenwu Gongjiang River large bridge	Right of K119+400	0.2	
73	Yangtang reservoir viaduct	Right of K121+330	2.0	
74	6＃earth borrow pit	K123+320	0.4	
75	7＃earth borrow pit	K139+640	0.2	
76	8＃earth borrow pit	K139+640	0.2	
77	9＃earth borrow pit	K143+900	0.2	
78	10＃earth borrow pit	K144+200	0.2	
79	Duimen viaduct	Right of K122+590	0.6	
80	G323-crossing viaduct	Right of K123+210	0.2	
81	Xiaobeitou viaduct	Left of K215+500	1.3	
82	Xikeng viaduct	Right of K126+460	0.2	
83	Anziqian viaduct	Left of K131+450	0.3	
84	Hechangbei viaduct	Right of K132+720	0.2	
85	Huangzhupai viaduct	Right of K134+780	0.4	

No	Name of works	Location or stake number of detour roads	Road length (m)	Subgrade width (m)
86	Ganjiang River super-large bridge	Right of K135+100	0.4	
87	Lingbei viaduct	Left of K136+450	0.5	
88	Huangsha'ao viaduct	Left of K138+400	0.2	
89	Tongtianyan (II) viaduct	Left of K140+300	0.3	
90	Shuikou large bridge	Left of K141+095	0.2	
91	Zhoujia viaduct	Right of K143+640	0.2	

2.4.3.10 Land occupation quantity of recommended alignment

The land occupation quantity of recommended alignment of the proposed highway is listed in Table 2.4.3.10-1.

Table 2.4.3.10-1 List of land occupation(mu)

Cities or counties belonged to	Paddy fields	Non-irrigated fields	Orchards	Water ponds	Forest land	Other land	Total
Zhanggong District	323. 4	390. 5	0	67. 9	998. 7	286. 8	2067. 3
Ganxian County	533. 2	83. 8	149. 5	107. 8	1729. 27	560. 5	3164. 07
Yudu County	1458. 95	306. 3	196	33. 24	2592. 7	195. 4	4782. 59
Huichang County	553. 98	19	1. 5	0	1534. 68	52. 6	2161. 76
Ruijin City	265. 6	0	30. 8	0	48. 3	15	359. 7
Total	3135. 13	799. 6	377. 8	208. 94	6903. 65	1110. 3	12535. 42

2.5 Roadbuilding materials and transportation conditions

The main roadbuilding materials divide into the local material and outside material according to the source. the local materials mainly include gravel, sheet stone(crushed stone), subgrade filler and so on. The outside materials are mainly steel reinforcement, cement, asphalt and so on.

2.5.1 Local materials

(1) Stone quarry

The various cities and counties the route passes through have stone quarries with the stone even in quality, high in strength and easy to excavate. The stone quarries are not far from the proposed highway with convenient local transportation. The stone quality and reserve can satisfy the project's requirements on pavement, protection, bridge and culvert.

The stone quarries along the route are mainly distributed in: Yunshishan of Ruijin, Wenwuba Township of Huichang, Tieshanlong and Anqiantan of Yudu, Datianxu and Meizikeng of Ganxian, Dalingbei of Zhanggong District.

⑵ Sand and gravel quarries

Along the route the sand and gravel resources are quite rich, in particular the latter half section of the route is near Gongjiang River and Ganjiang River, thus excavation and transport of sand and gravel are very convenient.

The sand and gravel along the route are mainly distributed in: Niuchepai of Ruijin, Bai'e, Zhutian of Huichang, Luoping and Laowuli of Yudu, Lingjiaoxia anad Qili Township of Ganxian, Shuixijie of Zhanggong District. These sand and gravel are mainly median to coarse grained with rich reserves and large mining quantity, the transportation condition can meet the project's need.

⑶ Subgrade filling material

The subgrade filling material uses rock waste dregs, natural clay, sandy soil and so on. The earth excavated from subgrade cutting section shall be used as much as possible, and stone excavated and tunnel mucking shall also be reasonably used according to actual situations, the insufficiency can be borrow nearby.

The distribution of quarries set up for this project is listed in Table 2.5.1-1.

Table 2.5.1-1 List of quarry distribution

No	Name of stone quarry	Location	Stake No to road	Distance to road (km)	Material description	Reserve (10,000 m^3)
1	Shunli markstone quarry	Jiulongmiao village of Shazhouba Township of Ruijin City	K31+013	15.5	Sandstone	50
2	Beixia stone quarry	Beixia village of Yunshishan Township of Ruijin City	K31+013	1	Limestone	100
3	Jiujiu stone quarry	Shimen village of Xijiang Township of Huichang County	K40+600	5.5	Limestone	100
4	Wanshikeng stone quarry	Wanshi village of Xiaomi Township of Huichang County	K48+600	14	Limestone	50
5	Luokou village stone quarry	Tongziwo of Luokou village of Zhuangkou Township of Huichang County	K48+600	13	Sandstone	50
6	Shangguan sand quarry	Shangguan village of Huanglin Township of Yudu County	K48+600	14		20
7	Gongguan sand quarry	Gongguan village of Huanglin Township of Yudu County	K48+600	17		50
8	Pubei sand quarry	Pubei village of Zhuangkou Township of Huichang County	K48+600	17		20
9	Shebei stone quarry	Shebei of Yuyang village of Huanglin Township of Yudu County	K55+000	1.5	Granite	20
10	Gangbei stone quarry	Shizi village of Bai'e Township of Huichang County	K62+500	.5	Limestone	50
11	Anbeishan stone quarry	Shuidong village of Bai'e Township of Huichang County	K62+500	1.5	Sandstone	50
12	Baisha River sand quarry	Zikeng village of Bai'e	K62+500	6		50

No	Name of stone quarry	Location	Stake No to road	Distance to road (km)	Material description	Reserve (10,000 m^3)
		Township of Huichang County				
13	Qiaonan sand quarry	Bridge head of Changzheng Bridge in Yudu County	K74+000	31		100
14	Ruijin Xinjian quarry	Shazhouba Township of Ruijin City	K75+050		Limestone	
15	Jinpeng stone quarry	Jinpeng village of Hefeng Township	K78+200	2	Limestone	120
16	Qilushan (Tieshilong) stone quarry	Tieshilong tungsten mine in Hefeng Township	K78+200	10	Metamorphic rock	50
17	Yudu sand quarry	Yudu county town	K92+500	6	Median and coarse-grained river sand and gravel	100
18	Xigang stone quarry	Xigang village of Luojiang Township	K102+100	8	Arkosite sandstone	100
19	Sanmenxia stone quarry	Sanmenqiao	K103+560	1.5	Median and coarse-grained sand	
20	Qiaozikeng stone quarry	Xiashan village of Luo'ao Township	K108+500	4	Granite	10
21	Haixia stone quarry	Xiashan village of Luo'ao Township	K109+500	1	Granite	150
22	Longxia stone quarry	Longxiashan of Jiangkou Township	K123+150	4	Red sandstone	32
23	Xindong stone quarry	Huangkengzi village of Molin Township	K123+150	11	Granite	12
24	Xinyuan stone quarry	Bantianwo village of Molin Township	K123+150	10	Granite and metamorphic sandstone	48
25	Hongjin stone quarry	Lingjiaoxia of Maodian Township	K123+150	6	Median and coarse-grained sand and gravel	
26	Ganxian Yunshun sand quarry	Laohujiao of Chutan Township	K134+000	3	Median and coarse-grained river sand	4
27	Hongyun stone quarry	Shikanzi of Chutan Township	K134+000	13	Black slate	15
28	Ruijin Rongsheng stone quarry	Hahu village of Hubian Township	K144+400	9	Granite	60
29	Dongfanghong cement factory	Molin Township of Ganxian County	K123+150	12	Cement from rotary kiln	

2.5.2 Externally purchased materials

(1) Cement

The cement production is big along the route, the main production factories are Ruijin cement plant, Huichang cement plant, Gannan cement plant, Dongfanghong cement plant and so on, the cement production and the quality can meet the project demand.

(2) Bituminous material

The asphalt needed by pavement intends to use imported asphalt.

⑶ Steel products

The steel reinforcements, steel plate and steel wire needed by the project can be supplied from plants in Nanchang, Xinyu, and Pingxiang, whose steel production and quality can meet the project demand.

2.6 Schedule arrangement

According to this project's works volume, fund raising, construction condition as well as highway network overall plan, the construction period is preliminarily set at: feasibility study, reconnaissance and design from June 2004 ~ June 2006, construction from July 2006 ~ June 2009, completion and open to traffic in at the beginning of July 2009.

2.7 Investment budget and capital raising

According to 《*Preliminary Design for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China*》 (Jiangxi Provincial Transportation Design Institute, Oct. 2005), the total investment for the whole line is 5.77169 billion yuan, with an average of 49.48419 million yuan each kilometer.

Chapter 3 Investigation and assessment of current environmental conditions

3.1 Overview of natural environment

3.1.1 Landform and topography

The route is mainly situated at the low hilly and rolling area in the south central Jiangxi Province, where the landform belongs to the corroded mid/low hilly and rolling sub-area in south Jiangxi Province and the topography (relief) is generally low in east and high in west with the mountain bodies mostly in a northeast-southwest direction. Due to river dissection, the mountain relief in the low hilly and rolling area is quite precipitous, the low mounds, hillocks and intramontane basins are mainly distributed along Gongshui River and its tributaries; within the area the highest mountain is Zhonggongzhang Mountain with an elevation of 996.8 meters. The route starts from the fault basin from Baiyunshan to Xijiang with its major landform characteristics being hillocks and valley basins; after passing by the rolling and hilly terrain composed by Jurassic series stratum and granite hilly terrain in Yuyang and Bai'e, the route runs through the low hilly and rolling terrain in Zhonggong’an near its destination and ends at Hefeng fault basin where the major landform characteristics are hillocks and valley basins. Below is the introduction of landform and topography in each section:

⑴ Origin K31+012.977～K34+800 section

This route section is mainly located in the wide Xijiang valley basin in Yunshishan, of which the K31+012.977~K33+300 section route is located in the wide Xijiang valley basin with smooth and open topography and a ground elevation between 184~191 meters, the surface grounds are paddy fields with Xijiang River meandering from east to west. The route overcrosses Xijaing River which is a tributary of Gongjiang River at K32+460 and undercrosses a low hillock body at K33+300~K33+800 where the mountain relief is steep in the west and slow in the west and the vegetation does not fully grow, and the maximum scaled height is nearly 40 meters. The route is located in a piedmont valley basin from K33+800 to K34+800 where the surface grounds are paddy fields, the terrain has a certain undulation which is generally high in the north and low in the south with a ground elevation between 187~200 meters, and there is a water ditch flowing from north to south in K34+440.

⑵ K34+800～K38+950 section

This route section aligns along a rolling and hillock terrain with large landform undulation and relatively steep mountain relief where there are developed with gulch valley basin with a ground elevation between 176 to 236 meters. The vegetation in hillsides is relatively developed and vegetation in the hilltops does not grow with bedrock exposed generally. Of which the K34+800 ~K36+200 route section aligns in a piedmont area along hillside and deep-cuts the mountain body where the landform has relatively large undulation in the horizontal and longitudinal directions. In this section, coal pits and old coal kilns left by coal-mining can be seen sporadically.

⑶ K38+950～K40+400 section

This route section is located in the Xijiang River valley basin in the Xijiang Basin where the topography is smooth and open with a ground elevation about 175 meters; the surface grounds are paddy fields with water ponds developed there and relatively clustered villages, of which the Xijiang River flows in the route area from southeast toward northwest in K39+140.

⑷ K40+400～K41+700 section

This route section is located in a rolling and hillock terrain composed by red clay in Xijiang Basin where the landform undulates gently with a ground elevation between 177~213 meters and underdeveloped vegetation; the surface grounds are non-irrigated fields and land reclamation fields. Of which the route right-cuts low hillock bodies in K40+600~K40+800, overcrosses G323 in K40+910, and overcrosses Gan-Long Railway in K41+500.

⑸ K41+700～K43+300 section

This route section is located in the Xijiang River tributary valley basin of the Xijiang Basin where the topography is smooth and open with a ground elevation between 177～181 meters; the surface grounds are paddy fields with water ponds developed there and relatively clustered villages, of which the Xijiang River flows in the route area from south to north in K43+185.

⑹ K43+300～K48+900 section

This route section aligns along a rolling and hillock terrain where the landform is undulated greatly and the mountain relief is steep, developed with gulch valley basin with a ground elevation between 177~310 meters, of which the K43+300 ~ K46+000 section is denuded landform composed by metamorphic rocks with relatively developed hillside vegetation and undeveloped hilltop vegetation, and the bedrock is exposed generally; the K46+000~K48+900 section is denuded landform composed by red sandstone with relatively undeveloped vegetation and the bedrock is exposed generally.

⑺ K48+900～K50+050 section

This route section is located in Shanshupai valley basin in the Xijiang Basin where the topography is open and the landform is slightly undulated with a ground elevation between 178～181 meters; the surface grounds are paddy fields with water ponds developed there and relatively clustered villages, of which the route crosses a road leading to Huichang County in K49+135 and crosses a brook in K49+930.

⑻ K50+050～K54+680 section

This route section is mainly located in a denuded rolling and hillock terrain composed by the Jurassic series sandstone and conglomerate where the landform is relatively gentle with a ground elevation between 179~244 meters and relatively undeveloped vegetation. The route overcrosses Dongfeng reservoir in K51+800~K52+080, and crosses a brook in K53+170; the K53+600~K54+150 route section is located in a long and narrow valley basin where the landform is smooth with a ground elevation about 180 meters; the surface grounds are paddy fields with a brook meandering in the center.

⑼ K54+680～K55+500 section

This route section is located in the edge of a long and narrow valley basin where the landform is smooth with a ground elevation between 187~194 meters, the surface grounds are paddy fields with a brook meandering in the left side of the route.

⑽ K55+500～K63+735 section

This route section aligns continuously along a hilly terrain composed of granite where the landform undulation is relatively big and gulch basin is developed with a ground elevation between 136~287 meters, which assumes a denuded landform with relatively undeveloped vegetation; the surface grounds are mainly planted with pine trees with serious soil erosion; the route overcrosses Gongjiang River in K61+765~K61+980, which flows in the route area from south to north.

⑾ K63+735～K64+300 section

This route section obliquely runs through a intra-mould valley basin where the landform undulates smoothly and low in the middle and high at two sides with a ground elevation between 151~183 meters; the surface grounds are paddy fields with a brook meandering from south to north in the middle. This route section mainly passes in a viaduct form.

⑿ K64+300～K70+800 section

This route section passes a low hilly and rolling terrain extending in a near south-north direction where the mountain relief is very precipitous with a ground elevation between 183~815 meters and highly developed vegetation, of which the K64+300~K66+500 section and K70+150~K70+800 section are in a piedmont accumulational low hilly terrain. This route section mainly passes in a tunnel form.

⒀ K70+800～K74+178.981 section

This route section is located in the Hefeng fault basin where there are mostly hillocks and valley basins with a ground elevation between 180~240 meters; the hillock is mainly composed by red clay with gentle landform undulation and relatively undeveloped vegetation, mostly pine woods, of which the K71+900~K72+325 section, K72+900~K73+700 section, and K73+860~K74+345 section are all located in broad valley basins where the surface grounds are paddy fields and the landforms are undulated to some degree, and generally there developed a water ditch in the middle.

⒁ K75+050～K82+000 section

This route section is located in Hefeng fault basin, mainly located in the north edge of the fault basin where the landforms are mostly hillocks, moulds, and valley basins with some light rolling terrain developed with limestone monadnocks, and the valley basins are paddy fields; the hillocks and mounds have average vegetation growth, the overall landform undulation is relatively gentle with a ground elevation between 175~250 meters. Of which the K75+300~K75+860 section left-cuts the mountain body along the hillside near piedmont; in the K75+860 ~ K76+380 section there developed with wide valley basin with the surface grounds being mostly paddy fields; the K76+380~K84+000 route section aligns along piedmont accumulational rolling and hillock terrain in the transit between basins and hill bodies with its south side being fault basin and north side being hill body; this route section has relatively developed vegetation, serious erosion of mountain body and relatively deep gulch dissection.

⒂ K82+000～K88+100 section

This route section passes low hills and hillock bodies extending in a near south-north direction of Wufeng Mountain where the landform undulation is very big and the mountain relief is precipitous with a ground elevation between 145~520meters and with developed vegetation, and there developed with a near east-west directional gulch and long and narrow valley basin. Of which the K82+000~K82+400 is piedmont accumulational hill bodies with relatively gentle landform undulation; the K82+400~K84+050 section passes through a major mountain peak with extremely precipitous relief and big landform undulation, so this section passes in a tunnel form; the K84+050~K88+100 section basically aligns along a near east-west directional long and narrow valley basin and lies in the south side of the valley basin in K84+050~K86+270 and obliquely crosses the valley basin in K86+270~K86+565; after K86+565, the route aligns along the north side of the valley basin where the overall topography is slowed down and the landform becomes gentle with mostly rolling and low hilly terrain, and extremely developed vegetation.

⒃ K88+100～K104+900 section

This route section is located in Yudu fault red clay basin where the topographical feature is denuded topography in rolling and hillock terrain with serious erosion and developed with gulch basin and valley basin, and the overall relief is becoming from high in the east to low in the west. Of which the K88+100~K90+000 section is sandstone and conglomerate denuded hill bodies where the landform undulation is relatively large with a ground elevation between 139~190 meters, and with undeveloped vegetation, exposed bedrock and perfectly round mountain bodies; the K90+000~K93+150 section is a denuded rolling and hilly terrain composed of argillaceous siltstone where the landform undulation is gentle with the ground elevation between 117～171 meters, the erosion is serious in partial hill bodies with undeveloped vegetation and exposed bedrock; the K93+150~K94+100 section is a denuded conglomerate hill bodies where the landform undulation is relatively large with a ground elevation between 115~166 meters, the hill bodies are perfectly round in places with undeveloped vegetation and exposed bedrock; the K94+100~K94+525 section is located in Shangxi river valley basin with gentle and open relief, and the surface grounds are paddy fields with a ground elevation about 115 meters; the route overcrosses Shangxi River about 30 meters wide in K94+450, which flows in the route area from south to north; the K94+525~K97+400 section is a denuded rolling and hilly terrain composed of strongly-weathering sandstone and conglomerate where the landform undulation is gentle with a ground elevation between 116～168 meters, erosion is serious in hill bodies with undeveloped vegetation and exposed bedrock; the K97+400 ~ K98+350 section is a denuded conglomerate hill bodies where the landform undulation is relatively large with a ground elevation between 111～174 meters, the hill bodies are perfectly round in places with undeveloped vegetation and exposed bedrock; the K98+350 ~K99+770 section is a denuded rolling and hilly terrain composed of argillaceous siltstone and polygonal red clay where the landform undulation is gentle with a ground elevation between 111～140 meters, erosion is serious in partial hill bodies with undeveloped vegetation; the K99+770~K100+630 section is located in Gongshui river valley basin with some undulation of landform, and the surface grounds are paddy fields with a ground elevation between 108～126 meters; the route overcrosses Gongshui River in K100+323~K100+630, which flows in the route area from north to south; the landform undulation is relatively large with a ground elevation between 108～175 meters and average growth of vegetation; The K104+200 ~K104+900 section is located in hillocks and valley basins composed of red clay where the landform undulation is gentle with a ground elevation about ??, the hillock vegetation is not developed, the valley basins are paddy fields, the route crosses G323 in K103+700, and crosses Gan-Long Railway in K104+320.

⒄ K104+900～K108+800 section

The route passes the near south-north extending hill bodies in Xiashan where the landform undulation is extremely large and the mountain relief is precipitous with a ground elevation between 115~430 meters; the vegetation is relatively developed and there grows a near east-west V-shaped long and narrow gulch. Of which the route crosses river valley basin in K108+400~K108+800 where the terrain is smooth with the ground elevation about 112 meters, and a small river is formed in the middle.

⒅ K108+800～K113+900 section

The route is located in a denuded rolling and hilly terrain composed of granite where the overall landform undulation is relatively big with ground elevation between

113~210 meters, and with average vegetation growth and serious hillside surface erosion. Of which the route passes a steep hill body in K108+800~K110+000 where the landform undulation is extremely large, this section mainly passes in the form of a tunnel; the route section is parallel to the Gan-Long Railroad in K110+000~K112+250 and aligns along the hillside near the piedmont area, and right-cuts the mountain body; the route undulation is big in both horizontal and longitudinal direction.

⒆ K113+900～K149+732 section

The route is located in Ganzhou red earth basin with denuded rolling and hillock terrain as its main topographical feature, and with developed valley basin and gulch basin, the overall landform undulation is relatively big with a ground elevation between 102~170 meters, the vegetation is not highly developed and the mountain body generally has exposed bedrock. The sections of K115+400~K118+350, K119+800~K122+530 and K140+400~K141+300 are located in sandstone and conglomerate denuded mountain bodies where the landform undulation is relatively large, and the mountain bodies are perfectly round in places with undeveloped vegetation and exposed bedrock. The route overcrosses Gongshui River and its river valley basin twice in K114+800~K115+425 and K118+350~K119+450 with the riverbed width about 300 meters, which flows in the route area in K115+015 from south to north and flows in the route area in K119+130 from north to south; the route overcrosses Ganjiang River and its east alluvial flood plain and valley basin in K134+900~K136+100, which flows in the bridge area from south to north with the riverbed width nearly 450 meters.

Thene is no karst topography along the Project.

3.1.2 Climate and meteorology

⑴ Climate characteristics

The project district lies in the south edge of middle subtropical zone belonging to subtropical hilly moist monsoon climate. Monsoon is prevalent in summer and winter; rainfall is centered in spring and summer with clear distinction between the four seasons, mild climate, sufficient heat, plentiful rainfall, short extreme weather and long non-frost period. The temperature and rainfall along the route are listed in Table 3.1.2-1 and 3.1.2-2.

Table 3.1.2-1 Temperature along the route (unite:℃)

Area	Annual average temperature	Annual average max temperature	Annual average min temperature
Ruijin City	18.9	24.1	15.0
Huichang County	19.3	24.6	15.5
Yudu County	19.6	24.4	16.0
Ganxian County	19.3	24.0	16.0
Zhanggong District	19.4	24.0	16.0
Ganzhou River	18.8	24.0	15.1

Table 3.1.2-2 Rainfall and non-frost period

Area	Non-frost period(day)	Annual average rainfall(mm)	Annual average raining days(day)	Raining month
Ruijin City	274	1721.9	164.2	April～June
Huichang County	280	1643.3	161.7	April～June
Yudu County	281	1545.7	156.4	April～June
Ganxian County	284	1476.7	156.3	April～June
Zhanggong District	284	1467.8	156.3	April～June
Ganzhou City	288	1605.4	162.2	April～June

According to road natural zoning, the area the route passes through belongs to Wuyi south mountain range moist area, namely Ⅳ6 zone.

⑵ Evaporation capacity

Ganzhou City's average evaporation capacity for many years is 1554.8mm, 50.6mm less than annual average rainfall. Along the proposed highway, Ruijin City's annual evaporation capacity is smaller than 1400 mm, other areas' evaporation capacities are 1400- 1700mm. In a year the evaporation capacity is relatively small from November to March, all smaller than 100mm each month; from April to October, the evaporation capacity of each month is above 110mm, and can reach 234.3mm in July, the largest in a whole year.

⑶ Wind direction and wind speed

The wind direction in the project region is mainly north wind or northerly wind, the period from October to March next year is winter wind time, from June to September is summer wind time; the winter wind is mostly north wind or northerly wind, while the summer wind is mostly southerly wind.

The annual average wind speed is 1.8m/s, the average wind speed difference is not big in each month within a year, usually among 1.6- 2.0m/s. The average wind speed in four seasons is 2.0m/s in winter, 1.7m/s in summer, the average wind speed in spring and autumn is all 1.8m/s.

3.1.3 Hydrology

This project passes through Ruijin, Huichang, Yudu, Ganxian, Zhanggong District, all subordinate to Ganzhou Prefecture. Around Ganzhou Prefecture there are overlapping mountains and undulating hills with dense and criss-crossed streams and rivers. Because the entire topography is high in periphery and low in the middle, the water system assumes a radiating pattern converging into the center- Zhanggong District of Ganzhou City. The region this project passes through is high in the east and low in the west in topography, belonging to Ganjiang River system of Yangtze valley; the route mainly crosses Gongjiang River and Ganjiang River.

Ganjiang River is so named because Zhangjiang River and Gongjiang River converge in Bajingtai of Ganzhou City. The main river source is Gongjiang River originating from Jigongdong of Shicheng, which is the biggest river in Ganzhou City and also in Jiangxi Province. Within the territory of Ganzhou Prefecture, Ganjiang River is 45km long (from Ganzhou's Bajingtai to Ganxian's Yaokou), it winds from south to north flowing on the hillocks and hills in Zhanggong District and Ganxian County with a fall head of 11m and average slope reduction of 0.24 ‰.

Gongjiang River was called Huhanshui River in ancient times, also called Yu River, Huichang River; in Ganxian County and Zhanggong District, it is nicknamed Donghe River. Gongjiang River originates from Jigongdong of Shicheng, flows into Ganjiang River in Bajingtai of Ganzhou City; it is a primary tributary of Ganjiang River with valley drainage area of 26589km^2. The main Gongjiang River is 278km long with fall head of 309m. From Huichang to Ganzhou Bajingtai, the river is 153km long with fall head of 66m and average slope reduction of 0.43‰. According to river course characteristic, roughly the section above Huichang is the upstream, from Huichang to Yudu is the mid-stream, and from Yudu to Ganzhou is the downstream.

3.1.4 Geotechnical conditions

Within the route area, the landform undulation is relatively big with many stratum exposures, complex lithological characteristics, deep cutting of mountain bodies by the route, and relatively large volume of earth and stone works. Along the route the geologic tectonic structures (fold and fault) are extremely developed; calcareous rock karst areas and coal formation stratum are developed in wide range with unfavorable geology existing such as goaf and depression, and the eluvial and diluvial red clay from weathering is high liquid limit unfavorable subgrade soil. Granite area's weathering layer (regolith) is thick, thus disadvantageous to slope stability, and also there developed with liman soft soil. Red sandstone areas have the hidden danger of zonal bedding landslide, therefore the geotechnical conditions within the overall assessment scope is of complex type. But different road sections have different zonal stabilities because their geological conditions are not quite the same.

The section from the origin K31+012 to K46+000 is mainly located in a calcareous rock karst area with partial growth of coal-formation stratum goafs, thus disadvantageous to the stability of highway construction, this section's geological conditions are of complex type; the section from K46+000 to Yuyang K54+600 is mainly located in a rolling and hillock terrain composed of Cretaceous and Jurassic clastic rock where the landform and geological conditions are relatively simple with undeveloped geological tectonic structure, this section's geological conditions are of simple type; the section from Yuyang K54+600 to destination Hefeng K75+050 passes successively through granite mountain bodies, precipitous metamorphic rock mountain bodies and calcareous rock karst area with complex geological conditions and many geological diseases and hidden dangers, this section's geological conditions are of complex type; the section from K75+000 to the main and alternative line's K87+000 successively crosses Hefeng basin and the steep Baizhu mountain body, Hefeng basin belongs to a calcareous rock karst area with existence of hidden danger of settlement and with partial growth of coal-formation stratum, which are disadvantageous to the stability of highway construction, this section's geological conditions are of complex type; the section from K87+000 of the main and alternative lines to K103+200 of main line and the along-the-river scheme's K101+750 section are mainly located in a rolling and hillock terrain composed of Cretaceous and Jurassic clastic rock with relatively simple landform and geological conditions and undeveloped geological tectonic structure, this section's geological conditions are of simple type; the section from K103+200 to K113+720 of Xiashan main line and the section from K101+750 to K113+720 of the along-the-river scheme line successively pass through a calcareous rock karst area, precipitous metamorphic rock mountain bodies and granite mountain bodies with complex geological conditions and many geological diseases and hidden dangers, this section's geological conditions are of complex type; the section from

K113+720 to destination K149+732 of the main alternative line is mainly located in a rolling and hillock terrain composed of Yudu Cretaceous system red clastic rock with relatively simple landform and geological conditions and undeveloped geological tectonic structure, and with the hidden danger of bedding landslide in partial places, this section's geological conditions are generally of simple type.

3.2 Assessment of current ecological environment

3.2.1 Soil environment

Along the proposed project, the soil type is mostly red loam, paddy soil, cultivated fluviogenic soil, yellow soil, which are mainly acidic; the cultivating soil is mainly paddy soil and fluviogenic soil.

In Ganzhou Prefecture, the total soil size is 55.280726 million mu (Chinese acre), of which farming soil size of 7.445376million mu accounting for 13.47% in the total; mountainous soil size of 47.83535 million mu accounting for 86.53% in the total. In this prefecture, there are 9 soil types and 16 sub-types, the 9 soil types are: Paddy soil, cultivated fluviogenic soil, rendzina, purple ochre, thick bone earth, red loam, yellow soil, yellow brown earth, mountainous soil, respectively, of which the paddy soil size is 6.966764 million mu accounting for 12.6% in the total with above 90% of the existing farmlands being paddy soil distributed in each county; the cultivated fluviogenic soil size is 132,420 mu accounting for 0.24% in the total with about 10% of the existing farmlands being fluviogenic soil; the rendzina size is 136,152 mu accounting for 0.25% in the total; the red loam size is biggest, up to 44.318721 million mu accounting for 80.17% in the total; the yellow soil size 2.205648 million mu accounting for 3.99% in the total.

Due to impacts from subtropical climatic conditions and human activity, the soil is distributed in the following rule: many valleys and basins are distributed between the mountains hills, the largest basin is Ganzhou basin amounting to more than 1,500 square kilometers; in the low mountainous area there are yellow loam and yellow soil; among ravine valleys there are a few brown sand paddy soil fields and yellow sand paddy soil fields. From Ganjiang River to Yaolanzhai, the soil types tend to be consistent with the soil type of the previous area with only difference in distribution size; other basins' soil distribution is basically the same presenting basin soil distribution regularity. The vertical distribution of soil is roughly: red loam - yellow loam - yellow soil -mountainous meadow soil.

3.2.2 Assessment of current vegetation in project region

The natural vegetation types within the assessment scope mainly includes coniferous forest, coniferous and broadleaf mixed forest, evergreen broadleaf forest, shrub and bush, grass and so on. The cash forest size is small. During investigation, we found fragmentary and small-sized oil-tea camellia forest, sweet orange forest and so on. The agricultural vegetation is mainly paddy field with the staple crop being rice. In non-irrigated fields outside the slope farmland grows wheat, rapeseed, legumes and peanut. Below we present each main type of vegetation and their characteristics:

(1) Coniferous forest

It is the most widely distributed and the major vegetation type within the assessment scope. In the community the prominent tree species are masson pine and China fur, sometimes the two tree species mix together into a co-dominant community. In the assessment scope the coniferous forest is mostly formed by sowing seed from aircraft or artificial afforestation when the original vegetation was destructed. Because of different climate and soil conditions and different forest formation time, during the investigation, we discovered that the coniferous forest communities in each place assume different characteristics in their level, structure and appearance. Of which, the forest with best form and appearance is the masson pine and fur mixed forest distributed in the low mountain and hilly area in Ailing of Ruijin; in this forest the masson pines and furs are mostly middle-aged trees with quite reasonable community age structure and rich under-forest bush layer and thick covering. The community's overall environment is moist with green and luxuriant appearance. But in Chutan and Jiangkou of Ganxian County, the mason pine forests are basically sparse, most of the masson pines are young trees with poor under-forest bush layer and underdeveloped covering, the total covering rate of the community does not surpass 50%, soil erosion of varying degree occurs.

(2) Coniferous and broadleaf mixed forest

The coniferous and broadleaf mixed forest along the route is not large in size, only found to be distributed near Liren of Yudu County during the investigation. In the forest community-building species are mason pine and Castanopsis. Under the forest the bushes are azalea, tea-oil tree, and China Loropetal, the grass layer is mainly Dicranopteris.

⑶ Evergreen broadleaf forest

Within the assessment scope, zonal vegetation such as natural forests can rarely see due to large-size reclaiming and deforestation. During the investigation, only nearby the villages we found natural secondary evergreen broadleaf forests with relatively good appearance, which are supposed to geomancy forest, so well-preserved. In such forest the predominant tree species are Castanopsis, schima superba, associated oriental white oak, and camphor tree; under the forest the bushes are has Spine Aral, Alangium platanifolium, azalea, and multiflorarose and so on; the herb is mainly ferns.

⑷ Shrub and grass

Distributed in barren hills, city suburbs and village vicinities. Within the assessment scope, in the hilly area around Ruijin's Yunshishan and Shazhouba where the base rock is limestone, mostly exposed and with thin soil layer, the forest is not suitable to grow, and it is also not suitable to reclaim; on these hills mostly grow bushes and herbs. The investigation discovered that in these shrubs the community-building specie is caesalpina japonica, other common bushes are pepper mulberry, white sandal-wood, vitex cannabifolia, and wild Chinese red pepper; the herbs are chrysanthemum indicum, artemisiacapillaris as well as some gramineae weeds. In the assessment scope the bushes and grasses distributed in other places are acid soil bush and grass, mostly formed by human influence.

The overall distribution of vegetation within the assessment scope is shown in Fig. 3.2.2-1。

3.2.3 Assessment of current wildlife animals and plants

3.2.3.1 Assessment of current wildlife plants

⑴ Within the assessment scope, the common arbor plants include gymnosperm and angiosperm

The gymnosperm includes Cycadaceae, Ginkgoaceae, Pinaceae, Cryptomeria, Cupressaceae, Araucariaceae, Podocarpaceae and so on, a total of 7 families with the common species shown in table 3.2.3.1-1. The angiosperm includes Magnoliaceae, Lauraceae, Berberidaceae, Juglandaceae, Rosaceae, Moraceae, Ulmaceae, Flacourtiaceae, Pittosporaceae, Proteaceae, Hypercaceae, Tiliaceae, Sterculiaceae, Bombacaceae, Papilionaceae, Euphorbiaceae, Malvaceae, Caprifoliaceae, Theaceae, Aquifoliaceae, Myrtaceae, Vitaceae, Celastraceae, Rhamnaceae, Simarubaceae, Ebenaceae, Sapindaceae, Rutaceae, Burseraceae, Anacardiaceae, Meliaceae, Ericaceae, Palmaceae, Aceraceae, Bignoniaceae, Oleaceae, Scrophulariaceae, Gramineae, Cesalpiniaceae, Platanaceae, Mimosaceae, Hamamelideceae, Salicaceae, Fagaceae, Bischofiaceae, Buxaceae, and so on, a total of 46 families with common species shown in table 3.2.3.1-2.

Table 3.2.3.1-1 List of common gymnosperm plants along the proposed highway

Family	Specie	Family	Specie
Cycadaceae	Cycas revoluta	Araucariaceae	Araucaria cunninghamia
Gingkoaceae	Ginkgo biloba	Podocarpaceae	Podocarpus macrophyllus
Pinaceae	Pinus massoniana, Pseudolarix amabilis, Pinus elliottii, pinus taeda	Cupressaceae	Cupressus funebris, P.orientalis, chamaecyperus pisifera, Platycladus orientalis, Junperus, Sabina chinensis, Sabina chinensis
Taxodiaceae	Cunninghamia lanceolata, Cryptomeriafortunei, Taxodium distichum, metasequoia		

Table 3.2.3.1-2 List of common angiosperm plants along the proposed highway

Family	Specie	Family	Specie
Magnoliaceae	*Michelia figo,* michelia alba, Lily magnolia, Zeyulan magnolia, *Liriodendron chinense*	Rhamnaceae	*Cornus officinalis,* Poncirus trifoliata, Paliurus ramosissimus
Lauraceae	*Cinnamonum camphora,* litsea cubeba, Lindera communis Hemsl, cinnamomum pedunculatum	Simarubaceae	*Ailanthus altissima*
Berberidaceae	Berberid, Nandina domestica Thunb	Ebenaceae	Persimmon, Diospyros lotus
Juglandaceae	Pterocarya stenoptera	Sapindaceae	*Sapindus mukorossi, Koelreuteria paniculata*
Rosaceae	Amygdalus persica, Prunus sp, P.mume, Prunus cerasifera, Pyrus bretschneideri REHB, Eriobotrva japonica, hypericum	Rutaceae	Citrus reticulata, Citrus sinensis, Turpihia pomifera, Cifrus hongheensis
Moraceae	*Morus alba, Ficus microcarpa,* Ficus carica	Burseraceae	Canarium album Raeusch
Ulmaceae	*Celtis tetrandra,* betel siberian elm	Anacardiaceae	*Pistacia chinensis,* Ziziphus var. spinosa
Flacourtiaceae	Xylosma japonicum	Meliaceae	Melia azedarach, Chukrasia tabularis, *Toona sinensis*
Pittosporaceae	Tobira	Ericaceae	*Rhododendron simsii Planch, N/A*
Proteaceae	Silk oak grevillea	Palmaceae	Trachycarpus fortunei
Guttiferae	Yellow Indian azalea	Aceraceae	Acer oliverianum
Tiliaceae	Grewia biloba	Bignoniaceae	Catalpa ovata
Sterculiaceae	*Firmiana simplex*	Oleaceae	*Ligustrum Vicaryi,* Dysophylla stellata, Osmanthus fragrans, Ligustrum sinense
Bombacaceae	*Gossampinus malabarica*	Scrophulariaceae	Pawlownia
Papillionaceae	*Robinia pseucdoacacia, Sophora japonica,* Chrysanthemum, *Cassia surattensis,* Glycine max	Gramineae	Phyllostachys sulphurea, Phyllestachyspubescens, phyllostachys bambusoides, sinocalamus
Euphorbiaceae	Firmiana simplex, Aleurites Fordii Hemsl, Sapium sebiferum, poinsettia, Vernicia fordii	Cesalpiniaceae	Gleditsia, Caesalpinia decapetala, Cercis chinensis Bunge, Bauhinia purpurea, Delonix regia

Family	Specie	Family	Specie
Malvaceae	Hibiscus syriacus, *Hibiscus mutabilis*	Platanaceae	*Platanus hispanica*
Caprifoliaceae	Bigleaf hydrangea	Mimosaceae	Acacia richii, acacia farnesiana, Acacia farnesiana
Theaceae	Camellia, schima superba, Camellia Oleifera Abel, Eurya	Hamamelideceae	Liquidambar formosana
Aquifoliaceae	angulata	Salicaceae	Salix babylonica Linn, Salix chaenomeloides, Salix matsudana, Populus euramevicana, Populus nigravar
Myrtaceae	Eucalyptus spp, fragrant pomegranate, Rhodomvrtus tomentosa	Fagaceae	Castanopsis sclerophylla, Castanopsis eyrei, *Castanea mollissima,* Cyciobala nopsis giauca
Vitaceae	Vitis vinifera	Bischofiaceae	Bischofia javanica
Celastraceae	Euonvmus japonlcus, Albo-marginatus	Buxaceae	Euonymus japonicus

(2) Within the assessment scope, the common bush plants include symplocos caudata, thymelaeaceae, Verbenaceae, lythraceae, ericaceae, papillionaceae, Rosaceae, rubiaceae, theaceae, Smilacaceae, and anacardiaceae and so on, the common species are listed in Table 3.2.3.1-3.

Table 3.2.3.1-3 list of common bushes along the proposed highway

Family	Specie	Family	Specie
Symplocos caudata	Symplocos baniculata	Rosaceae	Geum japonicum, Rosa multiflora, Rubus corchorifolia, Rubus buergeri
Thymelaeaceae	Wikstroemia	Rubiaceae	Gardenia Jasminoides
Verbenaceae	Vitex	Theaceae	Eurya muricata, Adinandra filipes
Lythraceae	Lagerstromia indica	Smilacaceae	Smilax china, Smilax glabra Roxb
Ericaceae	Cuculidae	Anacardiaceae	Rhus succedanea, Rhus chinensis Mill
Papillionaceae	Lespedeza formosa		

Within the assessment scope, herbaceous plants are many, some of the common species are as follows: Arundinella setosa, Miscanthus flavidus, Imperata cylindrica, and arundinella hirta of the Gramineae family; chrysanthemum, artemisiacapillaris of the Compositae family; prunella vulgaris and leonurus siribicus of the Orthodon family; cordate houttuynia of the Saururaceae family; Asiatic plantain of the Asiaticplantain family; Trachelospermum jasminoides of the Apocynaceae family; Lonicera japonica of the Caprifoliaceae family. Also included are hard awn and Woodwardia unigemmata of the Grammitidaceae family, and so on.

3.2.3.2 Assessment of current wildlife animals

Within the assessment scope, the commonly seen insects are: locust, cicada, musca, mosquito, butterfly, snout moth, moth, bee and so on. The main species include: yellow keel ceracris kiangsu, big leaf hopper, Thunberg, Big Dipper ladybug, verdigris gold fly, powderplatinum fly, yellow anlacophora femaralis, tea-oil treelikely armor, long-horned beetle, blue swallow tail, sweet orange swallowtail, jade belt swallowtail, line canyon butterfly, green jade canyon butterfly, Rice case worm, masson pine larva aculeata, cedar snout moth, Chinese scholartree chaerocampa oldenlandiae, eight ashesdiacrisias, tea white tussock moth, Chinese tallow tree cecropia moth, ugly face chaerocampa oldenlandiae, Chinese honey bee, golden yellow wasp, mugwort and so on.

Within the assessment scope the aquatic biological resources are rich, mainly fish, and shrimp, snail, freshwater mussel, turtle and so on. Of which the fish is largest in quantity, broadest in distribution and highest in value. Within the scope there are 14 branches and 40 species of fish, mainly, carp branch: black carp, grass carp, chub, Bighead crap, carp, crucian, blunt-snout bream, European bream, Varicorhinus, wheatear fish, opsariichthys uncirostris, Topmouth culter, Shutfle-like carp, red eye squat, Roseline Shark, Longnose gudgeon and so on; Cobitidae branch: Loach; Clarias fuscus branch: Clarias fuscus; Parasilurus asotus branch: Chinese catfish; Pseudobagrus branch: Pelteobayrus vachelli; Channa maculata branch: Snakehead; Symbranchir branch: Eel; Rachycentron canadum: Tilapia mossambica. The carp branch occupies a predominating position.

According to investigation, within the assessment scope, there are 1 item, 3 branches, and 5 species of amphibians; 2 items, 8 branches, and 25 species of reptiles; 13 item, 21 branches, and 56 species of birds, 6 items, 12 branches, and 19 species of beasts.

3.2.4 Current agricultural ecological environment

This project passes through Ruijin City, Huichang County, Yudu County, Ganxian County and Zhanggong District, which all are subordinate to Ganzhou Prefecture. The current population and land of each city and county along the route are listed in Table 3.2.4-1.

Table 3.2.4-1 Current population and land of each city and county along the route(2003)

Name of city and county	Population (10,000 persons)	Land size (mu)	Population density (person/km^2)	Farming land size(mu)	Basic farmland (mu)
Ruijin City	60.13	3675566.3	245	352976.2	300029.8
Huichang County	43.40	4064859.6	159	344569.9	305993.9
Yudu County	90.24	4343213.9	312	512921.4	442492
Ganxian County	55.67	4488315.0	186	402087.2	341774.1
Zhanggong District	45.57	729856.5	1071	150212.7	127680.8
Total	295.01	17301811.3	257	17627674	1517970.6
Ganzhou Prefecture	831.20	59085000	211	443563500	3965080
Jiangxi Province	4254.23	2500000000	251	34471500	29300775

The farming crops in Ruijin City are mostly paddy rice followed by sweet potato and legumes; the cash crops are sugar cane, peanut, rapeseed, tobacco, sesame seed, tea and so on. The lands along the route are mainly forestland, paddy field as well as non-irrigated field. The specialty agriculture is prosperous and export-oriented agriculture is booming. Specialty breeding industry centered on eel is rapidly developing, this area is Jiangxi Province's biggest eel breeding, processing and export base with maximal output of fresh eel 3,000 ton, dry eel 2,300 tons. The agricultural by-products are extremely rich, such as leaf tobacco, Chinese yam, ginger, water chestnut, auricularia auricula, sweet-scented osmanthus, Chinese chestnut, navel orange, green plum and so on, which are favored by consumers due to their superior quality.

The Huichang County's crops are primarily cereal crops, well known as the township of oil and rice. Among the grain crops, the paddy rice accounts for 87.5%, the soybean accounts for 5.2%, the sweet potato accounts for 4.8%, and miscellaneous grains account for 2.5%. Oil-bearing crops in Huichang County are mainly rapeseed, peanut and sesame seed, the cash crops are mainly sugarcane, tobacco, followed by cotton, jute, medicinal herbs, husked lotus, and water chestnut.

Grain crops in Yudu County are mostly paddy rice, followed by soybean, sweet potato, corn, barley, wheat, silkworm pea, and so on. The cash crops are mainly sugar cane, peanut, rapeseed, cotton, tobacco, sesame seed, and so on. In the soil, red earth (loam) accounts for 67.8% in the total county surfacesize, the paddy soil accounts for 11%. The agricultural development is speeding up, the structure of agriculture, forestry, husbandry and fishery witnessed tremendous change, "Three High Agriculture" and specialty agriculture are developing greatly, forming several big cultivation bases dominated by fruit production and creating new growth point for the rural economy.

Ganxian County possesses rich natural and productive resources with fruit growing, flue-cured tobacco, aquatic products, and vegetables being the pillar of agricultural economy. On the mountain grows navel orange, sweet orange, tea-oil tree and wood, bamboo, pomelo, plum, pear and jujube and so on; in the countryside produces paddy rice, tobacco, grape, mat grass, vegetables and so on. The crop growing structure continues to adjust. The County has undertaken appropriate agricultural structural adjustment aimed at market-orientation, agricultural benefit increasing and farmer income increasing, the result is that the grain growing size in the whole year is continuing to reduce while the growing size for cash crops such as flue-cured tobacco and mat grass continue to expand, forming specialty agricultural pillar industry featuring flue-cured tobacco, live pig, commodity vegetables, aquatic products.

Within Zhanggong District, the agricultural structure has undergone relatively big change through market regulation and reasonable allocation of agricultural resources, with the proportion of crop production dropping and cash crop growing size rising. Within the territory, the grain crops are mainly paddy rice, supplemented by sweet potato, soybean, and corn and so on. The cash crops are mainly vegetables, peanut, rapeseed, fruit and so on.

The area that the route passes through has large population but small farmland size, in particular construction of railroad and G23 as well as the construction (innovation) of local roads have already taken up a large quantity of land, therefore, the farmlands are extremely precious. In the alignment of this project, full consideration has been given to farmland protection.

3.3 Assessment of current water environment

3.3.1 Investigation of current water environment

3.3.1.1 Water environment functional zoning in project region

According to 《*Surface Water Environment Functional zoning in Jiangxi Province*》, the water quality functional zoning of related river sections of rivers crossed by the proposed highway is shown in Table 3.3.1.1-1. The water use function of Dongfeng reservoir, Jiuling reservoir, Maqimian reservoir and Niugutang reservoir is for agricultural irrigation and fishery, so their water quality functional zoning is not identified.

Tavle 3.3.1.1-1 Water functional zoning of related rivers along the proposed highway

No	Water body		Engineering form	Water quality functional zoning			
				Current use	Current water quality class	Planned main function	Water quality goal
1	Jiubao River	Upstream Xijiang River	Overcrossed by Jiubao River bridge in K32+470	—	—	—	—
2	Xijiang River	Tributary of Gongjiang River	Overcrossed by Xijiang River bridge in K39+150, Xijiang service area in K38+500	—	—	—	—
3	Dongfeng reservoir		Overcrossed by Dongfeng reservoir bridge in K51+710	For agricultural irrigation	—	—	—

No	Water body		Engineering form	Water quality functional zoning			
				Current use	Current water quality class	Planned main function	Water quality goal
4	Gongshui River	Gongjiang River	Overcrossed by Shangba Gongshui River viaduct in K63+025	For landscape and agriculture	III	For landscape and entertainment	III
5	Jiuling reservoir		Overcrossed by Jiuling reservoir bridge in K66+735	For agricultural irrigation	—	—	—
6	Maqimian reservoir		Overcrossed by Maqimian viaduct in K85+593	For agricultural irrigation	—	—	—
7	Shangxi River	Tributary of Gongjiang River	Overcrossed by Miaobei viaduct in K94+315	—	—	—	—
8	Gongjiang River		Overcrossed by Gaotan Gongjiang River bridge in K100+424, Yudu service area in K98+900	For industry and agriculture	III	For industry	IV
9	Gongjiang River		Overcrossed by Jiaolin Gongjiang River super-large bridge in K114+940	For landscape and agriculture	III	For landscape and entertainment	III
10	Niugutang reservoir		Overcrossed by Niugutang reservoir viaduct in K115+680	For agricultural irrigation	—	—	—
11	Gongjiang River		Overcrossed by Chenwu Gongjiang River bridge in K119+220	For landscape and agriculture	III	For landscape and entertainment	III
12	Ganjiang River		Ganjiang River super-large bridge in K135+491	For industry	III	For industry	IV

3.3.1.2 Relation between drinking water source along the route and the road location

The drinking water for Ruijin urban district comes from Nanhua reservoir located in Zetan Township in the south of the city, with a water catchment size of 152km^2 and the intake 3km from the south of the city, but the proposed highway will pass in the north of the city. Chenshi reservoir water is planned for drinking which is located within Rentian Township about 10km from Ridong reservoir in the north of the city, which is about 3km from the north of the proposed highway.

Huichang County town is 30km from the south of the proposed highway; the county town's drinking water source is more than 30km away from the proposed project.

Yudu County town is located in Gongjiang Township, the inhabitants drink the water from Gongjiang River, the water source intake is near a former noise elimination equipment plant on the north bank of Gongjiang River, which is about 20km downstream from the bridge site of the recommended scheme. The planned drinking water intake points in Gongjiang Township are: one is in 100m upstream Gutian railway bridge site (Meijiang River); one is in 500m downstream Changzheng bridge site in Gongjiang River. The planned two intake sites are more than 20km away from the Gongjiang River bridge site of the proposed highway.

People in Ganxian County town drink the water from Ganjiang River with the intake near Maodian. It is stipulated that from 1km upstream the intake to 200m downstream the intake is a class Ⅰ protectorate; from the convergence place between Gongjiang River and Taojiang River to 1km upstream the intake is a class Ⅱ protectorate. The intake is approximately 18km upstream from the proposed Ganjiang River super-large bridge.

People in Zhanggong District and Nankang city drink the water from Zhangjiang River; the proposed highway does not cross Zhangjiang River.

While people in the above cities drink river water, people living along the proposed highway mostly drink underground water.

3.3.2 Monitoring of current water quality

On May 2005, according to the route alignment proposed in the feasibility study documents, we conducted a water quality monitoring on representative water bodies that the route overpasses. After the route alignment was adjusted in design document, the locations of some river-crossing bridges have changed, so on October 2005, according to the route alignment proposed in the preliminary design documents, we conducted a supplementary water quality monitoring on representative water bodies that the route overpasses.

For some monitoring points identified in the feasibility study documents, in the preliminary design documents, there are some changes in the names of river-crossing bridges, but their locations of crossing the rivers do not change. In the preliminary design documents, the Jiaolin Gongjiang River super-large bridge and Ganjiang River super-large bridge correspond to the Xiaba Gongjiang River super-large bridge and Xizhou Ganjiang River super-large bridge in the feasibility study documents, here the names of monitoring points are unified to the names in the preliminary design documents.

In addition, the Shangba Gongshui River viaduct in the preliminary design documents is in 2.3km downstream Yangkou Gongjiang River super-large bridge site in the feasibility study documents. Because water quality in this river section does not change much, so the original water quality monitoring data is used.

⑴ Monitoring point laying-out

Sampling point layout：

① Monitoring point on May 2005: in 200m downstream Shangba Gongshui River viaduct site（K63+025）, in 200m downstream Jiaolin Gongjiang River super-large bridge site（K114+940）and in 200m downstream Ganjiang River super-large bridge site（K135+491）, to set up a water quality monitoring cross-section respectively.

② Monitoring point on October 2005: in 200m downstream Miaobei viaduct crossing Xijiang River site（K39+150）, in 200m downstream Shangxi River bridge site（K94+315）and Dongfeng reservoir bridge site（K51+710）.

Sample line-dropping：In each cross-section of Shangba Gongshui River viaduct and Jiaolin Gongjiang River super-large bridge, to set up three sampling perpendicular lines each; in each cross-section of Ganjiang River super-large bridge, to set up 5 sampling perpendicular lines. In the cross-sections of Xijiang River bridge, Shangxi River bridge and Mianjiang River bridge, to respectively set up one sampling perpendicular line (in place with obvious water flow) in one third distance from river bank. For Dongfeng reservoir, to set up one sampling perpendicular line in the bridge site.

Sampling water depth：When the water depth in the sampling cross-section is larger than 5m, to take a water sample from 0.5m below the water surface and from 0.5m above the river bed each; when the water depth is 1~5m, only to take a water sample from 0.5m below the water surface; when the water depth is less than 1m, the sampling point shall not be less than 0.3m from the water surface and shall not be less than 0.3m from the river bed. When the average water depth of reservoir is less than 10m, to take a water sample from 0.5m below the water surface and from no less than 0.5m above the river bed each; when the average water depth of reservoir is equal to or larger than 10m, to take a water sample each from 0.5m and 10m below the water surface and from no less than 0.5m above the river bed.

Water sample treatment：for each time, to mix water sample from each line of each sampling cross-section into one sample.

⑵ Sampling frequency

Two days in succession, one sampling each in morning and afternoon in each day.

⑶ Monitoring items and methods

Monitoring items: PH value, hypermanganate index, petroleum, and suspended substance.

The analytical methods see Table 3. 3. 2-1.

Table 3.3.2-1 List of water quality monitoring methods

No	Item	Analytical method	Standard and criteria
1	PH	Glass electrode method	GB6920－86
2	SS	Filter membrane method	GB11901—89
3	Hypermanganate index	Hypermanganate method	GB11892－89
4	Petroleum	Infrared photometric method	GB/T16488－1996

⑶ Monitored results

The monitored results of current water quality see Table 3.3.2-2.

Table 3.3.2-2 Monitored results of water quality unit: mg/L(except pH value)pH, no dimension

Monitoring site	Monitoring date	Analytical item and result			
		pH value	suspended substance	hypermanganate index	petroleum
Gongjiang River (Shangba Gongjiang River super-large bridge) K63+025	May 1 morning	7.71	6	2.0	0.04
	May 1 afternoon	7.58	10	1.8	0.04
	May 2 morning	7.55	12	2.3	0.05
	May 2 afternoon	7.46	11	2.3	0.05
Gongjiang River (Jiaolin Gongjiang River super-large bridge) K114+920	May 1 morning	7.86	15	1.5	0.03
	May 1 afternoon	7.93	12	1.7	0.03
	May 2 morning	7.50	14	2.3	0.04
	May 2 afternoon	7.72	14	2.3	0.04
Ganjiang River (Ganjiang River super-large bridge) K135+492	May 1 morning	7.21	7	2.9	0.04
	May 1 afternoon	7.46	19	3.7	0.05
	May 2 morning	7.54	10	2.4	0.05
	May 2 afternoon	7.12	15	2.5	0.04
Xijiang river (Xijiang river bridge) K39+150	Oct.11 morning	7.52	25	1.4	no detection
	Oct.11 afternoon	7.43	28	1.4	no detection
	Oct.12 morning	7.40	29	1.4	0.02
	Oct.12 afternoon	7.43	26	1.4	0.02
Shangxi river (Miaobei viaduct) K94+315	Oct.11 morning	8.40	48	3.8	0.03
	Oct.11 afternoon	8.73	43	3.9	0.04
	Oct.12 morning	8.33	49	3.6	0.06
	Oct.12 afternoon	8.46	50	3.8	0.05

Monitoring site	Monitoring date	Analytical item and result			
		pH value	suspended substance	hypermanganate index	petroleum
Doengfeng reservoir (Doengfeng reservoir bridge) K51+710	Oct.11 morning	7.74	20	1.5	no detection
	Oct.11 afternoon	7.87	25	1.5	0.02
	Oct.12 morning	7.70	21	1.6	0.02
	Oct.12 afternoon	7.88	28	1.6	0.03

3.3.3 Assessment of current water quality

(1) Assessment method

According to the "*Surface Water Environmental Quality Standard*" (GB3838-2002) issued by the State Environmental Protection Bureau and National Quality Inspection and Quarantine Bureau, water quality assessment adopts the single factor index method.

The single factor index calculates formula is:

$$P_i = \frac{C_i}{C_g}$$

in which:

P_i — single factor of pollutant i;

C_i — actually measured value of pollutant i;

C_g — assessment criterion of pollutant i.

pH value individual item water quality parameter calculation method:

$$P_i = \frac{pH_i - 7.0}{pH_b - 7.0} (pH_i \geq 7.0\text{时})$$

$$P_i = \frac{7.0 - pH_i}{7.0 - pH_b} (pH_i < 7.0\text{时})$$

in which:

pH_i — actually measured pH value

pH_b — upper and lower limits of pH value

When single factor index of water quality parameter >1, it indicates that the water quality parameter exceeds specified standard.

(2) Assessment enforcement standard

The assessment standard of the current water quality shall follow the functional zoning of river sections, except Ganjiang River super-large bridge section which applies class IV criteria of 《*Surface Water Environmental Quality Standard*》GB3838-2002(see table 1.9.1-1), other rivers all apply class III criteria, of which, the suspended substance applies the class Ⅲ standard of SL63-94《*Surface Water Resource Quality Standard*》 (see table 1.9.1-1).

(3) Assessment results

The water quality assessment results refer to Table 3.3.3-1.

Table 3.3.3-1 Current water quality assessment results unit: mg/L(except pH value)pH, no dimension

Monitoring cross-section	Monitoring item	Sampling item	Average valu	Assessment standard value	Single factor index
Gongjiang River (Shangba Gongjiang River super-large bridge) K63+025	pH value	May 1 morning	7.71	6～9	0.36
		May 1 afternoon	7.58		0.29
		May 2 morning	7.55		0.28
		May 2 afternoon	7.46		0.23
	Suspended solid	May 1 morning	6	30*	0.20
		May 1 afternoon	10		0.33
		May 2 morning	12		0.40
		May 2 afternoon	11		0.37
	Hypermanganate index	May 1 morning	2.0	6	0.33
		May 1 afternoon	1.8		0.30
		May 2 morning	2.3		0.38
		May 2 afternoon	2.3		0.38
	Petroleum	May 1 morning	0.04	0.05	0.80
		May 1 afternoon	0.04		0.80
		May 2 morning	0.05		1.00
		May 2 afternoon	0.05		1.00
Gongjiang River (Jiaolin Gongjiang River super-large bridge) K114+920	pH value	May 1 morning	7.86	6～9	0.43
		May 1 afternoon	7.93		0.47
		May 2 morning	7.50		0.25
		May 2 afternoon	7.72		0.36
	Suspended solid	May 1 morning	15	30*	0.50
		May 1 afternoon	12		0.40
		May 2 morning	14		0.47
		May 2 afternoon	14		0.47
	Hypermanganate index	May 1 morning	1.5	6	0.25
		May 1 afternoon	1.7		0.28
		May 2 morning	2.3		0.38
		May 2 afternoon	2.3		0.38
	Petroleum	May 1 morning	0.03	0.05	0.60
		May 1 afternoon	0.03		0.60
		May 2 morning	0.04		0.80
		May 2 afternoon	0.04		0.80
Ganjiang River (Ganjiang River super-large bridge) K135+492	pH value	May 1 morning	7.21	6～9	0.11
		May 1 afternoon	7.46		0.23
		May 2 morning	7.54		0.27
		May 2 afternoon	7.12		0.06
	Suspended solid	May 1 morning	7	30*	0.23
		May 1 afternoon	19		0.63
		May 2 morning	10		0.33
		May 2 afternoon	15		0.50
	Hypermanganate Index	May 1 morning	2.9	10	0.29
		May 1 afternoon	3.7		0.37
		May 2 morning	2.4		0.24
		May 2 afternoon	2.5		0.25
	Petroleum	May 1 morning	0.04	0.5	0.08
		May 1 afternoon	0.05		0.10
		May 2 morning	0.05		0.10
		May 2 afternoon	0.04		0.08

Monitoring cross-section	Monitoring item	Sampling item	Average valu	Assessment standard value	Single factor index
Xijiang river (Xijiang river bridge) K39+150	pH value	Oct.11 morning	7.52	6～9	0.26
		Oct.11 afternoon	7.43		0.215
		Oct.12 morning	7.40		0.2
		Oct.12 afternoon	7.43		0.215
	Suspended solid	Oct.11 morning	25	30*	0.83
		Oct.11 afternoon	28		0.93
		Oct.12 morning	29		0.97
		Oct.12 afternoon	26		0.87
	Hypermanganate Index	Oct.11 morning	1.4	6	0.23
		Oct.11 afternoon	1.4		0.23
		Oct.12 morning	1.4		0.23
		Oct.12 afternoon	1.4		0.23
	Petroleum	Oct.11 morning	no detection	0.05	—
		Oct.11 afternoon	no detection		—
		Oct.12 morning	0.02		0.4
		Oct.12 afternoon	0.02		0.4
Shangxi river (Miaobei viaduct) K94+315	pH value	Oct.11 morning	8.40	6～9	0.7
		Oct.11 afternoon	8.73		0.865
		Oct.12 morning	8.33		0.665
		Oct.12 afternoon	8.46		0.73
	Suspended solid	Oct.11 morning	48	30*	1.60
		Oct.11 afternoon	43		1.43
		Oct.12 morning	49		1.63
		Oct.12 afternoon	50		1.67
	Hypermanganate Index	Oct.11 morning	3.8	6	0.63
		Oct.11 afternoon	3.9		0.65
		Oct.12 morning	3.6		0.60
		Oct.12 afternoon	3.8		0.63
	Petroleum	Oct.11 morning	0.03	0.05	0.60
		Oct.11 afternoon	0.04		0.80
		Oct.12 morning	0.06		1.20
		Oct.12 afternoon	0.05		1.00
Dongfeng reservoir (Dongfeng reservoir bridge) K51+710	pH value	Oct.11 morning	7.74	6～9	0.37
		Oct.11 afternoon	7.87		0.435
		Oct.12 morning	7.70		0.35
		Oct.12 afternoon	7.88		0.44
	Suspended solid	Oct.11 morning	20	30*	0.67
		Oct.11 afternoon	25		0.83
		Oct.12 morning	21		0.70
		Oct.12 afternoon	28		0.93
	Hypermanganate Index	Oct.11 morning	1.5	6	0.25
		Oct.11 afternoon	1.5		0.25
		Oct.12 morning	1.6		0.27
		Oct.12 afternoon	1.6		0.27
	Petroleum	Oct.11 morning	no detection	0.05	—
		Oct.11 afternoon	0.02		0.40
		Oct.12 morning	0.02		0.40
		Oct.12 afternoon	0.03		0.60

*Note: " * "indicates class III standard of SL63-94 "Surface Water Resource Quality Standard".*

The assessment results indicate that：the three water quality indicators, namely the pH value, hypermanganate index and petroleum in the 6 monitoring cross-sections, all meet relevant water quality functional zoning requirement; the monitored results of suspended substance in Gongjiang River, Ganjiang River, Xijiang River and Dongfeng reservoir can satisfy class Ⅲ standard of SL63-94《Surface Water Resource Quality Standard》(see table1.9.1-1), the monitored results of suspended solid in Shangxi River cannot satisfy class Ⅲ standard of SL63-94《Surface Water Resource Quality Standard》(see table1.9.1-1).

3.4 Assessment of current acoustic environment

3.4.1 Current acoustic environment and survey of sensitive locations

Within the assessment scope of the Highway, the main noise pollution sources come from traffic noise of existing roads, production and living noise from residents, of which traffic noise is the major polluting source impacting the acoustic environment along the route, but only limited to some sections with highly commercialized streets on both sides such as Yejiaoping, Aizixia, Shanshupai, Dalingkeng, Yuantangwu, Shangwangwu, Xiaxiaowu and Shiyannao along G323; and Dabeinao, etc along the provincial Yudu-Pangushan road. Within the assessment scope, there is basically no large-scale industrial and mining enterprises, thus the acoustic environment is good.

The route selection has taken into full consideration city and town planning along the route so to avoid intensive buildings, but influenced by topography, surface culture and geological condition, the route will still unavoidably influence some areas. Within the assessment scope of this project, the acoustic sensitive locations along the route refer to Table 1.8-2～1.8-7.

3.4.2 Current acoustic environment quality monitoring

This project conducted monitoring of current acoustic environment. The monitoring points of the first monitoring of current acoustic environment were laid out according to the route alignment proposed in the feasibility study on May 2005. According to the adjustment in route alignment in the preliminary design on October 2005, the second monitoring points were arranged for current acoustic environment.

⑴ Monitoring point laying-out：

On May 2005, there are 12 monitoring points for current acoustic environmental quality, of which one is for cross-sectional monitoring in National Road 323, for details see Table 3.4.2-1.

On October 2005, there are 16 monitoring points for current acoustic environmental quality, for details see Table 3.4.2-2.

⑵ Monitoring items: Each Monitoring site will monitored for L10, L50, L90, LAeq, SD value in day and night.

⑶ Monitoring frequency: Each Monitoring site is monitored for two days in daytime (06:00-22:00) and nighttime (22:00-06:00). Each acoustic environmental monitoring time is 20 minutes. 5 points for traffic noise monitoring cross-section will be monitored synchronically.

⑷ Monitoring method: "*Ambient Noise Measurement Method in Urban Area*"(GB/T14623-93).

⑸ Other requirements: Monitoring shall record at the same time the surrounding environment characteristics, main noise sources, traffic flow, etc.

⑹ Monitored results: See Table 3. 4. 2-3 ~Table 3. 4. 2-5.

Table 3.4.2-1 the List of Monitoring sites for current acoustic environmental quality(May 2005)

No	Monitoring site	Stake no.	Type of sensitive location	Monitoring site location
1	Aozixia	K38+700～K38+950	Residence	1m in front of the first row of houses close to road
2	Hezibei	About 1km from K48+30～K49+200	Monitoring cross-section(5 Monitoring sites)	G323 traffic noise attenuation cross-section
3	Bai'e	K62+300～K62+500	Residence	1m in front of the first row of houses close to road
4	Shangwan, Xiawan	K79+900～K80+000	Residence	1m in front of the first row of houses close to road
5	Dabeinao	K86+400～K86+600	Residence	1m in front of the first row of houses close to road
6	Huangnitang	K100+500～K100+800	Residence	1m in front of the first row of houses close to road
7	Sanmen primary school	K100+500～K100+800	School	1m in front of the classroom close to road
8	Xiaba	K112+050～K112+200	Residence	1m in front of the first row of houses close to road
9	Dakengkou	K122+800～K123+200	Residence	1m in front of the first row of houses close to road
10	Wansong primary school	K122+800～K123+200	School	1m in front of the classroom close to road
11	Luobian, Zhaipai	K136+700～K136+900	Residence	1m in front of the first row of houses close to road
12	Yanfenggang	K146+100～K146+200	Residence	1m in front of the first row of houses close to road

Table 3.4.2-2 the List of Monitoring sites for current acoustic environmental quality(Oct. 2005)

No	Monitoring site	Stake no.	Type of sensitive location	Monitoring site location
1	Yangwu	K31+570～K31+820	Residence	1m in front of the first row of houses close to road
2	Yanba primary school	K34+500	School	1m in front of the classroom close to road

No	Monitoring site	Stake no.	Type of sensitive location	Monitoring site location
3	Xinxiaowu	K39+740～K40+050	Residence	1m in front of the first row of houses close to road
4	Wangjiangwan	K41+650～K41+800	Residence	1m in front of the first row of houses close to road
5	Datian primary school	K42+550	School	1m in front of the classroom close to road
6	Huoxing primary school	K43+900	School	1m in front of the classroom close to road
7	Xijiang Township sanatorium	K48+500	sanatorium	1m in front of the first row of houses close to road
8	Shanbei	K49+580～K49+740	Residence	1m in front of the first row of houses close to road
9	Heliaoxia	K56+120～K57+070	Residence	1m in front of the first row of houses close to road
10	Shihuiling	K75+050～K75+570	School	1m in front of the classroom close to road
11	Pengwu	K101+980～K102+520	Residence	1m in front of the first row of houses close to road
12	Sanmen middle school	K104+010～K104+110	School	1m in front of the classroom close to road
13	Chenwu	K119+450～K119+640	Residence	1m in front of the first row of houses close to road
14	Tianxin primary school	K132+500～K132+570	School	1m in front of the classroom close to road
15	Gangbian primary school	K142+340～K142+400	School	1m in front of the classroom close to road
16	Yeshan primary school	K147+200～K147+250	School	1m in front of the classroom close to road

Table 3.4.2-3 Monitored results for current acoustic environmental quality in sensitive locations(May 2005)

No	Monitoring site	Stake no.	Date	Time	Monitoring items and factors(dB)					Main noise source
					L_{Aeq}	L_{10}	L_{50}	L_{90}	SD	
1	Aozixia	K38+700～K38+950	2005.4.28	Daytime	50.2	54.0	44.2	39.1	5.8	Life
				Nighttime	46.1	49.9	41.1	38.8	3.7	Life
			2005.4.29	Daytime	51.0	55.1	44.4	39.5	5.7	Life
				Nighttime	45.3	49.8	41.2	38.9	3.5	Life
2	Bai'e	K62+300～K62+500	2005.5.1	Daytime	45.7	49.9	41.4	38.5	4.3	Natural and life
				Nighttime	36.3	40.5	35.4	31.5	4.0	Natural
			2005.5.2	Daytime	42.1	44.9	38.9	35.9	3.7	Natural
			2005.5.3	Nighttime	35.6	39.5	34.0	30.1	3.0	Natural
3	Shangwan, Xiawan	K79+900～K80+000	2005.4.30	Daytime	40.8	42.1	40.2	39.0	1.5	Life
				Nighttime	39.9	41.0	39.3	38.2	1.1	Life
			2005.5.1	Daytime	41.6	42.8	41.1	40.0	1.3	Life
				Nighttime	40.0	43.2	35.3	30.1	5.3	Life
4	Dabeinao	K86+400～K86+600	2005.4.28	Daytime	56.2	57.8	55.0	45.6	5.2	Traffic and life
				Nighttime	45.4	52.5	42.4	42.0	2.9	Traffic and life
			2005.4.29	Daytime	55.6	60.0	51.7	50.4	3.7	Traffic and life
				Nighttime	44.1	44.9	42.0	39.2	2.6	Traffic and life
5	Huangnitang	K100+500～K100+800	2005.4.27	Daytime	49.3	52.5	46.1	45.0	3.3	Traffic and life
				Nighttime	48.6	52.4	41.6	40.3	3.5	Traffic and life
			2005.4.28	Daytime	46.8	48.1	43.9	40.7	3.2	Traffic and life
				Nighttime	41.3	43.5	39.7	37.2	1.9	Traffic and life

No	Monitoring site	Stake no.	Date	Time	Monitoring items and factors(dB)					Main noise source
					L_{Aeq}	L_{10}	L_{50}	L_{90}	SD	
6	Sanmen primary school	K100+500～K100+800	2005.4.27	Daytime	55.9	59.8	49.8	45.0	6.2	Traffic and life
				Nighttime	46.3	56.5	43.7	39.9	6.5	Traffic and life
			2005.4.28	Daytime	57.1	60.2	55.6	52.3	2.9	Traffic and life
				Nighttime	47.2	58.4	44.5	40.1	5.9	Traffic and life
7	Xiaba	K112+050～K112+200	2005.5.1	Daytime	43.8	44.6	39.0	34.3	4.2	Natural and life
			2005.5.2	Nighttime	34.2	38.1	33.0	30.4	2.7	Natural
			2005.5.2	Daytime	38.2	40.1	34.4	33.1	3.3	Natural
			2005.5.3	Nighttime	34.8	39.2	33.5	30.5	2.8	Natural
8	Dakengkou	K122+800～K123+200	2005.4.26	Daytime	45.1	47.2	44.3	42.0	2.1	Life
				Nighttime	44.8	50.3	38.8	37.9	10.1	Life
			2005.4.27	Daytime	43.5	46.2	42.7	41.9	2.3	Life
				Nighttime	40.3	43.1	39.8	39.3	1.1	Life
9	Wansong primary school	K122+800～K123+200	2005.4.26	Daytime	51.7	54.7	46.1	43.1	4.8	Life
				Nighttime	45.8	53.9	39.2	38.7	3.9	Life
			2005.4.27	Daytime	49.9	52.0	49.5	48.7	2.0	Life
				Nighttime	40.2	44.1	39.8	38.7	1.3	Life
10	Luobian, Zhaipai	K136+700～K136+900	2005.5.1	Daytime	51.0	41.0	38.1	49.5	5.5	Life
				Nighttime	43.1	49.9	36.6	40.8	2.5	Life noise
			2005.5.2	Daytime	51.2	46.9	38.2	49.8	5.0	Life noise
				Nighttime	40.5	42.9	39.3	49.7	3.0	Life noise
11	Yanfenggang	K146+100～K146+200	2005.5.1	Daytime	46.3	52.6	34.9	34.2	6.4	Traffic and life
				Nighttime	41.6	43.5	39.0	35.9	3.3	Traffic and life
			2005.5.2	Daytime	43.5	47.2	43.1	41.3	2.2	Traffic and life
				Nighttime	39.6	41.0	39.3	38.0	0.9	Traffic and life

Table 3.4.2-4 Monitored results for traffic noise in cross-section of G323 in Hezibei(May 2005)

Monitoring site	Monitoring time		Distance to road center line(m)	Monitored noise value(dB)					Traffic volume(vehicle/hour)			
				L_{Aeq}	L_{10}	L_{50}	L_{90}	SD	Large vehicle	Median vehicle	Small vehicle	Agricultural vehicle
Hezibei About 1km from K48+300～K49+200	April 28 2005	Day	20	70.3	74.3	60.5	49.9	8.9	28	48	36	3
			40	60.3	64.0	55.5	46.2	6.5				
			60	52.7	55.0	45.4	41.3	5.5				
			80	51.1	52.9	46.1	42.9	4.2				
			120	50.2	51.5	44.3	41.7	4.3				
		Night	20	64.3	69.7	55.4	51.5	7.2	13	37	20	4
			40	62.8	68.2	52.1	50.9	6.0				
			60	57.0	64.1	51.3	47.9	7.0				
			80	52.0	53.5	51.1	47.4	5.4				
			120	50.2	52.0	49.5	45.2	4.8				
	April 29 2005	Day	20	71.0	75.1	60.9	50.3	9.0	32	44	45	4
			40	61.1	65.3	56.2	46.6	6.7				
			60	53.0	55.9	45.8	42.0	5.6				
			80	51.4	53.3	46.5	42.6	4.4				
			120	50.5	51.7	44.9	41.8	4.2				
		Night	20	64.2	69.9	55.3	52.0	7.0	14	4	18	3
			40	62.9	68.3	52.5	51.4	6.0				
			60	56.3	64.0	51.5	48.0	7.1				
			80	52.1	53.4	51.0	47.2	5.5				
			120	49.8	51.8	49.3	45.1	4.4				

Table 3.4.2-5 Monitored results for current acoustic environmental quality in sensitive locations(Oct. 2005)

No	Monitoring site	Stake no.	Date	Time	Monitoring items and factors(dB)					Main noise source
					L_{Aeq}	L_{10}	L_{50}	L_{90}	SD	
1	Yangwu	K31+570～K31+820	2005.10.1	Day	46.4	48.9	42.3	36.6	3.8	Life
				Night	38.5	42.3	33.7	30.9	4.2	Life
			2005.10.2	Day	45.1	47.9	41.7	37.1	3.6	Life
				Night	38.8	43.0	33.9	31.4	4.5	Life
2	Yanba primary school	K34+500	2005.10.1	Day	53.5	58.7	50.2	46.4	5.1	Life
				Night	38.2	41.4	34.1	31.0	3.5	Natural
			2005.10.2	Day	55.0	58.6	52.4	46.5	5.0	Life
				Night	38.1	41.2	33.6	31.1	3.4	Natural
3	Xinxiaowu	K39+740～K40+050	2005.10.1	Day	46.2	50.3	42.1	38.3	5.0	Natural
				Night	39.8	42.3	34.2	32.1	3.5	Natural
			2005.10.2	Day	49.5	53.4	46.5	40.8	5.1	Natural
				Night	39.9	42.2	35.0	32.5	3.3	Natural
4	Wangjiangwan	K41+650～K41+800	2005.10.11	Day	48.6	53.2	45.3	40.4	4.0	Life
				Night	37.8	41.6	34.1	30.0	4.2	Life
			2005.10.12	Day	47.6	55.4	45.0	40.3	4.1	Life
				Night	37.7	40.9	32.6	29.9	4.3	Life
5	Datian primary school	K42+550	2005.10.3	Day	55.7	60.1	52.2	49.8	2.8	Life
				Night	40.3	43.6	36.3	31.1	4.1	Natural
			2005.10.4	Day	56.3	62.2	53.4	48.6	2.9	Life
				Night	40.4	43.8	37.1	31.0	4.0	Natural
6	Huoxing primary school	K43+900	2005.10.3	Day	55.9	60.3	51.4	46.2	5.4	Life
				Night	39.1	42.1	33.5	31.0	3.5	Natural
			2005.10.4	Day	57.7	62.3	54.6	50.2	5.1	Life
				Night	39.3	42.4	34.0	31.1	3.3	Natural
7	Xijiang Township sanatorium	K48+500	2005.10.3	Day	55.9	60.3	51.4	45.8	4.3	Life
				Night	39.9	43.2	33.4	31.3	4.1	Natural
			2005.10.4	Day	54.6	60.0	51.2	47.5	4.9	Life
				Night	40.3	43.5	35.4	32.0	4.2	Natural
8	Shanbei	K49+580～K49+740	2005.10.5	Day	52.8	57.2	49.5	40.3	6.1	Traffic
				Night	44.8	47.2	43.9	37.8	2.9	Traffic
			2005.10.6	Day	53.3	58.8	50.1	40.5	6.0	Traffic
				Night	44.3	46.9	42.8	37.0	2.8	Traffic
9	Heliaoxia	K56+120～K57+070	2005.10.5	Day	45.7	50.2	40.5	37.3	4.7	Life
				Night	38.1	41.8	33.5	30.2	3.7	Life
			2005.10.6	Day	44.6	52.2	39.7	33.8	4.8	Life
				Night	37.7	40.6	33.0	29.8	3.8	Life
10	Shihuiling	K75+050～K75+570	2005.10.5	Day	43.6	45.2	39.8	33.5	3.8	Life
				Night	39.0	41.6	33.6	31.2	4.2	Life
			2005.10.6	Day	42.2	44.3	39.5	33.6	4.7	Life
				Night	39.1	41.7	34.0	31.4	3.9	Life
11	Pengwu	K101+980～K102+520	2005.10.7	Day	50.8	55.7	47.1	41.1	2.7	Life
				Night	40.0	41.3	36.5	34.2	2.1	Life
			2005.10.8	Day	52.2	57.1	48.8	43.5	2.5	Life
				Night	39.8	41.1	39.1	37.2	1.8	Life
12	Sanmen middle school	K104+010～K104+110	2005.10.7	Day	58.3	62.8	54.9	50.6	5.2	Traffic and life
				Night	45.2	49.8	43.1	39.7	3.7	Traffic and life
			2005.10.8	Day	57.1	60.1	53.2	50.0	2.9	Traffic and life
				Night	46.3	50.2	43.7	40.1	3.6	Traffic and life

No	Monitoring site	Stake no.	Date	Time	Monitoring items and factors(dB)					Main noise source
					L_{Aeq}	L_{10}	L_{50}	L_{90}	SD	
13	Chenwu	K119+450～K119+640	2005.10.7	Day	44.2	47.7	38.9	33.7	5.3	Life
				Night	39.7	41.4	38.8	36.0	1.3	Life
			2005.10.8	Day	46.1	50.5	44.9	40.2	2.7	Life
				Night	38.0	39.7	36.9	33.3	1.1	Life
14	Tianxin primary school	K132+500～K132+570	2005.10.7	Day	55.6	60.3	52.2	48.1	3.3	Life
				Night	38.9	40.1	36.2	33.0	2.5	Natural
			2005.10.8	Day	56.7	61.4	53.2	48.6	3.6	Life
				Night	40.2	42.9	37.7	33.5	2.8	Natural
15	Gangbian primary school	K142+340～K142+400	2005.10.9	Day	54.4	60.2	50.7	49.3	4.7	Life
				Night	39.2	42.2	37.0	32.3	3.2	Natural
			2005.10.10	Day	57.0	61.5	54.4	50.9	3.8	Life
				Night	40.5	44.1	38.8	34.0	3.6	Natural
16	Yeshan primary school	K147+200～K147+250	2005.10.9	Day	56.1	60.0	51.5	48.9	3.7	Life
				Night	40.1	42.8	37.0	33.9	2.9	Natural
			2005.10.10	Day	54.2	58.3	50.7	48.8	3.3	Life
				Night	41.2	45.3	38.2	34.0	3.6	Natural

3.4.3 Assessment of current acoustic environmental quality

The assessment results for current acoustic environment refer to Table 3.4.3-1,Table 3.4.3-2.

Table 3.4.3-1 Current acoustic environmental monitoring and assessment results(May 2005)

No	Monitoring site name (difference to the road)		Monitored noise value LeqdB(A)			Current condition	Main noise source
1	Aozixia K38+700～K38+950		Day	First time	50.2	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Life
				Second time	51		
			Night	First time	46.1		
				Second time	45.3		
2	Hezibei About 1km from K48+300～K49+200	20m	Day	First time	70.3	Satisfying class 4 acoustic quality standard(Day:70,Night:55)	Traffic
				Second time	71.0		
			Night	First time	64.3		
				Second time	64.2		
		40m	Day	First time	60.3		
				Second time	61.1		
			Night	First time	62.8		
				Second time	62.9		
		60m	Day	First time	52.7		
				Second time	53.0		
			Night	First time	57.0		
				Second time	56.3		
		80m	Day	First time	51.1	Satisfying class 4 acoustic quality standard(Day:70,Night:55)	
				Second time	51.4		
			Night	First time	52.0		
				Second time	52.1		
		120m	Day	First time	50.2	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	
				Second time	50.5		
			Night	First time	50.2		
				Second time	49.8		
3	Bai’e K62+300～K62+500		Day	First time	45.7	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life
				Second time	42.1		
			Night	First time	36.3		
				Second time	35.6		

No	Monitoring site name (difference to the road)	Monitored noise value LeqdB(A)			Current condition	Main noise source
4	Shangwan, Xiawan K79+900～K80+000	Day	First time	40.8	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life
			Second time	41.6		
		Night	First time	39.9		
			Second time	40		
5	Dabeinao K86+400～K86+600	Day	First time	56.2	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Traffic and Life
			Second time	55.6		
		Night	First time	45.4		
			Second time	44.1		
6	Huangnitang K100+500～K100+800	Day	First time	49.3	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Traffic and life
			Second time	46.8		
		Night	First time	48.6		
			Second time	41.3		
7	Sanmen primary school K100+500～K100+800	Day	First time	55.9	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Traffic and life
			Second time	57.1		
		Night	First time	46.3		
			Second time	47.2		
8	Xiaba K112+050～K112+200	Day	First time	43.8	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Natural
			Second time	38.2		
		Night	First time	34.2		
			Second time	34.8		
9	Dakengkou K122+800～K123+200	Day	First time	45.1	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life
			Second time	43.5		
		Night	First time	44.8		
			Second time	40.3		
10	Wansong primary school K122+800～K123+200	Day	First time	51.7	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Life
			Second time	49.9		
		Night	First time	45.8		
			Second time	40.2		
11	Luobian, Zhaipai K136+700～K136+900	Day	First time	51	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life
			Second time	51.2		
		Night	First time	43.1		
			Second time	40.5		
12	Yanfenggang K146+100～K146+200	Day	First time	46.3	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life and traffic
			Second time	43.5		
		Night	First time	41.6		
			Second time	39.6		

Table 3.4.3-2 Current acoustic environmental monitoring and assessment results(Oct. 2005)

No	Monitoring site name	Stake no.	Monitored noise value LeqdB(A)			Current condition	Main noise source
1	Yangwu	K31+570～K31+820	Day	First time	46.4	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life
				Second time	45.1		
			Night	First time	38.5		
				Second time	38.8		
2	Yanba primary school	K34+500	Day	First time	53.5	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life
				Second time	55.0		
			Night	First time	38.2		
				Second time	38.1		
3	Xinxiaowu	K39+740～K40+050	Day	First time	46.2	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Natural
				Second time	49.5		
			Night	First time	39.8		
				Second time	39.9		
4	Wangjiangwan	K41+650～K41+800	Day	First time	48.6	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life
				Second time	47.6		
			Night	First time	37.8		
				Second time	37.7		
5	Datian primary school	K42+550	Day	First time	55.7	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Life
				Second time	56.3		
			Night	First time	40.3		
				Second time	40.4		

No	Monitoring site name	Stake no.	Monitored noise value LeqdB(A)			Current condition	Main noise source
6	Huoxing primary school	K43+900	Day	First time	55.9	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Life
				Second time	57.7		
			Night	First time	39.1		
				Second time	39.3		
7	Xijiang Township sanatorium	K48+500	Day	First time	55.9	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Life
				Second time	54.6		
			Night	First time	39.9		
				Second time	40.3		
8	Shanbei	K49+580～K49+740	Day	First time	52.8	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Traffic
				Second time	53.3		
			Night	First time	44.8		
				Second time	44.3		
9	Heliaoxia	K56+120～K57+070	Day	First time	45.7	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life
				Second time	44.6		
			Night	First time	38.1		
				Second time	37.7		
10	Shihuiling	K75+050～K75+570	Day	First time	43.6	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life
				Second time	42.2		
			Night	First time	39.0		
				Second time	39.1		
11	Pengwu	K101+980～K102+520	Day	First time	50.8	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life
				Second time	52.2		
			Night	First time	40.0		
				Second time	39.8		
12	Sanmen middle school	K104+010～K104+110	Day	First time	58.3	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Traffic and life
				Second time	57.1		
			Night	First time	45.2		
				Second time	46.3		
13	Chenwu	K119+450～K119+640	Day	First time	44.2	Satisfying class 1 acoustic quality standard(Day:55,Night:45)	Life
				Second time	46.1		
			Night	First time	39.7		
				Second time	38.0		
14	Tianxin primary school	K132+500～K132+570	Day	First time	55.6	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Life
				Second time	56.7		
			Night	First time	38.9		
				Second time	40.2		
15	Gangbian primary school	K142+340～K142+400	Day	First time	54.4	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Life
				Second time	57.0		
			Night	First time	39.2		
				Second time	40.5		
16	Yeshan primary school	K147+200～K147+250	Day	First time	56.1	Satisfying class 2 acoustic quality standard(Day:60,Night:50)	Life
				Second time	54.2		
			Night	First time	40.1		
				Second time	41.2		

It can be seen that the acoustic environment in the corridor along the proposed highway is mainly subject to life noise and traffic noise in existing roads (national roads and village roads). The acoustic environmental quality in common villages can meet class II criteria of 《*Ambient Noise Standard in Urban Area*》（60dB in daytime and 50dB at nighttime）, some villages with better enviroenemtn can meet class I criteria （55dB in daytime and 45dB at nighttime）. The acoustic environmental quality in schools and sanatoriums can meet class II criteria of《*Ambient Noise Standard in Urban*

Area》(60dB in daytime and 50dB at nighttime). Except Yanba primary school, all other schools can not meet class I criteria（55dB in daytime and 45dB at nighttime）.

Traffic noise monitoring results on national road 323 indicate that its daily traffic volume is 174～189 vehicles/h and the acoustic environmental quality 120m away from the road can meet class II criteria and the acoustic environmental quality 120m within the road can meet class IV criteria.

3.5 Assessment of current ambient air

3.5.1 Status-quo investigation

The proposed highway runs mostly in the countryside and field, the ambient air quality in the open field keeps its natural state. Within the assessment scope, there is no large-scale pollution source with the existing pollutant mainly being automobile tail gas, secondary flying dust, carbon monoxide and total suspended particles produced from human life and production, etc. but the emission is relatively small. The route selection has taken into full consideration city and town planning along the route so to avoid intensive buildings, but influenced by topography, surface culture and geological condition, the route will still unavoidably influence some areas. The ambient air sensitive locations along the recommended route proposal refer to Table 1.8-2～1.8-6.

3.5.2 Status-quo monitoring

(1) Monitoring items：TSP, NO_2

(2) Monitoring site: The monitoring points for ambient air are selected according to the route alignment proposed in the feasibility study documents, compared to the route alignment proposed in the preliminary design documents, basically there is no variation in the two point locations, only there is some minor adjustment which exceeds the route by 200m(not within the assessment scope). The Monitoring site layout sees Table 3.5.2-1.

Table 3.5.2-1 Monitoring sites for current ambient air quality

No	Name of monitoring point	Stake no.	Relation to current route alignment	Type of sensitive location
1	Shangwan and Xiawan	K136+700～K136+900	About 500m	Residence
2	Luobian and Zhaipai	K79+900～K80+000	About 400m	Residence

(3) Time, frequency: Monitoring for 5 days in succession, of which NO_2 daily

average value is monitored for 24 hours every day to guarantees data valid for 18 hours; TSP is monitored once every day with sampling time no less than 12 hours each time.

(4) Sampling and analytical method: monitoring shall be carried out according to relevant regulations of "*Technical Specification of Environmental Monitoring*", "*Standard Manual of Atmospheric Environment Analytical Method*" and "*Air and Waste Gas Monitoring Analytical Method*" issued by National Environmental Protection Bureau, during monitoring, such meteorological conditions as temperature, atmospheric pressure, wind direction, wind speed, etc., will be recorded at the same time. See Table 3.5.2-2.

(5) The status-quo monitoring results see Table 3.5.2-3.

Table 3.5.2-2 Air pollutant monitoring and analytical methods

Monitoring items	Analytical method	Analytical instrument	Sampling instrument	Standard and specification
TSP	Weight method	TD12 analytical balance	TH-1000C11 TSP sampler	GB9802-86
NO_2	Naphthylamine diaminoethane spectrophotometry	722 spectrophotometer	TH-3000A air automatic sampler	GB/T15435-1995

Table 3.5.2-3 Ambient air quality monitored results unit：mg/m³

Monitoring position	Stake no.	Statistics index	NO_2		TSP
			Hourly average	Daily average	Daily average
Shangwan, Xiawan	K136+700～K136+900	Monitored value scope(mg/m^3)	0.003～0.090	0.012～0.016	0.03～0.03
Luobian, Zhaipai	K79+900～K80+000	Monitored value scope(mg/m^3)	0.003～0.018	0.005～0.006	0.05～0.07

3.5.3 Status-quo assessment

(1) Assessment method

Current ambient air quality assessment adopts single factor index method, the single factor calculation formula for each pollutant is:

$$P_i = \frac{C_i}{S_i}$$

in which：

i — a certain pollutant;

P_i — single factor of pollutant I;

C_i — actually measured value for pollutant,mg/m^3;

S_i — assessment criterion for pollutant i,mg/m^3.

(2) Assessment enforcement standard

TSP, NO_2 in the ambient air adopt corresponding environmental standards of the monitoring district, according to relevant regulations in "*Ambient Air Quality Standard*" (GB3095-96), class Ⅱ district standard is applied.

⑶ Assessment results

The assessment results refer to Table 3.5.3-1.

Table 3.5.3-1 Single factor index for ambient air pollutants

Monitoring position	Stake no.	Statistics index	NO_2		TSP
		Standard value (mg/l)	Hourly average	Daily average	Daily average
			0.24	0.12	0.30
Shangwan, Xiawan	K136+700～K136+900	Standard excess rate(%)	0	0	0
		standard index(P_i)	0.05	0.11	0.10
Shangwan, Xiawan	K79+900～K80+000	Standard excess rate(%)	0	0	0
		standard index(P_i)	0.03	0.05	0.20

Table 3.5.3-1 indicates that in the two sensitive locations, each concentration index for ambient air assessment does not exceed standard with the pollutant standard index less than 1, thus complying with the enforced environmental standard and with 100% standard satisfaction. According to the assessment principle of substituting point with line, the ambient air quality within the assessment scope is relatively good.

3.6 Assessment of current social environment

3.6.1 Names of counties and townships that the proposed highway runs through

The townships that the recommended alignment runs through are：Yunshishan Township of Ruijin City, Xijiang Township, Xiaomi Township, Bai'e Township and Zhuangkou Township of Huichang County, Huanglin Township, Hefeng Township, Licun Township, Xinbei Township, Luojiang Township and Luo'ao Township of Yudu, Jiangkou Township and Maodian Township of Ganxian, Shuidong Township, Shuixi Township, Hubian Township and Panlong Township of Zhanggong District.

3.6.2 Overall description of social economic environment in the project influenced region

3.6.2.1 Ganzhou Prefecture

⑴ Overview

Ganzhou Prefecture governs 1 district, 2 cities and 15 counties; it is Jiangxi Province's biggest management area. Ganzhou Prefecture borders Sanyang City and Longyan prefecture of Fujian Province in the east, meets Meizhou City, Heyuan City and Shaoguan City of Guangdong Province in the south, links with Chenzhou prefecture of Hunan province in the west, and borders Ji'an and Fuzhou of this province in the north. It is an important transition zone connecting the inland to the southeast coastal areas, historically well known as “the throat of five mountain ranges and of Jianxi, Fujian, Guangdong and Hunan”.

The whole prefecture’s landform is primarily dominated by hilly and mountainous regions, with basins dotted. The whole prefecture’s land size accounts for 23.5% of the total in the whole province. Within the territory distributed with extending mountains and criss-crossed rivers, the topography is high in the periphery and low in the middle, and the south side is higher than north side with average elevation about 500 meters. Ganjiang River is the biggest river within the boundary with its catchment size of $3.43\times10^4 km^2$.

The underground mineral resources in Ganzhou are abundant; the solid mineral products that have already been verified now are up to 64 kinds, particularly mostly nonferrous metals and rare metal, renowned as "world tungsten mine" and "kingdom of rare metals".

⑵ Development status of national economy

① Total national economy output and industrial structure

In 2003, Ganzhou Prefecture achieved a gross domestic product of 34,506 million yuan, increased by 12.5% compared with that of last year, the acceleration rate improves by 1.9 percentage points compared with that of last year, creating a new peak since 1997. Per capita gross domestic product reached 4293 yuan, 4.8 times of that of 1990. In 2003, Ganzhou’s primary, secondary and tertiary industries maintained a stable and coordinated development with the total outputs of primary, secondary and tertiary industries of 10,065,190,000 yuan, 11,271,020,000 yuan and 13,169,740,000 yuan respectively, the industrial structure has been realized a great adjustment transforming from "three, two, one" into "three, one, two", the three-industry structure changes from 31.4: 30.5: 38.1 of last year into 29.2: 32.7: 38.1.

② Industry

In 2003, the whole prefecture’s above-the-scale industrial enterprises produced a total output above 10 billion yuan, achieving 11.541 billion yuan, increased by 27.3% compared to the last year, of which local industry output value was 9.672 billion yuan, increased by 32.2%. The industrial enterprises realized an added value of 3.067 billion yuan, increased by 23.8% compared to the last year, of which local industry realized an added value of 2.329 billion yuan, increased by 29.3%.

③ Agriculture

Since *the Eighth Five-Year Plan Period*, the whole prefecture has forcefully developed the "Three Highs" agriculture, promoted the agricultural industrialization process, developed traditional resources of agriculture with great effort, and fostered new economic growth sectors, attaining remarkable achievements. The prefecture realized an agricultural gross output value of 15,431,960,000 yuan in 2003, increased by 3.11% compared with that of last year.

④ Commerce and trade

Ganzhou City's economic form is transformed from "closed type" into "open-type", the city has established a commercial system of diversified economies, diversified management forms, diversified circulation channels, and diversified managements, has developed a number of specialized and comprehensive fairs, urban commercial centers, initially forming a commerce and trade market network centering on cities. In 2003, the whole city's total retail sales of social consumables amounted to 12.014 billion yuan, increased by 10.87%; the total import and export value amounted to 231.37 million US dollars, of which the total export value was 130.85 million US dollars, the total import value was 100.52 million US dollars. Contract foreign capital introduced was 515.75 million US dollars; foreign capital actually used was 476.26 million US dollars.

⑤ People's life

The living standard of urban and rural inhabitants is increasing steadily, the food and shelter problem of majority of people has basically been solved, part of people have approached the better-off level, and some people become wealthy. In 2003 the savings deposit of urban and rural inhabitants in the whole city amounted to 26.859 billion yuan with per capita annual disposable income of urban inhabitant amounting to 6,723 yuan and per capita annual net income of rural inhabitant amounting to 2,240 yuan.

3.6.2.2 Ruijin City

⑴ Overview

Ruijin is located in the southeast border region of Jiangxi Province. It is situated at the west of south Mt. Wuyi section and at the upstream Gongjiang River (a tributary to

Ganjiang River) meeting Changting county of Fujian Province in the east, neighboring Huichang County in the south, Yudu County in the west, Ningdu County in the north, and Shicheng County in the northeast, it is the place connecting Jianxi, Fujian, Guangdong Provinces, named after "digs the gold (Jin), gold is prosperity (rui)". In 1994 the Ruijin County was elevated to city, and in 1999 it was approved as a municipality in Jiangxi, governed by Ganzhou City. Currently Ruijin governs 7 towns, 10 townships, 237 village committees.

Ruijin is located between north latitude 25°30' ~ 26°20' and east longitude 115°42' ~ 116°22', belonging to the subtropical monsoon moist climatic region. Within the boundaries distributed with extending mountains and peaks, and criss-crossed rivers, containing rich natural resources, diverse biological resources and live timber reserve volume of $384.6\times10^4m^3$. There are 13 types and 26 kinds of identified mineral resources such as gold, tungsten, uranium, rare earth, coal, limestone, fluorspar, porcelain clay and so on, of which those with large reserves are mainly limestone (855 million ton), dolomite (450 million ton), fluorspar (1.93 million ton), kaoline (910,000 ton), coal (9.185million tons); within the boundaries of Yunshishan and Shazhouba, the calcium oxide content in limestone amounts to 50/60 percent, with promising prospect. The theoretical reserves of hydro-energy are 93,336 kilowatts, 40,000 kilowatts are available for power generation, and the daily production of underground water is 447,000 tons.

⑵ Development status of national economy

① Major economic indicators and industrial structure

In 2003, Ruijin achieved a gross domestic product of 2.29762 billion yuan, increased by 12.9%, of which the primary industry grows by 2.6%, the second industry grows by 25.7%, and the tertiary industry grows by 13.4%. The economic structure continued to readjust with the percentages of the primary industry, second industry and tertiary industry adjusting from 32.3: 23.6:44.1 in 2002 into 29.6: 25.8: 44.6 in 2003.

② Industry

In 2003, the gross industrial output amounted to 1.401578 billion yuan, of which the secondary industry occupies 25.8%. Pillar industries such as food, building materials, pharmacy, needle production, minerals processing have been preliminarily established with some products enjoying market influence and remarkable competitiveness such as roasted eel, machine-made needle, Jiuhua Acetate

Suppositories hemorrhoids, fluorspar fine powder, of which some products are exported overseas, becoming an important export base and foreign exchange earner in Jiangxi Province.

③ Agriculture

Ruijin is big producer of grain, cooking oil, sugar cane, tobacco, fruit, tea, vegetable, pig, cow, poultry, and fish. The specialized agriculture is prosperous and export agriculture is in the thrust. Specialized breeding, mainly eel, is developing rapidly, it is Jiangxi Province’s biggest eel breeding, processing, exporting base. The agricultural byproducts are extremely rich such as leaf tobacco, Chinese yam, ginger, water chestnut, auricularia auricula, sweet-scented osmanthus, Chinese chestnut, navel orange, green plum and so on, which enjoy special favor among consumers. The whole city’s total agricultural output value amounted to 1.09397 billion yuan in 2003, increased by 4.0% compared to the last year.

④ Commerce and trade

Possessing various kinds of specialized and comprehensive wholesaling markets of $36\times10^4m^2$, In 2003, the whole city’s total retail sales of consumables amounted to 897.37 million yuan, increased by 7.06%.

⑤ People’s life

In 2003 year end, the whole city’s savings deposit amounted to 1.71723 billion yuan, the per capita annual salary of urban employees is 8,805 yuan, the per capita annual net income of rural inhabitant amounted to 2260.78 yuan, increased by 2.27% compared to the last year.

3.6.2.3 Huichang County

⑴ Overview

Huichang County is located in the eastern part of Jiangxi Province, in the west of Mt. Wuyi and north part of Nanling mountain between east longitude 115°19′～116°02′, north latitude 25°09′～25°55′. This county adjoins to Fujian and Guangdong. Huichang County is 56km long from east to west and 85km long from north to south with low hilly area surface accounting for 80% in the county’s total size. Within the county, the percentages of mountains, waters, fields, gardens, and roads can be summarized as "80% of mountains, 5& of waters, 10% of fields, 5% of roads and 5% of orchards". The county governs 19 townships.

Huichang County is rich in natural resources, especially the minerals, forest, water power, tourism. There are 30 kinds of identified minerals, mainly salt, tin, rare earth, tantalum niobium, limestone, and fluorspar. Within the county, the potential hydro electric power resources that can be developed are 37,600 kilowatts. Chexin hot spring is well known with rich underground mineral water. The forest types are many, mainly evergreen foliage forest, coniferous and broadleaf mixed forest, coniferous forest, bamboo grove, scrub forest and oil-tea camellia forest with a size of 2.2 million mu, live timber reserves of 5.8 million cubic meters and forest coverage rate of 56%. The county is a national fast-growing forest base county, and also a Yangtze River protective forest base.

⑵ Development status of national economy

① Major economic indicators and industrial structure

In 2003, the county's GDP amounted to 1.3684 billion yuan, increased by 11.6% compared to the last year, of which the primary industry completed 554.2million yuan, increased by 2.9% compared to the last year; the second industry completed 340.73 million yuan, increased by 14.6% compared to the last year; and the tertiary industry completed 473.47 million yuan, increased by 16.0% compared to the last year. The rural economy develops steadily, the industrial structure is adjusting continually with the percentages primary industry, second industry and tertiary industry changing from 43.3: 23.9: 32.8 in 2002 into 40.5: 24.9: 34.6 in 2003.

② Industry

In 2003, all state-owned and above-the-scale non-state-owned industrial enterprises in the county completed a gross industrial output of 351.239 million yuan.

③ Agriculture

The agriculture is forming a pattern of "grow grain, sugar and tobacco in fields, plant tree, fruit and bamboo in mountains, grow fish, frog and goose in water and breed pig, partridge and rabbit in garden". In 1998 this county was named by Ministry of Agriculture as the "township of Chinese francolin" and "township of Chinese meat rabbit". The county's total agricultural output amounted to 898.24 million yuan in 2003, increased by 10.48% compared to the last year.

④ Commerce and trade

The county's commerce and trade is prosperous. In 2003, the county's total retail sales of social consumables amounted to 584.32 million yuan; contract foreign capital amounted to 15.962 million US dollars, increased by 299% compared to the last year; foreign capital actually used was 11.762 million US dollars, increased by 194% compared to the last year; foreign exchange income from export was 4.315 million US dollars, increased by 8% compared to the last year; 70 internal projects were introduced with signed fund of 964.38 million yuan, the internal fund actually introduced was 708.48 million yuan, increased by 288% compared to the last year.

⑤ People’s life

In 2003 year end, the whole county’s savings deposit amounted to 669.16 million yuan, the per capita annual salary of urban employees is 8,441 yuan, the per capita annual net income of rural inhabitant amounted to 1389.23 yuan.

3.6.2.4 Yudu County

⑴ Overview

Yudu County is located in the south Jiangxi Province, east of Ganzhou Prefecture and the middle reaches of Gongjiang River. Situating at east longitude 115°11 ' to 115°41 ' and north latitude 25°35 ' to 26°21', the county is 83.25km long from north to south and 63.33km from west to east. This county borders Ruijin, Huichang County in the east, Anyuan County in the south, Ganxian County in the west, Xingguo county and Ningdu County in the north.

Yudu County belongs to hilly and low mountain terrain surrounded by extending mountains in the periphery and the topography is higher in south, east and north, slowing down to the center and west. Its northeast is the Mt. Wuyi remaining range, its south is the Jiulian Mountain of the Nanling sierra, its northwest is the Yushan sierra. The main rivers are Gongjiang River, Meijiang River, Lianjiang River. In the soil, the red earth accounts for 67.8% in the county’s total area, paddy soil accounts for 11%. Within the boundaries underground mineral resources are rich, the discovered metallic minerals include tungsten, iron, manganese, lead, zinc, copper, rare earth and so on, a total of 28 kinds, of which tungsten ore ranks the first distributed in 7 mining area of large and medium sizes. The non-metalliferous ores include coal, talc, calcium fluoride, potassium product, and limestone, a total of 24 kinds. The county governs 14 townships, 9 towns, 355 village committees.

⑵ Development status of national economy

① Major economic indicators and industrial structure

In 2003, the county's GDP amounted to 2.38375 billion yuan, increased by 12.38% compared to the last year, of which the primary industry completed 743.36 million yuan, the second industry completed 879.84 million yuan,; and the tertiary industry completed 760.55 million yuan. The rural economy develops steadily, the industrial structure is adjusting continually with the percentages primary industry, second industry and tertiary industry changing from 43.3: 23.9: 32.8 in 2002 into 40.5: 24.9: 34.6 in 2003. The financial revenue increases greatly, in 2003 the total financial revenue was 176.62 million yuan; the local financial income amounted to 130.09 million yuan. While the economic output increases steadily, the economic structure witnessed obvious improvement. The primary industry is consolidated and strengthened, the secondary and tertiary industries develop rapidly, the percentages primary industry, second industry and tertiary industry change from 34.2: 34.5: 31.3 in 2002 to are 31.2: 36.9: 31.9 in 2003.

② Industry

The county's industry includes 8 sectors: machinery, building materials, food, and minerals and so on with the main products being gear, cement, electric motor, ammonium carbonate, drink and wine, lead zinc and so on. In 2003 the county completed a gross industrial output of 483.5 million yuan, increased by 30.39% compared to the last year. The industrial growth structure changes too with the collective industry, joint and private enterprises growing faster, while the state-owned industrial development slowing down.

③ Agriculture

The agricultural development speeds up; the count's total agricultural output amounted to 1.16919 billion yuan by 2003, increased by 5.4% compared to the last year. The structure of agriculture, forestry, husbandry and fishery witnessed tremendous change, "Three High Agriculture" and specialty agriculture are developing greatly, forming several big cultivation bases dominated by fruit production and creating new growth point for the rural economy.

④ Commerce and trade

In the whole county, commerce and trade are prosperous. In 2003, the county's total retail sales of social commodity was 937.01 million yuan, the domestic capital introduced was 1.4363 billion yuan, increased by 1.83 times compared to the same period, the foreign capital introduced was 40.79 million US dollars, increased by 2.1 times compared to the same period times. The market system is perfecting steadily with supermarkets and specialty stores emerging one after another. The commodity supply has said goodbye to the rationing time of “Buy by Ticket”, realizing a historical transformation from seller market to buyer market.

⑤ People’s life

In 2003 year end, the whole county’s savings deposit amounted to 2.04482 billion yuan, the per capita annual salary of urban employees is 8,659 yuan, the per capita annual net income of rural inhabitant amounted to 2,004 yuan.

3.6.2.5 Ganxian County

(1) Overview

Ganxian County is located in the south Jiangxi Province and upstream Ganjiang River, it was establish as a county in 6th year of the Han Dynasty, named after a sentence in “*Shanhai Jing*”: the south has the Gan giant. The county has a history of more than 2,200 years. The County governs 9 towns, 10 townships, 5 administrative districts, 279 administrative villages. Ganxian County surrounds Ganzhou urban district; the political, economical and cultural center in south Jiangxi Province-it is the "first county in great distance of Ganjiang River".

In the county, the underground metal and non-metal minerals include tungsten, copper, rare earth, bismith, tin, aluminum, cobalt, gold, fluorspar, coal, yellow iron ore, limestone and so on. The rich agricultural products and mineral resources make Ganxian County vigorously developing a large number of enterprises engaging in rare earth and food processing and establishing famous specialty products such as rare earth, tungsten, salted duck, dry fruit, dried bean curd stick etc.

Ganxian County has convenient transportation and communication, and sufficient energy supply. There are 5 main rivers such as Pingjiang, Xinjiang, Taojiang, Gongjiang, Ganjiang flow in the county territory for 200 kilometers, enter into Poyang Lake and Yangtze River to the overseas; National Roads 105 and 323 run through the county territory to reach Fuzhou and Xiamen in the east, to reach Guangzhou, Shenzhen and Zhuhai in the south, to reach Changsha in the west and to reach Nanchang in the north, all in one day’s distance; The Chinese commercial aviation large-scale airport Huangjin

Airport is only 12km from the county town; the Beijing-Kowlon Railway runs through 5 townships (town) for 48km in the county with three railway stations in this county: Ganzhou east station, Ganxian north station and Nantang stations with annual passenger transport volume of 360,000 people (times) and cargo transport volume of 300 million tons; of which Ganzhou east station is one of the biggest freight terminals in Beijing-Kowlon Railway integrating passenger transportation, freight transportation, automotive operation, grouping, it is an important cargo collection and distribution center in south China. The Gan-Long Railroad under construction will link with the Beijing-Kowlon Railway in the county, which will make Ganxian County becoming a transportation hub in southeast China. Program-controlled telephone, mobile phone, and facsimile keep Ganxian County in convenient contact with other places in the country and overseas. In the county, water resources are rich with middle and small-scale hydroelectric power stations spreading all over, which can be linked to East China electrical network through reasonable laid power transformation project. This county is a big power supplier in south Jiangxi. The water plant with daily capability of 30,000 tons provides plentiful water supply to the industry and the people.

⑵ Development status of national economy

① Major economic indicators and industrial structure

In 2003, the county's GDP amounted to 1.61379 billion yuan, increased by 11% compared to the last year, of which the primary industry grows by 1.9%, the secondary industry grows by 22.9%, and the tertiary industry grows by 15.1%. The industrial structure is adjusting continually with the percentages primary industry, second industry and tertiary industry changing from 45.6:21.8:32.6 in 2002 into 41.7:24.8:33.5 in 2003. The financial gross income was 139.61 million yuan, increased by 23.2% compared to the last year.

② Industry

In 2003, the county's gross industrial output was 689.556 million yuan, increased by 69.5% compared to the last year, the industrial added value was 149.562 million yuan. The county has formed pillar industries centering on minerals, food, and light chemistry and has constructed Hongjin and Yangtang industrial parks.

③ Agriculture

In 2003 the county realized a total agricultural output of 1.032 billion yuan, increased by 2.2% compared to the last year.

④ Commerce and trade

Commerce and trade in the county are very prosperous with the construction of Guangcai Market which occupies a land size of 400 mu and has more than 1,600 shop. At present, the market has initially formed 12 characteristics transaction areas centering on nonstaple food, clothing, and electrical appliances and so on.

⑤ People's life

In 2003 year end, the whole county's savings deposit amounted to 1.432 billion yuan, increased by 16%, the per capita annual salary of urban employees is 8,064 yuan increased by 2.2%, the per capita annual net income of rural inhabitant amounted to 1,398 yuan.

3.6.2.6 Zhanggong District

(1) Overview

Zhanggong District of Ganzhou City is located between north latitude 25°40'~25°58' and east longitude 114°46'~115°03', bordering with Ganxian County in the east, south, and north, and bordering with Nankang City in the west. It is approximately 34km long from north to south, 28km wide from east to west. In December 1998, the former county level Ganzhou City was changed into Zhanggong District, which is is the political, economical, cultural and transportation center in south Jiangxi Province. The Beijing-Kowlon Railway and National Roads 105 and 323 run through the entire boundary with convenient transportation and favorable geographical location. Presently it governs 4 representative offices and 6 towns.

Zhanggong District is situated at the middle of Xingguo-Dayu depressed basin, belonging to low-mountain and rolling terrain with the entire topography inclining from southeast and northwest to the middle in a form of horse saddle. Gongjiang River flows into the district from Ganxian County in the east and Zhangjiang River flows into the district from Nankang County in the west, which confluence in the middle of the city into the Ganjiang River. The entire district is mostly mountains and hills with the size of both accounting for 65.7% of the total, the size of plain accounting for 26.1%, and water surface accounting for 8.2%.

Zhanggong District is rich in resources. Within the area the mineral resources include tungsten, rare earth, copper, gold, silver, tin, lead, zinc, limestone, fluorspar, barite, silica. Water resources are rich, the total length of Zhangjiang, Gongjiang and Ganjiang rivers in this district is 55.7km with annual radial flow of $6.37\times10^9 m^3$, hydro-energy reserves of 5.7×10^4KW.

⑵ Development status of national economy

① Major economic indicators and industrial structure

In 2003, the whole District’s GDP amounted to 5.91058 billion yuan, increased by 10.2% compared to the last year, the District’s GDP amounted to 1.96 billion yuan, increased by 12.6% compared to the last year, of which the primary industry grows by 5.5%, the secondary industry grows by 11%, and the tertiary industry grows by 17%. The industrial structure is adjusting continually with the percentages of primary industry, second industry and tertiary industry changing from 4.8:52.15:43.05 in 2002 into 4.6:51.7:43.7 in 2003. The financial gross income was 221.73 million yuan, increased by 25.6% compared to the last year, of which local financial income was 113.36 million yuan, increased by 23.36%.

② Industry

Zhanggong District is an emerging industrial city with complete industrial sectors. In 2003, the gross industrial output of above-scale enterprises in the whole district was 3.254758 billion yuan; the industrial added value was 737.275million yuan.

③ Agriculture

In 2003 the entire district’s total agricultural output was 378 million yuan, increased by 4% compared to the same period

④ Commerce and trade

Zhanggong District is Ganzhou's commercial trade center and collection and distribution center for various kinds of commodities, with prosperous business transactions. There are existing commercial points more than 7,900, various kind of trade markets 47, of which there are 7 specialized markets with trade volume more than hundred million yuan. In 2003 the entire district’s total retail sales of social commodity was 2.678 billion yuan, the total export was 41.57 million US dollars, contracted foreign capital amount was 66.07million US dollars, actually used foreign capital amount was 54.85 million US dollars.

⑤ People’s life

In 2003 year end, the savings deposit of urban and rural inhabitants in the whole district amounted to 6.266 billion yuan increased by 14%, the per capita annual disposable income of urban inhabitant amounting to 6,723 yuan increased by 8.9%, and the per capita annual net income of rural inhabitant amounting to 2863 yuan increased by 2.2%.

3.6.3 Major economic indicators within the project influenced areas

The 2003 major national economic indicators of Ganzhou Prefecture (the proposed project region) are listed in Table 3.6.3-1 as compared to these of Jiangxi Province, the national economy and per capita indicators of the five counties (city or district) under Ganzhou Prefecture's jurisdiction are listed in Table 3.6.3-2.

Table 3.6.3-1 Percentage of Ganzhou 2003 major national economic indicators in Jiangxi Province

Indicators	Unit	Jiangxi Province	Ganzhou Prefecture	Ganzhou/Jiangxi Province (%)
Land size	10,000 km^2	16.69	3.94	23.61
Total yearend population	10,000 persons	4254.23	831.20	19.54
GDP	100 million yuan	2830.00	345.06	12.19
Total agriculture output	100 million yuan	841.63	154.32	18.34
Grain production	10,000 tons	1450.30	199.07	13.73
Tea production	10,000 tons	0.24	0.04	16.67
Fruit production	10,000 tons	77.77	34.56	44.44
Aquatic production	10,000 tons	146.06	17.50	11.98
Fixed asset investment	100 million yuan	1379.97	155.49	11.27
Total retail sales of social consumables	100 million yuan	923.21	120.14	13.01
Total financial avenue	100 million yuan	285.80	31.40	10.99
University students	10,000 persons	36.43	3.59	9.85
High school students	10,000 persons	301.06	56.12	18.64
Medical personnel	persons	117755	15088	12.81
#doctors	persons	49289	8498	17.24
Patient bed number	10,000 beds	8.55	1.25	14.62
Average employee's salary	yuan/person·year	10521	9312	—

Table 3.6.3-2 2003 national economy and per capita indicators of project regions

Indicators \ Area	Ganzhou	Ruijin	Huichang	Yudu	Ganxian	Zhanggong
Land size (km^2)	39379.64	2447.98	2722.18	2893.09	2993.09	478.78
Total yearend population (person)	8311991	601265	433917	902351	556706	546017
Population density(person/km^2)	211	246	159	312	186	1140
Per capita farmland(mu)	0.53	0.54	0.57	0.47	0.57	0.13
GDP(10,000 yuan)	3450600	229762	136840	238375	161379	591058
Per capita GDP(yuan)	4293	3952	3261	2732	2998	11194
Percentages of primary industry, second industry and tertiary industry(%)	31.4:30.5:38.1	29.3:24.8:45.9	40.5:24.9:34.6	31.2:36.9:31.9	41.7:24.8:33.5	4.6:51.7:43.7
Per capita industrial output(yuan)	1388	2331	810	660		
Per capita agricultural output(yuan)	1857	1819	2070	1296	1860	694
Rural labor percentage in rural population(%)	52.9	49.2	56.2	47.3	53.6	53.9
Per capita grain cultivation size(mu)	0.8	0.8	0.9	0.7	0.9	0.2
Grain unit cultivation size and output(kg/mu)	317.7	301.8	335.7	281.3	302.8	322.1
Per capita grain production(kg)	239.5	229.5	298.6	185.2	280.0	48.7
Per capita tee and fruit orchard size(mu)	0.11	0.08	0.13	0.08	0.07	0.02
Per capita forestland size(mu)	5.42	4.57	7.54	3.46	6.18	0.67
Forest coverage rate(%)	74.4	72.3	79.2	70.5	75.1	51.0
Per capita breeding size(mu)	1.07	0.94	0.89	0.69	1.11	0.23
Per capita aquatic output(kg)	21.1	20.3	22.7	17.7	17.7	8.3
Per capita fixed asset investment(yuan)	1621	681	458	856	870	3647
Per capita total retail sales of social consumables(yuan)	1445	1492	1347	1038	959	4904
Per capita financial revenue *(yuan)	237	191	150	144	178	208
Per capita savings deposit of urban and rural inhabitants(yuan)	378	263	207	196	251	406
Average employee's salary(yuan)	9312	8805	8441	8659	8064	13710
Average per capita income for rural families(yuan)	2240	2261	1389	1475	1398	2864
Average housing size for rural families(m^2)	116.5	116.4	93.2	124.7	105.2	134.3
High school teacher number per 10,000 persons(person/10,000 persons)	35.3	37.0	33.6	30.5	31.3	30.9
Medical personnel number per 10,000 persons(person/10,000 persons)	22.5	11.6	10.6	14.0		
Patient bed number per 10,000 persons(bed/10,000 yuan)	15.1	7.5	8.2	11.5		

note：source from——2003Ganzhou and related counties' statistical annals.

Analyzing Table 3.6.3-1 and 3.6.3-2 for the current national economic development in the areas of the proposed highway, the following conclusion can be drawn:

⑴ Since the reform and open policy and in particular in recent years, the project region Ganzhou Prefecture and its governed Ruijin, Huichang, Yudu, Ganxian, Zhanggong (5 counties, city, district) witnessed big development in national economy and society. But still its economic output and the overall strength could not attain Jiangxi Province’s average level. In 2003, Ganzhou Prefecture's percentages of GDP, total agricultural output, grain, tea, aquatic product output, fixed asset investment, total retail sales for social consumables, gross financial income, college and middle school student number, medical personnel number, hospital bed number and average employee’s wage in Jiangxi provincial total are all smaller than those of its land size and year end total population in Jiangxi provincial total. The project region is an underdeveloped area in Chinese economy, people are not well-off.

⑵ Among the above 5 counties (city, district), except Zhanggong District, the other 4 counties (city)’s national economic per capita indicators such as GDP, per capital GDP, total agricultural output, financial revenue, and fixed asset investment, could not achieve Ganzhou Prefecture’s average level at present. Its agricultural economy occupies a greater proportion in the national economy while the industrial output is small, and the tertiary industry is also underdeveloped. In general, the economic foundation is weak; the economic strength is weak too. According to 2003 national economy and per capita major indicators, Zhanggong District ranks the first, followed by Ruijin City, Ganxian, Huichang County, and Yudu County.

⑶ The project regions’ agricultural production is characterized by sufficient labor force, small per capita farming land size, large per capita forestland size, tea orchard size, and breeding size. In 2003 Ganzhou Prefecture’s average per capita grain output and aquatic product output are 239.5kg and 21.1kg respectively. In 2003 among the 5 counties (city, district), except Huichang County, the average per capita grain output and aquatic product output of the other 4 counties cannot achieve Ganzhou Prefecture’s average per capita level.

⑷ Among the 5 counties (city, district), the people’s live standard and overall quality could not achieve Ganzhou Prefecture’s average level. Except Zhanggong

District, the other 4 counties (city)'s average employee's wage, farmer's average net income, per capita annual disposable income of urban inhabitant, High school teacher number per 10,000 persons, Medical personnel number per 10,000 persons, hospital bed number and total retail sales for social consumables and so on, are all lower than Ganzhou Prefecture's average level at present.

3.6.4 Road transportation characteristics and road infrastructure within project influenced areas

3.6.4.1 Road transportation characteristics within project influenced areas

Xiamen-Chengdu Expressway runs through the Jiangxi Province from east to west, which connects the economically developed Guangdong Province, the Yangtze River delta area as well as Fujian, Jianxi, Hunan, Guangxi, Guizhou, and Sichuan provinces. This road is not only one of Jiangxi Province's most important transportation trunkways, but also an important economical trunkway for speeding up the development and opening of Jiangxi, especially the south Jiangxi revolutionary area. It has the following characteristics: ⑴ historically-formed convenient channel; ⑵ dominated by freight transportation; ⑶ large percentage of heavy load vehicles; ⑷ large through-traffic volume.

To sum up, Xiamen-Chengdu Expressway is playing an extremely vital role in transportation, not only undertaking local massive transportation flow and serving for economical development along the route, but also undertaking the massive through traffic flow, thus is playing a vital role of "linking the ups and downs, connecting east with west".

3.6.4.2 Current technical conditions of relevant roads and existing problems

⑴ Current technical conditions of relevant roads

① National Road 319

National Road 319 within the territory of Jiangxi has two classes; its section within Ruijin is a part of Nanchang-Xiamen Road. Presently the Ruijin section of Nanchang-Xiamen Road is a class 2 road with subgrade width of 12m, pavement width of 9m and the pavement is cement concrete.

According to the statistical data from National Road 319 Lucaohu observation station (about 6km away from Ruijin City), the 2003 mixed traffic volume of this road section was 6,993 vehicles/day. At present, this road section maintains a good condition, but the section approaching Ruijin urban district has been commercialized seriously, exerting big influence on traffic capability.

② National Road 206

A south-north direction road, National Road 206 within the territory of Jiangxi is class Ⅱ and Ⅲ road, its Ruijin-Huichang section has been innovated into a class Ⅱ road with subgrade width of 12m, pavement width of 9m and the pavement is cement concrete.

According to the statistical data from National Road 206 Yunji observation station and Wuyang observation station, the 2003 mixed traffic volume of National Road 206 Ruijin section was 3,000 vehicles/day, which reduces slightly compared to past. The main reason was that in 2003 this road was under transformation and innovation, some traffic volume shifted to other roads.

③ National Road 323

National Road 323 is an east-west road basically parallel to the proposed highway in alignment, its technical grade is class Ⅱ with subgrade width of 12m, pavement width of 9m and the pavement is cement concrete.

According to the statistical data from National Road 323's observation stations in Ruijin Chaotian, Huichang Shanshupai, Ganxian Jiangkou and Meilin, the 2003 mixed traffic volume of National Road 323 Ruijin-Ganzhou section was 8826 vehicles/day, of which the 2003 mixed traffic volume of Ganxian Meilin section was 15257 vehicles/day. The existing road cannot meet the traffic volume demand which grows day by day.

④ National Road 105

National Road 105 is a south-north road, its Suichuan-Nankang section is class Ⅱ road with subgrade width of 12m and concrete pavement width of 9m.According to statistical data from National Road 105 Ganxian Shadi observation station, the 2003 mixed traffic volume in this road section was 9,620 vehicles/day. At present, this road section maintains a good condition, but the section approaching Ruijin urban district has been commercialized seriously, exerting big influence on traffic capability.

⑤ Related provincial roads

There are many provincial roads related to this project, mainly S229, S224, S223, S339 and so on. These provincial roads are mostly class Ⅲ and Ⅳ with bituminous or concrete pavement. At present most of these roads are in bad conditions, some are planning to innovate or under innovation now.

(2) Problems of existing roads

The road commercialized mileage increases year by year. Along with economic development, the road commercialized mileage of existing national roads increases every year, seriously affecting national road transportation and traffic safety. Along the routes there is dense population with large volume of mixed traffic and the vehicles move very slowly, especially during the transportation period for spring festival, traffic jams are very common.

The crowdedness increases and the service level drops. According to the statistical data from National Road 323's observation stations in Ruijin Chaotian, Huichang Shanshupai, Ganxian Jiangkou and Meilin, the 2003 mixed traffic volume of National Road 323 Ruijin-Ganzhou section was 8826 vehicles/day, of which the 2003 mixed traffic volume of Ganxian~Meilin section was 15257 vehicles per day. The existing road cannot meet the traffic volume demand which grows day by day.

Traffic accident is frequent. As a result of commercialized mileage increase, the township that the road passes by has dense population, leading to frequent traffic accidents and large property damage.

The whole line of Xiamen-Chengdu Expressway in the Jiangxi Provincial road network has not designed yet, and the whole trunkway network has not been formed yet. Classified roads occupy a small proportion in the total traffic mileage. The traffic volumes of main trunkways are saturated; some road sections experience vehicle congestion many times than the standard, leading to frequent traffic jams, which, on the other hand, result in frequent traffic accidents on these trunkways and heavy economic loss. The road infrastructure in some impoverished areas is very backward with very low road density and grade, far from adapting to daily growth of social economy.

3.6.5 Land resource utilization in project regions

3.6.5.1 Farmland size variation in project regions

The farmland size variation in project regions is shown in Table 3.6.5.1-1~3.6.5.1-3. Table 3.6.5.1-1 lists the year-end farmland sizes and per capita sizes of Ganzhou City in each characteristics year from 1949 to 2003. Table 3.6.5.1-2 and 3.6.5.1-3 list the farmland variations in recent years of Ganzhou City and its governed 5 counties (city, district) respectively.

Table 3.6.5.1-1 Historical cultivated land size and per capita cultivated size in Ganzhou unit：ha.

Year	Cultivated land size	Paddy field	Non-irrigated field	Per capita cultivated land size
1949	368033	303913	64120	0.12
1965	386480	351987	34496	0.09
1978	364994	327592	37402	0.06
1985	358116	321080	37036	0.05
1996	347110	309649	37461	0.04
2003	295709	263989	31720	0.04

Table 3.6.5.1-2 Recent cultivated land size change in Ganzhou unit：ha.

Item	2003	2002
Ⅰ. Actual cultivated land size in year beginning	310982	342333
1.paddy field	279298	303594
2.non-irrigated field	31684	38739
Ⅱ. Added cultivated land size in that year	2043	693
#New reclaiming	3	13
Orchards changed into cultivated lands	13	30
Other	2027	650
Ⅲ. Reduced cultivated land size in that year	17316	32044
#National capital construction land occupation	1879	3380
Other capital construction land occupation	689	3786
Re-afforestation from cultivated lands and re-planting of grass	12720	4644
Return cultivated lands into orchards	1200	1409
Other cultivated land reduction	828	18823
Ⅳ. Actual cultivated land size in yearend	395709	310982
1.paddy field	263989	279298
2.non-irrigated field	31720	31684

Table 3.6.5.1-3 Cultivated land sizes of each county in the project region unit：ha.

County or city	Actual cultivated land size in year end	Paddy field	Non-irrigated field	Reducton within the year	#Land occupied by national capital construction projects	Land occupied by other capital construction projects	Re-afforestation from cultivated lands and re-planting of grass
Ganzhou	295709	263989	31720	17316	1879	689	12720
Zhanggong	4837	3989	848	145	120		
Ganxian	21290	16718	4572	1810	74	66	1664
Yudu	28394	25873	2521	865	67	121	622
Huichang	16540	16011	529	858			744
Ruijin	21696	19359	2337	383	76		53

From Table 3.6.5.1-1～3.6.5.1-3：

⑴ During 54 years from 1949 to 2003, the farmland size in Ganzhou Prefecture is taking on a reduction tendency every year, with a total of size reduction of 72324m^2, reduced by 19.7%, of which the sizes of paddy field and non-irrigated field reduced by 13.1% and 50.5% relatively, the non-irrigated field size reduction is far more higher than that of paddy field.

⑵ During 54 years, the average per capita farmland reduction is remarkable in Ganzhou with its 2003 average per capita farmland size reduced by 66.7% compared to

1949, the main reason is obvious population growth in addition to the yearly reduction of farmland size reduction.

(3) In the recent 8 years from 1996 to 2003, the reduction rate of Ganzhou Prefecture's farmland size and per capita farmland size was not remarkable, which is due to the serious implementation by different counties of 1997~2010 overall land utilization plan and the total farmland quantity control.

(4) Compared with 2002, in 2003, the total farmland sizes of Ganzhou Prefecture and its governed 5 counties (city, district) witnessed increase in one way and decrease in the other, but the reduced farmland size was still bigger than the increased size. In that year, the farmland size reduction is mainly due to re-afforestation from cultivated lands and re-planting of grass, land occupied by national capital construction projects and other capital construction projects, which account for 73.5%, 10.9% and 4.0% respectively in that year’s farmland size reduction.

3.6.5.2 Current land utilization in counties (city, district) and townships along the oute

The 2003 year-end land utilization of each counties (city, district) and townships along the project is shown in Table 3.6.5.2-1 and Fig. 3.6.5.2-1, land type distribution map along the project.

Table 3.6.5.2-1 2003 current land utilization along the proposed highway **unit：mu**

Type / Area	Total land size	Agricultural land					Construction land			Unused land		Land use rate (%)	Land cultivation rate(%)	Double cropping factor(%)	Basic farmland protection size	Basic farmland protection rate(%)
		Cultivated	Orchards	Forestland	Meadow	Others	residents&factories&mines	transportation	water facility	Unused fields	Others					
Ganzhou Prefecture																85.0
Ruijin	36755663	3529762	403019	28952112	0	1408929	1191253	8529.7	18603.5	61385.4	38540.2	97.3	9.6	235.3	300029.8	85.0
Yeping	214653.5	44904.8	4863.3	118684.7	0	13263.3	12777.2	1530.9	180.2	14970.3	3478.8	91.4	20.9	226.3	40811.3	90.88
Huangbo	164495.7	25000.6	6357.4	99877.9	0	7784.7	8032.7	7225.0	2130.1	7728.4	358.9	95.1	15.2	259.7	21250.5	85.0
Shazhouba	111165.6	18517.3	5927.2	73861.9	0	3945.0	5947.7	966.5	215.0	931.7	953.3	98.4	16.7	216.3	17125.0	92.48
Yunshishan	171601.6	21404.1	1315.4	122401.6	0	4913.7	7296.9	1139.0	536.8	11905.3	688.7	92.7	12.5	257.6	198806.6	92.54
Xianghu	52711.8	12230.9	1364.9	25010.3	0	2654.5	6377.5	1552.8	157.4	1677.0	1686.5	93.6	23.2	233.4		
Huichang	4064859.6	344569.9	49538.5	3163947.7	50	142858.2	85737.8	11846.6	13025.5	202987.9	50297.5	93.8	8.5	173.3	305993.9	88.8
Xijiang	269238.3	38214.8	3404.9	166248.7	0	5648.7	11747.9	1029.0	4120.7	36528.0	2295.6	95.6	14.2	171.2	31294.4	81.89
Xiaomi	126645.7	13755.8	941.0	96145.1	0	4856.5	5077.4	564.3	2301.9	2205.7	798.0	97.6	10.9	165.8	12415.0	90.25
Bai'e	140790.6	15907.3	2784.7	101668.5	0	3684.4	3167.2	312.6	1517.4	2978.5	8770.0	91.7	11.3	186.1	14262.0	89.66
Zhuangkou	252110.8	22845.0	1129.4	211506.9	0	5222.4	4807.6	649.9	2522.3	2695.7	731.6	98.6	9.1	219.0	20103.9	88.0
Yudu	4343213.9	512921.4	35780.3	32467702	4436.3	205009.1	159582.0	10011.5	16460.3	63960.0	88282.8	96.5	11.8	216.6	442492	86.27
Huanglin	191062.0	17660.3	900.3	153470.5	0	7386.8	3611.0	1011.6	777.3	1631.4	4612.8	96.7	9.2	297.5	22326	126.4
Hefeng	219828.5	32364.2	1252.5	161899.8	0	6326.3	13001.7	368.9	410.3	1770.1	2434.7	98.1	14.7	179.9	27863	86.09
Licun	186794.4	16699.9	446.0	152050.6	0	7454.4	4917.7	289.4	364.5	2410.2	2163.3	97.6	8.9	229.0	15243	91.28
Xinbei	68856.6	11638.9	2323.4	38686.0	0	8000.3	2872.6	131.0	379.7	2571.4	2253.3	93.0	16.9	215.1	10587	90.96
Luojiang	182104.2	18957.6	2634.7	136798.7	0	9687.7	5394.3	128.7	736.9	3392.3	4373.3	95.7	10.4	194.3	16626	87.7
Luo'ao	241863.0	29651.7	2951.4	179698.8	0	10147.7	9342.7	1067.4	905.8	2724.3	5373.2	96.7	12.3	219.1	25748	86.83
Zishan	253492.9	36540.9	4982.2	175070.2	0	11588.0	11959.7	1240.2	1380.1	2557.8	8173.8	95.8	14.4	236.1	31854	87.17
Gongjiang	227339.9	34741.7	1213.2	135879.3	0	18461.6	19343.4	1332.6	1692.6	4642.0	10033.5	93.5	15.3	183.8	23752	68.37
Ganxian	4488315.0	402087.2	20962.1	3555534.0	22.8	123497.2	133319.8	13138.6	7275.4	48703.0	183774.9	94.8	9.0	200.2	341774.1	85.0
Jiangkou	181350.0	15254.0	10250.0	135100.0	0	-	16136.0	3050.0	1560.0	-	-	-	8.4	271.8	17173.5	112.6
Maodian	182300.0	13800.0	6200.0	135100.0	0	5200.0	15000.0	2100.0	1100.0	1600.0	2200.0	97.9	7.8	226.9	12100.0	87.68
Zhanggong	729856.5	150212.7	20945.9	327093.0	108.8	46019.4	90747.4	10927.0	2109.4	53293.1	28399.8	88.8	20.6	118.2	127680.8	85.0
Shuidong	36491.6	7866.7	3713.8	6090.4	0	2865.6	9312.5	517.9	95.3	974.9	5054.5	83.5	21.6	202.1	6686.7	85.0
Shuixi	94709.3	17490.7	2874.3	43389.5	46.0	3206.5	8677.6	561.1	1751.4	9253.5	7458.7	82.4	18.5	149.9	14867.1	85.0
Hubian	71670.6	20165.7	628.0	27093.3	17.9	4076.0	11743.6	846.5	1831.8	4877.7	390.1	92.7	28.1	225.3	17140.8	85.0
Panlong	63696.4	23202.4	2865.5	8991.9	35	7873.5	10552.3	254.2	53.5	6022.6	3845.5	84.5	36.4		19722.0	85.0

From Table 3.6.5.2:

⑴ Land utilization rates in Ruijin, Huichang, Yudu, Ganxian, Zhanggong District the proposed highway runs by are not high, all between 88.8% ~ 97.3%. Among them, land utilization rate in Ruijin City is the highest reaching 97.3%; that in Zhanggong District is the lowest only 88.8%. Land cultivation rate is somewhat low, between 8.5% ~ 20.6%, that in Zhanggong District is the highest, reaching 20.6%, and that in Huichang is the lowest only 8.5%. Land double cropping coefficient is high between 173.3% ~ 235.3%, that in Ruijin City is the highest reaching 235.3%, and that in Huichang County is the lowest only 173.3%.

⑵ Seeing from the current land utilization situations of various townships passed by the project, the land utilization rates are between 82.4% (Shuixi Township of Zhanggong District) ~ 98.4% (Shazhouba Township of Ruijin City), the land cultivation rates are between 7.8% (Maodian Township of Ganxian County) ~36.4% (Panlong Township of Zhanggong District), the land double cropping coefficients are between 149.9% (Shuixi Township of Zhanggong District) ~297.5% (Huanglin Township of Yudu County). The land utilization degrees in various townships along the route are different sharply. Generally, the various townships governed by Ruijin City have higher land utilization degree.

⑶ Among the 5 counties (city, district) and their governed various townships along the proposed project, though there are great differences in land utilization and development degree, but overall the land utilization and development degree is not high, there is still certain development potential.

3.6.6 Overview of tourism and relics resources in project region

The contents of this section is an excerpt from the《*Cultural Relics Assessment Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China*》 prepared by Jiangxi Provincial Archaeological Institute in Oct 2005.

The proposed project runs within the territory of Ganzhou Prefecture which boasts of 4 national-level cultural relic preservation units (18 spots), 2 national forest parks, 9 provincial-level scenic spots, 49 provincial-level cultural relic preservation units. Ganzhou City is the nation's unique Song city possessing cultural relics from Song Dynasty in best preservation, largest quantity and highest status, renowned as "the Song

City Museum". Ganzhou also features the rich Hakkas culture, it is Hakkas centered community, and also the birthplace for Hakkas culture, it is the biggest city in Hakkas region. Ganzhou also has rich Red Tour resources, for it is the central revolutionary base during the Second Revolutionary Civil War, the Chinese soviet temporary central government is located in Ruijin of Ganzhou Prefecture, the Long March also started from there.

3.6.6.1 Ruijin City

Ruijin City is located in the southwest of Wuyi Mountain, the main and offshoot of Wuyi Mountain extend in the whole territory distributed in large scale with low mountains and hills, only along the two banks of Mianshui River in the middle and Meijiang River in the north there are intermingled with low mounds, hillocks and valley basins. The Ruijin basin is one of the few basins in the south of Jiangxi. The river is mainly the Mianshui River, the tributaries include Ridong River, Huangsha River and Rentian River, of which the main tributary Ridong River is the source of Ganjiang River.

There are many former revolutionary sites: in Yeping, Shazhouba and Yunshishan, there are Chinese Soviet Republic temporary central government, central Soviet bureau, former residence of central revolutionary military committee, and comrade of Mao Zedong’s former residence, etc. a total of more than 10 national protection key relics; in Dabodi, there is the remains of Guanshan Victory; in Wuyang and Yunshishan there are the first bridge and the first mountain from which the the astonishing 12,500 kilometer Long Marches began.

According to survey, the major cultural relics distribution within Ruijin City near the route alignment of Ruijin-Ganzhou highway:

⑴ Former site of working people’s committee of temporary central government in Yunshishan：a city-level relics protection unit with history traced back to 1934, located in Donghu hotel of Yunshi village of Yunshishan Township.

⑵ Former site of national bank of temporary central government in Yunshishan：a city-level relics protection unit with history traced back to 1934, located in Xiabeizi of Fenglong village of Yunshishan Township.

⑶ Former site of national politics protection bureau of temporary central government in Yunshishan：a city-level relics protection unit with history traced back to

1934, located in Aiyuanlingxia of Beixia village of Yunshishan Township.

⑷ Former site of finance committee of temporary central government in Yunshishan：a city-level relics protection unit with history traced back to 1934, located in Xiatang of Fenglong village of Yunshishan Township.

⑸ Former site of CCP central bureau in Madaokou：a city-level relics protection unit with history traced back to 1934, located in Madaokou of Fenglong village of Yunshishan Township.

⑹ Former residence of central revolutionary military committee of Chinese Soviet Republic in Yanbei：a city-level relics protection unit with history traced back to 1934, located in Yanbei of Tianxin village of Yunshishan Township.

⑺ Former residence of Li De (Otto Braun)：a city-level relics protection unit with history traced back to 1934, located in Yanbei of Tianxin village of Yunshishan Township.

⑻ Former site of CCP central school in Shegongbei：a city-level relics protection unit with history traced back to 1934, located in Gongbei of Tianxin village of Yunshishan Township.

⑼ Former site of central youth communist league in Tianxin：a city-level relics protection unit with history traced back to 1934, located in Tianxin village of Yunshishan Township.

⑽ Former site of working people's inspection committee of temporary central government in Huangzhubei：a city-level relics protection unit with history traced back to 1934, located in Huangzhubei of Huangbei village of Yunshishan Township.

⑾ Former site of China trade union central executive bureau in Shapai：a city-level relics protection unit with history traced back to 1934, located in Shapai of Tianxin village of Yunshishan Township.

⑿ Former site of armament division of central revolutionary military committee：a city-level relics protection unit with history traced back to 1934, located in Maowudongxia of Tianxin village of Yunshishan Township.

⒀ Former site of printing factory of temporary central government in Yunshishan：a city-level relics protection unit with history traced back to 1934, located in Yanba village of Yunshishan Township.

⒁ Former site of post bureau of temporary central government in Yunshishan：a city-level relics protection unit with history traced back to 1934, located in Eposhixia of Shishan village of Yunshishan Township.

3.6.6.2 Huichang County

The county is located in the west foot of the south of Wuyi Mountain, there are mostly low mountains and hills in the whole county, only along the two banks of Gongshui River and Xiangshui River there are mostly river valley basins intermingled with low mounds and hillocks. The Panguzhang mountain peak in the southwest frontier is the highest with the elevation of 1184 m. The rivers belong to Gongshui water system, the tributaries include Xiangshui River, Lianshui River, Xijiang River and Mianshui River.

In "the highest peak outside Huichang town"—Lanshanling, there is the remains of battle defense works of the second civil revolutionary war and the wartime hospital site. In Wenwuba and Liguanshan of Zhantang, there is the former residence of comrade Mao Zedong and various former sites of revolutionary activities. The scenic spot Hanxian Crag near Yangjiaocheng of Junmenling is famous.

Through survey it is found that there is no important cultural relics distributed near Ruijin-Ganzhou highway route within the territory of Huichang County.

3.6.6.3 Yudu County

The Wuyi Mountain end range and Yushan Mountain extend in the east, south and northwestern part of the county. In the whole county, particularly in the surroundings there are distributed with large-sized mountains and hills which mostly present a northeast-southwest direction; because of river slicing, the mountain relief is relatively broken; The low mounds, hillocks and mountain basins are distributed relatively widely along Gonghsui River Meijiang River. The terrain around the county town is particularly wide, low and flat. The Pangushan Mountain in the south of the territory is the highest with the elevation of 1312 m; the highest peak of Yushan mountain in the northwest of the territory is only 634 m above sea level. The rivers are mostly Gongshui River and its tributary Meijiang River.

Among the scenic spots within the territory of Yudu County there are Luotianyan and Panshan park and Pangu West Lake of Pangushan tungsten mine 3 kilometers from the south of the county town. Luotianyan is not merely beautiful, but there are many handwritten stone scripts such as Yue Fei, Wen Tianxiang, Wang Shouren, Jie Jin and Badashanren.

According to survey, the major cultural relics distribution within Yudu County near the route alignment of Ruijin-Ganzhou highway:

(1) Luotianyan stone carvings：a provincial-level relics protection unit with history traced back to Song-Qing Dynasty, located in about 2.5km from south bank of Gongjiang River in Gongjiang Township. The Luotianyan temple was established in the Southern Dynasty and was famous during North Song Dynasty. The Temple was a brick timber structure built along the rock, there are 11 relief statues of Buddha in the rock wall of the temple. Engraved in the cliffs of nearly 2 kilometers around the temple are nearly 70 scripts of such celebrities as Yue Fei and Wen Tianxiang from Song Dynasty, Wang Maode of Yuan Dynasty, Wang Shouren, Luo Hongxian, Huang Honggang, He Tinghe from Ming Dynasty, and Li Yuanding, Yi Xueshi and Badashanren from Qing Dynasty.

3.6.6.4 Ganxian County

There are mostly hill and mountain topography in Ganxian County with extending and overlapping mountain peaks everywhere, river slicing and alternating basins and valleys. Roughly the relief is higher in southeast than in northwest, the highest peak is Shuiji in the southeast with elevation of 1185 m. besides Ganjaign River and Gongshui River, there are also large tributaries such as Taojiang River and Pingjiang River flowing into the whole area.

There are the former site of Soviet government in the second civil revolutionary war in such places as Tiancun and Bailu, etc. on the peak of Dongshan Hill in Tiancun Township there is the famous Baohua temple of Song Dynasty.

Through survey it is found that there is no important cultural relics distributed near Ruijin-Ganzhou highway route within the territory of Ganxian County.

3.6.6.5 Zhanggong District

Zhanggong District lies in the upstream of Ganjiang River and is located in the converge place of Zhangshui and Gongshui Rivers where the river valley is wide in the middle and the terrain is smooth, particularly in Zhangshui River valley; in the south and north there are mostly low mountains and hills, the Fengshan mountain peak lying in the southeast has an elevation up to 1016 m; in transition areas between plains and low mountains and hills, there are distributed low mounds and hillocks forming an obvious topography in a saddle form.

Zhanggong District is abundant in scenic spots, mainly locating 10 kilometers northwest of the city, for example the Tongtianyan Cave built in North Song Dynasty boasts of numerous ancient stone engravings, stone shrines and stone engraving statues, renowned as the artistic treasure-house of Chinese engraving; There is Bajingtai standing in the converge place of Zhangshui and Gongshui rivers which was built in North Song Dynasty, there is Yugutai lying on the highest point of the city Luosiling which was built in Tang Dynasty, and ancient site of chinaware kiln in Qili of Shuidong Township, there are the ancient city wall of Song Dynasty and ancient Confucian Temple of Qing Dynasty. In addition there is the stupa pagoda (also called Ciyun Pagoda) built in the period of North Song Dynasty and there is a scenic spot Kongtong Mountain in southeast which is famous in successive dynasties (also called Fengshan Mountain).

According to survey, the cultural relics distribution within Zhanggong District along the route alignment of Ruijin-Ganzhou highway:

⑴ Qili kiln site：a provincial-level relics protection unit with history traced back to Tang-Yuan Dynasty, located in about 2km from north bank of Gongjiang River along Qili village to Yanao village of Shuidong Township, with a size of 75700 m^2 and 16 accumulations. In autumn and winter of 1975-1977, two successive excavations have been made in Shaziling, Zhangwuling and Zhouwuwu, which unearthed relics including pot, earthen bowl , pot, bowl, disc, cup, small cup, tray, stove, bottle, inkstone, etc., the glazed porcelains include blue and green vitreous enamel, bluish white vitreous enamel, white vitreous enamel, dark brown vitreous enamel, dark reddish vitreous enamel and pottery. The ornamental tactics include pile molding, delineating, impressing, kiln changing. Particularly, the vitreous enamel decoration and imitative lacquerware thin foetus sauced vitreous enamel are of unique style. Some products were once exported abroad. In the excavation in Zhangwuling in 1977, there discovered two Long kilns of Song Dynasty. (see *Cultural Relics in Jiangxi* issue 4 of 1990)

⑵ Li Bo ancestral temple: a city-level relics protection unit with history traced back to Ming Dynasty, located in Lilaoshan village of Shuidong Township. The temple is an earth wood structure of civilian residence style in south Jiangxi featuring 4 windows and 3 halls with depth of 10.60m and surface width of 9.10m. it is the place for worshipping Li Bo, the ancestor of local Li's clan, who came from Luoyang of Henan Province and was a high official in Qian prefecture during Tang Dynasty （821-824）. Lilaoshan village is an earlier resettlement for northern immigrants in Ganzhou Prefecture known to us.

⑶ Baita bridge：a city-level relics protection unit with history traced back to Qing Dynasty, located in a stream about 1km west from Zhushan village of Shuidong Township, it is also called Top Scholar Bridge, first built in the village road to Ganzhou in Song Dynasty by a landlord in Qili in order to celebrate Chi Mengli who got the top title in imperial examination in 1274 of Song Dynasty. The current bridge is a single-span arch bridge rebuilt in qing Dynasty constructed by red stone and overpassing Taoyuan stream, it is 22.60m long and 4.90m wide.

⑷ Xianniang temple：a city-level relics protection unit with history traced back to Qing Dynasty, located in Silian village mouth of Qili village of Shuidong Township, rebuilt in 1843 of Qing Dynasty. The current temple worships Tianhua Mother and the Goddess Of Mercy with a size of 372 m^2. the temple is brick and wood structure with two footage in front and rear which is 11.65m wide and 31.9 deep. The first footage has three storeys, the floor is the gate passage, the second storey is a theater stage, the third stoery is Confucius pavilion decorated by color painting and wood carving. The second footage is the hall installed with god throne and oracle.

⑸ Wanshou palace：a city-level relics protection unit with history traced back to Qing Dynasty, located in the dining hall of Ganzhou Wood Store in Qili village of Shuidong Township. It is a famous Daoism temple dedicated to the Immortal Xu. the temple is brick and wood structure originally with three footages in front and rear but only the second and third footage are left, which is 20m wide and 30m deep occupying a surface of 600 m^2. The wood structures have relief sculptures and color paintings. There is a stone bridge over the well between the second and third footages, the stone columns are carved by vivid animals.

⑹ Chi's ancestral temple: a city-level relics protection unit with history traced back to Qing Dynasty, located in Zhongfang of Qili village of Shuidong Township. It was first built in 1745 of Qing Dynasty to celebrate Chi Mengli, an ancestor, who got the top title in imperial examination in Song Dynasty, it is also called “Dunben Hall” for the glory of ancestors. The current ancestral temple is a brick and wood structure with a size of 219 m^2, inside the temple there are a well, theater stage and octagonal well, important wood structures are decorated by relief pictures.

⑺ Mazuyan stone carvings: a city-level relics protection unit with history traced back to Yuan Dynasty, located in Mazuyan village of Shuidong Township. It was so named because the learned monk in Tang Dynasty, Mazu Daoyi once lived there and later deserted because of mountain ghost. The original temple was destroyed, there exist 4 scripts in the crag wall, the eligible scripts are the script carved by Quan Jingzhai, an official of Yuan Dynasty in 1532 when he visited this place, there are 9 lines with 8 characters in regular script for each line, another was made by Wu Rang an official of Ming Dynasty in 1601, a total of 14 lines in regular script.

⑻ Yuhong Pagoda：a provincial-level relics protection unit with history traced back to Ming Dynasty, located in Liansan of Chizhu village of Shuixi Township. The pagado was named after Su Sih’s poem-“river flows like a rainbow”, it was built by Xie Jie, an official in Ming Dynasty. The pagoda faces the south and near a river with 9 storeys and 6 angles, about 30m high. It is a brick pagoda with stairs inside through which one can climb to the 9th floor. There is a script in the pagoda brick which reads “Pagoda in Wanli Age”. The original pagoda wood structure has been destroyed.

⑼ Tongtianyan stone cave：a national-level key relics protection unit with history traced back to North Song-Minguo Dynasty, located in Shibitang of Tongtianyan village of Shuixi Township. It is so named due to“peaks extending up to the heaven”, its size is about 66.5 hectares belonging to Danxia topography featuring deep valleys, giant trees and beautiful scenery. The Tongtianyan crag is divided into the east and west crags with all stone sculpture centering on the east crags such as Wanggui crag, Tongxin crag, Longhu crag, Tongtian crag and Cuiwei crag. There are 359 stone statues and 128 scripts, of which 33 scripts in Song Dynasty and 36 in Ming Dynasty, the others are all script after Qing Dynasty. The earliest stone script was made in north Song Dynasty which reads roughly “Chen Jinzhi, Lin Anjie, Yang Zichang, Xiao Ruhui and Zeng Baochen arrived at this place in spring”.

⑽ Liyuan civilian architecture：a city-level relics protection unit with history traced back to Qing Dynasty, located in Liyuan village of Hubian Township. Today there exist Luowu and Liuyi Buildings belonging to civilian residential architecture of Qing Dynasty, built by Xiao's family clan. The architecture is elegant and fine with rich local features of south Jiangxi. During the anti-Japanese war period, this place has been used for the Jiangxi provincial second nursery (directed by Jiang Fangliang) created by Jiang Jinguo and Jiang Fangliang.

⑾ He Huanwen's tomb：a city-level relics protection unit with history traced back to 1942, located in a hill slope about 350m southeast of Gangbianpai of Gangbian village of Hubian Township. He Huanwen, the father of He Zizhen, lived in Ganxian County as a hermit after the Red Army's Long March in 1934 and died in Gangbian village on June 1938. Later on he was buried in this place. The tomb is a brick chamber structure 1.8m wide and 1.38m high. In the stone stele there are a script which reads roughly "Gentleman He Huanwen was buried in this place in 1941".

Chapter 4 Environmental Impact Predication and Assessment

4.1 Assessment of ecological environmental impact

4.1.1 Impact on land utilization by land occupation

4.1.1.1 Road land occupation's impact on land size of each type

This project will permanently take up lands with a total size of 12535.42mu, of which 3934.73 mu for cultivated lands (mostly paddy fields and non-irrigated fields), 377.8 mu for orchard fields (mostly fruit orchards and tea garden), 6903.65 mu for forest lands, 208.94mu for water ponds, and 1110.3mu for other lands (mostly housing, industry and mining,transportation,and unused lands).The sizes of land permanently occupied by the proposed highway in each county (city or district) and its governed townships and their percentages in their current respective land sizes are listed in Table 4.1.1.1-1.

Table 4.1.1.1-1 Relation between road right-of-way with existing land

Land type	City or county	Township	Existing land	land used for highways	Percentage of land used for highways in existing land (%)
Cultivated land	Ruijin City	Whole city	122057.7	200.93	0.16
		Yunshishan Township	21404.1	200.93	0.94
	Huichang County	Whole county	344569.9	725.85	0.21
		Xijiang Township	38214.8	376.64	0.99
		Xiaomi Township	13755.8	210.53	1.53
		Bai'e Township	15907.3	138.68	0.87
	Yudu County	Whole county	512921.4	1935.37	0.38
		Hefeng Township	32364.2	809.67	2.50
		Huanglin Township	17660.3	134.15	0.76
		Licun Township	16699.9	92.84	0.56
		Gongjiang Township	34741.7	140.21	0.40
		Xinbei Township	11638.9	57.42	0.49
		Luojiang Township	18957.6	251.51	1.33
		Luo'ao Township	29651.7	449.57	1.52
	Ganxian County	Whole county	402087.2	839.81	0.21
		Jiangkou Township	15254	193.97	1.27

Land type	City or county	Township	Existing land	land used for highways	Percentage of land used for highways in existing land (%)
		Maodian Township	13800	487.47	3.53
		Chutan Township	9194	158.37	1.72
	Zhanggong District	Whole district	150212.7	530.8	0.35
		Shuixi Township	17490.7	194.17	1.11
		Hubian Township	20165.7	301.12	1.49
		Panlong Township	23202.4	35.51	0.15
Orchard fields	Huichang County	Whole county	49538.5	5.5	0.01
		Xijiang Township	3404.9	5.5	0.16
	Yudu County	Whole county	35780.3	146.95	0.41
		Hefeng Township	1252.5	13.27	1.06
		Licun Township	446	3.6	0.81
		Gongjiang Township	1213.2	5.48	0.45
		Luojiang Township	2323.4	26.42	1.14
		Luo'ao Township	2634.7	98.18	3.73
	Ganxian County	Whole county	20962.1	183.58	0.88
		Jiangkou Township	10250	93.43	0.91
		Maodian Township	6200	85.26	1.38
		Chutan Township	3096	4.89	0.16
	Zhanggong District	Whole district	20945.9	67.58	0.32
		Shuixi Township	3713.8	21.5	0.58
		Hubian Township	628	46.08	7.34
Forestlands	Ruijin City	Whole city	439836.4	94.47	0.02
		Yunshishan Township	122401.6	94.47	0.08
	Huichang County	Whole county	3163947.7	1553.5	0.05
		Xijiang Township	166248.7	700.82	0.42
		Xiaomi Township	96145.1	351	0.37
		Bai'e Township	101668.5	501.68	0.49
	Yudu County	Whole county	3246770.2	2759.95	0.09
		Hefeng Township	161899.8	380.03	0.23
		Huanglin Township	153470.5	345.82	0.23
		Licun Township	152050.6	465.63	0.31
		Gongjiang Township	135879.3	306.11	0.23
		Xinbei Township	38686	177.02	0.46
		Luojiang	136798.7	383.34	0.28

Land type	City or county	Township	Existing land	land used for highways	Percentage of land used for highways in existing land (%)
		Township			
		Luo'ao Township	179698.8	702	0.39
	Ganxian County	Whole county	3555534	1407.96	0.04
		Jiangkou Township	135100	447.94	0.33
		Maodian Township	135100	764.59	0.57
		Chutan Township	90000	195.43	0.22
	Zhanggong District	Whole district	327093	781.68	0.24
		Shuixi Township	43389.5	359.32	0.83
		Hubian Township	27093.3	409.87	1.51
		Panlong Township	8991.9	12.49	0.14
Other farming lands	Yudu County	Whole county	205009.1	10.01	0.00005
		Hefeng Township	6326.3	3.15	0.05
		Luo'ao Township	10147.7	6.86	0.07
	Zhanggong District	Whole district	46019.4	11.56	0.03
		Shuixi Township	3206.5	11.56	0.36
Lands for housing, industry and mining	Ruijin City	Whole city	40432	8.75	0.02
		Yunshishan Township	7296.9	8.75	0.12
	Huichang County	Whole county	85737.8	33.56	0.04
		Xijiang Township	11747.9	18.88	0.16
		Xiaomi Township	5077.4	9.08	0.18
		Bai'e Township	3167.2	5.6	0.18
	Yudu County	Whole county	159582	48.12	0.03
		Hefeng Township	13001.7	17.26	0.13
		Huanglin Township	3611	10.59	0.29
		Licun Township	4917.7	1.23	0.03
		Gongjiang Township	19343.4	1.6	0.01
		Xinbei Township	2872.6	0.36	0.01
		Luojiang Township	5394.3	2.21	0.04
		Luo'ao Township	9342.7	14.87	0.16
	Ganxian County	Whole county	133319.8	23.76	0.02
		Jiangkou Township	16136	2.48	0.02
		Maodian Township	15000	16.97	0.11
		Chutan Township	3423	4.31	0.13
	Zhanggong District	Whole district	90747.4	15.93	0.02
		Shuixi	8677.6	7.05	0.08

Land type	City or county	Township	Existing land	land used for highways	Percentage of land used for highways in existing land (%)
		Township			
		Hubian Township	11743.6	8.64	0.07
		Panlong Township	10552.3	0.24	0.002
Lands for transportation	Yudu County	Whole county	10011.5	41.26	0.41
		Hefeng Township	368.9	11.72	3.18
		Licun Township	289.4	1.66	0.57
		Gongjiang Township	1332.6	3.9	0.29
		Xinbei Township	131	7.03	5.37
		Luojiang Township	128.7	2.81	2.18
		Luo'ao Township	1067.4	14.14	1.32
	Ganxian County	Whole county	13138.6	16.86	0.13
		Jiangkou Township	3050	4.08	0.13
		Maodian Township	2100	10.73	0.51
		Chutan Township	104	2.05	1.97
	Zhanggong District	Whole district	10927	8.58	0.08
		Shuixi Township	561.1	0.72	0.13
		Hubian Township	846.5	7.27	0.86
		Panlong Township	254.2	0.59	0.23
Lands for water facilities	Ruijin City	Whole city	18603.5	4.06	0.02
		Yunshishan Township	536.8	4.06	0.76
	Huichang County	Whole county	13025.5	43.89	0.34
		Xijiang Township	4120.7	13.85	0.34
		Xiaomi Township	2301.9	15.64	0.68
		Bai'e Township	1517.4	14.4	0.95
	Yudu County	Whole county	16460.3	80.69	0.49
		Hefeng Township	410.3	9.58	2.33
		Licun Township	364.5	15.81	4.34
		Gongjiang Township	1692.6	20.14	1.19
		Xinbei Township	379.7	2.36	0.62
		Luojiang Township	736.9	4.39	0.60
		Luo'ao Township	905.8	28.41	3.14
	Ganxian County	Whole county	7275.4	83.73	1.15
		Jiangkou Township	1560	15.85	1.02
		Maodian	1100	45.88	4.17

Land type	City or county	Township	Existing land	land used for highways	Percentage of land used for highways in existing land (%)
		Township			
		Chutan Township	500	22	4.40
	Zhanggong District	Whole district	2109.4	62.06	2.94
		Shuixi Township	1751.4	29.35	1.68
		Hubian Township	1831.8	30.94	1.69
		Panlong Township	53.5	1.77	3.31
Unutilized lands	Huichang County	Whole county	202987.9	18.12	0.01
		Xijiang Township	36528	13.8	0.04
		Bai'e Township	2978.5	4.32	0.15
	Yudu County	Whole county	63960	337.05	0.53
		Hefeng Township	1770.1	4.4	0.25
		Huanglin Township	1631.4	12.24	0.75
		Licun Township	2410.2	43.49	1.80
		Gongjiang Township	4642	158.81	3.42
		Xinbei Township	2571.4	13.07	0.51
		Luojiang Township	3392.3	28.23	0.83
		Luo'ao Township	2724.3	76.81	2.82
	Ganxian County	Whole county	48703	61.88	0.13
		Jiangkou Township	—	6.56	—
		Maodian Township	1600	14.64	0.92
		Chutan Township	29253	40.68	0.14
	Zhanggong District	Whole district	53293.1	46.24	0.09
		Shuixi Township	9253.5	46.24	0.50
Other unutilized lands	Yudu County	Whole county	88282.8	16.82	0.02
		Hefeng Township	2434.7	2.37	0.10
		Luojiang Township	4373.3	8.35	0.19
		Luo'ao Township	5373.2	6.1	0.11
	Ganxian County	Whole county	6557.1	64.75	0.99
		Jiangkou Township	—	33.64	—
		Maodian Township	2200	13.21	0.6
		Chutan Township	—	17.9	—
	Zhanggong District	Whole district	28399.8	3.11	0.01
		Shuixi Township	7458.7	3.11	0.04

From Table 4.1.1.1-1, it is clear that:

(1) Among the project's permanent land occupation, the percentage of forestlands to be occupied is the largest (55.07%), followed by cultivated lands (31.39%); the percentages of other lands are 13.54%.

(2) In terms of the percentages of different land types to be occupied in the 5 counties (city or district) along the highway in their respective land types, occupation of cultivated lands is smallest in Ruijin County (0.16%) and largest in Yudu County (0.38%); occupation of orchards is smallest in Ruijin County (no occupation) and largest in Ganxian County(0.88%); occupation of forestlands is smallest in Ruijin County(0.02%) and largest in Zhanggong District (0.24%); occupation of other farming lands is smallest in Ruijin County, Huichang County and Ganxian County (no occupation), and largest in Zhanggong District (0.03%); occupation of lands for housing, industry and mining is smallest in Zhanggong District (0.0176%) and largest in Huichang County (0.04%); occupation of lands for transportation is smallest in Ruijin County and Huichang County (no occupation) and largest in Yudu County (0.41%); occupation of lands for water facilities is smallest in Ruijin (0.02%) and largest in Zhanggong District (2.94%); occupation of unutilized lands is smallest in Ruijin County(no occupation) and largest in Yudu County (0.53%); occupation of other unutilized lands is smallest in Ruijin County and Huichang County (no occupation) and largest in Ganxian County (0.99%).

(3) In terms of the percentages of different land types to be occupied in the townships along the highway in their respective land types, occupation of cultivated land is smallest in Panlong Township of Zhanggong District (0.15%) and largest in Maodian Township of Ganxian County (3.53%); occupation of orchards is smallest in Yunshishan of Ruijin City, Xiaomi Township and Bai'e Township of Huichang County, Huanglin Township and Xinpi Township of Yudu County and Panlong Township of Zhanggong District (no occupation), and largest in Hubian Township of Zhanggong District (7.34%); occupation of forestlands is smallest in Yunshishan of Ruijin City (0.08%) and largest in Hubian Township of Zhanggong District (1.51%); occupation of other farming lands is largest in Shuixi Township of Zhanggong District (0.36%) followed by Luo'ao (0.07%) and Hefeng (0.05%) in Yudu County, and no occupation in other townships; occupation of lands for housing, industry and mining is smallest in

Panlong Township of Zhanggong District (0.002%) and largest in Huanglin Township of Yudu County (0.29%); occupation of lands for transportation is smallest in Yunshishan Township of Ruijin, Xijiang Township, Xiaomi Township and Bai'e Township of Huichang County, and Huanglin Township of Yudu County (no occupation), and largest in Xinpi Township of Yudu County (5.37%); occupation of lands for water facilities is smallest in Huanglin Township of Yudu County (no occupation) and largest in Chutan Township of Ganxian county (4.4%); occupation of unutilized lands is smallest in Yunshishan Township of Ruijin City, Xiaomi Township of Huichang County and Hubian Township and Panlong Township of Zhanggong District (no occupation), and largest in Gongjiang Township of Yudu County (3.42%)；occupation of other unutilized lands is smallest in Yunshishan Township of Ruijin City, Xijiang Township, Xiaomi Township and Bai'e Township of Huichang County, Huanglin Township, Licun Township, Gongjiang Township and Xinpi Township of Yudu County, Hubian Township and Panlong Township of Zhanggong District (no occupation), and largest in Maodian Township of Ganxian County (0.6%).

4.1.1.2 Road land occupation impact on land utilization: analysis and suggestions

Land utilization rate in the different counties (city or district) and townships (town) along the proposed highway is relatively high, mostly above 95%; the contradiction between agricultural and non-agricultural land uses is relatively tense. Construction of this project will undoubtedly produce adverse impacts on land utilization along the route, and especially on local agricultural production due to size reduction of cultivated lands, orchards and forestlands.

(1) In order to reduce the adverse impacts on local land utilization along the route and to mitigate the contradiction between agricultural and non-agricultural land uses, this project's construction unit will follow relevant regulations and procedures to go through land use report, which will be included in the land use plan.

(2) According to relevant land management regulations of the country and Jiangxi Province and overall land utilization requirement of Ganzhou Prefecture and each county (city, district) along the route, in order to fully utilize land resource, farmland occupation will be coordinated with reclaiming, that is to develop and reclaim new land so to increase the effective cultivated size and to guarantee a dynamic equilibrium of cultivated land size. Because of the enormous social and economic benefits of this

project, the highway's land use will realize special transformation of their values. In addition, because construction of this project will lead to emergence of new industrial zone and commercial network along the route, so, the land use pattern of both sides of the highway will occur great change with land used for industry, commerce and transportation increasing to some extent. In order to avoid occupying excessive valuable cultivated land resources, it is proposed that land administrative department strengthen the approval and management on different construction land uses along the highway.

4.1.2 Impact on animals and plants along the route

Vegetation destroyed by this highway construction is mostly forestlands and farming lands, among them the total size of forestlands is 6903.65mu(55.07%), the total size of farmland is 3934.73mu(31.39%). The forestlands within the assessment scope along the route are mostly cash forest, so the road construction will not produce long-term destructive influence on the vegetation along the route, in addition, the trees and young crops that this project will destroy in land acquisition will be compensated for.

Permanent land occupation of this project will produce irrecoverable destruction on original vegetation, perturbation on the soil, and interference on the biological habitats of wild animal and soil within the land acquisition scope; the natural environment, especially the original vegetation will be greatly impacted. Temporary projects during construction (such as detour roads, prefabricating grounds, mixing plants and construction campsites, etc.) will destroy the original vegetation, which, can be resumed gradually after taking certain recovery measure. In addition, machinery transportation and rolling and construction workers' trampling during constructing will also produce some perturbation to a certain extent to the vegetation in operation areas and peripheral places.

This vegetation types in the land occupied by the project are mainly cash forest and farmland, so during construction stage the destruction to artificial vegetation and agricultural vegetation of areas along the route is relatively obvious, but in the late construction stage, planting of road main works and land reclaiming on temporary land use such as earth borrow and waste banks can effectively solve the problems of ecological recovery of regional vegetation or ecological compensation along the route.

The construction unit of the proposed highway will implement highway planting and beautification in strict accordance with relevant requirements of the Ministry of Communications. This can not only compensate for and restore some original vegetation destroyed during construction of the highway to a certain extent, but also can play a role in protecting subgrade, reducing soil erosion, reducing traffic fling dust and noise etc.

Within the assessment scope for this highway, the animal species are mostly domestic animals, poultry and some common little wild animals that are few in population, which are not very demanding for living environment and are adaptable to human activity. This road construction has not caused and changed their habitant environment greatly, will not interfere their normal life, which can still continue surviving in the areas along the route.

According to investigations, there is no natural preservation zone within the assessment scope, the two natural preservation zones nearest to this project are Qiyunshan Natural Preservation Zone and Yangling Natural Preservation Zone, which are about 90km and 70km from the project respectively. The distribution of natural preservation zones in Jiangxi Province is shown in Fig. 4.1.2-1.

4.1.3 Impact on ecological environment by earth borrowing and waste disposal

Currently this project will set up 12 earth borrowing pits and 24 waste banks. See Table2.4.3.8-1,Table2.4.3.8-2 for details of earth borrowing pits and waste banks along the whole line.

4.1.3.1 Impact analysis of earth borrow pits

According to the requirement on subgrade earth borrowing of Road Subgrade Design Specification issued by Ministry of Communications, setting-up of subgrade earth borrowing pits shall follow the following regulations:

(1) In smooth and flat topography, pits should be set up on one side of the embankment. When the horizontal slope of ground is steeper than 1:10, pits should be set up on the top of embankment.

(2) Either ends of bridge approach are unsuitable to set up earth pit, if required under special circumstances earth pits can be set up on the downstream side with a berm of no less than 4 m wide needed.

(3) The earth borrows pits acting as water drainage at the same time should guarantee that water discharges smoothly. Its depth shall not exceed the underground

water level of this area and shall join to the inlet elevation of bridges and culverts; Its longitudinal gradient shall not be smaller than 2‰, and should not be smaller than 1‰ in flat sections.

(4) When earth borrowing is deep, the distance from toe of slope to earth borrowing pit should guarantee slope stable, the inboard wall of earth borrowing pit should be protected properly.

(5) In good farmland section, when the embankment filling quantities are large and centralized, and when underground water level is high, earth can be transported from far away or borrowed collectively.

(6) Setting up collective earth borrow pits outside the line shall be planned in accordance with the earth borrow quantities of each section and with regard to subgrade water drainage, topography, soil property, construction method and land use saving. Local government should also be consulted to determine earth borrowing range and depth so as to give consideration to construction of farmland, water conservancy, fish pond, environmental protection and soil erosion reduction, etc. At the same time after the pits are used to take earth, necessary water drainage, protection and planting measures should be taken to prevent soil erosion and land from being idle.

In accordance with the basic principles for setting up earth borrowing pits, the recommended alignment of this project, according to different topographical conditions and earth and stone balance situation of each highway section, will set up 12 earth borrowing pits taking up mostly lap,unused land but not good farmlands; and at the same time protection works and afforestation works are designed. The assessment believes that the setting up of earth borrow pits accords with the requirement on subgrade earth borrowing of "*Road Subgrade Design Specification*".

In line with economizing land, the site selection of earth borrowing pits for this project takes advantage of low-yielding land, and protection and afforestation projects are undertaken for these earth pits so as to satisfy the basic requirements of harmonious development between road construction and environmental protection. In terms of environmental protection, the alignment of earth borrowing of this project is technically rational and feasible too. However supervision over earth borrowing pit construction should be strengthened to ensure that earth pits are leveled in time during construction so that earth pit construction is accompanied by leveling and after one pit is finished, it shall be immediately restored, thus controlling the adverse effect on the environment by project earth borrowing to a minimum limit.

4.1.3.2 Impact analysis of waste bank

The "*Road Subgrade Design Specification*" issued by Ministry of Communications stipulates the following principles on setting up earth waste banks:

(1) Waste earth should not be dumped casually, and necessary water drainage, protection and afforestation measures shall be taken. Hillside waste earth disposal should not influence the hill body and attention shall be paid to avoid destroying or burying woods, farmland and other project facilities in the lower side of subgrade. Abandoning waste earth along river should avoid blocking river courses or rushing farmlands and houses.

(2) Waste banks shall be designed with regards to local farmland construction and natural environment, and should utilize waste earth to reclaim farmlands. Waste banks besides road can be located in nearby lowland or on one downhill side of original cutting. When the transverse slope of ground is less than 1:5 they can be set up on both sides of the cutting. Distance between inboard slope toe to cutting top of waste bank should depend on soil property and the cutting slope height generally no smaller than 5m; when the slope cutting is relatively high and soil property is bad, the distance shall be greater than 5m.

(3) Waste banks can be generally piled into a ladder-shaped cross section with slope not steeper than 1:1.5, and should also be in harmony with surrounding environment.

(4) Abandoning the waste earth along the river should be prevented from aggravating erosion of downstream subgrade and riverbank, waste earth shall be prevented from blocking and polluting the river course, and protection facilities should be set up in case of necessity. Waste earth disposed of in bridge end shall not be piled on bridge pier and block bridge hole.

(5) Waste banks can't be set up on soft soil ground.

The proposed project lies in mountainous area with large volumes of earth and stone works in some places especially in tunnels, and mostly stone works. The earth and stone works excavated from subgrade shall be used as subgrade filling materials as much as possible in order to reduce waste earth. At present, a total of 24 waste banks are set up,10 of them are tunnel slag banks. In laying out waste banks, the designing unit follows the *Road Subgrade Design Specification* and adopts centralized piling in the design. In principle, the waste banks are located in lowland on both sides of subgrade by giving consideration to local natural environment and farmland construction so as to take as little farmlands as possible and as much low-yielding wastelands as possible. Through verification, the waste banks are mostly located in natural gulches without occupying basic farmlands. To mitigate the adverse effect of waste earth (slag), the designing unit needs to design protection and planting measures for waste banks. Waste banks (especially large-sized waste banks for tunnels) are specially designed with necessary protection facility, water drainage and environmental protection measures so to prevent waste earth from blocking river course and polluting environment or causing the mud-rock flow, thus satisfying the basic requirement for harmonious development between road construction and environmental protection. In terms of environmental protection, the waste banks laid-out for this project are basically reasonable, but it is required that while implementing the above-mentioned protection and planting measures, supervision over waste bank construction should be strengthened to ensure that the top soil in waste banks are kept before waste disposal, which will be used in remedying and reclaiming after waste disposal, thus controlling the adverse effect on the environment by waste earth disposal to a minimum limit.

Waste banks for this project are mainly located in the heads or sides of troughes. Because this area belongs to low-mountain and hilly terrain with criss-crossed gullies, the water catchment size of ditch head of is generally very small and the flood flow is very small too, and flood factor has already been considered in designing the waste banks. Through analyzing, the waste banks of this project will not influence the flood discharge of natural ditches.

In order to reduce the perturbation on ecological environment by the engineering construction, the recommended alignment has planned to set up 7 tunnels altogether with total length of 9548.5m. Generally speaking, in a same highway section, tunneling will produce much less disturbance on topography and ecological environment than deep cutting, while the impact on environment by tunnel construction is mainly the impact of waste earth land occupation on environment. Statistics show that tunnel footage of one meter for a two-lane highway will produce an average waste earth volume of more than 90m3 (real cubic), so the waste slag produced from tunneling needs to take large surface area, and even more for long tunnel. This project needs to build a number of long and large tunnels, which will inevitably produce a large volume of tunnel waste. For this project, the location selection for tunnel waste banks, especially for the long and large tunnels, are decided by designing unit and water conservation report compiler by comprehensively considering project economy, environmental protection, water and soil conservation, etc., and protection and planting measures are designed for them. In order to reduce tunnel waste destruction on ecological environment, the designing unit mainly adheres to the two following principles in handling waste slags: one is to turn waste into usable by using waste slag to fill subgrade or to reclaim fields; another one is to change harmful into harmless, that is, when farmlands are to be occupied inevitably, the waste banks shall be turned into cultivated lands so as to make up the cultivated lands that the waste slag occupies.

4.1.4 Impact on ecological environment by temporary works

4.1.4.1 Environmental impact analysis of construction detour roads

Construction detour roads are needed to access to construction sites and earth borrow pits and waste banks, setting–up for this project's detour roads is shown in Table 2.4.3.8-2.

It can be seen that the construction detour roads for this project are set up by two methods: first to use existing roads of county, township and village levels, and to renovate and use existing roads of township and village levels level; second to newly build some detour roads of short distance for the purpose to reduce large fill/cut and reduce soil erosion and ecological disruption.

Detour roads should be dealt with according to actual circumstances after the project is finished: one situation is that they can be handed to local road administrative department for maintenance so that they can be used as roads of township and village levels; another situation is that the detour roads which are unable to be used after the project is finished must be undergone ecological restoration by planting trees and growing grass so as to reduce soil erosion.

4.1.4.2 Environmental impact analysis of construction site

Construction of bridges, tunnels and intersections needs to set up temporary construction site, see Table 2.4.3.8-1 for the setting-up of construction site for this project.

It can be seen that construction sites will unavoidably take up some cultivated lands and forestlands, so in the next stage of design, adjustment and optimization, attention shall be given to: the location of construction site should be selected preferably in wastelands and lands with inferior quality, and shall be far away from schools, sanatoriums, hospitals and villages, they shall be located 200m leeward away from the above-mentioned sensitive locations. At the same time, they should be located far away from rivers in order to reduce impact on water quality. As for the setting-up of construction campsite, preferably villager's houses shall be rented if there is village nearby, if it is necessary to select a new site, the construction campsite shall not occupy farmlands or only occupy a minimum size of farmlands, and shall be far away from water bodies.

Because land occupation by construction site is short-termed, the land occupied should be restored and protected well after construction is over so as to reduce the impact on ecological environment to a minimum. After the project if finished, the surface ground of construction site should be cleared up, the and hardened concrete should be removed and piled up in designated dreg disposal area, at the same time it is necessary to do a good job in water and soil conservation, to improve the soil and to reclaim them into cultivated lands or forestlands.

4.1.5 Impact analysis of solid waste

4.1.5.1 Impact analysis of solid waste during construction stage

(1) Production and living garbage’s impact on environment during construction stage

Construction workers will unavoidably produce some solid waste in working and constructing. Solid waste is the final shape of many kinds of pollutants with very complicated compositions. Solid waste’s impact on surrounding environment is manifested at first in land occupation, topography and vegetation destruction. If solid waste is not handled and utilized, they must be put in a certain place, which will take up certain amounts of land. The larger the quantity needs to be stored, the larger the size of land to be occupied. Lands that can be used for planting grains and trees are no longer available for such purposes because a large amount of solid waste are placed there, which is a kind of resource waste from the point of view of resource protection.

Secondly such impact is manifested in polluting soil and underground water. Because the solid waste is piled up in the open for a long time, some harmful substances among them will be filtrated and soaked out with oozing to permeate into the underground, making the soil and underground water polluted. If poisonous and harmful solid waste is piled in a certain place, it will influence the normal reproduction and growth of local microorganism and animals and plants, constituting a threat to local ecological balance. Thirdly, the impact is manifested in polluting surface water, once solid waste and harmful substance enter the rivers and lakes, it can cause the river to deposit and block as well as underground water pollution, the consequence is also very serious. Fourthly, the impact is manifested in polluting the atmosphere. Solid waste contains a large amount of dust and other tiny particles, which not only contain elements harmful to human body, but also large amount of pathogenic germs. Under the blowing of wind, the harmful substance and pathogenic germ can fly everywhere, polluting the air and then endangering people's health. Fifthly, the impact is manifested in interfering the landscape of residential areas where the construction campsites locate.

So, it can be found out from the above analysis that if corresponding protective measures are not adopted, solid waste and living garbage will produce adverse influence on natural environment and people’s health.

⑵ Impact on surrounding environment by construction site’s garbage

Construction garbage in road construction site mainly refer to the remaining roadbuilding material, including stones, sand, lime, bitumen, cement, steel, timber, prefabricated components, etc. The aforesaid roadbuilding materials are purchased in a planned way according to the construction progress, but due to the huge consumption of earth and stone works in highway engineering, there will always be some inevitable small volume of roadbuilding materials left, put and piled up in a disorderly manner in shed or in the open, contrasting very incongruously with surrounding environment, causing visual pollution. If lime or cement permeates into the underground with water, which will make the soil hardening and pH value rising, and at the same time, polluting the underground water, thus depriving this land of production capacity, wasting the precious land resource. The bitumen mixture is even more harmful.

In order to reduce and eliminate the above-mentioned solid waste impact on environment, first the plan and operational procedure shall be followed to control strictly and to reduce remaining supplies. Once there are remaining materials, they shall be preserved well in an orderly manner and kept properly so to be used for repairing rural roads or construction in surrounding areas, thus alleviating construction garbage's impact on environment.

4.1.5.2 Impact analysis of solid waste during operation stage

Solid wastes during operation stage mainly come from the garbage in service area, such as waste paper, life garbage, plastic product and so on, whose harm to environment is mainly the destruction of landform and vegetation beauty, thus causing visual pollution to the people. Moreover drivers and passengers may throw wastes out of window at will in the journey, which also can cause environmental pollution. In order to protect natural environment along the highway, first publicity must be strengthened so to make drivers, conductors and passengers aware of environmental protection and to make them protect environment involuntarily. At the same time, garbage cans shall be installed in service areas, which shall be cleared properly and regularly.

After the proposed highway is completed and open to traffic, the service areas will have many personnel passing and resting every day, plus their own service personnel, therefore in each day massive life sewage and garbage will be produced. The average garbage output each person each day is set to be 2kg/d·person, and service area can accommodate 80 people each day. It is estimated preliminarily that this project's service areas, management stations and maintenance divisions will produce life garbage of 540kg/d each day. Garbage produced from service areas, management stations and maintenance divisions mainly comes from public toilet, lodging, and dining. These garbage ingredients are mostly remains from kitchens, which make up about 60% of the total according to investigation. The kitchen remains are all perishable animal and plant materials with high water content about 40-50%.

In summary, because this operation of this project will produce relatively high output of daily garbage, and its ingredient is mostly easily perishable matters, therefore if handled improperly, this garbage will bring adverse impact to the environment, especially will cause the pollution to periphery water body. Therefore, garbage produced from service area, management station and maintenance division where population is centralized must be handled properly so to avoid or reduces its negative impact on environment.

4.1.6 Impact on basic farmlands by project construction

In designing, this project has carried out comparisons of various alternative alignments so as to reduce occupation on cultivated land as much as possible. For road sections passing farmland and cultivated land, necessary engineering measures have already been taken, for instance: shrinking fill subgrade slope, or reducing embankment filling height under the prerequisite of being permitted by route longitudinal gradient in order to reduce occupation of farmland and cultivated land. In the course of construction, the arable topsoil of farmland and cultivated land to be occupied is used in reclaiming earth borrowing and waste banks and in soil amelioration of inferior land or other cultivated land. In addition, the cultivated land taken up by the project will be compensated for in strict accordance with the policy of compensation for land acquisition. So, this project's adverse impact on basic farmland along the route is short-termed, after implementing the environmental protection proposal for the basic farmland, this adverse effect on farmland and cultivated land by the project can be alleviated effectively.

(1) Impact analysis on basic farmland quantity along the route

The project construction will not reduce the total amount of basic farmland along the route. The construction unit will enforce conscientiously the "*People's Republic of China Law on Land Management*" and "*Regulations on Basic Farmland Protection*" to pay in due time the land compensation, allowance for removal and resettlement and compensation for young crops, as well as farmland reclaiming fee if required according to relevant regulations so as to ensure that the quantity of local basic farmland will not be reduced. Route design will follow the principle of reducing farmland occupation as much as possible and will reclaim new cultivated land according to the dynamic equilibrium of general provincial and municipal cultivated land quantity, especially for the reclaiming of temporary land occupation such as earth borrowing and waste banks and construction sites, with consideration given to basic farmland construction plan, rational utilization, and land resource development at the same time. Construction will be accompanied by protection to combine temporary and permanent protection measures together and to plant arbors, bushes, turf and climbing plants within the road right-of-way so as to strengthen ecological protection, to reduce soil erosion, and to maintain dynamic equilibrium of ecological environment.

⑵ Project construction's impact analysis on basic farmland quality along the route

The engineering construction's impact on basic farmland quality along the route is slight with the main reason analyzed as follows:

① Environmental protection function possessed by road project

Route design and selection have already been carried out in accordance with the standards of the Ministry of Communications such as "*Road Route Design Specification*", "*Road Subgrade Design Specification*", *and "Environmental Protection Design Specification of Road Project*", etc. As long as construction is undertaken and each environmental protection measure specified in the environmental impact assessment report is implemented according to design documents strictly, the newly built highway's impact on environment along the route will be reduced to a minimum. In the road pavement and subgrade works, specific requirements have been made on subgrade earth and stone works including earth borrow pits, cut slope, fill slope, etc. Earth is forbidden to be taken away and waste earth is forbidden to be dumped in the range of basis farmlands, land acquisition shall not exceed the scope specified in design documents, at the same time the earth borrowing pits and subgrade slopes are protected by various forms of protection measures, drainage systems and planting works so as to prevent new soil erosion from occurring and prevent pressing and covering the farmland. Being part of the highway engineering, these works can not only protect the highway project itself, but also can mitigate the negative impacts on natural environment by road construction, and besides can protect the functions of basic farmland along the route too. For example, protection works, drainage systems and planting works can reduce soil erosion, thus would not erode and cover the basic farmland along the route; construction of drainage system will make road runoff produced in rainy season enter into local rivers along side ditches and drainage ditches, thus will not erode or pollute the basic farmland along the route; after the afforestation (planting) project is implemented, not only vegetation can be restored but also soil erosion can be reduced, thus beautifying the road and preventing wind and sand storm and indirectly protecting the function of basic farmland along the route; bridge and culvert works guarantee the noncongestion of local river system, do not influence the irrigation system of basic farmland along the route, thus ensuring the irrigation water for basic farmland, and water is the lifeblood of agriculture; if basic farmland cannot obtain water irrigation, their output of grain, oil and vegetables will be influenced.

② Environmental protection function possessed by facilities along the route

The establishment of traffic safety facilities can not only guarantee the security of vehicles running on the highway, but also can protect the function of basic farmland. Safety facilities of highway can prevent running vehicles from rushing into farmland due to accident, which can exert an influence on basic farmland along the route.

Highway construction will separate the basic farmland operators and their basic farmland apart on both sides of the highway, but the road has designed corresponding number of passageways and skywalk bridges so to be beneficial to effective management of basic farmland by local people along the route in order to prevent the quality of basic farmland from reducing.

③ Environmental protection measures of the road

This highway project has put forward corresponding environmental protection measures in this report concerning ecological environment, water and soil conservation, water environment, acoustic and air environments, etc. of which vegetation recovery, water and soil conservation, covering soil to reclaiming fields etc. all have something to do with protection of basic farmland along the route directly. Implementation of the above-mentioned proposal can control soil erosion produced from road construction or initial operation from eroding and covering the basic farmland along the route. Highway afforestation can play a role in preventing wind and sand storm, the topsoil of earth borrowing pits can be used to reclaim new fields. In terms of social environment, road construction can forcefully improve local transportation conditions and raise transportation efficiency, thus sharply promoting local economic development and also benefiting the exchange and promotion of agricultural technology as well as transportation of fertilizers and pesticides. Implementation of the above-mentioned measures will help to further increase the farmland quality along the route.

To sum up, construction of this project will not reduce the total amount of the basic farmlands along the route; its impact on the quality of basic farmlands along the route is slight.

4.1.7 Impact on ecological environment during operation stage

⑴ Impact on natural ecological environment

① Direct impact

As a corridor connecting intraregional economies, this project, because of frequent human activity, will inevitably exert an impact on the wild animal habitant environment of areas along the route, especially on those animals with little population and community, resulting in reduced individual contact of animals, obstructed gene flows, reduced species variability, reduced individual competitiveness and adaptability, reduced individual quantity and quality and final impact on the whole animal community. In addition, in highway section with heavy traffic, when amphibious or other slowly-moving animals pass through the highway, their death rate will increase too.

This project will set up 170 culverts, 4 super-large bridges, 44 large bridges, 25 medium bridges, 203 passageways. This project will set up 6 interchanges and 49 grade separations. These bridges, passageways, culverts, interchanges and grade separations can alleviate the separating from the highway to a great extent, in addition, within the assessment scope, no wild animal species that are protected by the country are found, so impact of segregation and direct injury is very small.

② Indirect impact

The animals and plants are influenced by surface rivers and underground water level, the quantity and species in individual location will change to some degree, but as far as this highway is concerned, such change is extremely small. This is because the proposed highway is an expressway, a large number of bridges and culverts are set up in order to meet the basic engineering requirements of highway. Therefore, bridges and culverts to be set up can indirectly protect vegetation along the highway and hydrology or river system.

After this project is put into operation, automobile tail gas will produce a certain impact on animals and plants in both sides of the highway, traffic noise will also exert an impact on some animals; generally most species can adapt to this and some sensitive species will migrate to other places. With the widespread use of unleaded gas and environmental protection fuel, this kind of impact will be reduced gradually.

In addition, highway operation will make people's contacts swifter and more convenient, but the garbage which passengers discard during travel will produce an unfavorable impact on natural environment.

⑵ Impact on agricultural ecological environment

The areas along the project are dominated mostly by agricultural economy with inconvenient traffic conditions such as low road grade, very bad rural road state, mostly being earth or grit roads, which has been restricting to a great extent the further development of local agriculture, for instance long-distance transport of agricultural products such as fresh fruit and vegetables, etc. are influenced.

After this project is completed, most detour roads can be undergone simple transformation which can meet local people's life and agricultural production requirement. And after the proposed highway is put into operation, it can directly promote the utilization and development of local lands, speed up the introduction of advanced agricultural technology, further improve agricultural ecological environment, optimize the pattern of farmland cultivation, improve the per unit yield of crops, and realize transformation in land resource utilization.

4.2 Prediction and assessment of water environmental impact

4.2.1 Impact analysis during construction stage

4.2.1.1 Impact analysis on water environment by bridge substructure construction

During the initial bridge pier construction stage, cofferdam or island building can produce some perturbation in riverbed bottom, therefore increasing the suspension matters such as silt in partial water body. The bridge pier construction uses driven cast-in-place pile with driving taking place in the cofferdam, the water within the cofferdam well is separated from the river, thus boring will not affect the river water quality. The foundation construction's biggest potential pollutant to water body is boring dregs, which are great in volume for large bridge construction. If discharged at will, they may block downstream river and reduce water quality, therefore it is required to strictly follow related stipulations by Ministry of Communications to haul the boring dregs out of river and to deposit with certain protective measures. The depositing place shall be consulted and agreed with concerned environmental protection bureau and water conservancy bureau. Hauling and depositing process must be supervised by environmental protection personnel, casual discarding of dregs is not allowed in order to minimize the adverse impacts of dregs on river water quality and flood prevention.

4.2.1.2 Impact on water quality by construction vessels

Bridge construction vessels are generally small in tonnage (seldom exceed 90kw) with sanitary sewage and oily wastewater produced from a single vessel about 1 ton every day. The ship wastewater is mainly cabin-washing water and cabin floor water. The cabin-washing water mainly contains silt with little volumes of oil and iron rust which can precipitate quickly if held still; cabin floor water is the water leaked from various floodgates, valves and pipelines in the compartment, and mixed oily water of machinery lubricating oil and fuel oil with average annual amount about 10% of the ship tonnage. Wastewater composition is complicated, if discharged casually, it will reduce water quality, so casual discharging is forbidden.

4.2.1.3 Impact of construction campsite's sanitary sewage on water body

Sanitary sewage of the proposed project mainly comes from each construction campsite, mostly in the form of sewage and excrement sewage produced from construction workers and dining and washing, which contains fat, detergent and other kinds of organic matters. The major pollutants of sewage are shown in Table 4.2.1.3-1.

Table 4.2.1.3-1 Life sewage composition of construction workers

Major pollutant	BOD_5	COD	Total nitrogen(N)	SS	Petroleum	animal and vegetable oils
Concentration(mg/L)	100~150	200~300	20~70	200~300	2~10	10~20

The sewage emission in construction campsite is calculated by:

$$Qs=(K\cdot q_i\cdot V_i)/1000$$

where：Qs——The sewage emission of facilities along the route, t/d;

q_i——water consumption quota for each person each day, L/ (person · d)

V_i——Number of people in service area;

K——Discharging coefficient in service area, generally 0.6- 0.9, it is 0.8 for this project.

During highway construction, the engineering construction is divided into bid sections, each bid section is also divided into many construction divisions, and each construction division has a management and construction staff of about 50-100 people. Construction worker's water consumption is 80L every day for each worker, and about 3.2- 6.4 tons of sanitary sewage will be produced. If the above-mentioned sewage directly enters into nearby water body without treatment, it will adversely impact the water function.

Generally speaking, the sanitary sewage in construction site is only limited to construction stage, and is short-termed. For the whole line, sewage discharge is scattered with small volume. So as long as properly treated they will not produce heavy impact to nearby environment, for example to set up septic tank; the sewage is discharged for farmland irrigation after precipitating, the mud after precipitating is regularly cleared up and used in fertilizing farmland, and the precipitating pool is buried after construction. At the same time, construction campsites will be located far away from water bodies, thus it can effectively avoid pollution on water environment.

4.2.2 Impact analysis during operation stage

After the highway is constructed and in operation, with yearly increase of traffic volume, the vehicle's tail gas, oil and other harmful substances fallen on road surface will increase year by year. Once the above pollutants enter into water body along with rainfall runoff, they will exert a certain influence on the water quality. In addition, the production and life sewage discharge produced from service areas, tollgate stations, and maintenance divisions along the route can also cause pollution to water body in partial manner.

4.2.2.1 Pavement runoff's impact on water quality of nearby water body

The proposed highway pavement is mainly bituminous concrete, belonging to waterproof area with fast runoff production and convergence. Pavement runoff amount during rainfall is calculated by:

$$W=A\times L\times h\times 10^{-3}$$

In which： W—pavement runoff volume in unit length(m^3/d);

A—subgrade width(m);

L－road length(m);

h—rainfall intensity(mm/d).

It can be seen from the above formula that pavement runoff flow is decided by the precipitation. Along the route, the annual average precipitation is 1605.4mm. Runoff volumes of major bridges of the proposed highway during rainfall are estimated as listed in Table 4.2.2.1-1.

Table 4.2.2.1-1 Estimated bridge floor runoff volumes during operation stage

No	Road section	Stake No	Length (m)	Annual average pavement runoff volume (m^3/a)
1	Pavement	K31+013～K149+728	116815	4688318
2	Jiubao river	K32+470	327	13124
3	Xijiang river	K39+150	187	7505
4	Gongjiang river	K63+025	1407	56470

No	Road section	Stake No	Length (m)	Annual average pavement runoff volume (m^3/a)
5	Shangxi river	K94+315	487	19546
6	Gongjiang river	K100+424	497	19947
7	Gongjiang river	K114+940	1087	43627
8	Gongjiang river	K118+920	1367	54865
9	Ganjiang river	K135+491	1337	53661
10	Dongfeng reservoir	K51+710	807	32389
11	JIuling reservoir	K66+735	307	12321
12	Maqimian reservoir	K85+593	367	14730
13	Niugutang reservoir	K115+680	127	5097

It can be seen from the above table that the above super-large bridges will have large floor runoff, but this is the total sum of many rainfalls during a year. The pollutants brought by floor runoff during rainfall are mostly suspended substances and a few amount of petroleum, mostly occurring in the initial raining period the flow volume and speed of the rivers crossed by the road are relatively stable with great dilution ability. Within the assessment scope of downstream section of bridge location there is no centralized drinking water intake. So, it can be thought that the impact on water quality from bridge floor runoff is very small.

However, once the vehicle which transports hazardous articles occurs leakage accident in river-crossing bridge section, it will cause pollution on water quality. So in order to prevent river-crossing bridge section from occurring leakage accident of hazardous articles resulting in water pollution, the 12 bridges crossing rivers and reservoirs of this project are required to have guardrails strengthened and reinforced, and the bridge floor runoff shall be collected and dealt with so that they will not enter into water bodies directly.

4.2.2.2 Sewage impact on water body produced from facilities along the route

The land occupation and staffing of facilities along the route are listed in Table 4.2.2.2-1.

Table 4.2.2.2-1 List of major transportation facilities along the route

No	Items	Central stake No	Size of occupied land (mu)	Staffing
I	Service area and parking lot			
1	Xijiang service area	K38+500	120	30
2	Yudu service area	K98+900	120	30
3	Yuyang service area	K58+700	15	15
4	Hefeng parking lot	K79+950	15	15
5	Ganxian parking lot	K122+100	15	15
II	Management center and station, etc			

<table>
<tr><th>No</th><th>Items</th><th>Central stake No</th><th>Size of occupied land (mu)</th><th>Staffing</th></tr>
<tr><td rowspan="3">1</td><td>Huichang north interchange tollgate</td><td rowspan="3">K50+241</td><td>15</td><td rowspan="3">40</td></tr>
<tr><td>Huichang north management station</td><td>20</td></tr>
<tr><td>Huichang tunnel management station</td><td>15</td></tr>
<tr><td>2</td><td>Ruijin-Ganzhou maintenance center</td><td></td><td>60</td><td>20</td></tr>
<tr><td rowspan="2">3</td><td>Zhonggongzhang tunnel management station</td><td rowspan="2">K78+300</td><td>20</td><td rowspan="2">25</td></tr>
<tr><td>Hefeng interchange tollgate</td><td>15</td></tr>
<tr><td rowspan="2">4</td><td>Yudu interchange tollgate</td><td rowspan="2">K92+200</td><td>15</td><td rowspan="2">25</td></tr>
<tr><td>Yudu management station</td><td>20</td></tr>
<tr><td rowspan="2">5</td><td>Luo’ao interchange tollgate</td><td rowspan="2">K101+700</td><td>15</td><td rowspan="2">25</td></tr>
<tr><td>Xiashan tunnel management station</td><td>15</td></tr>
<tr><td rowspan="2">6</td><td>Ganxian interchange tollgate</td><td rowspan="2">K124+000</td><td>15</td><td rowspan="2">25</td></tr>
<tr><td>Ganxian management station</td><td>20</td></tr>
<tr><td rowspan="3">7</td><td>Ganzhou north interchange tollgate</td><td rowspan="3">K139+400</td><td>18</td><td rowspan="3">45</td></tr>
<tr><td>Ruijin-Ganzhou Highway management center</td><td>25</td></tr>
<tr><td>Ruijin-Ganzhou Highway monitoring and telecom center</td><td>25</td></tr>
</table>

⑵ The major pollutant contents in life sewage produced from each service area are listed in Table 4.2.2.2-2.

Table 4.2.2.2-2 Major pollutant contents in unprocessed life sewage produced from along-the-line facilities

Item / Sewage type	pH	COD_{Cr} (mg/L)	BOD_5 (mg/L)	Oil and grease (mg/L)	Petroleum (mg/L)	SS (mg/L)
Life sewage	—	500	220	50	—	220

⑶ Sewage discharge volume calculation

Sewage discharge volume in facilities along the proposed highway is estimated by the following formula：

$$Qs=(K\cdot q_i\cdot V_i)/1000$$

In which：Qs——sewage discharge volume in facilities along the proposed highway (t/d);

q_i——water quota of every person each day(L/person·d);

V_i——The number of people in service;

K——sewage discharge coefficient in service area

The parameters in the formula are determined by：

① q_i is determined according to the concrete work habit, life characteristic and regional environmental characteristic in Jiangxi Province, each person's daily water use quota, it can adopt the common figure 80L/d.

② the staff number V_i of tollgate station, maintenance division and management subcenter can be calculated by designed staffing, that is by the staffing number listed in

Table 4.2.2.2-1.

The formal staff number in service area is 30 people; temporary 1-2 workers can be employed according to needs. This service area sets up integrated service building, parking area, public toilet, gas station, repair shop, etc. at both sides in order to serving vehicles from different directions for parking, resting, repairing and fueling. The number of drivers and passengers stopping in the service area every day is generally 1500 persons, most of them stay here for short rest and for dining with staying time not exceeding 2 hours, only very few may stay here for 1- 2 days, the resident population of each day can be set at 170 persons. So, the resident population in service area of each day can be calculated at 200 people.

③ The sewage discharge coefficient in service area K is generally 0.6-0.9, this project adopts 0.7.

According to the above formula and parameters, the sanitary sewage discharge situations in transportation engineering facilities along the highway can be estimated out, see Table 4.2.2.2-3.

Table 4.2.2.2-3 Estimated sewage discharge volumes in transportation facilities along the highway

No	Items	Central stake No	Population(person)	Sewage volume(t/d)
I	Service area and parking lot			
1	Xijiang service area	K38+500	30	11.2
2	Yudu service area	K98+900	30	11.2
3	Yuyang service area	K58+700	15	0.84
4	Hefeng parking lot	K79+950	15	0.84
5	Ganxian parking lot	K122+100	15	0.84
II	Management center and station, etc			
1	Huichang north interchange tollgate Huichang north management station Huichang tunnel management station	K50+241	40	2.24
2	Ruijin-Ganzhou maintenance center		20	1.12
3	Zhonggongzhang tunnel management station Hefeng interchange tollgate	K78+300	25	1.40
4	Yudu interchange tollgate Yudu management station	K92+200	25	1.40
5	Luo'ao interchange tollgate Xiashan tunnel management station	K101+700	25	1.40
6	Ganxian interchange tollgate Ganxian management station	K124+000	25	1.40
7	Ganzhou north interchange tollgate Ruijin-Ganzhou Highway management center Ruijin-Ganzhou Highway monitoring and telecom center	K139+400	45	2.52
Total				36.4

4.2.2.3 Feasibility study of pollution prevention measures and standard-satisfying discharge

In summary, the daily sewage discharge volume of various transportation management facilities along the proposed highway is up to 36.4t, if discharged without any treatment measures, This will produce impact on surrounding environment, especially on the water quality of nearby receptive water bodies (Xijiang service area is close to Xijiang River, Yudu service area is close to Gongjiang River). So sewage disposal measures shall be adopted to prevent sanitary sewage from entering into water body and polluting the water quality.

From the predicted results of sewage amount in Table 4.2.2.2-3, it can be seen that the sewage amount produced from service area is the largest, about 11.2t/d; the sewage amount produced from parking area, tollgate station and, administrative station is relatively small, about 1 ton every day. So small sewage disposal equipment of corresponding treatment capacity should be installed in each place according to the predicted sewage amount.

Because the main pollutants in sewage of service area are BOD_5, COD_{Cr}, etc. it is suitable to adopt biochemical treatment. Concrete sewage disposal technological process can be considered according to the actual conditions, but outlet water quality needs to meet class 1 limits of sewage comprehensive discharge standard GB8978-1996. The following treatment process is suggested as shown in Fig.4.2.2.3-1. The dining sewage from service area shall be collected separately, which, after treated in oil-separating tank, is discharged into the regulating tank with life sewage where the water volume and quality are regulated, then the sewage enters into the primary sediment tank to remove suspended substances of larger particles, again it enters into contact oxidation tank for oxygen treatment, then enters into secondary sediment tank to separate the solid from liquid; after the secondary sediment tank, the sewage is disinfected and can be discharged.

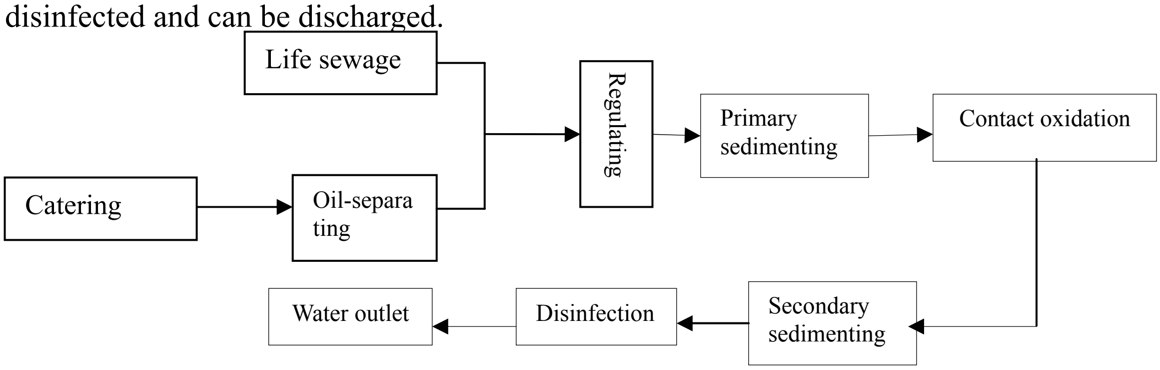


Fig. 4.2.2.3-1 Sewage treatment procedure diagram in service area

Small-scale sewage disposal equipment has the advantages of simple and convenient operation, easy maintenance and management, if it is in good quality and proper operation, it can make the outlet water quality reaching class 1 criteria of *Comprehensive Sewage Discharge Standard* (GB8978-1996), the outlet water will not produce serious adverse impact on water quality of receptive water bodies.

In order to guarantee the outlet water quality of sewage disposal equipment, it is important to carry on good maintenance and management to the sewage disposal equipment. After this project is completed the whole route will set up 3 management stations, each station will be staffed with one full-time environmental protection technical person who is responsible for the environmental protection in the jurisdictional section. Such full-time environmental protection technical person will periodically maintain and inspect the equipment to ensure its normal operation, in case of problem, such problem can be immediately found out and repaired so that the outlet water quality can reach class 1 criteria of *Comprehensive Sewage Discharge Standard* (GB8978-1996).

4.2.2.4 Impact on existing farmland irrigation pattern

Along the proposed highway, there has been established a comparatively perfect water conservancy and irrigated system with good irrigation and water conservancy conditions. The highway and water canals intersect in the form of culvert. Design of all bridges and culverts has considered flood discharge, irrigation requirement and convenience to local people's production and life. During design, for head-cut ditches and disabled ditches due to road construction, and ditches that can be resumed their irrigation function, appropriate realignment, merging and linking have been designed by considering route vertical plane design. Therefore, the road construction will not cause large adverse impact on field irrigation.

4.3 Prediction and assessment of acoustic environmental impact

4.3.1 Prediction and assessment of acoustic environmental impact during construction stage

4.3.1.1 Noise pollution sources and characteristics during construction stage

This project is large in size with construction period lasting for 3 years. Construction technique is complicated for this project involving many kinds of large-and-middle-sized machinery and equipment carrying on mechanized construction. The characteristic of construction machinery noise is high noise level and irregularity, which will often exert a great impact on acoustically sensitive locations such as villages, small towns and schools near construction site, so great importance must be attached to construction machinery noises produced from highway construction.

The acoustic environmental impact prediction during construction stage is carried out mainly based on analogy analysis of relevant data. Machinery frequently used in road construction includes transport vehicles, road graders, large-scale mixers, pile drivers, excavators, etc. as well as other construction machinery such as air compressor, steam hammer, etc., but only for use in a short time. The analogical and monitored noise results of major highway construction machinery see Table 4.3.1.1-1.

Table 4.3.1.1-1 Measured sound value of highway construction machinery

Machinery and equipment	Measurement distance (m)	Sound level (dB)	Remarks
Pile driver	15	95～105	Different types of driver have different noise level
Excavator	5	84	Pneumatic type
Bulldozer	5	86	
Loader	5	90	Wheel type
Mixer	2	90	
Spreader	5	87	
Scraper	5	93	
Grader	5	90	
Roller	5	86	Vibrating type
Truck	7.5	89	The heavier its load, the louder the noise
Vibrator	15	81	
Tamper	15	90	
Self-discharging truck	5	82	
Mobile crane	7.5	89	

Road construction noise has its own characteristics, manifested in：

(1) The construction machinery is various in type, there are different construction machinery at different construction stages, even in the same construction stage, construction machinery put into operation is varied in number too, which show the randomness of construction noise and irregularity.

⑵ Noise source of different equipment is different, some equipment noise takes on the form of vibrative, acute and pulse characteristics, exerting a great impact on people; some equipment's noise frequency (such as the mixer) is low, difficult to attenuate, thus making people feel frustrated; The noise of construction machinery is relatively big, but their difference in sound level is still very great with some equipment producing operation noise up to about 110dB.

⑶ Noise source of construction is different from general fixed noise source and moving noise source, construction machinery are generally exposed in outdoors and they will move within a small circle in a certain time, which can increase noise pollution range in this period of time compared with fixed noise source, but still limited within local range compared moving noise source. The noise of construction machinery can be regarded as point sound source.

4.3.1.2 Predicting method and mode of construction noise

In view of the complexity of construction noise, and the regionality and phase nature of construction noise, this report calculates out the noise pollution range of different construction equipment at different construction stage according to the national "*Construction Boundary Noise Level Limit*" (GB12523-90) so that construction units can take proper noise pollution prevention and control measures according to actual conditions.

Construction noise can be regarded approximately as point sound source, point sound source attenuation mode can be used to estimate noise values at different distance from noise source, and the predicting mode is as follows:

$$L_i = L_0 - 20\lg\frac{R_i}{R_0} - \Delta L$$

in which: L_i — predicted construction noise value Ri m from the sound source, dB;

L_o — construction noise level R_0 *m* from the sound source, dB;

$\triangle L$— additional attenuation produced from barrier, vegetation, air, etc.

Impact on a certain predicting point with several construction machinery in operation can be predicted by superimposing the sound level according to the following formula.

$$L = 10\lg\sum_{i=1}^{n}10^{0.1\times L_i}$$

4.3.1.3 Calculation and impact analysis of construction noise coverage

(1) Construction noise impact coverage calculation

The above-mentioned predicting method and mode are used to calculate the noise coverage of various kinds of equipment during construction; the results are listed in Table 4.3.1.3-1.

Table 4.3.1.3-1 Construction equipment's noise impact coverage

Construction stage	Construction machinery	Standard limit (dB)		Impact coverage (m)	
		Daytime	Nighttime	Daytime	Nighttime
Earth and stone works	Loader	75	55	28.1	210.8
	Grader			28.1	210.8
	Scraper			39.7	281.2
	Excavator			14.1	118.6
Piling	Pile driver	85	Forbidden	126.2	/
Structure	Mixer	70	55	20.0	100.2
	Vibrator			53.2	224.4
	Tamper			126.2	474.3
	Mobile crane			66.8	266.1
	Truck			66.8	266.1
	Spreader			35.4	167.5
	Grader			50.0	210.8

(2) Impact analysis of construction noise

From Table 4.3.1.3-1, the following conclusions can be drawn:

① In the course of actual construction, many sets of machinery may at work at the same time in one place, then noise impacted coverage will be larger than the predicted value, considering that the actual conditions are comparatively complicated, it is very difficult to make use of sound level superimposition formula for calculation.

② Construction noise will have a certain impact on the acoustic environmental quality along the route; this kind of noise impact mainly appears in a range 130m from construction site in daytime and 480m from construction site in nighttime. By the calculated result, the most serious construction machinery of noise pollution is pile driver and rammer (tamper), which generally speaking will be used in subgrade and bridge construction, while other construction machinery noises are relatively low.

③ Heavy-duty equipment and high-noise power generating house will cause serious damage to construction operators. With growth of construction operators' working age, various kinds of injuries, especially hearing damage, will be displayed, and some damages are not recoverable. Relevant data prove that noise deafness not only relates to sound level, but also to exposure time. The danger of noise will also bring about many kinds of diseases in human body. It is obvious that heavy-duty equipment noise will exert big impact on construction staff member and residents around. In highway section near schools, the heavy-duty construction equipment with high noise should be used in limited time and construction shall avoid schooling time.

④ The acoustic sensitive locations along this project are mainly residential areas and schools, construction noise may affect theirs normal life and study, especially large-scale equipment's noise will produce big impact on inhabitants. In road sections nearby school, high-noise heavy construction equipment should be used in limited time to avoid construction in schooling hours. In road sections nearby residential areas, high-noise heavy construction equipment should be used in limited time to avoid construction at night. Regarding residential areas and schools near construction sites, noise sampling and monitoring shall be conducted. If the monitored value exceeds the allowed figure, construction units must be obliged to take noise reduction measures.

⑤ Construction noise pollution is short-termed. In order to protect inhabitants' normal life and rest, the construction units are required to strengthen the environmental protection consciousness and good-mannered construction so to reduce construction noise impact on environment as much as possible.

4.3.2 Prediction and assessment of acoustic environmental impact during operation stage

4.3.2.1 Noise predicting mode

(1) Traffic noise predicting mode

① The calculation formula of hourly traffic noise value received by predicting point when model i vehicles go on daytime or nighttime:

$$\left(L_{eq}\right)_{\mathrm{h}} = L_{w,i} + 10 \cdot \lg\left(\frac{N}{v_i \cdot T}\right) - \Delta L_{distance} + \Delta L_{ground} + \Delta L_{barrier} - 16$$

in which:

$L_{eq(h)}$	——	Vehicle's hourly equivalent sound level, dB;
$L_{w,i}$	——	Vehicle's average radiation noise level interference point, dB;
N	——	Hourly traffic volume, vehicle/h;
i	——	Large, median and small vehicles;
v_i	——	The average speed of Model i vehicles, km/h;
T	——	The predicting time of L_{Aeq}, set at 1h;
$\triangle L_{distance}$	——	Distance attenuation of predicting point r from noise equivalent lane, dB;

$\triangle L_{ground}$ —— Noise attenuation due to ground of predicting point r from noise equivalent lane, dB;

$\triangle L_{barrier}$ —— Barrier additional attenuation in noise transmission, dB(A).

② Traffic noise level received by predicting point of each type of vehicles in daytime or nighttime is calculated by the following formula:

$$(L_{Aeq})_{traffic} = 10\lg\left[10^{0.1(L_{Aeq})_L} + 10^{0.1(L_{Aeq})_M} + 10^{0.1(L_{Aeq})_S}\right] - \Delta L_1$$

in which：

$(L_{Aeq})_L$, $(L_{Aeq})_M$, $(L_{Aeq})_S$——traffic noise level received by predicting point of large , medium, small-sized vehicles in daytime or nighttime, dB;

$(L_{Aeq})_{traffic}$——traffic noise level received by predicting point in daytime or nighttime, dB;

$\triangle L_1$——traffic noise correction caused by highway curve or limited length section, dB(A).

③ Ambient noise predicting formula of predicting point in daytime or nighttime:

$$(L_{Aeq})_{inadvance} = 10\lg\left[10^{0.1(L_{Aeq})_{traffic}} + 10^{0.1(L_{Aeq})_{background}}\right]$$

in which： (L_{Aeq}) in advance — ambient noise predicted value of predicting point in daytime or nighttime, dB;

$(L_{Aeq})_{background}$ — ambient noise background value in predicting point, dB.

Other symbols same as above.

(2) Determination of mode parameters

① Vehicle speed

$$v_i = k_1 \cdot u + k_2 + \frac{1}{k_3 \cdot u + k_4}$$

$$u_i = N_{\sin gl-lanehourly} \cdot [\eta_i + m \cdot (1-\eta_i)]$$

in which：

v_i — predicting speed of model i vehicle, k_1, k_2, k_3, k_4, m are factors set from Table 4.3.2.1-1.

Table 4.3.2.1-1 Common factors for predicting vehicle speed

Vehicle type	k_1	k_2	k_3	k_4	m
Large vehicle	-0.061748	149.65	-0.000023696	-0.02099	1.2102
Median vehicle	-0.057537	149.38	-0.000016390	-0.01245	0.8044

Small vehicle	-0.051900	149.39	-0.000014202	-0.01254	0.70957

u_i —— Equivalent number of this type of vehicles;

$N_{\text{Single-lane hourly}}$ —— Single-lane hourly traffic volume;

η_i —— Vehicle composition ratio;

m —— Weighted factor of other types of vehicle

② $L_{w,i}$

Average radiating sound level of each vehicle type is calculated by:

large vehicle: $L_{w,l}=22.0+36.32\ lgV_l$

median vehicle: $L_{w,m}=8.8+40.48\ lgV_m$

small vehicle: $L_{w,s}=12.6+34.73\ lgV_s$

in which: $L_{w,l}$, $L_{w,m}$, $L_{w,s}$ are the average radiating sound level of large, median and small vehicles.

③ Distance attenuation $\Delta L_{\text{distance}}$ calculation

A. When hourly traffic volume in carriageway is larger than 300 vehicles/h

$$\Delta L_{distance}=10\times\lg\left(\frac{r_0}{r}\right)$$

B. When hourly traffic volume in carriageway is less than 300 vehicles/h

$$\Delta L_{distance}=15\times\lg\left(\frac{r_0}{r}\right)$$

where:

r —— Distance from carriageway center line to predicting point, m;

r_0 —— Distance from carriageway center line to reference point, r_0=7.5m;

④ Ground attenuation ΔL_{ground}

$$\Delta L_{\text{ground}}=10\times\lg\left(\frac{r_o}{r}\right)^{\alpha}$$

in which: α is a constant from 0.3～0.7 according to the different sound absorption nature by ground;for soft ground with good sound absorption, α is larger, or vice versa.

⑤ $\Delta L_{\text{longitudinal gradient}}$

large vehicle: $\Delta L_{\text{longitudinal gradient}}=98\times\beta$

median vehicle: $\Delta L_{\text{longitudinal gradient}}=73\times\beta$

small vehicle：$\Delta L_{\text{longitudinal gradient}} = 50 \times \beta$

⑥ $\Delta L_{\text{pavement}}$

Bituminous concrete pavement's $\Delta L_{\text{pavement}}$ is set at 0dB.

⑦ Calculation of traffic noise correction $\triangle L_1$ caused by road curving or limited-length section

$$\Delta L_1 = -10\lg(\theta/180)$$

in which：θ——angle from predicting point to two road ends(degree).

⑧ $\Delta L_{\text{barrier}}$

$$\Delta L_{barrier} = \Delta L_{wood} + \Delta L_{ruralhouse} + \Delta L_{sound-shadow-zone}$$

i $\triangle L_{\text{wood}}$ is the additional attenuation caused by wood strip.

$\triangle L_{\text{wood}}$ is the additional attenuation caused by wood strip, calculated by：

$$\Delta L_{wood} = k \cdot b$$

in which：

k: average attenuation caused by wood strip, usually k=1.0dB/10m;

b: wood strip width the noise passes, m。

The additional attenuation caused by wood strip varies in different regions, for example, the wood strip in north China is of small density, so the attenuation shall be reduced suitably.

ii $\triangle L_{rural\ house}$

$\triangle L_{rural\ house}$ is the additional attenuation caused by rural houses, calculated by Table 4.3.2.1-2, refer to Fig. 4.3.2.1-1.

Table 4.3.2.1-2 Estimates of attenuation caused by rural houses

S/S_0	attenuationΔL
First row of houses：40%～60%	3dB
Second row of houses：70%～90%	5dB
Every addition row of houses	1.5dB max. attenuation≤10dB

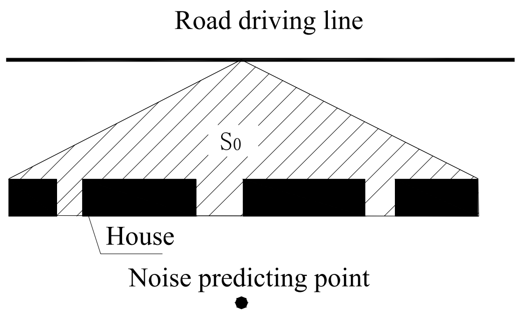


Fig. 4.3.2.1-1 Noise reduction calculation by rural house

S is the sum of the surface size of first row of houses, S_0 is the size of the oblique part(including houses)

iii $\triangle L_{\text{sound-shadow-zone}}$

$\triangle L_{\text{sound-shadow-zone}}$ is the attenuation caused by predicting point locating in the sound-shadow-zone of high embankment or low cutting.

To calculate δ from Fig. 4.3.2.1-2, when the predicting point is within the sound-shadow-zone,δ ＝ c-a-b;when the predicting point is within the sound-shadow-zone,δ＝a+b-c。

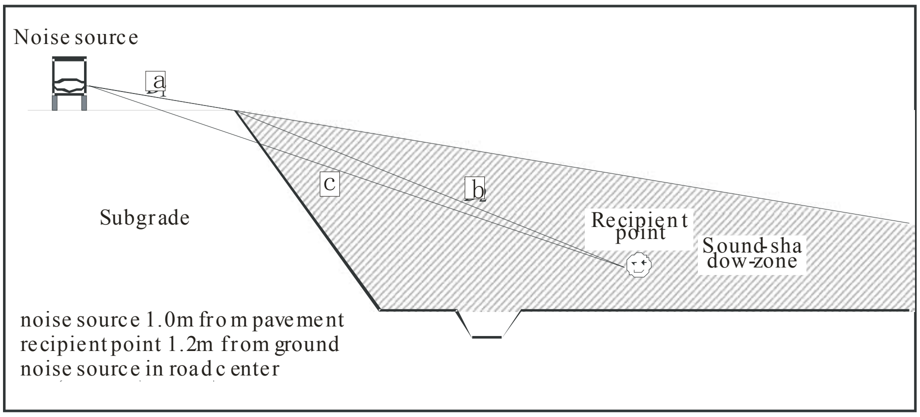


Fig. 4.3.2.1-2 Calculation illustration of sound path differenceδ

In calculating attenuation, adopt Fresnel figure *N*, which is defined as：

$$N_{\max} = \frac{2\delta}{\lambda}$$

in which：λis sound wave length(m), set at 500Hz during prediction;σis sound path difference of direct sound and diffract sound(m).

Attenuation calculation module is:

for point source:

$$\Delta L_{\text{barrier}} = 10 \times \lg(3 + 10 \times N_{\max})$$

for line source:

$$\Delta L_{\text{barrier}} = \begin{cases} 10 \times \lg\left(\dfrac{3 \times \pi \times \sqrt{(1-t^2)}}{4 \times \arctan\sqrt{\dfrac{(1-t)}{(1+t)}}}\right) & (t \le 1) \\ 10 \times \lg\left(\dfrac{3 \times \pi \times \sqrt{(t^2-1)}}{2 \times \ln(t + \sqrt{(t^2-1)})}\right) & (t > 1) \end{cases}$$

in which:

$$t = 20 \times N_{\max}/1.02$$

4.3.2.2 Traffic noise prediction and assessment in each section

According to the above-mentioned calculation formulae and parameter setting, the predicted traffic noise values of each section during operation stage are calculated as shown in Table 4.3.2.2-1. The data does not contain predicted traffic noise values 200 m from road center line under circumstances of sound shadow attenuation and background noise situation. According to class 1 standard (namely 55dB in daytime, 45dB in nighttime), class 2 standard (namely 60dB in daytime, 50dB in nighttime) and class 4 standard (namely 70dB in daytime, 55dB in nighttime) specified in GB3096-93, the standard-satisfying distances of traffic noise at both sides see Table 4.3.2.2-2.

Table 4.3.2.2-1 Traffic noise predicted values of each section during operation stage

Section	Assessment year	Day or Night	Predicted traffic noise values at difference horizontal distance from road center line(dB)										
			20m	30m	40m	50m	60m	80m	100m	120m	150m	180m	200m
Yunshishan～Huichang (K31+012.977～K50+248)	Short-term (2009)	Day	67.2	63.8	61.4	59.6	58.1	55.7	53.8	52.1	50.1	48.4	47.3
		Night	61.6	57.4	54.5	52.3	50.5	47.6	45.3	43.4	40.9	38.9	37.7
	Mid-term (2015)	Day	69.7	66.4	64.2	62.5	61.1	58.8	57.0	55.5	53.5	51.9	50.9
		Night	63.6	59.4	56.5	54.3	52.5	49.6	47.3	45.3	42.9	40.9	39.7
	Long-term (2023)	Day	71.7	68.5	66.3	64.5	63.1	60.8	59.0	57.5	55.6	53.9	52.9
		Night	67.2	63.7	61.3	59.5	58.0	55.6	53.6	52.0	50.0	48.2	47.2
Huichang～Hefeng (K50+248～K78+181)	Short-term (2009)	Day	67.9	64.6	62.3	60.5	59.1	56.8	54.9	53.4	51.4	49.7	48.7
		Night	62.0	57.8	54.9	52.7	50.9	48.0	45.7	43.7	41.3	39.3	38.1
	Mid-term (2015)	Day	70.1	66.8	64.6	62.9	61.5	59.2	57.4	55.8	53.9	52.3	51.3
		Night	64.0	59.8	56.9	54.7	52.9	49.9	47.6	45.7	43.3	41.3	40.1
	Long-term (2023)	Day	72.0	68.8	66.6	64.8	63.4	61.2	59.3	57.8	55.9	54.2	53.3
		Night	67.7	64.3	62.0	60.3	58.8	56.5	54.6	53.0	51.0	49.3	48.3
Hefeng～Yudu (K78+181～	Short-term (2009)	Day	68.1	64.9	62.6	60.9	59.4	57.2	55.3	53.8	51.8	50.2	49.2
		Night	62.1	57.9	55.1	52.8	51.0	48.1	45.8	43.9	41.5	39.4	38.2
	Mid-term (2015)	Day	70.2	67.0	64.7	63.0	61.6	59.3	57.5	56.0	54.0	52.4	51.4
		Night	64.1	59.9	57.0	54.8	53.0	50.1	47.8	45.9	43.4	41.4	40.2

Section	Assessment year	Day or Night	Predicted traffic noise values at difference horizontal distance from road center line(dB)										
			20m	30m	40m	50m	60m	80m	100m	120m	150m	180m	200m
K90+225)	Long-term (2023)	Day	72.1	68.9	66.7	64.9	63.5	61.3	59.4	57.9	56.0	54.3	53.4
		Night	67.9	64.5	62.3	60.5	59.1	56.7	54.9	53.3	51.3	49.7	48.7
Yudu～Luo'ao (K90+225～K101+230)	Short-term (2009)	Day	68.4	65.2	63.0	61.3	59.9	57.6	55.8	54.2	52.3	50.6	49.7
		Night	62.4	58.2	55.3	53.1	51.3	48.4	46.1	44.1	41.7	39.7	38.5
	Mid-term (2015)	Day	70.4	67.2	65.0	63.3	61.9	59.6	57.8	56.2	54.3	52.7	51.7
		Night	64.4	60.2	57.3	55.1	53.2	50.3	48.0	46.1	43.7	41.6	40.4
	Long-term (2023)	Day	72.4	69.1	66.9	65.2	63.8	61.5	59.7	58.1	56.2	54.6	53.6
		Night	68.3	65.1	62.8	61.1	59.7	57.4	55.6	54.1	52.1	50.5	49.5
Luo'ao～Ganxian (K101+230～K124+244)	Short-term (2009)	Day	68.9	65.6	63.4	61.7	60.3	58.0	56.2	54.7	52.7	51.1	50.1
		Night	62.8	58.6	55.7	53.5	51.7	48.8	46.5	44.6	42.1	40.1	38.9
	Mid-term (2015)	Day	70.8	67.6	65.3	63.6	62.2	59.9	58.1	56.6	54.7	53.0	52.0
		Night	65.6	61.9	59.3	57.3	55.7	53.0	51.0	49.2	47.0	45.2	44.1
	Long-term (2023)	Day	72.6	69.4	67.2	65.4	64.0	61.8	59.9	58.4	56.5	54.8	53.8
		Night	68.6	65.3	63.1	61.4	60.0	57.7	55.9	54.3	52.4	50.8	49.8
Ganxian～Ganzhou north (K124+244～K139+377)	Short-term (2009)	Day	69.3	66.1	63.9	62.2	60.7	58.5	56.6	55.1	53.2	51.5	50.6
		Night	63.3	59.1	56.2	54.0	52.1	49.2	46.9	45.0	42.6	40.5	39.3
	Mid-term (2015)	Day	71.2	67.9	65.7	64.0	62.6	60.3	58.5	57.0	55.0	53.4	52.4
		Night	66.3	62.6	60.1	58.2	56.6	54.1	52.1	50.4	48.2	46.4	45.4
	Long-term (2023)	Day	72.9	69.7	67.5	65.7	64.3	62.0	60.2	58.7	56.8	55.1	54.1
		Night	68.9	65.6	63.4	61.7	60.3	58.0	56.2	54.7	52.7	51.1	50.1
Ganzhou north～Huangjin (K139+377～K149+728)	Short-term (2009)	Day	69.6	66.3	64.1	62.4	61.0	58.7	56.9	55.4	53.4	51.8	50.8
		Night	63.5	59.3	56.4	54.2	52.4	49.5	47.2	45.2	42.8	40.8	39.6
	Mid-term (2015)	Day	71.4	68.2	66.0	64.2	62.8	60.6	58.7	57.2	55.3	53.6	52.7
		Night	66.7	63.1	60.7	58.8	57.3	54.8	52.8	51.1	49.0	47.3	46.2
	Long-term (2023)	Day	73.1	69.9	67.7	66.0	64.5	62.3	60.5	58.9	57.0	55.3	54.4
		Night	69.1	65.9	63.7	61.9	60.5	58.3	56.4	54.9	53.0	51.3	50.3

Table 4.3.2.2-2 Standard-satisfying distances of each road section in assessment year

Section	Assessment year	Assessment time	Standard-satisfying distances (m)		
			Class 1 (m)	Class 2 (m)	Class 4 (m)
Yunshishan～Huichang (K31+012.977～K50+248)	Short-term (2009)	Day	87	48	< 20.0
		Night	103	63	38
	Mid-term (2015)	Day	127	70	< 20.0
		Night	124	77	47
	Long-term (2023)	Day	160	89	25
		Night	243	150	86
Huichang～Hefeng (K50+248～K78+181)	Short-term (2009)	Day	99	54	< 20.0
		Night	107	66	40
	Mid-term (2015)	Day	133	73	20
		Night	129	80	49
	Long-term (2023)	Day	166	93	26
		Night	266	168	96
Hefeng～Yudu (K78+181～K90+225)	Short-term (2009)	Day	104	56.1	< 20.0
		Night	108	67	40.2
	Mid-term (2015)	Day	135	74.1	20.6
		Night	131	80.7	49.2
	Long-term (2023)	Day	168	93.8	26.5
		Night	274	173.8	98.6
Yudu～Luo'ao (K90+225～K101+230)	Short-term (2009)	Day	110	59	< 20.0
		Night	111	69	41
	Mid-term (2015)	Day	139	76	21
		Night	134	83	50
	Long-term (2023)	Day	172	97	27
		Night	293	190	108
	Short-term	Day	116	63	< 20.0

Section	Assessment year	Assessment time	Standard-satisfying distances (m)		
			Class 1 (m)	Class 2 (m)	Class 4 (m)
Luo'ao～Ganxian (K101+230～K124+244)	(2009)	Day	116	63	< 20.0
		Night	115	72	43
	Mid-term (2015)	Day	145	79	23
		Night	183	111	65
	Long-term (2023)	Day	177	99	28
		Night	298	196	111
Ganxian～Ganzhou north (K124+244～K139+377)	Short-term (2009)	Day	122	67	< 20.0
		Night	120	75	45
	Mid-term (2015)	Day	151	83	24
		Night	207	125	73
	Long-term (2023)	Day	182	103	29
		Night	305	202	116
Ganzhou north～Huangjin (K139+377～K149+728)	Short-term (2009)	Day	126	69	< 20.0
		Night	123	76	46
	Mid-term (2015)	Day	155	86	24
		Night	223	136	78
	Long-term (2023)	Day	187	106	30
		Night	310	207	119

From Table 4.3.2.2-1 and 4.3.2.2-2, it can be seen that：

⑴ According to class 1 standard limit in GB3096-93(day:55dB,night:45dB), the farthest standard-satisfying distances in daytime along the two sides of the highway in short-term stage, mid-term stage and long-term stage are 126m, 155m and 187m respectively from road center line; The farthest standard-satisfying distances in nighttime along the two sides of the highway in short-term stage, mid-term stage and long-term stage are 123m, 223m and 310m respectively from road center line.

⑵ According to class 2 standard limit in GB3096-93(day:60dB,night:50dB), the farthest standard-satisfying distances in daytime along the two sides of the highway in short-term stage, mid-term stage and long-term stage are 69m, 86m and 106m respectively from road center line; The farthest standard-satisfying distances in nighttime along the two sides of the highway in short-term stage, mid-term stage and long-term stage are 76m, 136m and 207m respectively from road center line.

⑶ According to class 4 standard limit in GB3096-93(day:70dB,night:55dB), the farthest standard-satisfying distances in daytime along the two sides of the highway in short-term stage, mid-term stage and long-term stage are 20m, 24m and 30m respectively from road center line; the farthest standard-satisfying distances in nighttime along the two sides of the highway in short-term stage, mid-term stage and long-term stage are 46m, 78m and 119m respectively from road center line.

4.3.2.3 Traffic noise prediction and analysis in viaduct sections

Considering that this project has many viaduct sections, noise predictions are conducted on viaduct sections with altitude difference between pavement and ground of 10m, 15m, 20m and 25m respectively, the predicted results are listed in Table 4.3.2.3-1～4.3.2.3-4.

Table4.3.2.3-1 Traffic noise predicted values of each section during operation stage (height difference:10m)

Section	Assessment year	Day or Night	Predicted traffic noise values at difference horizontal distance from road center line(dB)										
			20m	30m	40m	50m	60m	80m	100m	120m	150m	180m	200m
Yunshishan～Huichang (K31+012.977～K50+248)	Short-term (2009)	Day	50.3	51.2	51.5	51.4	51.2	50.1	48.8	47.3	45.3	43.7	42.8
		Night	42.9	44.0	44.4	44.3	43.8	42.2	40.3	38.5	36.2	34.2	33.1
	Mid-term (2015)	Day	52.8	53.9	54.3	54.4	54.2	53.3	52.0	50.7	48.8	47.2	46.3
		Night	44.9	46.0	46.4	46.3	45.8	44.2	42.3	40.5	38.2	36.2	35.1
	Long-term (2023)	Day	54.9	55.9	56.3	56.4	56.2	55.3	54.0	52.7	50.8	49.3	48.4
		Night	50.3	51.1	51.4	51.4	51.1	50.0	48.7	47.2	45.2	43.6	42.7
Huichang～Hefeng (K50+248～K78+181)	Short-term (2009)	Day	51.0	52.0	52.4	52.4	52.2	51.2	49.9	48.5	46.6	45.1	44.1
		Night	43.3	44.4	44.8	44.7	44.1	42.5	40.7	38.9	36.5	34.6	33.5
	Mid-term (2015)	Day	53.2	54.2	54.7	54.7	54.6	53.7	52.4	51.0	49.1	47.6	46.7
		Night	45.3	46.4	46.8	46.6	46.1	44.5	42.7	40.9	38.5	36.6	35.4
	Long-term (2023)	Day	55.2	56.2	56.6	56.7	56.5	55.6	54.4	53.0	51.1	49.6	48.7
		Night	50.8	51.7	52.1	52.1	51.9	50.9	49.6	48.2	46.2	44.7	43.7
Hefeng～Yudu (K78+181～K90+225)	Short-term (2009)	Day	51.3	52.3	52.7	52.7	52.5	51.6	50.3	49.0	47.1	45.5	44.6
		Night	43.5	44.6	44.9	44.8	44.3	42.7	40.8	39.1	36.7	34.7	33.6
	Mid-term (2015)	Day	53.3	54.4	54.8	54.9	54.7	53.8	52.5	51.2	49.3	47.7	46.9
		Night	45.4	46.5	46.9	46.8	46.3	44.7	42.8	41.0	38.7	36.7	35.6
	Long-term (2023)	Day	55.3	56.3	56.7	56.8	56.6	55.7	54.4	53.1	51.2	49.7	48.8
		Night	51.0	51.9	52.3	52.4	52.1	51.2	49.9	48.5	46.6	45.0	44.1
Yudu～Luo'ao (K90+225～K101+230)	Short-term (2009)	Day	51.6	52.6	53.1	53.1	52.9	52.0	50.8	49.4	47.5	46.0	45.1
		Night	43.7	44.8	45.2	45.0	44.5	42.9	41.1	39.3	36.9	35.0	33.8
	Mid-term (2015)	Day	53.6	54.6	55.1	55.1	54.9	54.0	52.8	51.4	49.5	48.0	47.1
		Night	45.7	46.8	47.2	47.0	46.5	44.9	43.1	41.3	38.9	37.0	35.8
	Long-term (2023)	Day	55.5	56.5	57.0	57.0	56.9	56.0	54.7	53.3	51.5	49.9	49.0
		Night	51.4	52.5	52.9	53.0	52.8	51.9	50.6	49.3	47.4	45.8	45.0
Luo'ao～Ganxian (K101+230～K124+244)	Short-term (2009)	Day	52.0	53.0	53.5	53.6	53.4	52.5	51.2	49.8	48.0	46.4	45.5
		Night	44.1	45.2	45.6	45.5	45.0	43.4	41.5	39.7	37.4	35.4	34.3
	Mid-term (2015)	Day	54.0	55.0	55.4	55.5	55.3	54.4	53.1	51.8	49.9	48.4	47.5
		Night	48.6	49.2	49.3	49.1	48.7	47.5	46.0	44.4	42.3	40.5	39.5
	Long-term (2023)	Day	55.8	56.8	57.2	57.3	57.1	56.2	54.9	53.6	51.7	50.2	49.3
		Night	51.7	52.7	53.2	53.2	53.1	52.2	50.9	49.5	47.6	46.1	45.2
Ganxian～Ganzhou north (K124+244～K139+377)	Short-term (2009)	Day	52.5	53.5	53.9	54.0	53.8	52.9	51.7	50.3	48.4	46.9	46.0
		Night	44.6	45.7	46.1	45.9	45.4	43.8	42.0	40.2	37.8	35.9	34.7
	Mid-term (2015)	Day	54.3	55.4	55.8	55.9	55.7	54.8	53.5	52.2	50.3	48.7	47.8
		Night	49.3	50.0	50.2	50.1	49.7	48.6	47.1	45.6	43.5	41.8	40.8
	Long-term (2023)	Day	56.1	57.1	57.5	57.6	57.4	56.5	55.2	53.9	52.0	50.5	49.6
		Night	52.0	53.0	53.5	53.6	53.4	52.5	51.2	49.8	48.0	46.4	45.5
Ganzhou north～Huangjin (K139+377～K149+728)	Short-term (2009)	Day	52.7	53.8	54.2	54.3	54.1	53.2	51.9	50.6	48.7	47.1	46.2
		Night	44.8	45.9	46.3	46.2	45.6	44.0	42.2	40.4	38.1	36.1	35.0
	Mid-term (2015)	Day	54.6	55.6	56.0	56.1	55.9	55.0	53.8	52.4	50.5	49.0	48.1
		Night	49.7	50.5	50.7	50.6	50.3	49.2	47.8	46.3	44.3	42.6	41.6
	Long-term (2023)	Day	56.3	57.3	57.7	57.8	57.6	56.7	55.5	54.1	52.2	50.7	49.8
		Night	52.3	53.3	53.7	53.8	53.6	52.7	51.4	50.1	48.2	46.7	45.8

Table4.3.2.3-2 Traffic noise predicted values of each section during operation stage（height difference:15m）

Section	Assessment year	Day or Night	Predicted traffic noise values at difference horizontal distance from road center line(dB)										
			20m	30m	40m	50m	60m	80m	100m	120m	150m	180m	200m
Yunshishan～Huichang (K31+012.977～K50+248)	Short-term (2009)	Day	47.4	48.0	48.3	48.5	48.5	48.1	47.5	46.6	45.1	43.5	42.5
		Night	39.4	40.1	40.6	40.8	40.8	40.2	39.2	37.9	36.0	34.1	32.9
	Mid-term (2015)	Day	50.0	50.7	51.2	51.4	51.5	51.3	50.7	50.0	48.5	47.1	46.1
		Night	41.4	42.1	42.6	42.8	42.8	42.2	41.2	39.9	38.0	36.1	34.9
	Long-term (2023)	Day	52.0	52.8	53.2	53.4	53.5	53.3	52.8	52.0	50.6	49.1	48.1
		Night	47.4	47.9	48.3	48.4	48.4	48.0	47.4	46.5	45.0	43.4	42.4
Huichang～Hefeng (K50+248～K78+181)	Short-term (2009)	Day	48.2	48.8	49.3	49.5	49.5	49.2	48.7	47.8	46.4	44.9	43.9
		Night	39.8	40.5	41.0	41.2	41.2	40.6	39.6	38.3	36.4	34.5	33.3
	Mid-term (2015)	Day	50.4	51.1	51.6	51.8	51.9	51.7	51.1	50.3	48.9	47.4	46.5
		Night	41.8	42.5	43.0	43.2	43.1	42.6	41.5	40.3	38.3	36.4	35.2
	Long-term (2023)	Day	52.4	53.1	53.5	53.8	53.8	53.6	53.1	52.3	50.9	49.4	48.5
		Night	48.0	48.6	49.0	49.2	49.2	48.9	48.3	47.5	46.0	44.5	43.5
Hefeng～Yudu (K78+181～K90+225)	Short-term (2009)	Day	48.4	49.1	49.6	49.8	49.8	49.6	49.1	48.3	46.8	45.3	44.4
		Night	39.9	40.7	41.1	41.3	41.3	40.7	39.7	38.5	36.5	34.6	33.4
	Mid-term (2015)	Day	50.5	51.2	51.7	51.9	52.0	51.8	51.2	50.5	49.1	47.6	46.6
		Night	41.9	42.6	43.1	43.3	43.3	42.7	41.7	40.4	38.5	36.6	35.4
	Long-term (2023)	Day	52.4	53.2	53.6	53.9	53.9	53.7	53.2	52.4	51.0	49.5	48.6
		Night	48.2	48.8	49.2	49.4	49.5	49.2	48.6	47.8	46.3	44.8	43.9
Yudu～Luo'ao (K90+225～K101+230)	Short-term (2009)	Day	48.8	49.5	49.9	50.2	50.3	50.0	49.5	48.7	47.3	45.8	44.9
		Night	40.2	40.9	41.4	41.6	41.5	41.0	40.0	38.7	36.7	34.8	33.7
	Mid-term (2015)	Day	50.8	51.5	52.0	52.2	52.3	52.1	51.5	50.7	49.3	47.8	46.9
		Night	42.2	42.9	43.4	43.6	43.5	43.0	41.9	40.7	38.7	36.8	35.6
	Long-term (2023)	Day	52.7	53.4	53.9	54.1	54.2	54.0	53.4	52.6	51.2	49.8	48.8
		Night	48.6	49.3	49.8	50.0	50.1	49.9	49.3	48.6	47.1	45.7	44.7
Luo'ao～Ganxian (K101+230～K124+244)	Short-term (2009)	Day	49.2	49.9	50.4	50.6	50.7	50.5	49.9	49.1	47.7	46.3	45.3
		Night	40.6	41.3	41.8	42.0	42.0	41.4	40.4	39.1	37.2	35.3	34.1
	Mid-term (2015)	Day	51.1	51.9	52.3	52.5	52.6	52.4	51.9	51.1	49.7	48.2	47.2
		Night	45.7	46.0	46.2	46.2	46.0	45.5	44.7	43.7	42.0	40.3	39.3
	Long-term (2023)	Day	52.9	53.7	54.1	54.4	54.4	54.2	53.7	52.9	51.5	50.0	49.1
		Night	48.9	49.6	50.1	50.3	50.4	50.2	49.6	48.8	47.4	45.9	45.0
Ganxian～Ganzhou north (K124+244～K139+377)	Short-term (2009)	Day	49.7	50.4	50.8	51.1	51.1	50.9	50.4	49.6	48.2	46.7	45.8
		Night	41.0	41.8	42.2	42.4	42.4	41.9	40.8	39.6	37.6	35.7	34.5
	Mid-term (2015)	Day	51.5	52.2	52.7	52.9	53.0	52.8	52.2	51.4	50.0	48.6	47.6
		Night	46.4	46.8	47.0	47.1	47.0	46.6	45.8	44.9	43.3	41.6	40.6
	Long-term (2023)	Day	53.2	54.0	54.4	54.6	54.7	54.5	54.0	53.2	51.8	50.3	49.3
		Night	49.2	49.9	50.4	50.6	50.7	50.5	49.9	49.1	47.7	46.3	45.3
Ganzhou north～Huangjin (K139+377～K149+728)	Short-term (2009)	Day	49.9	50.6	51.1	51.3	51.4	51.2	50.6	49.8	48.4	47.0	46.0
		Night	41.3	42.0	42.5	42.7	42.7	42.1	41.1	39.8	37.9	36.0	34.8
	Mid-term (2015)	Day	51.8	52.5	52.9	53.2	53.2	53.0	52.5	51.7	50.3	48.8	47.9
		Night	46.8	47.3	47.6	47.7	47.6	47.2	46.5	45.6	44.0	42.4	41.4
	Long-term (2023)	Day	53.5	54.2	54.6	54.9	54.9	54.7	54.2	53.4	52.0	50.5	49.6
		Night	49.4	50.2	50.6	50.9	50.9	50.7	50.2	49.4	48.0	46.5	45.6

Table4.3.2.3-3 Traffic noise predicted values of each section during operation stage（height difference:20m）

Section	Assessment year	Day or Night	Predicted traffic noise values at difference horizontal distance from road center line(dB)										
			20m	30m	40m	50m	60m	80m	100m	120m	150m	180m	200m
Yunshishan～Huichang (K31+012.977～K50+248)	Short-term (2009)	Day	45.4	45.8	46.1	46.3	46.3	46.2	45.9	45.4	44.4	43.2	42.3
		Night	38.1	37.4	37.8	38.1	38.2	38.0	37.5	36.8	35.3	33.8	32.7
	Mid-term (2015)	Day	48.0	48.6	49.0	49.2	49.3	49.4	49.1	48.7	47.8	46.7	45.9
		Night	40.1	39.4	39.8	40.1	40.2	40.0	39.5	38.7	37.3	35.8	34.7
	Long-term (2023)	Day	50.0	50.6	51.0	51.2	51.4	51.4	51.2	50.7	49.8	48.7	47.9
		Night	45.3	45.7	46.0	46.2	46.2	46.1	45.8	45.2	44.2	43.1	42.2
Huichang～Hefeng (K50+248～K78+181)	Short-term (2009)	Day	46.2	46.7	47.0	47.2	47.3	47.3	47.0	46.6	45.6	44.5	43.7
		Night	38.5	37.8	38.2	38.5	38.6	38.4	37.9	37.1	35.7	34.1	33.1
	Mid-term (2015)	Day	48.4	48.9	49.3	49.6	49.7	49.7	49.5	49.1	48.2	47.1	46.3
		Night	40.5	39.8	40.2	40.4	40.5	40.4	39.9	39.1	37.7	36.1	35.1
	Long-term (2023)	Day	50.4	50.9	51.3	51.6	51.7	51.7	51.5	51.0	50.1	49.0	48.3
		Night	45.9	46.4	46.8	47.0	47.0	47.0	46.7	46.2	45.3	44.1	43.3
Hefeng～Yudu (K78+181～K90+225)	Short-term (2009)	Day	46.4	47.0	47.3	47.6	47.7	47.7	47.4	47.0	46.1	45.0	44.2
		Night	38.6	37.9	38.3	38.6	38.7	38.6	38.0	37.3	35.8	34.3	33.2
	Mid-term (2015)	Day	48.5	49.1	49.5	49.7	49.9	49.9	49.6	49.2	48.3	47.2	46.4
		Night	40.6	39.9	40.3	40.6	40.7	40.5	40.0	39.3	37.8	36.3	35.2
	Long-term (2023)	Day	50.5	51.0	51.4	51.7	51.8	51.8	51.6	51.1	50.2	49.1	48.4
		Night	46.1	46.6	47.0	47.2	47.3	47.3	47.0	46.5	45.6	44.5	43.7
Yudu～Luo’ao (K90+225～K101+230)	Short-term (2009)	Day	46.8	47.3	47.7	48.0	48.1	48.1	47.9	47.5	46.6	45.5	44.7
		Night	38.9	38.2	38.6	38.8	38.9	38.8	38.3	37.5	36.1	34.5	33.5
	Mid-term (2015)	Day	48.8	49.3	49.7	50.0	50.1	50.1	49.9	49.5	48.6	47.5	46.7
		Night	40.9	40.2	40.6	40.8	40.9	40.8	40.3	39.5	38.1	36.5	35.5
	Long-term (2023)	Day	50.7	51.2	51.6	51.9	52.0	52.0	51.8	51.4	50.5	49.4	48.6
		Night	46.6	47.2	47.6	47.8	48.0	48.0	47.7	47.3	46.4	45.3	44.5
Luo’ao～Ganxian (K101+230～K124+244)	Short-term (2009)	Day	47.2	47.8	48.2	48.4	48.5	48.6	48.3	47.9	47.0	45.9	45.1
		Night	39.3	38.6	39.0	39.3	39.4	39.2	38.7	38.0	36.5	35.0	33.9
	Mid-term (2015)	Day	49.1	49.7	50.1	50.3	50.5	50.5	50.2	49.8	48.9	47.8	47.0
		Night	43.5	43.8	43.9	43.9	43.9	43.6	43.1	42.4	41.3	40.0	39.1
	Long-term (2023)	Day	51.0	51.5	51.9	52.2	52.3	52.3	52.1	51.6	50.7	49.6	48.9
		Night	46.9	47.4	47.8	48.1	48.2	48.2	48.0	47.6	46.7	45.6	44.8
Ganxian～Ganzhou north (K124+244～K139+377)	Short-term (2009)	Day	47.7	48.2	48.6	48.9	49.0	49.0	48.8	48.3	47.4	46.3	45.6
		Night	39.7	39.1	39.5	39.7	39.8	39.7	39.2	38.4	37.0	35.4	34.4
	Mid-term (2015)	Day	49.5	50.1	50.5	50.7	50.8	50.9	50.6	50.2	49.3	48.2	47.4
		Night	44.3	44.6	44.8	44.9	44.8	44.6	44.2	43.6	42.5	41.2	40.4
	Long-term (2023)	Day	51.2	51.8	52.2	52.4	52.6	52.6	52.3	51.9	51.0	49.9	49.1
		Night	47.2	47.7	48.2	48.4	48.5	48.5	48.3	47.9	47.0	45.9	45.1
Ganzhou north～Huangjin (K139+377～K149+728)	Short-term (2009)	Day	47.9	48.5	48.9	49.1	49.2	49.3	49.0	48.6	47.7	46.6	45.8
		Night	40.0	39.3	39.7	40.0	40.1	39.9	39.4	38.6	37.2	35.6	34.6
	Mid-term (2015)	Day	49.8	50.3	50.7	51.0	51.1	51.1	50.9	50.4	49.5	48.4	47.7
		Night	44.7	45.1	45.3	45.5	45.5	45.3	44.9	44.4	43.3	42.1	41.2
	Long-term (2023)	Day	51.5	52.0	52.4	52.7	52.8	52.8	52.6	52.2	51.2	50.2	49.4
		Night	47.5	48.0	48.4	48.7	48.8	48.8	48.6	48.1	47.2	46.1	45.4

Table4.3.2.3-4 Traffic noise predicted values of each section during operation stage（height difference:25m）

Section	Assessment year	Day or Night	Predicted traffic noise values at difference horizontal distance from road center line(dB)										
			20m	30m	40m	50m	60m	80m	100m	120m	150m	180m	200m
Yunshishan～Huichang (K31+012.977～K50+248)	Short-term (2009)	Day	43.7	44.1	44.4	44.5	44.6	44.6	44.4	44.0	43.3	42.5	41.8
		Night	36.8	35.3	35.7	35.9	36.0	36.1	35.8	35.3	34.3	33.1	32.3
	Mid-term (2015)	Day	46.4	46.9	47.2	47.5	47.6	47.7	47.6	47.4	46.8	46.0	45.4
		Night	38.8	37.3	37.7	37.9	38.0	38.1	37.8	37.3	36.3	35.1	34.3
	Long-term (2023)	Day	48.5	48.9	49.3	49.5	49.7	49.7	49.6	49.4	48.8	48.0	47.4
		Night	43.7	44.0	44.3	44.4	44.5	44.5	44.3	43.9	43.2	42.4	41.7
Huichang～Hefeng (K50+248～K78+181)	Short-term (2009)	Day	44.5	45.0	45.3	45.5	45.6	45.7	45.5	45.3	44.6	43.8	43.2
		Night	37.2	35.7	36.1	36.3	36.4	36.5	36.2	35.7	34.7	33.5	32.7
	Mid-term (2015)	Day	46.8	47.3	47.6	47.9	48.0	48.1	48.0	47.7	47.2	46.4	45.8
		Night	39.2	37.7	38.0	38.3	38.4	38.4	38.2	37.7	36.7	35.5	34.6
	Long-term (2023)	Day	48.8	49.2	49.6	49.8	50.0	50.1	50.0	49.7	49.1	48.3	47.7
		Night	44.3	44.7	45.0	45.2	45.3	45.3	45.2	44.9	44.2	43.4	42.8
Hefeng～Yudu (K78+181～K90+225)	Short-term (2009)	Day	44.8	45.3	45.6	45.8	46.0	46.1	45.9	45.7	45.1	44.3	43.7
		Night	37.4	35.8	36.2	36.4	36.6	36.6	36.3	35.9	34.9	33.7	32.8
	Mid-term (2015)	Day	46.9	47.4	47.8	48.0	48.1	48.2	48.1	47.9	47.3	46.5	45.9
		Night	39.3	37.8	38.2	38.4	38.5	38.6	38.3	37.8	36.8	35.6	34.8
	Long-term (2023)	Day	48.9	49.3	49.7	49.9	50.1	50.2	50.1	49.8	49.2	48.4	47.8
		Night	44.5	44.9	45.3	45.5	45.6	45.6	45.5	45.2	44.6	43.8	43.1
Yudu～Luo'ao (K90+225～K101+230)	Short-term (2009)	Day	45.2	45.6	46.0	46.2	46.4	46.5	46.4	46.1	45.5	44.8	44.2
		Night	37.6	36.1	36.4	36.7	36.8	36.8	36.6	36.1	35.1	33.9	33.0
	Mid-term (2015)	Day	47.2	47.7	48.0	48.2	48.4	48.5	48.4	48.1	47.5	46.8	46.2
		Night	39.6	38.1	38.4	38.7	38.8	38.8	38.6	38.1	37.1	35.9	35.0
	Long-term (2023)	Day	49.1	49.6	49.9	50.2	50.3	50.4	50.3	50.0	49.5	48.7	48.1
		Night	45.0	45.5	45.8	46.1	46.2	46.3	46.2	46.0	45.4	44.6	44.0
Luo'ao～Ganxian (K101+230～K124+244)	Short-term (2009)	Day	47.2	47.8	48.2	48.4	48.5	48.6	48.3	47.9	47.0	45.9	45.1
		Night	39.3	38.6	39.0	39.3	39.4	39.2	38.7	38.0	36.5	35.0	33.9
	Mid-term (2015)	Day	49.1	49.7	50.1	50.3	50.5	50.5	50.2	49.8	48.9	47.8	47.0
		Night	43.5	43.8	43.9	43.9	43.9	43.6	43.1	42.4	41.3	40.0	39.1
	Long-term (2023)	Day	51.0	51.5	51.9	52.2	52.3	52.3	52.1	51.6	50.7	49.6	48.9
		Night	46.9	47.4	47.8	48.1	48.2	48.2	48.0	47.6	46.7	45.6	44.8
Ganxian～Ganzhou north (K124+244～K139+377)	Short-term (2009)	Day	46.1	46.5	46.9	47.1	47.3	47.4	47.3	47.0	46.4	45.6	45.1
		Night	38.5	37.0	37.3	37.6	37.7	37.7	37.5	37.0	36.0	34.8	33.9
	Mid-term (2015)	Day	47.9	48.4	48.7	49.0	49.1	49.2	49.1	48.9	48.3	47.5	46.9
		Night	42.6	42.8	43.0	43.1	43.1	43.0	42.7	42.3	41.5	40.5	39.9
	Long-term (2023)	Day	49.7	50.1	50.5	50.7	50.9	50.9	50.8	50.6	50.0	49.2	48.6
		Night	45.6	46.1	46.4	46.7	46.8	46.9	46.8	46.6	46.0	45.2	44.6
Ganzhou north～Huangjin (K139+377～K149+728)	Short-term (2009)	Day	46.3	46.8	47.1	47.4	47.5	47.6	47.5	47.3	46.7	45.9	45.3
		Night	38.7	37.2	37.6	37.8	37.9	38.0	37.7	37.2	36.2	35.0	34.2
	Mid-term (2015)	Day	48.2	48.6	49.0	49.2	49.4	49.5	49.4	49.1	48.5	47.7	47.1
		Night	43.1	43.4	43.6	43.7	43.7	43.6	43.4	43.0	42.3	41.4	40.7
	Long-term (2023)	Day	49.9	50.3	50.7	50.9	51.1	51.2	51.1	50.8	50.2	49.5	48.9
		Night	45.9	46.3	46.7	46.9	47.1	47.2	47.1	46.8	46.2	45.4	44.8

It can been seen from the above prediction that, for viaduct section with height difference of 10～25m, traffic noise has the largest impact in a range of 40～80m from rod center line, the larger the height difference between viaduct and surface ground, the smaller the traffic noise value. It can be seen that the predicted traffic noise values in viaduct section with height difference more than 15m from the ground all do not exceed 55dB in daytime during the short, mid and long-term operation stages and do not exceed 45dB at nighttime during short-term operation stage, and slightly exceed 45dB during the mid and long-term operation stages. Viaduct section with height difference more than 20m only slightly exceeds 45dB at night during the long-term operation stage. Therefore, villages locating in a viaduct section with height difference more than 20m will not be considered as an acoustic environmental sensitive location for prediction.

4.3.2.4 Ambient noise prediction and assessment in sensitive locations

Ambient noise prediction in sensitive locations should consider highway sections where they are located and their corresponding ground covering, road structure, height of embankment or cutting, limited-length sound source of highway, topography and culture, etc. by superimposing the predicted traffic noise values and corresponding acoustic environment background values. The environment background values comes from current acoustic environmental monitored results.

Table 4.3.2.3-1～4.3.2.3-2 are the predicted ambient noise results during operation stage at sensitive locations along the recommended alignment and comparison alternative alignments for the proposed highway respectively. Table 4.3.2.3-3～4.3.2.3-4 are the noise impact analysis during operation stage at sensitive locations along the recommended alignment and comparison alternative alignments for the proposed highway respectively.

Table 4.3.2.4-1 Predicted ambient noise results at sensitive locations for the proposed highway(the recommended alignment) unit: dB

No	Name of sensitive locations	Stale No.	Distance from road center (m)	predicted results						excess						Background noise		Assessment standard
				Short-term		Mid-term		Long-term		Short-term		Mid-term		Long-term				
				Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
1	Taoziyuan (I)	K31+100～K31+380	120	50.0	41.7	52.1	42.8	53.7	47.9	√	√	√	√	√	2.9	46.4	38.8	1
2	Taoziyuan (II)	K31+370～K31+480	34	55.7	49.1	58.2	51.0	60.1	55.2	√	√	√	√	√	0.2	46.4	38.8	4
			80	49.4	41.6	51.3	42.6	52.7	47.0	√	√	√	√	√	2	46.4	38.8	1
3	Yangwu (I)	K31+570～K31+820	32	54.7	48.0	57.1	49.9	59.0	54.1	√	√	√	√	√	√	46.4	38.8	4
			80	49.4	41.5	51.2	42.6	52.7	47.0	√	√	√	√	√	2	46.4	38.8	1
4	Yangwu (II)	K31+860～K32+320	44	55.3	48.3	57.9	50.1	59.8	54.7	√	√	√	√	√	√	46.4	38.8	4
			80	50.2	42.3	52.3	43.6	53.9	48.3	√	√	√	√	√	3.3	46.4	38.8	1
5	Loubei	K33+700～K34+300	54	52.6	45.2	55.0	46.8	56.8	51.5	√	√	√	√	√	√	46.4	38.8	4
			80	49.8	42.0	51.8	43.1	53.3	47.7	√	√	√	√	√	2.7	46.4	38.8	1
6	Yanba primary school	K34+500	38	56.6	45.3	57.7	47.0	58.7	51.6	1.6	0.3	2.7	2	3.7	6.6	55	38.2	1
7	Zaozixia	K34+560～K34+820	46	54.1	46.3	56.2	47.9	57.8	52.4	√	√	√	√	√	√	49.5	39.9	4
			80	53.0	44.4	55.0	45.7	56.6	50.7	√	√	√	0.7	1.6	5.7	49.5	39.9	1
8	Chazixia	K34+560～K34+820	26	62.1	55.4	64.6	57.3	66.6	61.9	√	0.4	√	2.3	√	6.9	49.5	39.9	4
			80	52.1	42.8	53.7	43.9	55.1	49.0	√	√	√	√	0.1	4	49.5	39.9	1
9	Lingxia	K34+800～K35+350	34	52.7	44.4	54.4	45.8	55.9	50.3	√	√	√	√	√	√	49.5	39.9	4
			80	51.2	42.3	52.5	43.2	53.7	47.2	√	√	√	√	√	2.2	49.5	39.9	1
10	Citangxia	K39+220～K39+640	140	51.2	41.8	52.6	42.6	53.8	47.1	√	√	√	√	√	2.1	49.5	39.9	1
11	Fengshuxia	K39+380～K39+640	44	56.4	49.0	58.8	50.8	60.6	55.4	√	√	√	√	√	0.4	49.5	39.9	4
			80	51.8	42.9	53.4	44.0	54.7	48.5	√	√	√	√	√	3.5	49.5	39.9	1
12	Qiangong village	K39+640～K39+960	60	54.9	46.8	57.2	48.4	58.9	53.5	√	√	√	√	√	√	49.5	39.9	4
			80	53.4	44.7	55.6	46.2	57.2	51.4	√	√	0.6	1.2	2.2	6.4	49.5	39.9	1
13	Xinxiaowu	K39+740～	34	57.1	50.3	59.5	52.1	61.4	56.3	√	√	√	√	√	1.3	49.5	39.9	4

No	Name of sensitive locations	Stale No.	Distance from road center (m)	predicted results						excess						Background noise		Assessment standard
				Short-term		Mid-term		Long-term		Short-term		Mid-term		Long-term				
				Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
		K40+050	80	51.3	42.2	52.6	43.1	53.7	47.3	√	√	√	√	√	2.3	49.5	39.9	1
14	Jiuquping	K40+140～K40+260	38	55.4	48.1	57.6	49.9	59.4	54.1	√	√	√	√	√	√	49.5	39.9	4
			80	51.2	42.2	52.5	43.1	53.6	47.1	√	√	√	√	√	2.1	49.5	39.9	1
15	Changjiangqiao Laozhaixia	K40+360～K41+100	30	56.0	49.1	58.3	51.0	60.2	55.1	√	√	√	√	√	0.1	48.6	37.8	4
			80	50.6	41.1	52.1	42.2	53.3	46.9	√	√	√	√	√	1.9	48.6	37.8	1
16	Wangjiangwan	K41+650～K41+800	44	52.5	44.0	54.4	45.6	55.9	50.3	√	√	√	√	√	√	48.6	37.8	4
			80	52.0	43.0	54.0	44.5	55.5	49.6	√	√	√	√	0.5	4.6	48.6	37.8	1
17	Jiaojiangtou	K42+300～K42+540	25	55.8	48.9	58.0	50.8	59.8	54.9	√	√	√	√	√	√	48.6	37.8	4
			80	50.6	41.1	52.1	42.2	53.3	46.9	√	√	√	√	√	1.9	48.6	37.8	1
18	Tangtouxia	K42+600～K42+800	80	52.9	44.0	55.1	45.5	56.7	51.0	√	√	0.1	0.5	1.7	6	48.6	37.8	1
19	Datian primary school	K42+550	180	56.6	41.4	56.8	41.9	57.1	45.5	1.6	√	1.8	√	2.1	0.5	56.3	40.4	1
20	Hetang	K42+600～K42+700	80	52.9	44.0	55.1	45.5	56.7	51.0	√	√	0.1	0.5	1.7	6	48.6	37.8	1
21	Qiuqiu	K42+900～K43+100	34	58.4	51.5	60.9	53.4	62.9	57.9	√	√	√	√	√	2.9	48.6	37.8	4
			80	51.6	42.2	53.4	43.6	54.9	48.8	√	√	√	√	√	3.8	48.6	37.8	1
22	Huoxing primary school	K43+900	110	57.9	41.1	58.2	41.9	58.5	46.1	2.9	√	3.2	√	3.5	1.1	57.7	39.3	1
23	Xijiang Township sanatorium	K48+500	174	56.7	42.8	57.4	43.8	58.2	49.2	1.7	√	2.4	√	3.2	4.2	55.9	40.3	1
24	Shanshupai	K48+900～K49+460	30	55.4	47.4	56.6	48.5	57.8	52.0	√	√	√	√	√	√	53.3	44.8	4
			80	54.0	45.6	54.6	46.0	55.2	48.2	√	0.6	√	1	0.2	3.2	53.3	44.8	1
25	Shanbei village	K49+580～K49+740	32	54.4	46.1	55.3	46.7	56.1	49.7	√	√	√	√	√	√	53.3	44.8	4
			80	53.7	45.3	54.2	45.6	54.6	47.2	√	0.3	√	0.6	√	2.2	53.3	44.8	1
26	Yuyang	K53+700～K54+150	40	50.8	42.8	52.6	44.2	54.2	49.3	√	√	√	√	√	√	45.7	38.1	4
			80	50.2	41.9	51.9	43.2	53.4	48.4	√	√	√	√	√	3.4	45.7	38.1	1

No	Name of sensitive locations	Stale No.	Distance from road center (m)	predicted results						excess						Background noise		Assessment standard
				Short-term		Mid-term		Long-term		Short-term		Mid-term		Long-term				
				Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
27	Heliaoxia	K56+120～K57+060	28	55.4	48.1	57.5	50.0	59.4	54.7	√	√	√	√	√	√	45.7	38.1	4
			80	50.6	42.3	52.4	43.6	54.0	49.0	√	√	√	√	√	4	45.7	38.1	1
28	Shijing	K71+950～K72+330	110	49.5	42.0	51.5	43.1	53.2	48.5	√	√	√	√	√	3.5	43.6	39.1	1
29	Shangduan	K73+550～K73+800	26	52.3	45.3	54.3	46.9	56.1	51.7	√	√	√	√	√	√	43.6	39.1	4
			80	49.5	42.3	51.4	43.5	53.1	48.5	√	√	√	√	√	3.5	43.6	39.1	1
30	Huangtian	K74～K74+280	42	59.2	51.2	61.5	53.1	63.4	58.9	√	√	√	√	√	3.9	43.6	39.1	4
			80	51.8	43.5	54.0	44.9	55.8	51.1	√	√	√	√	0.8	6.1	43.6	39.1	1
31	Shihuiling	K75+050～K75+570	32	58.6	51.9	60.8	53.7	62.7	58.2	√	√	√	√	√	3.2	43.6	39.1	4
			80	49.2	42.0	51.1	43.1	52.7	48.0	√	√	√	√	√	3	43.6	39.1	1
32	Tudi	K76+175～K76+400	100	51.4	43.3	53.6	44.7	55.4	50.6	√	√	√	√	0.4	5.6	43.6	39.1	1
33	Youliaobei	K76+435～K76+825	26	61.0	54.6	63.2	56.5	65.2	60.8	√	√	√	1.5	√	5.8	43.6	39.1	4
			80	51.1	43.2	53.1	44.5	54.9	50.2	√	√	√	√	√	5.2	43.6	39.1	1
34	Tangmianshang	K76+445～K77+160	30	59.7	53.0	61.9	54.9	63.9	59.4	√	√	√	√	√	4.4	43.6	39.1	4
			80	49.4	42.1	51.3	43.3	53.0	48.4	√	√	√	√	√	3.4	43.6	39.1	1
35	Daping	K77+680～K77+900	140	49.7	41.7	51.7	42.7	53.4	48.6	√	√	√	√	√	3.6	43.6	39.1	1
36	Hantang	K78+350～K78+480	50	56.4	48.5	58.5	50.3	60.3	55.9	√	√	√	√	√	0.9	43.6	39.1	4
			80	50.5	42.7	52.4	43.9	54.1	49.6	√	√	√	√	√	4.6	43.6	39.1	1
37	Chiyu	K79+850～K80+130	90	50.1	42.5	51.8	43.7	53.5	49.0	√	√	√	√	√	4	43.6	39.1	1
38	Hongtang	K99+170～K99+560	30	60.8	53.3	62.6	55.3	64.4	60.1	√	√	√	0.3	√	5.1	52.2	40	4
			80	54.2	43.2	55.1	44.4	56.1	50.3	√	√	0.1	√	1.1	5.3	52.2	40	1
39	Xinwu	K99+610～K99+910	80	55.1	44.6	56.2	46.0	57.5	52.2	0.1	√	1.2	1	2.5	7.2	52.2	40	1

No	Name of sensitive locations	Stale No.	Distance from road center (m)	predicted results						excess						Background noise		Assessment standard
				Short-term		Mid-term		Long-term		Short-term		Mid-term		Long-term				
				Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
40	Pengwu	K101+980～K102+520	32	60.2	52.7	61.9	55.7	63.6	59.2	√	√	√	0.7	√	4.2	52.2	40	4
			80	54.4	43.7	55.3	46.6	56.4	50.6	√	√	0.3	1.6	1.4	5.6	52.2	40	1
41	Tianzigang	K102+700～K102+910	160	53.6	41.8	54.3	44.3	55.0	48.5	√	√	√	√	√	3.5	52.2	40	1
42	Shuiduan	K102+880～K103+080	30	58.3	50.4	59.8	53.4	61.3	56.8	√	√	√	√	√	1.8	52.2	40	4
			80	54.3	43.5	55.2	46.4	56.2	50.3	√	√	0.2	1.4	1.2	5.3	52.2	40	1
43	Xiamaoping	K103+490～K103+840	26	55.5	46.1	56.6	49.6	57.9	52.7	√	√	√	√	√	√	52.2	40	4
			80	54.1	43.2	54.8	45.8	55.8	49.7	√	√	√	0.8	0.8	4.7	52.2	40	1
44	Maoping	K103+790～K104+300	26	55.5	46.1	56.6	49.6	57.9	52.7	√	√	√	√	√	√	52.2	40	4
			80	53.6	42.5	54.2	44.8	55.0	48.4	√	√	√	√	√	3.4	52.2	40	1
45	Zhaijiaoxia	K104+940～K105+050	28	53.7	42.8	54.4	45.9	55.2	48.7	√	√	√	√	√	√	52.2	40	4
			80	52.9	41.3	53.3	42.9	53.8	45.8	√	√	√	√	√	0.8	52.2	40	1
46	Xiaba	K114+530～K114+850	90	51.4	43.2	52.8	45.9	54.3	50.0	√	√	√	0.9	√	5	46.1	39.7	1
47	Pingzigao	K119+600～K119+860	20	51.3	43.5	52.7	47.1	54.2	49.8	√	√	√	√	√	√	46.1	39.7	4
			80	52.1	43.9	53.7	46.9	55.2	50.9	√	√	√	1.9	0.2	5.9	46.1	39.7	1
48	Xiaomenkou	K119+600～K119+860	20	50.9	43.2	52.3	46.7	53.8	49.4	√	√	√	√	√	√	46.1	39.7	4
			80	51.8	43.7	53.3	46.5	54.9	50.5	√	√	√	1.5	√	5.5	46.1	39.7	1
49	Laohupai	K124+650～K124+880	30	60.3	53.4	62.1	56.7	63.8	59.7	√	√	√	1.7	√	4.7	46.1	39.7	4
			80	51.1	43.0	52.5	46.2	53.8	49.5	√	√	√	1.2	√	4.5	46.1	39.7	1
50	Wansong primary school	K126+710～K126+740	110	54.0	46.9	54.8	48.6	55.8	51.1	√	1.9	√	3.6	0.8	6.1	51.7	45.8	1
51	Zouwu	K132+260～K132+400	30	56.4	49.2	58.1	52.7	59.7	55.6	√	√	√	√	√	0.6	46.1	39.7	4
			80	51.2	43.1	52.6	46.3	54.0	49.6	√	√	√	1.3	√	4.6	46.1	39.7	1
52	Shizishuxia	K132+340～	30	61.3	54.3	63.1	57.7	64.8	60.7	√	√	√	2.7	√	5.7	46.1	39.7	4

No	Name of sensitive locations	Stale No.	Distance from road center (m)	predicted results						excess						Background noise		Assessment standard
				Short-term		Mid-term		Long-term		Short-term		Mid-term		Long-term				
				Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
		K132+670	80	51.4	43.1	52.7	46.5	54.1	49.8	√	√	√	1.5	√	4.8	46.1	39.7	1
53	Tianxin primary school	K132+500～K132+570	40	57.4	43.4	57.8	46.7	58.2	49.5	2.4	√	2.8	1.7	3.2	4.5	56.7	40.2	1
54	Hechangbei	K132+680～K132+850	30	54.6	47.2	56.2	50.8	57.8	53.7	√	√	√	√	√	√	46.1	39.7	4
			80	50.0	42.2	51.2	44.9	52.4	48.0	√	√	√	√	√	3	46.1	39.7	1
55	Paishang	K141+200～K141+400	26	54.2	46.6	55.8	50.6	57.3	53.2	√	√	√	√	√	√	46.1	39.7	4
			80	51.6	43.4	53.0	47.1	54.4	50.1	√	√	√	2.1	√	5.1	46.1	39.7	1
56	Shanbiantoushang	K141+570～K141+800	90	52.9	44.2	54.4	48.4	55.9	51.7	√	√	√	3.4	0.9	6.7	46.1	39.7	1
57	Gangbianpai	K142+290～K142+430	26	62.8	56.1	64.6	59.6	66.3	62.3	√	1.1	√	4.6	√	7.3	46.1	39.7	4
			80	51.3	43.2	52.6	46.7	54.0	49.7	√	√	√	1.7	√	4.7	46.1	39.7	1
58	Gangbian primary school	K142+340～K142+400	160	57.6	42.3	57.9	45.7	58.2	48.8	2.6	√	2.9	0.7	3.2	3.8	57	40.5	1
59	Tengshuwo	K142+310～K142+450	50	57.7	49.7	59.5	54.0	61.1	57.1	√	√	√	√	√	2.1	46.1	39.7	4
			80	54.7	45.9	56.3	50.4	57.9	53.7	√	0.9	1.3	5.4	2.9	8.7	46.1	39.7	1
60	Yongquangangshang	K144+340～K144+640	20	57.0	50.1	58.7	53.8	60.3	56.2	√	√	√	√	√	1.2	46.1	39.7	4
			80	52.2	43.8	53.6	47.7	55.1	50.8	√	√	√	2.7	0.1	5.8	46.1	39.7	1
61	Cangxia	K147+230～K147+350	30	60.5	53.6	62.3	57.2	64.0	59.9	√	√	√	2.2	√	4.9	46.1	39.7	4
			80	52.4	44.0	53.9	48.0	55.3	51.1	√	√	√	3	0.3	6.1	46.1	39.7	1
62	Yeshan primary school	K147+200～K147+250	80	58.3	46.5	59.1	50.8	60.0	54.0	3.3	1.5	4.1	5.8	5	9	56.1	41.2	1
63	Hhefeng interchang linking-up road K0+620～K0+880	Zhongduan	80	45.8	41.5	46.7	42.4	47.8	43.5	√	√	√	√	√	√	43.6	39.1	1
64	Hhefeng interchang linking-up road K1+800～K2+200	Fengshu	20	51.2	47.1	52.9	48.8	54.7	50.6	√	√	√	√	√	√	43.6	39.1	4
			65	45.8	41.5	46.7	42.4	47.8	43.6	√	√	√	√	√	√	43.6	39.1	1

No	Name of sensitive locations	Stale No.	Distance from road center (m)	predicted results						excess						Background noise		Assessment standard
				Short-term		Mid-term		Long-term		Short-term		Mid-term		Long-term				
				Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
65	Hhefeng interchang linking-up road K1+900～K1+950	Xiabao sanatorium	140	44.1	39.6	44.3	39.9	44.7	40.3	√	√	√	√	√	√	43.6	39.1	1
66	Yudu interchang linking-up road K2+400～K2+600	Aonao	20	53.6	45.4	54.2	46.9	55.1	48.5	√	√	√	√	√	√	52.2	40	4
			65	52.5	41.4	52.6	42.1	52.8	42.9	√	√	√	√	√	√	52.2	40	1
67	Yudu interchang linking-up road K5+150～K5+300	Shuibei	20	55.4	49.1	56.5	50.9	57.9	52.6	√	√	√	√	√	√	52.2	40	4
			65	52.5	41.9	52.7	42.7	53.0	43.7	√	√	√	√	√	√	52.2	40	1

Note：1.“√”means not excessive, engineering factor change will influence the precision of noise prediction;
2. Assessment standard: class 1(day:55dB, night:45dB), class 4(day:70, night:55).

Table 4.3.2.4-2 Predicted ambient noise results at sensitive locations for the proposed highway (Sanmen comparison section’s scheme Ⅱ) unit：dB

No	Name of sensitive locations	Stake No.	Distance from road center (m)	predicted results						excess						Background noise		Assessment standard
				Short-term		Mid-term		Long-term		Short-term		Mid-term		Long-term				
				Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
1	Pengwu	K102+275～K102+525	40	60.2	52.7	61.9	55.7	63.6	59.2	√	√	√	0.7	√	4.2	52.2	40	4
			80	54.4	43.7	55.3	46.6	56.4	50.6	√	√	0.3	1.6	1.4	5.6	52.2	40	1
2	Sanmen	K103+575～K103+790	26	59.2	51.8	60.8	54.7	62.4	57.9	√	√	√	√	√	2.9	52.2	40	4
			80	53.8	42.8	54.5	45.3	55.4	49.1	√	√	√	0.3	0.4	4.1	52.2	40	1
3	Sanmen junior school	K104+010～K104+110	40	60.7	51.2	61.6	53.7	62.7	57.0	5.7	6.2	6.6	8.7	7.7	12	58.3	46.3	1

Note：1.“√”means not excessive, engineering factor change will influence the precision of noise prediction;
2. Assessment standard: class 1(day:55dB, night:45dB), class 4(day:70dB, night:55dB).

Table 4.3.2.4-3 Impact analysis of acoustically sensitive locations during operation stage（recommended scheme） unit：dB

Section	No	Name of sensitive locations	Stake No.	Distance from road center(m)	Subgrade height (m)	Predicting point height (m)	Ambient noise added value		Assessment standard	Standard excess
							Day	Night		
Yunshishan～Huichang	1	Taoziyuan (I)	K31+100～K31+380	120	7	1.2	7.3	9.1	1	Noise excess by 2.9dB at night in long-term operation stage
	2	Taoziyuan (II)	K31+370～K31+480	34	6	1.2	13.7	16.4	4	Noise excess by 0.2dB at night in long-term operation stage
				80			6.3	8.2	1	Noise excess by 2dB at night in long-term operation stage
	3	Yangwu (I)	K31+570～K31+820	32	7	1.2	12.6	15.3	4	Not excessive
				80			6.3	8.2	1	Noise excess by 2dB at night in long-term operation stage
	4	Yangwu (II)	K31+860～K32+320	44	6	1.2	13.4	15.9	4	Not excessive
				80			7.5	9.5	1	Noise excess by 3.3dB at night in long-term operation stage
	5	Loubei	K33+700～K34+300	54	10	1.2	10.4	12.7	4	Not excessive
				80			6.9	8.9	1	Noise excess by 2.7dB at night in long-term operation stage
	6	Yanba primary school	K34+500	38	10	1.2	3.7	13.4	1	Noise excess by1.6～3.7dB in day time, 0.3～6.6dB at night in short/mid/long-term operation stage
	7	Zaozixia	K34+560～K34+820	46	9	1.2	8.3	12.5	4	Not excessive
				80			7.1	10.8	1	Noise excess by 1.6dB in day time, 0.7～5.7dB at night in mid/long-term operation stage
	8	Chazixia	K34+560～K34+820	26	1	1.2	17.1	22	4	Noise excess by 0.4～6.9dB at night in short/mid/long-term operation stage
				80			5.6	9.1	1	Noise excess by 0.1 dB in day time, 4dB at night in long-term operation stage
	9	Lingxia	K34+800～K35+350	34	12	1.2	6.4	10.4	4	Not excessive
				80			4.2	7.3	1	Noise excess by 2.2dB at night in long-term operation stage
	10	Citangxia	K39+220～K39+640	140	6	1.2	4.3	7.2	1	Noise excess by 2.1dB at night in long-term operation stage
	11	Fengshuxia	K39+380～K39+640	44	5	1.2	11.1	15.5	4	Noise excess by 0.4dB at night in long-term operation stage
				80			5.2	8.6	1	Noise excess by 3.5dB at night in long-term operation stage
	12	Qiangong village	K39+640～K39+960	60	4	1.2	9.4	13.6	4	Not excessive
				80			7.7	11.5	1	Noise excess by 0.6～2.2dB in day time, 1.2～6.4dB at night in mid/long-term operation stage
	13	Xinxiaowu	K39+740～K40+050	34	5	1.2	11.9	16.4	4	Noise excess by 1.3dB at night in long-term operation stage
				80			4.2	7.4	1	Noise excess by 2.3dB at night in long-term operation stage

Section	No	Name of sensitive locations	Stake No.	Distance from road center(m)	Subgrade height (m)	Predicting point height (m)	Ambient noise added value		Assessment standard	Standard excess
							Day	Night		
	14	Jiuquping	K40+140～K40+260	38	7	1.2	9.9	14.2	4	Not excessive
				80			4.1	7.2	1	Noise excess by 2.1dB at night in long-term operation stage
	15	Changjiangqiao Laozhaixia	K40+360～K41+100	30	6	1.2	11.6	17.3	4	Noise excess by 0.1dB at night in long-term operation stage
				80			4.7	9.1	1	Noise excess by 1.9dB at night in long-term operation stage
	16	Wangjiangwan	K41+650～K41+800	44	12	1.2	7.3	12.5	4	Not excessive
				80			6.9	11.8	1	Noise excess by 0.5dB in day time, 4.6dB at night in long-term operation stage
	17	Jiaojiangtou	K42+300～K42+540	25	6	1.2	11.2	17.1	4	Not excessive
				80			4.7	9.1	1	Noise excess by 1.9dB at night in long-term operation stage
	18	Tangtouxia	K42+600～K42+800	80	7	1.2	8.1	13.2	1	Noise excess by 0.1～1.7dB in day time, 0.5～6dB at night in mid/long-term operation stage
	19	Datian primary school	K42+550	180	7	1.2	0.8	5.1	1	Noise excess by 1.6～2.1dB in day time in short/mid/long-term operation stage, 0.5 dB at night in long-term operation stage Background value in day time already excessive
	20	Hetang	K42+600～K42+700	80	7	1.2	8.1	13.2	1	Noise excess by 0.1～1.7dB in day time, 0.5～6dB at night in mid/long-term operation stage
	21	Qiuqiu	K42+900～K43+100	34	3	1.2	14.3	20.1	4	Noise excess by 2.9dB at night in long-term operation stage
				80			6.3	11	1	Noise excess by 3.8dB at night in long-term operation stage
	22	Huoxing primary school	K43+900	110	7	1.2	0.8	6.8	1	Noise excess by 2.9～3.5dB in day time in short/mid/long-term operation stage, 1.1 dB at night in long-term operation stage Background value in day time already excessive
	23	Xijiang Township sanatorium	K48+500	174	0	1.2	2.3	8.9	1	Noise excess by 1.7～3.2dB in day time in short/mid/long-term operation stage, 4.2 dB at night in long-term operation stage Background value in day time already excessive
	24	Shanshupai	K48+900～K49+460	30	10	1.2	4.5	7.2	4	Not excessive
				80			1.9	3.4	1	Noise excess by 0.2dB in day time in long-term operation stage,0.6～3.2dB in short/mid/long-term operation stage
	25	Shanbei village	K49+580～K49+740	32	15	1.2	2.8	4.9	4	Not excessive
				80			1.3	2.4	1	Noise excess by 0.3～2.2dB at night in short/mid/long-term operation stage
	26	Yuyang	K53+700～K54+150	40	2	1.2	8.5	11.2	4	Not excessive
				80			7.7	10.3	1	Noise excess by 3.4dB at night in long-term operation stage

Section	No	Name of sensitive locations	Stake No.	Distance from road center(m)	Subgrade height (m)	Predicting point height (m)	Ambient noise added value		Assessment standard	Standard excess
							Day	Night		
	27	Heliaoxia	K56+120～K57+060	28	6	1.2	13.7	16.6	4	Not excessive
				80			8.3	10.9	1	Noise excess by 4dB at night in long-term operation stage
Huichang～Hefeng	28	Shijing	K71+950～K72+330	110	15	1.2	9.6	9.4	1	Noise excess by 3.5dB at night in long-term operation stage
	29	Shangduan	K73+550～K73+800	26	10	1.2	12.5	12.6	4	Not excessive
							9.5	9.4	1	Noise excess by 3.5dB at night in long-term operation stage
	30	Huangtian	K74～K74+280	42	1	1.2	19.8	19.8	4	Noise excess by 3.9dB at night in long-term operation stage
				80			12.2	12	1	Noise excess by 0.8dB in day time, 6.1dB at night in long-term operation stage
	31	Shihuiling	K75+050～K75+570	32	4	1.2	19.1	19.1	4	Noise excess by 3.2dB at night in long-term operation stage
				80			9.1	8.9	1	Noise excess by 3dB at night in long-term operation stage
	32	Tudi	K76+175～K76+400	100	4	1.2	11.8	11.5	1	Noise excess by 0.4dB in day time, 5.6dBat night in long-term operation stage
	33	Youliaobei	K76+435～K76+825	26	2	1.2	21.6	21.7	4	Noise excess by 1.5～5.8dB at night in mid/long-term operation stage
				80			11.3	11.1	1	Noise excess by 5.2dB at night in long-term operation stage
	34	Tangmianshang	K76+445～K77+160	30	3	1.2	20.3	20.3	4	Noise excess by 4.4dB at night in long-term operation stage
				80			9.4	9.3	1	Noise excess by 3.4dB at night in long-term operation stage
	35	Daping	K77+680～K77+900	140	3	1.2	9.8	9.5	1	Noise excess by 3.6dB at night in long-term operation stage
Hefeng～Yudu	36	Hantang	K78+350～K78+480	50	2	1.2	16.7	16.8	4	Noise excess by 0.9dB at night in long-term operation stage
				80			10.5	10.5	1	Noise excess by 4.6dB at night in long-term operation stage
	37	Chiyu	K79+850～K80+130	90	13	1.2	9.9	9.9	1	Noise excess by 4dB at night in long-term operation stage
Yudu～Luo’ao	38	Hongtang	K99+170～K99+560	30	2	1.2	12.2	20.1	4	Noise excess by 0.3～5.1dB at night in mid/long-term operation stage
				80			3.9	10.3	1	Noise excess by 0.1～1.1 dB in day time in mid/long-term operation stage, 5.3dB at night in long-term operation stage
	39	Xinwu	K99+610～K99+910	80	4	1.2	5.3	12.2	1	Noise excess by 0.1～2.5dB in day time, 1～7.2dB at night in short/mid/long-term operation stage
	40	Pengwu	K101+980～K102+520	32	4	1.2	11.4	19.2	4	Noise excess by 0.7～4.2dB at night in mid/long-term operation stage
				80			4.2	10.6	1	Noise excess by 0.3～5.6dB in mid/long-term operation stage

Section	No	Name of sensitive locations	Stake No.	Distance from road center(m)	Subgrade height (m)	Predicting point height (m)	Ambient noise added value		Assessment standard	Standard excess
							Day	Night		
Luo'ao ～ Ganxian	41	Tianzigang	K102+700～K102+910	160	5	1.2	2.8	8.5	1	Noise excess by 3.5dB at night in long-term operation stage
	42	Shuiduan	K102+880～K103+080	30	6	1.2	9.1	16.8	4	Noise excess by 1.8dB at night in long-term operation stage
				80			4	10.3	1	Noise excess by 0.2～1.2dB in day time, 1.4～5.3dB at night in mid/long-term operation stage
	43	Xiamaoping	K103+490～K103+840	26	10	1.2	5.7	12.7	4	Not excessive
				80			3.6	9.7	1	Noise excess by 0.8dB in day time in long-term operation stage, 0.8～4.7dB at night in mid/long-term operation stage
	44	Maoping	K103+790～K104+300	26	10	1.2	5.7	12.7	4	Not excessive
				80			2.8	8.4	1	Noise excess by 3.4dB at night in long-term operation stage
	45	Zhaijiaoxia	K104+940～K105+050	28	18	1.2	3	8.7	4	Not excessive
				80			1.6	5.8	1	Noise excess by 0.8dB at night in long-term operation stage
	46	Xiaba	K114+530～K114+850	90	16	1.2	8.2	10.3	1	Noise excess by 0.9～5dB at night in mid/long-term operation stage
	47	Pingzigao	K119+600～K119+860	20	14	1.2	8.1	10.1	4	Not excessive
				80			9.1	11.2	1	Noise excess by 0.2dB in day time, 1.9～5.9dB at night in mid/long-term operation stage
	48	Xiaomenkou	K119+580～K120	20	15	1.2	7.7	9.7	4	Not excessive
				80			8.8	10.8	1	Noise excess by 1.5～5.5dB at night in mid/long-term operation stage
Ganxian ～ Ganzhou north	49	Laohupai	K124+650～K124+880	30	4	1.2	17.7	20	4	Noise excess by 1.7～4.7dB at night in mid/long-term operation stage
				80			7.7	9.8	1	Noise excess by 1.2～4.5dB at night in mid/long-term operation stage
	50	Wansong primary school	K126+710～K126+740	110	15	1.2	4.1	5.3	1	Noise excess by 0.8dB in day time in long-term operation stage, 1.9～6.1dB at night in short/mid/long-term operation stage Background value in day time already excessive
	51	Zouwu	K132+260～K132+400	30	7	1.2	13.6	15.9	4	Noise excess by 0.6dB at night in long-term operation stage
				80			7.9	9.9	1	Noise excess by 1.3～4.6dB at night in mid/long-term operation stage
	52	Shizishuxia	K132+340～K132+670	30	3	1.2	18.7	21	4	Noise excess by 2.7～5.7dB at night in mid/long-term operation stage
				80			8	10.1	1	Noise excess by 1.5～4.8dB at night in mid/long-term operation stage
	53	Tianxin primary school	K132+500～K132+570	40	0	1.2	1.5	9.3	1	Noise excess by 2.4～3.2dB in day time time in short/mid/long-term operation stage, 1.7～4.5dB at night in mid/long-term operation stage Background value in day time already excessive

Section	No	Name of sensitive locations	Stake No.	Distance from road center(m)	Subgrade height (m)	Predicting point height (m)	Ambient noise added value		Assessment standard	Standard excess
							Day	Night		
	54	Hechangbei	K132+680～K132+850	30	9	1.2	11.7	14	4	Not excessive
				80			6.3	8.3	1	Noise excess by 3dB at night in long-term operation stage
Ganzhou north ～ Huangjin	55	Paishang	K141+200～K141+400	26	10	1.2	11.2	13.5	4	Not excessive
				80			8.3	10.4	1	Noise excess by 2.1～5.1dB at night in mid/long-term operation stage
	56	Shanbiantoushang	K141+570～K141+800	90	-2	1.2	9.8	12	1	Noise excess by 0.9dB in day time in long-term operation stage, 3.4～6.7dB at night in mid/long-term operation stage
	57	Gangbianpai	K142+290～K142+430	20	6	1.2	20.2	22.6	4	Noise excess by 1.1～7.3dB at night in short/mid/long-term operation stage
				80			7.9	10	1	Noise excess by 1.7～4.7dB at night in mid/long-term operation stage
	58	Gangbian primary school	K142+340～K142+400	160	5	1.2	1.2	8.3	1	Noise excess by 2.6～3.2dB in day time time in short/mid/long-term operation stage, 0.7～3.8dB at night in mid/long-term operation stage Background value in day time already excessive
	59	Tengshuwo	K142+310～K142+450	50	6	1.2	15	17.4	4	Noise excess by 2.1dB at night in long-term operation stage
				80			11.8	14	1	Noise excess by 1.3～2.9dB in day time in mid/long-term operation stage, 0.9～8.7dB at night in short/mid/long-term operation stage
	60	Yongquangangshang	K144+340～K144+640	20	4	1.2	14.2	16.5	4	Noise excess by 1.2dB at night in long-term operation stage
				80			9	11.1	1	Noise excess by 0.1dB in day time in long-term operation stage, 2.7～5.8dB at night in mid/long-term operation stage
	61	Cangxia	K147+230～K147+350	30	4	1.2	17.9	20.2	4	Noise excess by 0.3dB in day time in long-term operation stage, 3～6.1dB at night in mid/long-term operation stage
				80			9.2	11.4	1	Noise excess by 0.3～6.1dB in mid/long-term operation stage
	62	Yeshan primary school	K147+200～K147+250	80		1.2	3.9	12.8	1	Noise excess by 3.3～5dB in day time, 1.5～9dB at night in short/mid/long-term operation stage Background value in day time already excessive
Hefeng interchange linking-up road	63	K0+620～K0+880	Zhongduan	80	1	1.2	4.2	4.4	1	Not excessive
	64	K1+800～K2+200	Fengshu	20	5	1.2	11.1	11.5	4	Not excessive
				65			4.2	4.5	1	Not excessive
	65	K1+900～K1+950	Xiabao sanatorium	140	1	1.2	1.1	1.2	1	Not excessive
Yudu interchange	66	K2+400～K2+600	Aonao	20	6	1.2	2.9	8.5	4	Not excessive
				65			0.6	2.9	1	Not excessive

Section	No	Name of sensitive locations	Stake No.	Distance from road center(m)	Subgrade height (m)	Predicting point height (m)	Ambient noise added value		Assessment standard	Standard excess
							Day	Night		
linking-up road	67	K5+150～K5+300	Shuibei	20	2	1.2	5.7	12.6	4	Not excessive
				65			0.8	3.7	1	Not excessive

Note：Assessment standard: class 1(day:55dB, night:45dB), class 4(day:70, night:55).

Table 4.3.2.4-4 Impact analysis of acoustically sensitive locations during operation stage（scheme II of Sanmen comparison section） unit：dB

Section	No	Mileage stake	Name of sensitive locations	Distance from road center (m)	Subgrade height (m)	Predicting point height (m)	Ambient noise added value		Assessment standard	Standard excess
							day	night		
罗坳～赣县	1	K102+275～K102+525	Pengwu	40	3	1.2	11.4	19.2	4	Noise excess by 0.7～4.2dB at night in mid/long-term operation stage
				80			4.2	10.6	1	Noise excess by 0.3～5.6dB in mid/long-term operation stage
	2	K103+575～K103+790	Sanmen	26	8	1.2	10.2	17.9	4	Noise excess by 2.9dB at night in long-term operation stage
				80			3.2	9.1	1	Noise excess by 0.3～4.1dB in mid/long-term operation stage
	3	K104+010～K104+110	Sanmen middle school	40	2	1.2	4.4	10.7	1	Noise excess by 5.7～12dB in short/mid/long-term operation stage

Note：Assessment standard: class 1(day:55dB, night:45dB), class 4(day:70, night:55).

From the predicted results of sensitive locations：

⑴ Prediction and calculation of 67 sensitive locations identified in the recommended scheme indicate that among them there are 5 sensitive locations satisfying the noise standard and the other 62 sensitive locations have noise excess of different degrees. The 5 sensitive locations satisfying the noise standard all locate in interchange linking-up road.The predicted results of 3 sensitive locations in scheme Ⅱ of Sanmen comparison section are exceeding standard. Among the sensitive locations with noise excess, 43% sensitive locations exceed standard at night during the long-term operation stage. Except xiabao sanatorium, the predicted results of 8 schools and 1 sanatorium along the route exceed standard during the short, mid and long-term operation stage, of which the ambient background noise values in Datian primary school, Huoxing primary school, Xijaing Township sanatorium, Sanmen middle school, Wansong primary school, Tianxin primary school, Gangbian primary school and Yeshan primary school have already exceeded class 1 criteria (55dB in daytime and 45dB at nighttime) of *Ambient Noise Standard in Urban Area* (GB3096-93).

⑵ The main reasons for noise excess in sensitive locations are：

① Increasing traffic volume in the proposed highway during long-term operation stage;

② Sensitive locations are close to the highway, or sensitive locations are located within an acoustic assessment scope with higher acoustic requirement such as class 1 criteria;

③ Some sensitive locations that enforce class 1 criteria already have excessive background noise value such as Datian primary school and Xijaing Township sanatorium, a total of 8 sensitive locations.

⑶ During the long-term operation stage of the recommended highway scheme, the noise will increase by 0.8～21.6dB in daytime and 2.4～22.6dB at night than the current situations.

4.4 Prediction and assessment of ambient air impact

4.4.1 Prediction and assessment of ambient air impact during construction stage

The major ambient air pollution in road construction stage is flying dust produced from mixing lime and soil, from material stock grounds and from leakage/spillover of material transportation, as well as dust from temporary roads and unpaved road surface. The assessment factor during construction stage is total suspension particle (TSP).

(1) Dust pollution from mixing lime and soil

Base course construction needs to set up pavement base course mixing station, whose location will be determined during construction stage. According to relevant testing results, the TSP concentration in the air is 8.849mg/m^3 in 50m leeward wind direction of mixing station, 1.703mg/m^3 in 100m leeward wind direction of mixing station, and 0.483mg/m^3 in 150m leeward wind direction of mixing station; class 2 standard requirement of national environmental air quality can be basically satisfied outside 300m. Assessing by the above-mentioned monitored data and surrounding air quality standard and considering the prevailing wind direction throughout the year along the route during construction stage, the above mixing stations should be set up 300m away from the leeward wind direction in sensitive village.

(2) Stock grounds for bulk materials

Lime, cement and other bulk materials are apt to fly dust under wind force, the flying dust is basically concentrated on the scope 50m in leeward wind direction, considering its harmful effect to human body and plant, protection work should be well done during storage. Measures such as sprinkling water and covering cloth can effectively prevent the wind from blowing dust.

(3) Transportation of bulk materials

Lime, gravel, sand and other bulk materials are very likely to cause dust pollution during their transportation whose impact coverage can reach 150m leeward wind direction (on 150m leeward wind direction, TSP pollution may still exceed class 2 air quality standard by 4 times), so vehicles transporting bulk materials must be managed strictly, prevention measures such as sprinkling water and covering cloth can be taken.

(4) Detour roads

If detour roads have pavement or adopt gravel/sand to pave, then their transport flying dust is relatively light. If the builder's detour roads are only earth road surface, the dust pollution caused by vehicle transport will be more serious, and the impact coverage will be relatively large. According to relevant data, wind-borne flying dust belongs to falling dust with small particle diameter (10-20μm), in unpaved road surface (earth), dust with particle diameter smaller than 5μm accounts for 8%, dust with particle diameter 5-10μm accounts for 24%, dust with particle diameter greater than 30μm accounts for 68%, so temporary roads, unpaved detour roads and roads under construction are extremely likely to produce flying dust. But compared to dust pollution caused by mixing station, hazard from wind-borne flying dust is relatively small with shorter impacting cycle. In order to reduce dust amount and to effectively reduce its adverse effect on resident's normal life, it is proposed to frequently sprinkle water in populous residences. Sprinkling water can effectively reduce dust according to relevant data (reduces 70% of dust amount).

⑸ Bituminous pavement construction's impact on ambient air along the route

According to tested data of relevant bitumen mixing equipment, if advanced bituminous concrete mixing equipment (Italian MV2A) is adopted, then in normal running of the equipment, its bituminous smoke discharge concentration is 22.7mg/m^3, complying with bituminous smoke discharges limit in GB16297-1996 "*Comprehensive Discharge Standard of Air Pollutant*".

This project intends to build bituminous structural surface course, the bituminous smoke produced from asphalt boiling and stirring will produce certain impact on this region's ambient air. According to our institute's measurement on Beijing Dayangfang asphalt mixing station, if advanced bituminous concrete mixing equipment (Italian MV_{2A}) is adopted, then at 100m leeward, the bituminous smoke discharge concentration can meet with requirement of GB16297-1996 "*Comprehensive Discharge Standard of Air Pollutant*". If field boiling and mixing equipment is adopted, then the bituminous smoke discharge concentration will greatly surpass the discharge standard. Therefore, mixing stations shall not be set up in places 300m leeward of which there are sensitive locations (hospitals, schools or large residences).

4.4.2 Prediction and assessment of ambient air impact during operation stage

4.4.2.1 Meteorological analysis of pollution

⑴ Surface wind

① Wind direction

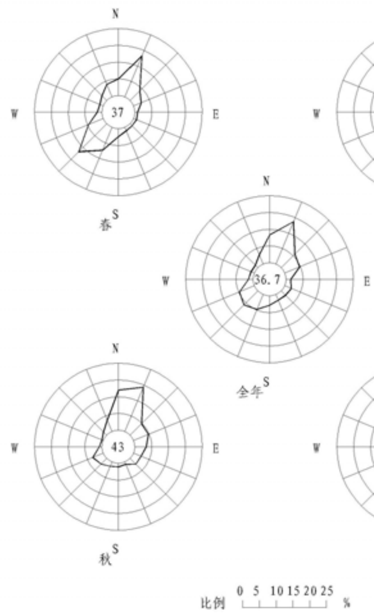
According to the routine meteorological statistics of the latest 3 years provided by National Meteorological Center, the annual prevailing wind direction in Ruijin City is the NNE wind with frequency of 13.7%; the annual prevailing wind direction in Huichang County is the S wind with frequency of 10.0%; the prevailing wind direction in Yudu County is the N wind with frequency 4.3%; the annual prevailing wind direction in Ganzhou City is the NNW wind with frequency of 9.0%. Statistics of wind direction, frequency, average wind speed, and pollution coefficients in the above 4 places are shown in Table 4.4.2.1-1; the rose maps of wind direction and frequency see Fig. 4.4.2.1-1.

Table 4.4.2.1-1 Wind direction frequency, average wind speed, and pollution coefficient(2001～2003)

Place name	Month	Statistics item	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	C
Ruijin City	Jan	Wind direction frequency	5.7	19.3	5.7	5.0	1.7	3.3	0.7	1.0	1.0	1.3	2.0	4.3	1.7	1.3	1.3	2.3	38.3
		Average wind speed	2.2	2.2	1.7	1.7	0.9	0.8	0.3	1.0	1.2	1.5	1.1	1.1	0.9	0.7	0.9	1.8	
		Pollution coefficient	2.6	8.7	3.4	3.0	1.9	4.3	2.0	1.0	0.9	0.9	1.8	3.9	1.9	2.0	1.4	1.3	
	April	Wind direction frequency	5.0	13.3	4.0	2.3	0.7	0.8	0.7	1.0	2.3	7.3	11.7	4.7	1.3	1.0	2.0	4.0	37.0
		Average wind speed	6.0	2.3	1.4	1.6	1.7	0.5	1.0	1.8	1.4	2.1	1.9	2.0	1.6	1.3	1.3	1.7	
		Pollution coefficient	0.8	5.8	2.8	1.5	0.4	1.6	0.7	0.5	1.7	3.4	6.0	2.4	0.8	0.8	1.5	2.4	
	July	Wind direction frequency	2.7	4.3	4.3	5.3	1.0	2.0	3.7	4.7	8.0	14.3	10.0	8.7	1.7	1.0	1.0	1.0	20.3
		Average wind speed	1.7	2.1	1.5	1.2	1.0	1.1	1.3	1.7	1.5	2.0	1.8	1.6	2.1	1.5	1.2	1.0	
		Pollution coefficient	1.6	2.1	2.9	4.4	1.0	1.8	2.8	2.8	5.5	7.2	5.7	5.3	0.8	0.7	0.9	1.0	
	Oct	Wind direction frequency	12.0	14.3	4.7	4.7	3.3	2.3	2.3	0.7	1.0	1.3	2.3	3.3	0.7	0.3	1.3	3.7	43.0
		Average wind speed	7.3	2.1	1.8	1.5	1.1	1.2	0.8	0.5	1.2	0.8	1.6	1.4	0.7	0.3	1.3	2.0	
		Pollution coefficient	1.6	6.8	2.6	3.0	3.1	2.0	3.0	1.3	0.9	1.6	1.5	2.3	1.0	1.0	1.0	1.9	
	Year	Wind direction frequency	8.3	13.7	5.7	4.7	1.3	2.0	1.7	1.7	2.7	4.7	5.7	4.7	1.3	1.0	1.0	3.0	36.7
		Average wind speed	2.3	2.1	1.7	1.5	1.4	1.3	1.4	1.6	1.6	2.0	2.0	1.6	1.4	1.5	1.7	1.9	
		Pollution coefficient	3.6	6.5	3.4	3.1	1.0	1.5	1.2	1.0	1.6	2.3	2.9	2.9	1.0	0.7	0.6	1.6	
Huichang County	Jan	Wind direction frequency	13.0	2.0	0.7	0.3	0.3		1.3	1.7	4.3	1.3	0.3		2.0	2.7	12.3	8.3	50.3
		Average wind speed	6.0	1.7	1.0	0.7	0.3		1.2	1.4	2.6	1.3	0.3		1.2	1.7	2.0	2.1	
		Pollution coefficient	2.2	1.2	0.7	0.5	1.0		1.1	1.2	1.7	1.0	1.0		1.7	1.6	6.3	3.9	
	April	Wind direction frequency	6.7	2.7	0.7	0.7	0.7	1.0	2.7	7.0	16.3	2.3	2.0	0.3	2.0	4.7	7.7	5.7	38.7
		Average wind speed	5.5	1.5	1.0	1.0	0.7	0.3	1.2	2.0	3.0	1.9	2.6	0.3	1.1	2.3	2.1	2.0	
		Pollution coefficient	1.2	1.7	0.7	0.7	1.0	3.0	2.3	3.6	5.5	1.2	0.8	1.0	1.9	2.1	3.6	2.8	
	July	Wind direction frequency	4.0	1.3	1.0	1.0	1.0	1.3	5.7	10.0	24.3	4.3	1.3	1.7	0.7	2.3	1.0	2.0	24.3
		Average wind speed	6.7	2.8	1.1	0.8	1.0	1.0	1.9	2.2	2.3	2.2	1.2	2.2	1.3	1.2	1.2	0.5	
		Pollution coefficient	0.6	0.5	0.9	1.2	1.0	1.3	3.0	4.5	10.4	2.0	1.1	0.8	0.5	1.9	0.8	4.3	
	Oct	Wind direction frequency	10.3	1.7	0.7	0.3	0.7	1.0	3.0	2.0	2.7	0.7		0.3	1.0	4.7	7.3	10.3	50.3
		Average wind speed	5.9	1.6	0.5	0.3	0.3	1.0	1.2	1.8	1.7	1.3		0.3	1.4	1.6	2.3	2.3	
		Pollution coefficient	1.8	1.1	1.3	1.0	2.0	1.0	2.6	1.1	1.5	0.5		1.0	0.7	2.9	3.1	4.6	
	Year	Wind direction frequency	9.0	2.7	1.3	0.0	1.0	0.7	3.0	4.3	10.0	1.7	1.0	0.3	1.7	3.7	6.3	7.3	49.0
		Average wind speed	6.1	2.1	2.1	1.4	1.2	1.1	1.4	1.9	2.5	2.2	2.1	2.1	1.6	1.8	1.9	2.1	
		Pollution coefficient	1.5	1.3	0.6	0.0	0.8	0.6	2.2	2.2	4.0	0.8	0.5	0.2	1.0	2.1	3.3	3.5	

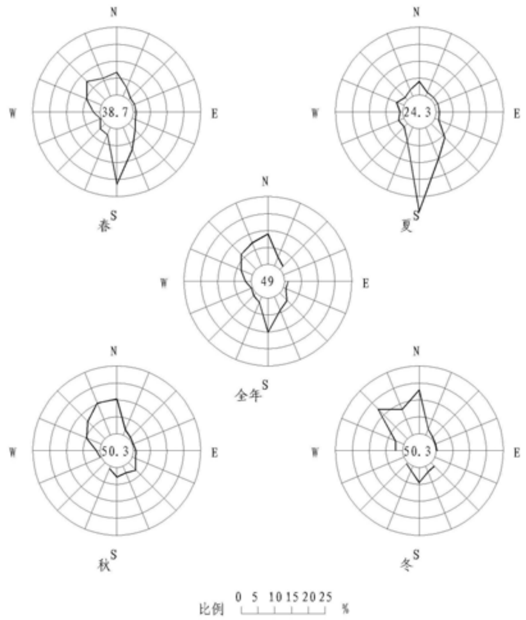
Place name	Month	Statistics item	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	C
Yudu County	Jan	Wind direction frequency	4.7	1.7	2.7			0.3	0.3		0.7	0.7				0.7	3.7	1.5	81.0
		Average wind speed	4.6	0.8	1.0			0.3	0.3		0.5	1.3				0.5	0.7	4.0	
		Pollution coefficient	1.0	2.2	2.7			1.0	1.0		1.3	0.5				1.3	5.6	0.4	
	April	Wind direction frequency	3.3	1.3	3.3	0.3	1.0	1.0	0.7	1.7	3.0	1.3	5.3	1.3	3.3	4.0	1.2	1.9	66.0
		Average wind speed	5.2	0.7	1.0	0.7	0.7	0.7	0.3	1.9	1.9	1.6	2.2	1.6	1.5	0.7	4.0	4.7	
		Pollution coefficient	0.6	2.0	3.3	0.5	1.5	1.5	2.0	0.9	1.6	0.8	2.4	0.9	2.2	6.0	0.3	0.4	
	July	Wind direction frequency	3.3	1.3	2.7	0.7	4.3	2.3	3.7	8.0	18.0	6.0	23.0	1.7	4.0	1.0	1.1	1.0	50.0
		Average wind speed	3.2	0.8	1.3	1.0	1.1	1.4	4.2	1.4	4.0	1.3	1.5	1.8	1.4	0.8	1.0	2.0	
		Pollution coefficient	1.0	1.6	2.1	0.7	3.9	1.6	0.9	5.9	4.5	4.7	15.7	0.9	2.8	1.2	1.1	0.5	
	Oct	Wind direction frequency	4.7	1.0	1.3	0.3	2.3	1.0	1.3	0.3	1.0	1.0	1.3	0.7	1.7	1.3	1.2	1.3	72.0
		Average wind speed		0.8	0.7	0.7	0.9	0.8	1.7	0.3	1.3	1.0	0.9	0.3	1.5	1.0	1.3	4.3	
		Pollution coefficient		1.2	2.0	0.5	2.6	1.3	0.8	1.0	0.8	1.0	1.4	2.0	1.1	1.3	0.9	0.3	
	Year	Wind direction frequency	4.3	1.3	2.3	0.0	1.7	1.0	1.7	1.0	2.0	1.7	2.7	1.0	2.0	1.0	1.3	1.5	68.7
		Average wind speed	4.4	1.3	1.2	1.6	1.3	1.2	1.4	1.5	1.5	1.8	1.7	1.5	1.3	1.1	1.0	3.0	
		Pollution coefficient	1.0	1.1	1.9	0.0	1.3	0.8	1.2	0.7	1.4	0.9	1.6	0.7	1.5	0.9	1.3	0.5	
Ganzhou City	Jan	Wind direction frequency	9.7	8.3	5.3	7.3	4.0	1.0	1.7	0.7	0.7	1.7	1.7	0.7	2.0	1.3	1.6	1.8	39.3
		Average wind speed	5.1	1.6	1.4	1.2	1.0	0.7	1.0	1.3	0.7	1.0	1.3	0.7	1.3	2.0	1.7	3.0	
		Pollution coefficient	1.9	5.3	3.8	5.9	3.9	1.5	1.7	0.5	1.0	1.7	1.3	1.0	1.5	0.7	1.0	0.6	
	April	Wind direction frequency	9.3	6.0	2.7	5.3	1.7	1.0		2.0	2.7	5.3	5.0	3.7	3.0	0.9	1.5	1.7	37.7
		Average wind speed	4.8	1.7	1.1	1.2	1.0	2.0		1.7	1.6	2.0	2.3	1.7	0.7	3.0	2.0	5.0	
		Pollution coefficient	1.9	3.5	2.5	4.4	1.7	0.5		1.2	1.7	2.6	2.2	2.2	4.3	0.3	0.8	0.3	
	July	Wind direction frequency	2.0	2.3	5.7	8.3	4.7	2.3	3.3	5.3	7.3	8.3	11.3	1.7	1.0	1.0	0.7	0.8	32.0
		Average wind speed	3.0	0.7	1.8	2.0	1.6	1.6	1.6	1.6	2.0	2.0	2.0	2.3	1.4	1.0	1.7	0.7	
		Pollution coefficient	0.7	3.2	3.2	4.2	2.9	1.5	2.1	3.3	3.7	4.2	5.6	0.7	0.7	1.0	0.4	1.2	
	Oct	Wind direction frequency	5.3	4.7	4.7	8.0	6.3	2.0	1.3	0.7	1.7	2.3	2.0	1.7	1.7	0.7	2.2	2.2	46.7
		Average wind speed	6.0	1.5	1.2	1.4	1.3	1.5	0.7	1.0	1.0	1.7	1.5	1.6	1.5	1.7	0.7	3.0	
		Pollution coefficient	0.9	3.1	3.9	5.9	5.0	1.3	2.0	0.7	1.7	1.4	1.3	1.1	1.1	0.4	3.4	0.7	
	Year	Wind direction frequency	7.0	5.3	5.0	8.7	3.3	1.7	1.3	1.3	2.0	4.0	3.3	2.3	2.3	1.2	4.8	1.8	38.7
		Average wind speed	5.0	1.5	1.5	1.5	1.4	1.3	1.4	1.8	1.9	2.1	1.9	1.6	1.3	2.3	1.7	3.0	
		Pollution coefficient	1.4	3.5	3.3	5.8	2.3	1.3	1.0	0.7	1.1	1.9	1.7	1.4	1.8	0.5	2.9	0.6	

note：Source from National Meteorological Center



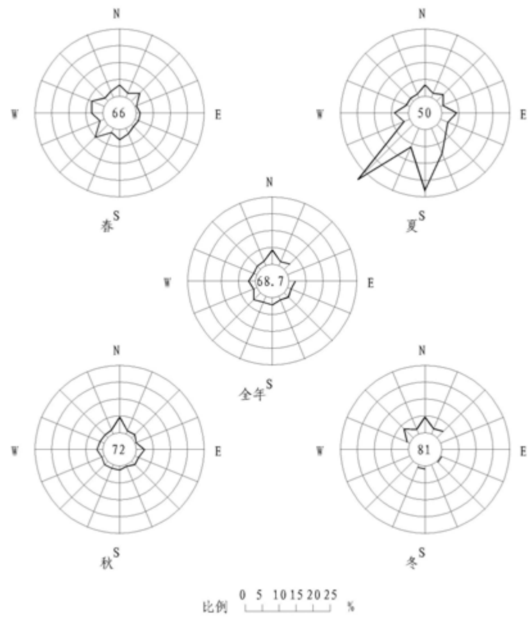
瑞金风向频率玫瑰图

RuiJin



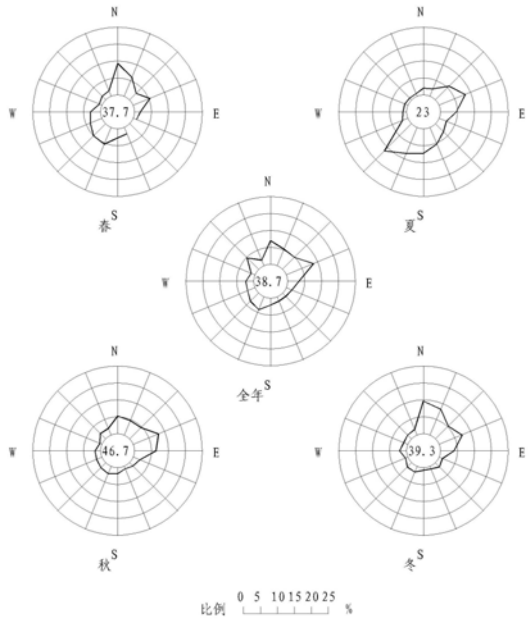
会昌风向频率玫瑰图

HuiChang



于都风向频率玫瑰图

YuDu



赣州风向频率玫瑰图

GanZhou

Fig. 4.4.2.1-1 Rose maps of wind direction and frequency

② Static wind

Wind with speed smaller than 1. 0m/s is static wind, which is unfavorable to diffusion of air pollutants, especially when the static wind and inverse temperature appear at the same time, it is apt to cause serious ambient air pollution. The annual static wind frequencies in Ruijin City, Huichang County, Yudu County and Ganzhou City are 36.7%, 49.0%, 68.7%, and 38.7% respectively. The static wind frequency is highest in Yudu County with its pollutant diffusion condition worse than other 3 counties.

③ Wind speed

Wind speed is an important factor determining ambient air's dilution ability to pollutant diffusion. The seasonal and annual wind speeds of each place in each direction are listed in Table 4. 4. 2. 1-1. The many years' average wind speeds in Ruijin City, Huichang County, Yudu County and Ganzhou City are 1.6m/s, 1.6m/s, 1.1m/s and 1.9m/s respectively. By contrast, because wind speed is the smallest in Yudu County, it is relatively unfavorable to diffusion of pollutants.

④ Pollution coefficient

Considering pollution degree in some direction, it is required to comprehensively consider the impact from wind direction frequency and average wind speed, so pollution coefficient needs to be calculated by the following formula:

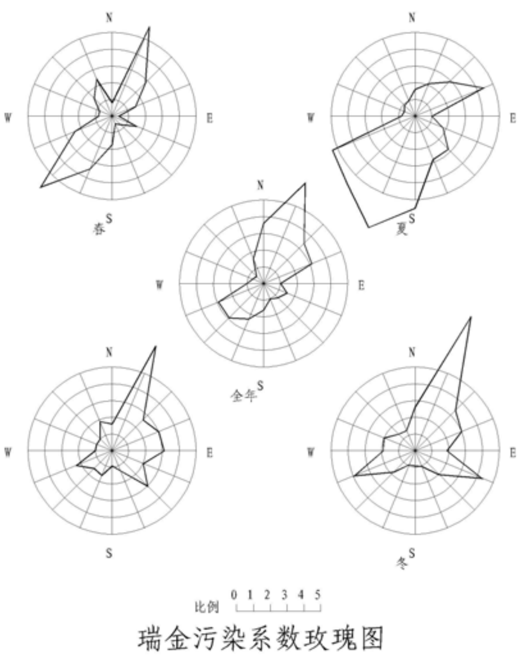
$$C_p = \frac{f_i}{V_i}$$

in which: C_p —— average pollution coefficient;

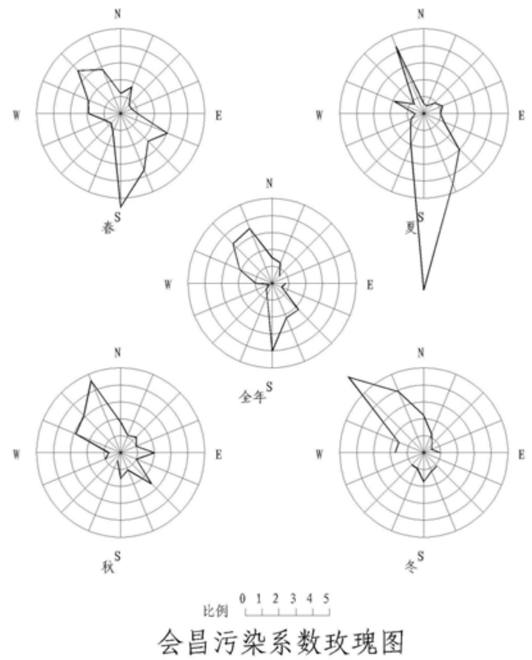
f_i —— frequency of certain wind direction;

V_I —— average speed of certain wind direction.

The calculation results see Table 4.4.2.1-1. The pollution coefficient of certain position is large, indicating that the leeward pollution degree of that wind direction is high. Calculation results show that the direction with largest pollution coefficient in a year in Ruijin City is NNE, is NNW in Huichang County, is NE in Yudu County, and NEN in Ganzhou City. The rose maps of pollution coefficient in accumulated years along the route are illustrated in Fig.4.4.2.1-2.



RuiJin



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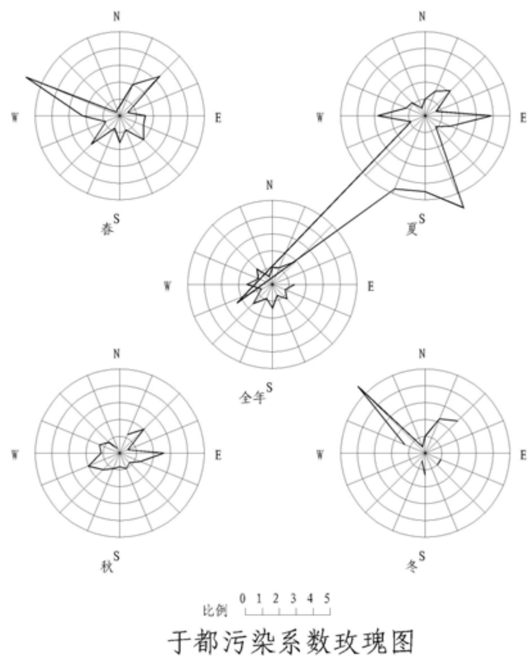

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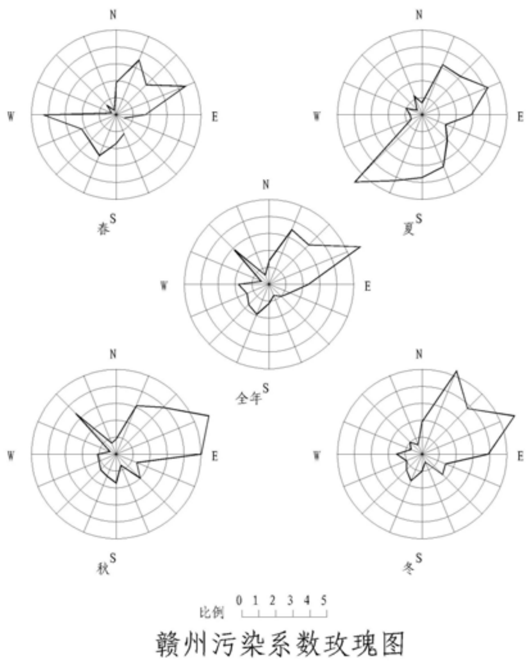


GanZhou

Fig. 4.4.2.1-2 Rose maps of pollution coefficient

(3) Air stability determination

Air stability is a basic parameter indicating atmospheric dilution ability and turbulence intensity. According to the observed data of surface wind direction, wind speed, and cloud amount, Pasquale's stability classification is adopted. According to the observed data by meteorological department, the atmospheric stability degree of areas along the project mostly takes on neutral D degree. The atmospheric stability classification in the assessment area is shown in Table 4.4.2.1-2.

Table 4.4.2.1-2 Atmospheric stability classification

Season	Unstable				Neutral	Stable		
	A	B	C	∑	D	E	F	∑
Spring	2.7	9.5	3.8	16.0	66.6	7.9	9.5	17.4
Summer	1.9	14.7	8.2	24.8	54.3	13.6	7.3	20.9
Autumn	3.8	15.9	5.5	25.2	45.3	11.8	17.6	29.6
Winter	1.1	11.7	6.1	18.9	47.5	13.3	20.3	33.6
Whole year	2.4	12.9	5.9	21.2	53.5	11.6	13.6	25.2

From Table 4.4.2.1-2, it can be seen that the neutral stability D occurs the most frequently in a year, about 53.5%, followed by stability E and F, about 25.2%; the unstable A, B and C have the least frequency, about 21.2%. The stability in a year assumes neutral to stable condition.

4.4.2.2 Pollutant discharge source intensity calculation of automobile tail gas

After this project is put into operation, the automobile tail gas (exhaust) is the main source of ambient air pollutant, the size of pollutant emission is proportional to traffic volume, and is also related to vehicle composition and operating condition.

(1) Traffic volume estimate

Traffic volume estimate and vehicle composition are same as above.

(2) Automobile pollutant discharge source intensity calculation

Gaseous pollutant discharge source intensity calculation follows the formula:

$$Q_j = \sum_{i=1}^{3} A_i \cdot E_{ij} \cdot 3600^{-1}$$

in which: Q_j —— discharge intensity of type j gaseous pollutant, mg/s·m;

A_i —— hour traffic volume model i vehicles, vehicle/h;

E_{ij} —— Under the operation condition of automobile special road, single vehicle's discharge factor of model i vehicle and j pollutant in predicting year (adopt the recommended values of "*Environmental Impact Assessment Specifications for Road Construction*", mg/vehicle·m.

Peak hour source intensity calculation formula:

$$Q_{LG} = Q_L \cdot A_G$$

in which：A_G is peak hour coefficient, set at 0.061;

Daily average source intensity calculation formula：

$$Q_{Lr} = \frac{Q_L \bullet A_r}{R}$$

in which：A_r is traffic volume coefficient in daytime, set at 83.0%.

R is hour number of a day, set at 16.

The above source intensity calculation formula can be used to calculate the ambient air pollutant source intensity of the proposed highway. The prediction and assessment factor chosen for this project is NO_2 and CO, the pollutant single-vehicle discharge factor adopts the recommended figures in "*Environmental Impact Assessment Specification for Road Construction Project*", the conversion coefficient for NO_X and NO_2 is 0.8. Pollutant source intensity values are listed in Table 4.4.2.2-1.

Table 4.4.2.2-1 NO_2 and CO discharge source intensity of the proposed highway unit：mg/(m·s)

Pollutant	Road section name	Short-Term		Mid-Term		Long-Term	
		Daily average	Peak	Daily average	Peak	Daily average	Peak
NO_2	Yunshishan～Huichang (K31+012.977～K50+248)	0.457	0.537	0.711	0.836	1.107	1.302
	Huichang～Hefeng (K50+248～K78+181)	0.499	0.586	0.770	0.906	1.186	1.395
	Hefeng～Yudu (K78+181～K90+225)	0.515	0.605	0.794	0.933	1.213	1.426
	Yudu～Luo'ao (K90+225～K101+230)	0.543	0.638	0.839	0.986	1.282	1.507
	Luo'ao～Ganxian (K101+230～K124+244)	0.596	0.701	0.906	1.065	1.359	1.598
	Ganxian～Ganzhou north (K124+244～K139+377)	0.658	0.774	0.984	1.157	1.454	1.710
	Ganzhou north～Huangjin (K139+377～K149+728)	0.695	0.817	1.039	1.221	1.534	1.804
CO	Yunshishan～Huichang (K31+012.977～K50+248)	2.080	2.445	3.233	3.802	5.037	5.923
	Huichang～Hefeng (K50+248～K78+181)	2.269	2.668	3.505	4.121	5.398	6.348
	Hefeng～Yudu (K78+181～K90+225)	2.343	2.755	3.611	4.246	5.519	6.490
	Yudu～Luo'ao (K90+225～K101+230)	2.470	2.905	3.816	4.487	5.833	6.859
	Luo'ao～Ganxian (K101+230～K124+244)	2.714	3.191	4.122	4.848	6.184	7.272

Pollutant	Road section name	Short-Term		Mid-Term		Long-Term	
		Daily average	Peak	Daily average	Peak	Daily average	Peak
	Ganxian～Ganzhou north (K124+244～K139+377)	2.995	3.521	4.478	5.266	6.616	7.780
	Ganzhou north～Huangjin (K139+377～K149+728)	3.160	3.716	4.725	5.557	6.981	8.209

4.4.2.3 Ambient air pollutant diffusion mode

Because the proposed highway is located in various kinds of topographical features, so the diffusion mode adopts the discharge pollutant diffusion mode in each topography recommended in "*Environmental Impact Assessment Specifications for Road Construction Project*".

(1) If the road is close to cliff, the following formula is adhered to：

$$C_{PR}=\frac{\eta}{\sqrt{2\pi}\sigma_y}\left\{\exp\left[-\frac{1}{2}\left(\frac{y}{\sigma_y}\right)^2\right]+\exp\left[-\frac{1}{2}\left(\frac{2L_0-y}{\sigma_y}\right)^2\right]\right\}$$

$$\eta=Q_j\Big/\sqrt{2\pi}\cdot U\cdot\sigma_z(r)$$

$$r=\left[y^2+\left(z/e\right)^2\right]^{1/2}$$

$$e=\sigma_z/\sigma_y$$

In which：C_{PR}——pollutant concentration of predicting point R at discharge height of valid source, mg/m^3;

L_0——distance from cliff to center line of line source, m.

(2) When the road passes through valleys, the following formula is adhered to:

$$C_{PR}=\frac{\eta}{\sqrt{2\pi}\sigma_y}\left\{\exp\left[-\frac{1}{2}\left(\frac{2L_0-y}{\sigma_y}\right)^2\right]+\exp\left[-\frac{1}{2}\left(\frac{2R_0+y}{\sigma_y}\right)^2\right]\right\}$$

in which：L_0——distance from road centre line to left valley wall, m;

R_0——distance from road centre line to right valley wall, m;

(3) If the road is located in plain or rolling terrain, the following formula is adhered to：

- When the angle between wind direction and linear source is 0°<θ< 90°, the diffusion mode is：

$$C_{PR} = \frac{Q_j}{U}\int_A^B \frac{1}{2\pi\sigma_y \cdot \sigma_z} \exp\left[-\frac{1}{2}\left(\frac{y}{\sigma_y}\right)^2\right]\left\{\exp\left[-\frac{1}{2}\left(\frac{z-h}{\sigma_z}\right)^2\right] + \exp\left[-\frac{1}{2}\left(\frac{z+h}{\sigma_z}\right)^2\right]\right\}dl$$

in which: C_{PR} — pollutant concentration produced by road linear source section AB on predicting point R, mg/m^3;

U — average wind speed of predicting section at effective discharge source height, m/s;

Q_j — model *j* gaseous pollutant discharge source intensity, mg/vehicle·m;

σ_y,σ_z — horizontal and transverse wind direction and vertical diffusion parameter, m;

x — distance of leeward wind direction from linear source infinitesimal middle point to predicting point, m;

y — distance of transverse wind direction from linear source infinitesimal middle point to predicting point, m;

Z — height from predicting point to ground, m;

h — effective discharge source height, m;

A, B — Linear source starting and terminal points.

- When wind direction is vertical to linear source(θ=90°), the diffusion mode is：

$$C_{vertical} = \left(\frac{2}{\pi}\right)^{1/2}\frac{Q_j}{U\sigma_z}\exp\left[-\left(\frac{h^2}{2\sigma_z^2}\right)\right]$$

- When wind direction is parallel to linear source(θ=0°), the diffusion mode is：

$$C_{parallel} = \left(\frac{1}{2\pi}\right)^{1/2}\frac{Q_j}{U\sigma_z(r)}$$

$$r = \left(y^2 + \frac{z^2}{e^2}\right)^{1/2}$$

$$e = \sigma_z / \sigma_y$$

In which:

r — equivalent distance from infinitesimal to predicting point, m;

e — conventional diffusion parameter ratio;

The meanings of other notations are the same as above. The diffusion parameters are determined according to "*Environmental Impact Assessment Specifications for Road*

Construction Project".

4.4.2.4 Ambient air impact prediction and assessment

(1) Automobile exhaust diffusion prediction along the route

Under D stability degree, the NO_2 and CO diffusion predicted results in each section of the proposed highway in each predicting year are listed in Table 4.4.2.4-1～4.4.2.4-3 and Table 4.4.2.4-4～4.4.2.4-6.

① Yunshishan interchange～Huichang interchange

The NO_2 peak hour max concentration and daily max concentration in this section is 0.087mg/m^{3}and 0.074mg/m^3 respectively occurring in long-term operation stage, accounting for 36.3% and 61.7% in assessment criterion value respectively; The CO peak hour max concentration and daily max concentration in this section is 0.397mg/m^{3}and 0.337mg/m^3 respectively occurring in long-term operation stage, accounting for 3.97% and 8.43% in assessment criterion value respectively.

② Huichang interchange～Hefeng interchange

The NO_2 peak hour max concentration and daily max concentration in this section is 0.093/m^3 and 0.079mg/m^3 respectively occurring in long-term operation stage, accounting for 38.8% and 65.8% in assessment criterion value respectively; The CO peak hour max concentration and daily max concentration in this section is 0.425mg/m^3 and 0.362 mg/m^3 respectively occurring in long-term operation stage, accounting for 4.25% and 9.05% in assessment criterion value respectively.

③ Hefeng interchange～Yudu interchange

The NO_2 peak hour max concentration and daily max concentration in this section is 0.135mg/m^3 and 0.115mg/m^3 respectively occurring in long-term operation stage, accounting for 56.3% and 95.8% in assessment criterion value respectively; The CO peak hour max concentration and daily max concentration in this section is 0.614 mg/m^3 and 0.522mg/m^3 respectively occurring in long-term operation stage, accounting for 6.14% and 13.05% in assessment criterion value respectively.

④ Yudu interchange～Luo'ao interchange

The NO_2 peak hour max concentration and daily max concentration in this section is 0.143mg/m^3 and 0.121mg/m^3 respectively occurring in long-term operation stage, accounting for 59.6% and 100.8% in assessment criterion value respectively; The CO peak hour max concentration and daily max concentration in this section is 0.649mg/m^3

and 0.552mg/m^3 respectively occurring in long-term operation stage, accounting for 4.49% and 13.80% in assessment criterion value respectively.

⑤ Luo'ao interchange～Ganxian interchange

The NO_2 peak hour max concentration and daily max concentration in this section is 0.090mg/m^3 and 0.077mg/m^3 respectively occurring in long-term operation stage, accounting for 37.5% and 64.2% in assessment criterion value respectively; The CO peak hour max concentration and daily max concentration in this section is 0.411mg/m^3 and 0.349mg/m^3 respectively occurring in long-term operation stage, accounting for 4.11% and 8.73% in assessment criterion value respectively.

⑥ Ganxian interchange～Ganzhou north interchange

The NO_2 peak hour max concentration and daily max concentration in this section is 0.141mg/m^3 and 0.120mg/m^3 respectively occurring in long-term operation stage, accounting for 58.8% and 100.0% in assessment criterion value respectively; The CO peak hour max concentration and daily max concentration in this section is 0.643mg/m^3 and 0.547mg/m^3 respectively occurring in long-term operation stage, accounting for 6.43% and 13.68% in assessment criterion value respectively.

⑦ Ganzhou north interchange～Huangjin interchange

The NO_2 peak hour max concentration and daily max concentration in this section is 0.102mg/m^3 and 0.087mg/m^3 respectively occurring in long-term operation stage, accounting for 42.5% and 72.5% in assessment criterion value respectively; The CO peak hour max concentration and daily max concentration in this section is 0.464 mg/m^3 and 0.394mg/m^3 respectively occurring in long-term operation stage, accounting for 4.64% and 9.85% in assessment criterion value respectively.

Table 4.4.2.4-1 NO_2 diffusion prediction during short-term operation stage (2009) unit：mg/m^3

Road section	Traffic condition	Angle between wind direction and road	Distance to road center line(m)								
			20	30	40	50	60	80	100	150	200
Yunshishan～Huichang (K31+012.977～K50+248)	Daily average	90°	0.031	0.030	0.028	0.026	0.024	0.020	0.017	0.013	0.010
		0°	0.019	0.016	0.014	0.012	0.011	0.009	0.007	0.005	0.004
	Peak hour	90°	0.036	0.035	0.033	0.030	0.028	0.024	0.020	0.015	0.012
		0°	0.022	0.019	0.017	0.015	0.013	0.010	0.009	0.006	0.005
Huichang～Hefeng (K50+248～K78+181)	Daily average	90°	0.033	0.032	0.030	0.028	0.026	0.022	0.019	0.014	0.011
		0°	0.021	0.018	0.016	0.014	0.012	0.010	0.008	0.006	0.004
	Peak hour	90°	0.039	0.038	0.036	0.033	0.030	0.026	0.022	0.016	0.013
		0°	0.024	0.021	0.018	0.016	0.014	0.011	0.010	0.007	0.005
Hefeng～Yudu (K78+181～K90+225)	Daily average	90°	0.049	0.047	0.044	0.041	0.038	0.032	0.028	0.021	0.016
		0°	0.020	0.018	0.016	0.014	0.013	0.010	0.009	0.006	0.005
	Peak hour	90°	0.057	0.055	0.051	0.048	0.044	0.038	0.033	0.024	0.019
		0°	0.023	0.021	0.019	0.017	0.015	0.012	0.010	0.007	0.006
Yudu～Luo'ao (K90+225～K101+230)	Daily average	90°	0.051	0.049	0.046	0.043	0.040	0.034	0.029	0.022	0.017
		0°	0.021	0.019	0.017	0.015	0.013	0.011	0.009	0.007	0.005
	Peak hour	90°	0.060	0.058	0.054	0.050	0.047	0.040	0.035	0.025	0.020
		0°	0.025	0.022	0.020	0.017	0.016	0.013	0.011	0.008	0.006
Luo'ao～Ganxian (K101+230～K124+244)	Daily average	90°	0.034	0.033	0.031	0.029	0.027	0.023	0.019	0.014	0.011
		0°	0.027	0.023	0.019	0.017	0.014	0.012	0.010	0.007	0.005
	Peak hour	90°	0.040	0.039	0.037	0.034	0.031	0.027	0.023	0.016	0.013
		0°	0.032	0.027	0.023	0.019	0.017	0.014	0.011	0.008	0.006
Ganxian～Ganzhou north (K124+244～K139+377)	Daily average	90°	0.054	0.048	0.042	0.037	0.033	0.027	0.022	0.016	0.012
		0°	0.030	0.025	0.021	0.018	0.016	0.013	0.011	0.007	0.006
	Peak hour	90°	0.064	0.056	0.049	0.044	0.039	0.031	0.026	0.019	0.014
		0°	0.035	0.029	0.025	0.021	0.019	0.015	0.012	0.009	0.007
Ganzhou north～Huangjin (K139+377～K149+728)	Daily average	90°	0.039	0.039	0.037	0.034	0.031	0.026	0.022	0.016	0.013
		0°	0.031	0.026	0.022	0.019	0.017	0.013	0.011	0.008	0.006
	Peak hour	90°	0.046	0.046	0.043	0.040	0.037	0.031	0.026	0.019	0.015
		0°	0.037	0.031	0.026	0.023	0.020	0.016	0.013	0.009	0.007

Table 4.4.2.4-2 NO_2 diffusion prediction during mid-term operation stage (2015) unit：mg/m^3

Road section	Traffic condition	Angle between wind direction and road	Distance to road center line(m)								
			20	30	40	50	60	80	100	150	200
Yunshishan～Huichang (K31+012.977～K50+248)	Daily average	90°	0.048	0.046	0.043	0.040	0.037	0.031	0.027	0.020	0.015
		0°	0.030	0.026	0.022	0.019	0.017	0.014	0.012	0.008	0.006
	Peak hour	90°	0.056	0.054	0.051	0.047	0.043	0.037	0.032	0.023	0.018
		0°	0.035	0.030	0.026	0.023	0.020	0.016	0.014	0.010	0.007
Huichang～Hefeng (K50+248～K78+181)	Daily average	90°	0.052	0.050	0.047	0.043	0.040	0.034	0.029	0.021	0.017
		0°	0.032	0.028	0.024	0.021	0.019	0.015	0.012	0.009	0.007
	Peak hour	90°	0.061	0.059	0.055	0.051	0.047	0.040	0.034	0.025	0.020
		0°	0.038	0.033	0.028	0.025	0.022	0.018	0.015	0.010	0.008
Hefeng～Yudu (K78+181～K90+225)	Daily average	90°	0.075	0.072	0.067	0.063	0.058	0.050	0.043	0.032	0.025
		0°	0.031	0.027	0.024	0.022	0.019	0.016	0.013	0.010	0.007
	Peak hour	90°	0.088	0.084	0.079	0.074	0.068	0.058	0.050	0.037	0.029
		0°	0.036	0.032	0.029	0.025	0.023	0.019	0.016	0.011	0.009
Yudu～Luo'ao (K90+225～K101+230)	Daily average	90°	0.079	0.076	0.071	0.066	0.061	0.052	0.045	0.033	0.026
		0°	0.033	0.029	0.026	0.023	0.020	0.017	0.014	0.010	0.008
	Peak hour	90°	0.093	0.089	0.084	0.078	0.072	0.062	0.053	0.039	0.031
		0°	0.038	0.034	0.030	0.027	0.024	0.020	0.017	0.012	0.009
Luo'ao～Ganxian (K101+230～K124+244)	Daily average	90°	0.051	0.051	0.048	0.044	0.041	0.034	0.029	0.021	0.017
		0°	0.041	0.034	0.029	0.025	0.022	0.017	0.015	0.010	0.008
	Peak hour	90°	0.060	0.059	0.056	0.052	0.048	0.040	0.034	0.025	0.020
		0°	0.048	0.040	0.034	0.030	0.026	0.021	0.017	0.012	0.009
Ganxian～Ganzhou north (K124+244～K139+377)	Daily average	90°	0.081	0.072	0.063	0.055	0.049	0.040	0.033	0.024	0.018
		0°	0.044	0.037	0.032	0.027	0.024	0.019	0.016	0.011	0.009
	Peak hour	90°	0.096	0.084	0.074	0.065	0.058	0.047	0.039	0.028	0.022
		0°	0.052	0.044	0.037	0.032	0.028	0.022	0.019	0.013	0.010
Ganzhou north～Huangjin (K139+377～K149+728)	Daily average	90°	0.059	0.058	0.055	0.051	0.047	0.039	0.034	0.024	0.019
		0°	0.047	0.039	0.033	0.029	0.025	0.020	0.017	0.012	0.009
	Peak hour	90°	0.069	0.068	0.064	0.060	0.055	0.046	0.039	0.029	0.022
		0°	0.055	0.046	0.039	0.034	0.030	0.024	0.020	0.014	0.011

Table 4.4.2.4-3 NO_2 diffusion prediction during long-term operation stage (2023) unit：mg/m^3

Road section	Traffic condition	Angle between wind direction and road	Distance to road center line(m)								
			20	30	40	50	60	80	100	150	200
Yunshishan～Huichang (K31+012.977～K50+248)	Daily average	90°	0.074	0.072	0.067	0.062	0.058	0.049	0.042	0.031	0.024
		0°	0.046	0.040	0.035	0.030	0.027	0.022	0.018	0.013	0.010
	Peak hour	90°	0.087	0.084	0.079	0.073	0.068	0.057	0.049	0.036	0.028
		0°	0.054	0.047	0.041	0.036	0.031	0.025	0.021	0.015	0.012
Huichang～Hefeng (K50+248～K78+181)	Daily average	90°	0.079	0.077	0.072	0.067	0.062	0.052	0.045	0.033	0.026
		0°	0.049	0.043	0.037	0.032	0.029	0.023	0.019	0.014	0.011
	Peak hour	90°	0.093	0.090	0.085	0.079	0.073	0.062	0.053	0.039	0.030
		0°	0.058	0.050	0.044	0.038	0.034	0.027	0.023	0.016	0.012
Hefeng～Yudu (K78+181～K90+225)	Daily average	90°	0.115	0.110	0.103	0.096	0.089	0.076	0.066	0.048	0.038
		0°	0.047	0.042	0.037	0.033	0.030	0.024	0.020	0.015	0.011
	Peak hour	90°	0.135	0.129	0.121	0.113	0.104	0.089	0.077	0.057	0.045
		0°	0.055	0.049	0.044	0.039	0.035	0.029	0.024	0.017	0.013
Yudu～Luo'ao (K90+225～K101+230)	Daily average	90°	0.121	0.116	0.109	0.101	0.094	0.080	0.069	0.051	0.040
		0°	0.050	0.044	0.039	0.035	0.031	0.026	0.022	0.015	0.012
	Peak hour	90°	0.143	0.136	0.128	0.119	0.110	0.094	0.081	0.060	0.047
		0°	0.058	0.052	0.046	0.041	0.037	0.030	0.025	0.018	0.014
Luo'ao～Ganxian (K101+230～K124+244)	Daily average	90°	0.077	0.076	0.072	0.066	0.061	0.051	0.044	0.032	0.025
		0°	0.061	0.052	0.044	0.038	0.033	0.026	0.022	0.015	0.012
	Peak hour	90°	0.090	0.089	0.084	0.078	0.072	0.060	0.052	0.038	0.029
		0°	0.072	0.061	0.051	0.044	0.039	0.031	0.026	0.018	0.014
Ganxian～Ganzhou north (K124+244～K139+377)	Daily average	90°	0.120	0.106	0.093	0.082	0.073	0.059	0.049	0.035	0.027
		0°	0.066	0.055	0.047	0.040	0.035	0.028	0.023	0.016	0.013
	Peak hour	90°	0.141	0.125	0.109	0.096	0.085	0.069	0.058	0.041	0.032
		0°	0.077	0.065	0.055	0.047	0.041	0.033	0.027	0.019	0.015
Ganzhou north～Huangjin (K139+377～K149+728)	Daily average	90°	0.087	0.086	0.081	0.075	0.069	0.058	0.050	0.036	0.028
		0°	0.069	0.058	0.049	0.043	0.037	0.030	0.025	0.017	0.013
	Peak hour	90°	0.102	0.101	0.095	0.088	0.081	0.068	0.058	0.042	0.033
		0°	0.081	0.068	0.058	0.050	0.044	0.035	0.029	0.020	0.016

Table 4.4.2.4-4 CO diffusion prediction during short-term operation stage (2009) unit：mg/m^3

Road section	Traffic condition	Angle between wind direction and road	Distance to road center line(m)								
			20	30	40	50	60	80	100	150	200
Yunshishan～Huichang (K31+012.977～K50+248)	Daily average	90°	0.139	0.135	0.127	0.117	0.108	0.092	0.079	0.058	0.045
		0°	0.087	0.075	0.065	0.057	0.050	0.040	0.034	0.024	0.018
	Peak hour	90°	0.164	0.158	0.149	0.138	0.127	0.108	0.093	0.068	0.053
		0°	0.102	0.088	0.076	0.067	0.059	0.048	0.040	0.028	0.022
Huichang～Hefeng (K50+248～K78+181)	Daily average	90°	0.152	0.147	0.138	0.128	0.118	0.100	0.086	0.063	0.049
		0°	0.095	0.082	0.071	0.062	0.055	0.044	0.037	0.026	0.020
	Peak hour	90°	0.179	0.173	0.163	0.151	0.139	0.118	0.101	0.074	0.058
		0°	0.111	0.096	0.083	0.073	0.064	0.052	0.043	0.031	0.024
Hefeng～Yudu (K78+181～K90+225)	Daily average	90°	0.222	0.212	0.199	0.185	0.171	0.146	0.127	0.093	0.074
		0°	0.091	0.081	0.072	0.064	0.057	0.047	0.039	0.028	0.022
	Peak hour	90°	0.261	0.249	0.234	0.217	0.201	0.172	0.149	0.110	0.086
		0°	0.107	0.095	0.085	0.075	0.067	0.055	0.046	0.033	0.026
Yudu～Luo'ao (K90+225～K101+230)	Daily average	90°	0.234	0.223	0.210	0.195	0.180	0.154	0.134	0.098	0.078
		0°	0.096	0.085	0.076	0.067	0.060	0.049	0.042	0.030	0.023
	Peak hour	90°	0.275	0.263	0.247	0.229	0.212	0.182	0.157	0.116	0.091
		0°	0.113	0.101	0.089	0.079	0.071	0.058	0.049	0.035	0.027
Luo'ao～Ganxian (K101+230～K124+244)	Daily average	90°	0.153	0.151	0.143	0.132	0.122	0.103	0.088	0.064	0.050
		0°	0.123	0.103	0.087	0.075	0.066	0.052	0.043	0.030	0.024
	Peak hour	90°	0.180	0.178	0.168	0.156	0.143	0.121	0.103	0.075	0.059
		0°	0.144	0.121	0.103	0.088	0.077	0.062	0.051	0.036	0.028
Ganxian～Ganzhou north (K124+244～K139+377)	Daily average	90°	0.247	0.219	0.192	0.169	0.150	0.121	0.102	0.072	0.056
		0°	0.135	0.114	0.096	0.083	0.073	0.058	0.048	0.034	0.026
	Peak hour	90°	0.291	0.257	0.225	0.198	0.176	0.143	0.119	0.085	0.066
		0°	0.159	0.134	0.113	0.098	0.085	0.068	0.056	0.040	0.031
Ganzhou north～Huangjin (K139+377～K149+728)	Daily average	90°	0.179	0.176	0.167	0.154	0.142	0.119	0.102	0.074	0.058
		0°	0.143	0.120	0.102	0.088	0.077	0.061	0.051	0.035	0.027
	Peak hour	90°	0.210	0.207	0.196	0.181	0.166	0.140	0.120	0.087	0.068
		0°	0.168	0.141	0.120	0.103	0.090	0.072	0.059	0.042	0.032

Table 4.4.2.4-5 CO diffusion prediction during mid-term operation stage (2015) unit：mg/m³

Road section	Traffic condition	Angle between wind direction and road	Distance to road center line(m)								
			20	30	40	50	60	80	100	150	200
Yunshishan～Huichang (K31+012.977～K50+248)	Daily average	90°	0.217	0.209	0.197	0.183	0.168	0.143	0.123	0.090	0.070
		0°	0.135	0.117	0.101	0.088	0.078	0.063	0.052	0.037	0.029
	Peak hour	90°	0.255	0.246	0.232	0.215	0.198	0.168	0.144	0.105	0.083
		0°	0.159	0.137	0.119	0.104	0.092	0.074	0.062	0.044	0.034
Huichang～Hefeng (K50+248～K78+181)	Daily average	90°	0.235	0.227	0.214	0.198	0.182	0.155	0.133	0.097	0.076
		0°	0.146	0.127	0.110	0.096	0.085	0.068	0.057	0.040	0.031
	Peak hour	90°	0.276	0.267	0.251	0.233	0.214	0.182	0.156	0.114	0.090
		0°	0.172	0.149	0.129	0.112	0.099	0.080	0.067	0.047	0.037
Hefeng～Yudu (K78+181～K90+225)	Daily average	90°	0.341	0.326	0.307	0.285	0.264	0.226	0.195	0.144	0.113
		0°	0.140	0.125	0.111	0.099	0.088	0.072	0.061	0.044	0.034
	Peak hour	90°	0.402	0.384	0.360	0.335	0.310	0.265	0.229	0.169	0.133
		0°	0.165	0.147	0.130	0.116	0.104	0.085	0.072	0.051	0.040
Yudu～Luo'ao (K90+225～K101+230)	Daily average	90°	0.361	0.345	0.324	0.301	0.279	0.238	0.206	0.152	0.120
		0°	0.148	0.132	0.117	0.104	0.093	0.076	0.064	0.046	0.036
	Peak hour	90°	0.424	0.406	0.381	0.354	0.328	0.280	0.243	0.179	0.141
		0°	0.174	0.155	0.138	0.122	0.110	0.090	0.076	0.054	0.042
Luo'ao～Ganxian (K101+230～K124+244)	Daily average	90°	0.233	0.230	0.217	0.201	0.185	0.156	0.133	0.097	0.076
		0°	0.186	0.156	0.133	0.114	0.100	0.080	0.066	0.046	0.036
	Peak hour	90°	0.274	0.270	0.256	0.237	0.217	0.183	0.157	0.114	0.089
		0°	0.219	0.184	0.156	0.134	0.118	0.094	0.078	0.054	0.042
Ganxian～Ganzhou north (K124+244～K139+377)	Daily average	90°	0.370	0.327	0.286	0.252	0.224	0.181	0.152	0.108	0.083
		0°	0.202	0.170	0.144	0.124	0.109	0.086	0.072	0.050	0.039
	Peak hour	90°	0.435	0.384	0.337	0.296	0.263	0.213	0.179	0.127	0.098
		0°	0.238	0.200	0.169	0.146	0.128	0.102	0.084	0.059	0.046
Ganzhou north～Huangjin (K139+377～K149+728)	Daily average	90°	0.267	0.264	0.249	0.231	0.212	0.179	0.153	0.111	0.087
		0°	0.213	0.179	0.152	0.131	0.115	0.091	0.076	0.053	0.041
	Peak hour	90°	0.314	0.310	0.293	0.271	0.249	0.210	0.180	0.130	0.102
		0°	0.251	0.211	0.179	0.154	0.135	0.107	0.089	0.062	0.048

Table 4.4.2.4-6 CO diffusion prediction during long-term operation stage(2023) unit：mg/m^3

Road section	Traffic condition	Angle between wind direction and road	Distance to road center line(m)								
			20	30	40	50	60	80	100	150	200
Yunshishan～Huichang (K31+012.977～K50+248)	Daily average	90°	0.337	0.326	0.307	0.284	0.262	0.222	0.191	0.139	0.109
		0°	0.210	0.182	0.157	0.137	0.121	0.098	0.082	0.058	0.045
	Peak hour	90°	0.397	0.384	0.361	0.334	0.308	0.261	0.224	0.164	0.129
		0°	0.247	0.214	0.185	0.162	0.143	0.115	0.096	0.068	0.053
Huichang～Hefeng (K50+248～K78+181)	Daily average	90°	0.362	0.350	0.329	0.305	0.281	0.238	0.205	0.149	0.117
		0°	0.225	0.195	0.169	0.147	0.130	0.105	0.088	0.062	0.048
	Peak hour	90°	0.425	0.411	0.387	0.358	0.330	0.280	0.241	0.176	0.138
		0°	0.265	0.229	0.198	0.173	0.153	0.123	0.103	0.073	0.056
Hefeng～Yudu (K78+181～K90+225)	Daily average	90°	0.522	0.499	0.469	0.435	0.403	0.345	0.298	0.220	0.173
		0°	0.214	0.191	0.169	0.151	0.135	0.110	0.093	0.066	0.052
	Peak hour	90°	0.614	0.587	0.551	0.512	0.474	0.406	0.351	0.259	0.204
		0°	0.252	0.225	0.199	0.177	0.158	0.130	0.109	0.078	0.061
Yudu～Luo'ao (K90+225～K101+230)	Daily average	90°	0.552	0.527	0.495	0.460	0.426	0.364	0.315	0.232	0.183
		0°	0.226	0.202	0.179	0.159	0.142	0.117	0.098	0.070	0.055
	Peak hour	90°	0.649	0.620	0.582	0.541	0.501	0.429	0.371	0.273	0.215
		0°	0.266	0.237	0.210	0.187	0.167	0.137	0.116	0.083	0.064
Luo'ao～Ganxian (K101+230～K124+244)	Daily average	90°	0.349	0.345	0.326	0.302	0.277	0.234	0.200	0.145	0.114
		0°	0.279	0.235	0.199	0.171	0.150	0.119	0.099	0.069	0.054
	Peak hour	90°	0.411	0.406	0.384	0.355	0.326	0.275	0.235	0.171	0.134
		0°	0.328	0.276	0.234	0.202	0.176	0.140	0.116	0.082	0.063
Ganxian～Ganzhou north (K124+244～K139+377)	Daily average	90°	0.547	0.483	0.423	0.372	0.331	0.268	0.224	0.159	0.123
		0°	0.299	0.251	0.213	0.183	0.160	0.128	0.106	0.074	0.057
	Peak hour	90°	0.643	0.568	0.498	0.438	0.389	0.315	0.264	0.187	0.145
		0°	0.351	0.295	0.250	0.216	0.189	0.150	0.125	0.087	0.067
Ganzhou north～Huangjin (K139+377～K149+728)	Daily average	90°	0.394	0.389	0.368	0.341	0.313	0.264	0.226	0.164	0.128
		0°	0.315	0.265	0.225	0.193	0.169	0.135	0.112	0.078	0.060
	Peak hour	90°	0.464	0.458	0.433	0.401	0.368	0.310	0.265	0.193	0.151
		0°	0.371	0.312	0.264	0.228	0.199	0.158	0.131	0.092	0.071

⑵ Impact assessment on ambient air along the proposed highway

Linear superimposition of predicted diffusion concentration and background concentration is the predicted value of ambient air quality. Background value is calculated as the average daily NO_2 concentration value of Monitoring sites; the background value chooses the maximum 0.015 mg/m^3 in 5 days' current situation monitoring. The peak value and daily average value and their pollution conditions in each assessment year are listed in Table 4.4.2.4-7.

From Table 4.4.2.4-7, the following conclusions can be arrived：

① The NO_2 peak hour max concentration in 20m is 0.079mg/m^3, the daily average max concentration is 0.069mg/m^3 during the short-term operation stage; The NO_2 peak hour max concentration in 20m is 0.111mg/m^3, the daily average max concentration is 0.096mg/m^3 during the median operating stage; the NO_2 peak hour max concentration in 20m is 0.156mg/m^3, the daily average max concentration is 0.135mg/m^3 during the long-term operating stage.

② The NO_2 peak hour concentrations in 20m from road center line of each section of the proposed highway can meet the class 2 limits for ambient air quality standard during the short, mid and long-term operation stages;

③ The NO_2 daily average concentrations in 20m from road center line of each section of the proposed highway can meet the class 2 limits for ambient air quality standard during the short and mid-term operation stages;

④ The NO_2 daily average concentration standard-satisfying distance of each section of the proposed highway during long-term operation stage are: 40m for Hefeng interchange～Yudu interchange, 50m for Yudu interchange～Luo'ao interchange, 35m outside for Ganxian interchange～Ganzhou north interchange, 20m for other three sections.

Table 4.4.2.4-7 NO_2 concentration prediction during operation stage (stability D) unit：mg/m^3

Operation stage	Name of road section	Traffic condition	Distance to road center line(m)									Standard-satisfying distance (m)
			20	30	40	50	60	80	100	150	200	
Short-term (2009)	Yunshishan～Huichang (K31+012.977～K50+248)	Daily	0.046	0.045	0.043	0.041	0.039	0.035	0.032	0.028	0.025	20
		Peak	0.051	0.050	0.048	0.045	0.043	0.039	0.035	0.030	0.027	20
	Huichang～Hefeng (K50+248～K78+181)	Daily	0.048	0.047	0.045	0.043	0.041	0.037	0.034	0.029	0.026	20
		Peak	0.054	0.053	0.051	0.048	0.045	0.041	0.037	0.031	0.028	20
	Hefeng～Yudu (K78+181～K90+225)	Daily	0.064	0.062	0.059	0.056	0.053	0.047	0.043	0.036	0.031	20
		Peak	0.072	0.070	0.066	0.063	0.059	0.053	0.048	0.039	0.034	20
	Yudu～Luo'ao (K90+225～K101+230)	Daily	0.066	0.064	0.061	0.058	0.055	0.049	0.044	0.037	0.032	20
		Peak	0.075	0.073	0.069	0.065	0.062	0.055	0.050	0.040	0.035	20
	Luo'ao～Ganxian (K101+230～K124+244)	Daily	0.049	0.048	0.046	0.044	0.042	0.038	0.034	0.029	0.026	20
		Peak	0.055	0.054	0.052	0.049	0.046	0.042	0.038	0.031	0.028	20
	Ganxian～Ganzhou north (K124+244～K139+377)	Daily	0.069	0.063	0.057	0.052	0.048	0.042	0.037	0.031	0.027	20
		Peak	0.079	0.071	0.064	0.059	0.054	0.046	0.041	0.034	0.029	20
	Ganzhou north～Huangjin (K139+377～K149+728)	Daily	0.054	0.054	0.052	0.049	0.046	0.041	0.037	0.031	0.028	20
		Peak	0.061	0.061	0.058	0.055	0.052	0.046	0.041	0.034	0.030	20
Mid-term (2015)	Yunshishan～Huichang (K31+012.977～K50+248)	Daily	0.063	0.061	0.058	0.055	0.052	0.046	0.042	0.035	0.030	20
		Peak	0.071	0.069	0.066	0.062	0.058	0.052	0.047	0.038	0.033	20
	Huichang～Hefeng (K50+248～K78+181)	Daily	0.067	0.065	0.062	0.058	0.055	0.049	0.044	0.036	0.032	20
		Peak	0.076	0.074	0.070	0.066	0.062	0.055	0.049	0.040	0.035	20
	Hefeng～Yudu (K78+181～K90+225)	Daily	0.090	0.087	0.082	0.078	0.073	0.065	0.058	0.047	0.040	20
		Peak	0.103	0.099	0.094	0.089	0.083	0.073	0.065	0.052	0.044	20
	Yudu～Luo'ao (K90+225～K101+230)	Daily	0.094	0.091	0.086	0.081	0.076	0.067	0.060	0.048	0.041	20
		Peak	0.108	0.104	0.099	0.093	0.087	0.077	0.068	0.054	0.046	20
	Luo'ao～Ganxian (K101+230～K124+244)	Daily	0.066	0.066	0.063	0.059	0.056	0.049	0.044	0.036	0.032	20
		Peak	0.075	0.074	0.071	0.067	0.063	0.055	0.049	0.040	0.035	20
	Ganxian～Ganzhou north (K124+244～K139+377)	Daily	0.096	0.087	0.078	0.070	0.064	0.055	0.048	0.039	0.033	20
		Peak	0.111	0.099	0.089	0.080	0.073	0.062	0.054	0.043	0.037	20
	Ganzhou north～Huangjin (K139+377～K149+728)	Daily	0.074	0.073	0.070	0.066	0.062	0.054	0.049	0.039	0.034	20
		Peak	0.084	0.083	0.079	0.075	0.070	0.061	0.054	0.044	0.037	20
Long-term (2023)	Yunshishan～Huichang (K31+012.977～K50+248)	Daily	0.089	0.087	0.082	0.077	0.073	0.064	0.057	0.046	0.039	20
		Peak	0.102	0.099	0.094	0.088	0.083	0.072	0.064	0.051	0.043	20
	Huichang～Hefeng (K50+248～K78+181)	Daily	0.094	0.092	0.087	0.082	0.077	0.067	0.060	0.048	0.041	20
		Peak	0.108	0.105	0.100	0.094	0.088	0.077	0.068	0.054	0.045	20
	Hefeng～Yudu (K78+181～K90+225)	Daily	0.130	0.125	0.118	0.111	0.104	0.091	0.081	0.063	0.053	40
		Peak	0.150	0.144	0.136	0.128	0.119	0.104	0.092	0.072	0.060	20
	Yudu～Luo'ao (K90+225～K101+230)	Daily	0.136	0.131	0.124	0.116	0.109	0.095	0.084	0.066	0.055	45
		Peak	0.158	0.151	0.143	0.134	0.125	0.109	0.096	0.075	0.062	20
	Luo'ao～Ganxian (K101+230～K124+244)	Daily	0.092	0.091	0.087	0.081	0.076	0.066	0.059	0.047	0.040	20
		Peak	0.105	0.104	0.099	0.093	0.087	0.075	0.067	0.053	0.044	20
	Ganxian～Ganzhou north (K124+244～K139+377)	Daily	0.135	0.121	0.108	0.097	0.088	0.074	0.064	0.050	0.042	35
		Peak	0.156	0.140	0.124	0.111	0.100	0.084	0.073	0.056	0.047	20
	Ganzhou north～Huangjin (K139+377～K149+728)	Daily	0.102	0.101	0.096	0.090	0.084	0.073	0.065	0.051	0.043	20
		Peak	0.117	0.116	0.110	0.103	0.096	0.083	0.073	0.057	0.048	20

⑶ Impact analysis of sensitive locations

NO_2 pollution in sensitive locations is related to emission of automobile tail gas, meteorological condition, and also to the horizontal distance from sensitive locations to the road, namely the larger the traffic volume, the larger pollutant emission; the closer the distance to road, the higher the pollutant concentration; the less the wind speed, the more unfavorable to diffusion and the higher the pollutant concentration. When sensitive locations are in leeward of wind direction, the impact degree is larger.

There are a total of 67 sensitive locations in the recommended alignment of this project; analyses and predicting indicate that when the sensitive locations are in leeward wind direction during the long-term operation stage, standard exceeding may probably occur in 3 sensitive locations, accounting for 4.8% in the total. Sensitive locations with high probability of standard excess are listed in Table 4.4.2.4-8.

Table 4.4.2.4-8 List of sensitive locations with predicted standard excess

Route alignment	Road section name	Sensitive locations with excessive standard
Recommended alignment	Yudu～Luoao(K90+225～K101+230)	Pengwu
	Ganxian～Ganzhou north(K124+244～K139+377)	Laohupai, Shiziishuxia

For the sensitive locations exceeding the standard, representative locations are chosen to conduct monitoring during operation stage; according to the result of monitoring, necessary pollution reducing measures will be taken.

According to the above-mentioned predicted results, it can be seen that impacts on ambient air quality by each route alignment of this project is relatively slight.

4.4.2.5 Assessment of tunnel air pollution

Ventilation in highway tunnel is to inject fresh air into the tunnel so to dilute the exhaust and fume produced from automobiles within the tunnel and to make the air quality within the tunnel and fume visibility able to ensure the drivers and passengers' health and driving safety. 《*Highway Tunnel Ventilation and Illumination Design Standard*》（JTJ026.1-1999）has detailed specifications on tunnel ventilation design.

For the major pollutant CO within tunnel, when full horizontal ventilation and semi-horizontal ventilation are adopted, CO design concentration is set to be the values in Table 4.4.2.5-1; when longitudinal ventilation is adopted, CO design concentration is set to be the values in Table 4.4.2.5-1 plus 50ppm.

Table 4.4.2.5-1 CO design concentrationδ

Tunnel length（m）	≤1000	≥3000
δ（ppm）	250	200

note：when the tunnel length is 1000m～300m, interpolation method can be used to obtain the values.

This project's recommended scheme will set up 7 tunnels, of which one tunnel is longer than 3000m (Zhonggongzhang tunnel), 2 tunnels are between 1000m～3000m, 4 tunnels shorter than 1000m, for details see Table 2.4.3.4-1. According to the standard values listed in Table 4.4.2.5-2, the CO design concentrations adopt different criteria.

Zhonggongzhang tunnel, the longest tunnel of this project, is chosen to analyze and predict. According to matter conservation principle of tunnel pollutants, the predicting module for tunnel poisonous and toxic gas concentration is:

$$C = \frac{Q_L \bullet X}{S \bullet U}$$

in which: C —— pollutant concentration in certain cross-section of tunnel, mg/m^3;

Q_L——pollutant discharge source intensity, mg/s·m;

X —— distance from certain cross-section to entrance, m;

S —— tunnel cross-section surface, m^2;

U —— air flow speed within tunnel, m/s.

The air flow speed in one-way tunnel depends on the piston function of vehicles running in tunnel, generally does not exceed 5m/s according to experience. If mechanical ventilating device is adopted, the wind speed in tunnel can be increased. For this calculation, the wind speed adopts 5m/s and 8m/s; the cross-sectional surface S in the tunnel is set at $52.5m^2$.

The predicted concentrations of carbon monoxide and nitrogen oxide in tunnel are listed in Table 4.4.2.5-1.

Table 4.4.2.5-1 Predicted automobile pollutant concentration in tunnel unit: mg/m^3

Predicting item		Wind speed (m/s)	Assessment duration	Predicting distance (m)				
				300	600	900	1200	1800
CO	Daily	5	Short-term(2009)	2.86	5.72	8.58	11.44	17.16
			Mid-term(2015)	4.42	8.83	13.25	17.67	26.50
			Long-term(2023)	6.80	13.61	20.41	27.21	40.82
		8	Short-term(2009)	2.76	5.52	8.28	11.04	16.56
			Mid-term(2015)	1.79	3.57	5.36	7.15	10.72
			Long-term(2023)	4.25	8.50	12.76	17.01	25.51
	Peak	5	Short-term(2009)	3.36	6.72	10.09	13.45	20.17
			Mid-term(2015)	5.19	10.39	15.58	20.78	31.17
			Long-term(2023)	8.00	16.00	24.00	32.00	48.00
		8	Short-term(2009)	3.25	6.49	9.74	12.99	19.48
			Mid-term(2015)	2.10	4.20	6.30	8.41	12.61
			Long-term(2023)	5.00	10.00	15.00	20.00	30.00
NO_2	Daily	5	Short-term(2009)	0.475	0.951	1.426	1.902	2.853
			Mid-term(2015)	0.734	1.467	2.201	2.935	4.402
			Long-term(2023)	1.130	2.261	3.391	4.521	6.782
		8	Short-term(2009)	0.297	0.594	0.891	1.189	1.783
			Mid-term(2015)	0.459	0.917	1.376	1.834	2.751
			Long-term(2023)	0.706	1.413	2.119	2.826	4.239
	Peak	5	Short-term(2009)	0.559	1.118	1.677	2.235	3.353
			Mid-term(2015)	0.863	1.726	2.589	3.451	5.177

Predicting item	Wind speed (m/s)	Assessment duration	Predicting distance (m)				
			300	600	900	1200	1800
		Long-term(2023)	1.329	2.658	3.987	5.317	7.975
	8	Short-term(2009)	0.349	0.699	1.048	1.397	2.096
		Mid-term(2015)	0.539	1.079	1.618	2.157	3.236
		Long-term(2023)	0.831	1.661	2.492	3.323	4.984

We can see from Table 4.4.2.5-2:

When U =5.0m/s, the CO peak concentration in 1800m within tunnel during highway long-term operation stage is 48.00mg/m^3, complying with the limit requirement (312.5mg/m^3) of 250ppm for normal tunnel operation.

When U =8.0m/s, the CO peak concentration in 1800m within tunnel during highway long-term operation stage is 30.00mg/m^3. This indicates that when mechanical ventilation is adopted, CO concentration is lower in the tunnel. It can be thought that when the tunnel installed with mechanical ventilation equipment is in normal operation, the CO concentration within tunnel complies with tunnel design specification requirement.

When there occurs traffic jam in the tunnel, the vehicle speed and wind speed reduce greatly, the CO and NO_2 concentrations will increase by many times and difficult to spread, thus endangering human body. In addition, carbon smoke and other particles discharged from Diesel engines greatly reduce the visibility in tunnel, influencing traffic safety and people's health. So when the tunnel length exceeds 1000 meters, it is very necessary to install mechanical ventilating equipment.

The 3 tunnels longer than 1000m of this project (Zhonggongzhang tunnel, Yudu tunnel and Xiashan tunnel) and Jiuling tunnel which is 540m long are all installed with mechanical ventilating equipment. The other 3 tunnels are all less than 305m in length, adoption of natural ventilation can meet requirements.

4.4.2.6 Impact analysis of boiler fume discharge and kitchen oil smoke discharge in service area

This project does not install heating boilers, for drinking water (drinking and bathing) it is suggested to adopt electric heater. In case of boiler being required by project designing, then the boiler smoke and exhaust must enforce the standard grade or relevant regulation identified by local environmental protection department from the "*Pollutant Discharge Standard of Boiler*" (GB13271-2001), discharge is only allowed after meeting standard.

Restaurant kitchen must be installed with oil smoke purifying facilities so to make discharge up to standard. The smoke outlet shall not point at buildings vulnerable to such impact. Smoke discharge system should be sealed intactly so to discharge up to standard.

4.5 Impact on social environment

4.5.1 Coordination analysis between the proposed highway and relevant planning

4.5.1.1 Coordination with national and Jiangxi provincial highway planning

On December 17, 2004, the "*National Highway Network Plan*" was approved by the State Council. The "*National Highway Network Plan*" specifies that China national highway network adopts radiating and criss-crossing layout pattern, constituting a transportation system centering from central cities and radiating to outside in every directions, which comprises 7 trunkways radiating from Beijing, 9 north-south trunkways and 18 east-west trunkways, abbreviated as "7918 road net" with overall scale of probably 85,000 kilometers. Now the "7918 road net" has completed 25,000 kilometers, and 16,000 kilometers are under construction. After the national highway network plan is completed, a highway network will emerge which will "link the capital to provincial capitals, provincial capital to other provincial capital and cover important counties and cities".

Xiamen-Chengdu Expressway is an east-west project in the national highway plan "7918 road net" which originates from Xiamen city of Fujian, runs by Longyan of Fujian, Ruijin and Ganzhou of Jiangxi, Chenzhou of Hunan, Guilin of Guangxi, Guiyang of Guizhou, and finally ends at Chengdu of Sichuan with a total length of 2631km approximately. It connects the developed eastern China with central China which is vigorously developing its economy as well as western China which is undergoing the Great West Development, it is an important link for the economy and transportation in east, central and west China, construction of this highway will reduce the distance between the east, central south and southwest regions, will effectively adjust the road network architecture of east, central and west regions, will urge the unbalanced regional economic development to gradually turning into balanced development. This project, being a part of the national highway within Jiangxi Province, is without doubt a constituent belonging to national highway network, whose construction will have more practical promoting function in forming the national highway network as soon as possible and in exploiting road network effect.

According to Jiangxi Provincial highway plan, up to 2015, the highway traffic developmental strategy of Jiangxi Province should adapt to the provincial economic and social development with moderate development in advance, forming a road skeleton of "three verticals and four horizontals" in the entire province, and the important economical cities in the province shall be linked by expressways. Xiamen-Chengdu Expressway Jiangxi section is the fourth horizontal expressway and is one of Jiangxi Province's main trunkways.

This project is one section of Xiamen-Chengdu Expressway within Jiangxi Province, which intersects with the planned Jinan-Guangzhou Highway nearby Yeping at Ruijin City, and intersects with Daqing-Guangzhou Highway (the Jiangxi section has completed) nearby Panlong at Zhanggong District. This project is not only a big east-west channel within Jiangxi Province, but also the best channel in Ganzhou connecting two north-south highways in Jiangxi Province, therefore this project construction will greatly promote the formation of highway skeleton in Jiangxi Province, will reduce the distance with Fujian, Guangdong, Hunan and other peripheral provinces, thus fully exploiting highway network effect.

4.5.1.2 Coordination with Ganzhou urban development and planning

"*Ganzhou Urban Overall Development Conceptual Plan*" was already approved by the third session of the Second Ganzhou Prefectural National People's Congress, and was approved to effect by Ganzhou People's Government in its municipal government document [2004] No. 175. This plan aims to build Ganzhou City into a regional modernized key city in the border among Jianxi, Guangdong, Fujian and Hunan provinces. the planning area reaches Meilin Township of Ganxian in the east, Fenggang Township of Nankang city in the west, Shuixi Township of Zhanggong District in the north (covers Tongtianyan scenic spot), and Tankou Township of Nankang city in the south with a planned size of: territory–the whole city governs 15 counties, two county-level cities, Zhanggong District and Ganzhou economic development zone with a size of $3.94 \times 10^4 km^2$; central city-Zhanggong District, Nankang city, Ganxian as well as Ganzhou economic development zone with a size of $5367km^2$; central urban place - construction size of $100km^2$. As a city, Ganzhou is positioned as a Chinese historical and cultural city, as a transportation hub and commercial center in the border among

Jianxi, Guangdong, Fujian and Hunan provinces, and as an economic, cultural, and tour center in south Jiangxi Province.

Urban industrial layout and urban transportation system are closely related. Ganzhou's urban express road network and Ganzhou's several highways for external connection will play decisive role in forming city industrial pattern. The several highways connecting Ganzhou and peripheral cities are the axis in future Ganzhou industrial pattern. The Chengdu-Xiamen Expressway, Jianxi-Guangdong Expressway, Beijing-Kowlon Railway, National Road 323 and 105 will be the major extending axis for the second industry and tertiary industry.

According to the urban transportation framework of the "*Ganzhou City Overall Plan*" (1996~2010), three highways will be constructed to correspond to Ganzhou City's 3 development axes respectively:

First- north-south developmental axis, Nanchang (Jiangxi) ~ Ganzhou (Jiangxi) ~ Heyuan (Guangdong) ~ Shenzhen (Guangdong);

Second – south-north developmental axis, Hong Kong ~Guangdong ~ Ruijin (Jiangxi) ~Dongying (Shandong);

Third – east-west developmental axis: Xiamen (Fujian) ~ Longyan (Fujian) ~ Ganzhou (Jiangxi) ~ Chenzhou (Hunan) ~ Chengdu (Sichuan).

Construction of these three highways will be helpful to the formation of Ganzhou's developmental axis.

Thus it can be seen that Ganzhou overall plan has listed this project-Xiamen-Chengdu Expressway (Chengdu-Xiamen Expressway in urban planning) as Ganzhou's trunkway for external communication and as one of the axis. The relations between the proposed highway and Ganzhou City urban planning are shown in Fig. 4.5.1.2-1.

This project overcrosses Ganjiang River near Xizhou of Ganxian County, this bridge site is approximately 5.5km away from Bajingtai of Ganzhou urban district. According to field reconnaissance, it is more ideal to overcross Ganjiang River near Baita of Zhanggong District, but because this bridge site is basically close to the outer ring expressway bridge site in Ganzhou City, after listening to the opinion of Ganzhou City plan department, this bridge site is given up, reserved to Ganzhou City outer ring expressway.

In summary, construction of the proposed Xiamen-Chengdu Expressway Jiangxi section not only coordinates with the Ganzhou City overall planning, moreover it will have positive influence on the earlier formation of Ganzhou urban developmental axis.

4.5.1.3 Relation with Tongtianyan scenic spot

The Tongtianyan scenic spot falls into the planned scope of "*Ganzhou Urban Overall Plan*" (1996 ~ 2010), locating in Shuixi Township of Zhanggong District. Within this scenic spot, there is the reputed national key cultural relic preservation unit-Tongtianyan rock cave. In aligning the route, this factor was considered; the current alignment is approximately 2km away from the scenic spot. The Tongtianyan scenic spot features rock cave art, inscription on cliff and Danxia landform, integrating sightseeing, touring and historical research, it also functions as a suburb park. Tongtianyan rock cave, known as the "first cave in south China", was announced in 1988 by the State Council as a state-level cultural relic preservation unit, while the Tongtianyan scenic spot containing the rock cave was listed in 1995 as a Jiangxi provincial-level scenic spot. According to the Tongtianyan scenic spot planning (2001 ~ 2015), this scenic spot reaches Yangui Lake in the north, Luohu dam in the south, Yulong Lake in the west, National Road 105 in the east with a planned size of 5.6km^2. In the periphery of the scenic spot, that is, Luobian and Shizhu villages of Shuixi Township, Yaoxia and Shanbian villages of Hubian Township, this scope is delimited as the peripheral influence area of the scenic spot with a size of 27km^2.

According to the planning (2001～2015) of Tongtianyan scenery zone, the protection of Tongtianyan scenery zone is divided into five grades: top protection zone (protectorate), primary protection zone, secondary protection zone, tertiary protection zone and peripheral influenced area. The scopes and protection requirements for each grade are as follows:

⑴ Top protection zone（surface area 0.05km^2）:

①The protection area for historical relics and sites within the scenery zone is the core for landscape protection, thus classified as the top protection zone.

②It is forbidden to build any construction facility within the top protection zone.

⑵ Primary protection zone（surface area 0.35km^2）:

①The protection area for natural landscape within the scenery zone is located in the nearby areas of primary scenery spots and cultures, which is within the visual scope of primary scenery spots and features a high-flavor Danxia topography, so classified as primary protection zone.

②Within the primary protection zone, it is allowed to build necessary pedestrian tour roads and relevant facilities, but forbidden to build any facilities unrelated to the landscaping and forbidden to arrange accommodations for tourists, automobiles shall not enter into this zone.

⑶ Secondary protection zone（surface area 4.0km^2）:

① Within the scenery zone, the scenery spots and cultures other than those in the above two protection zones and their relevant natural environment are classified as secondary protection zone.

② Within the secondary protection zone, it is allowed to arrange a few accommodation facilities, but it is necessary to constrain construction unrelated to landscape tour and it is necessary to control automobiles entering into this zone.

⑷ Tertiary protection zone（surface area 1.2km^2）:

① Within the scenery zone, the areas outside the above protection zones of different grade are classified as tertiary protection zone.

② Within the tertiary protection zone, it is required to orderly control each construction and facilities and to make them in harmony with the landscaping.

⑸ Peripheral influenced area:

① Outside the scenery zone, the area from Luobian village, Tongtianyan village and Shizhu village of Shuixi Township, and Yaoxia village and Shanbian village of Hubian Township which are taken as the boundary limit are classified as the peripheral influenced area.

② Within this area, it is forbidden to build any polluting projects, it is required to do good work in planting and environmental protection, to enhance village planning and management within this area, and to maintain the ecological balance within the scenery area.

According to investigation, the proposed highway is about 200m away from the north border of the peripheral influenced area of this scenic spot and about 1.5km away from the core scenic area (Tongtianyan Cave). The relation between the proposed highway and Tongtianyan scenic spot is shown in Fig. 4.5.1.3-1.

Thus it can be seen that there is some distance between the proposed highway and the peripheral area and core area of Tongtianyan scenic spot, and construction of the proposed highway will not produce adverse impact on Tongtianyan rock cave, a national-protection key relics unit.

4.5.1.4. Coordination with other relevant planning

⑴ Relation to Yudu County overall planning

According to 《Yudu County Overall Planning (revised) (2003 ~ 2020)》, Yudu County urban planning control scope covers some administrative villages of Gongjiang Township, Mengkou and Yuezhou villages of Luo'ao Township with a planned size of 120km2. Land that can be used for development mainly concentrates on the east of the town and Gongjiang River's south bank area. In the near future, the key is to construct and develop the forestry industrial park in the east and south; in the far future, the key is to extend over Gongjiang River and to develop in the southeast.

The design document for the proposed highway has made some adjustments on the connection plan of Yudu interchange, which will link with the constructed roads in the Yudu County Chalin Industrial Park, and by these constructed roads and the Red Army Bridge it will link with Yudu County town and National Road 323, thus in this way the Yudu interchange can conveniently connect the Industrial Park, the Yudu County town and National Road 323 simultaneously. Thus it can be seen that the route alignment of this highway section in Yudu county town and the adjusted Yudu interchange after preliminary design conform to the urban planning and development direction of Yudu County, and the Yudu County government expressed satisfaction regarding this. Therefore this project does not have disturbance to the Yudu County's urban town planning.

⑵ Relation to overall planning of other cities along the route

Besides the planning of above-mentioned cities, others related to the proposed highway are planning of Xijiang Township of Huichang County, Huanglin Township of Yudu County and Jiangkou Township of Ganxian County. According to investigation, the overall planning of these townships has not formed texts yet, mostly only at the stage of planning, moreover town planning has already reserved alignment location for Xiamen-Chengdu Expressway. So, construction of this project will not bring adverse impact on the overall planning of cities and towns along the route.

To sum up, the route selection has considered the cooperation between the road and village/town development plan. With regard to the principle of "close to city but not through city, convenience to city traffic and accord with overall route alignment, and meet road alignment shape requirement", the route selection is carried out for both near-term use and long-term planning so as to benefit city's exterior transportation and to better service economic development and people's life along the route. When each alignment is drafted preliminarily, the urban construction plan is taken into account in route alignment by having widely solicited the opinions of every local government along the route, and fully considering easy access of traffic to/from the highway for local towns, factories and mines, etc. In laying-out interchanges, the designing unit has investigated the current situations, future planning and development data of towns, factories and mines along the route, has confirmed that the proposed highway will not interfere with urban development plan along the route, and it can promote a fast development of economy along the route.

What deserves to be mentioned is that in recent years the country has forcefully strengthened infrastructure construction and enlarged investment of road construction, thus offering extremely favorable conditions for making this project implemented ahead of time and undoubtedly for the urban construction plan implementation along the highway.

4.5.2 Positive impacts on local economic development and industrial sector adjustment

Construction of the proposed highway will produce an enormous impetus to local economic development and will exert some influence on local labor force constitution and industrial sector structure.

(1) With the construction and operation of the proposed highway, it will greatly improve local transportation condition, and will connect with several local trunkways, which will certainly accelerate the commodity exchange with outside and will promote local social and economic development.

Jiangxi Province is the only region adjoining Pearl delta area, Changjiang River delta area and south Fujian economic zone at the same time. For Jiangxi to take off in central China, it is essential to establish the port system for the open-type economical development, which must be preceded by transportation construction so as to consummate the port infrastructure and building good environment for open-type economy. According to relevant data, although Xiamen is the deepwater port estuary with shortest distance to Nanchang, but presently only 2% of cargo from Nanchang is actually exported through Xiamen port, while the majority of cargo exportation has chosen some farther ports, for example, 40% of the cargo chooses Shanghai port, 37% chooses Shenzhen port, and others by Ningbo port. The important reason for this is the bad road transportation conditions in Jianxi and Fujian provinces, which is the "the bottleneck" hindering cargo flow. The proposed project is a main thoroughfare for Jiangxi (particularly Ganzhou City) to connect Fujian, it is an important channel for Jiangxi to the ocean. Construction of this road will certainly speed up Jiangxi's export-oriented economy and the take-off of south Jiangxi Province.

The project region Ganzhou City is the famous revolutionary area, but mountainous enclosed-type economy hinders the social economic development to a great degree, and backward transportation condition has affected the passengers and cargo circulation and turnover. At present Ganzhou's economy is still quite backward in the national level, until now there are still 8 state-level poverty counties (including project directly-influenced areas such as Huichang, Yudu, and Ganxian). Gannan (South Jiangxi) possesses 99 kinds of mineral resources, especially tungsten and rare earth, renowned as the "the world tungsten birthplace" and "rare earth kingdom". Gannan is one of 18 national key forest regions, is an emerging fruit industry base and one of the biggest producers of navel orange and sweet pomelo, is a major producer of cash crops in Jiangxi Province such as sugar cane, leaf tobacco, soybean, peanut, husked lotus, watermelon, etc. resources are rich along the proposed project, economy is backward, impoverished population is large; construction of the proposed project will greatly improve regional transportation condition, will speed up resource development and utilization along the route, will speed up poverty reduction to people along the route.

After completion, this project will greatly improve the road condition in Ganzhou and even in Jiangxi, will remarkably increase traveling capability, which will not only solve the traffic jam problem, reduce traffic accident, moreover will accelerate exchange between Ganzhou City and various big cities in the nation, thus providing necessary conditions for improving Ganzhou's investment environment, further attracting investments, and activating economy. After completion of this project, improved transportation condition will foster along-the-route regional construction and development, will guide the industrial structure layout becoming more reasonable, will promote rapid development of trade, tourism, architecture, transportation, processing, breeding and specialty agriculture within influenced areas. Emerging new industries and their development will provide more employment opportunities to society, and will exploit bigger economic and social benefits.

⑵ Steadily increased transportation benefit

Construction and development of Jishou-Chadong highway will greatly enhance the overall through capability of the road network, raising vehicles' average speed by a large margin, greatly raising the transportation benefit and social benefit. Highways can promote change in transport equipment, transport structure and travel ideology. As an important sign of modern traffic, highways will present higher and newer demands on transportation vehicles, transportation quality and people's concept. After operation of highways, low-grade automobiles are restrained from running on highways, which will compel transport enterprises to upgrade vehicles, improve services. Highways can change people's idea that automobile transportation is only suitable for median and short-distance transport. With increase of highway mileage and improvement of the whole road network, the distance of automobile transportation extends constantly. Valuable goods, high value-added products and fresh goods can adopt convenient and flexible door-to-door automobile transportation which can deliver them to all parts of the country rapidly. Passenger transportation also takes on a trend of median and long-distance transportation too.

⑶ Road construction can expand domestic demand, push economic growth and absorb work force, with the project region being the first beneficiary.

Latest sampling statistical reports on road construction projects made by the Ministry of Communications shows that a great development of road construction can greatly promote workforce employment, increase farmers' income, and promote the development of relevant industries such as steelmaking and energy, etc., thus playing an important role in economic development. This report indicates that in January – September of last year, road construction has provided 3,510,000 jobs altogether, of which, 890,000 jobs in road projects, 890,000 jobs in other industries, and 1,390,000 jobs to farmers. Road construction has consumed 4,500,000 tons of steel, 31,600,000 tons of cement, 1,900,000 cubic meters of timber, 1,920,000 tons of bitumen, 516,900,000 cubic meters of grit materials, 7,640,000 tons of petrol and diesel oil. The above-mentioned data of road construction's promoting economic growth in our country indicates that construction of Jishou-Chadong Highway can drive the development of relevant industries such as building materials and steel in the area along the highway, can offer some employments and spur the local economic growth.

⑷ Forming a highway economic belt

Operation of this Highway will play a positive role to the development of resources, industrial structure adjustment, and horizontal economic contact along the route. In addition to promoting the overall economic growth of counties and cities along the route, the proposed Highway will provide special favorable transportation conditions for the economic development of township enterprises along the route can drive the construction of country fairs and accelerate commodity circulation.

Construction of this project can shorten the temporal and spatial distance of cities and counties in the project region, can further enhance the economic link among cities and counties in the project region, making them into an organic integrity with own characteristics and complementary advantages, thus improving investment climate, strengthening efforts in soliciting and attracting outside investment, promoting opening to the outside world.

Construction and development of highways will accelerate passenger and commodity movement; a fast, noncongested transportation will play increasingly important role in breaking market segmentation, developing big commerce and big circulation, and in setting up and developing socialist market economy system. The region where this Highway runs possesses abundant tourism resources, while operation of this highway will shorten travel time, raise tour comfort, convenience and continuity, shift the tourism from go-and-see to stay-and-see, thus promoting development of tourism service trade. Because of the highway, the abundant agricultural and mineral resources in remote areas can be developed and utilized more.

⑸ Highway development make industrial sector more rational

Relevant statistical data indicates that construction of highway will bring 8 new changes to enterprises along the project: the first is that 77.6% of the enterprises will have wider contacts and extensive, swifter information source; the second is that 77.1% of the enterprises will improve their competition consciousness and competitiveness;

the third is that 83.1% of enterprises will strengthen their opening consciousness; the fourth is that 63.4% of the enterprises will improve investment environment; the fifth is that 79.0% of enterprises will strengthen market ideology; the sixth is that 89.3% of the enterprises will improve freight transportation validity; the seventh is that 66.8% of the enterprises will strengthen innovative consciousness; the eighth is that 83.4% of the enterprises will think their development prospect is better.

Construction and development of the expressway will not only effectively promote economic development along the route and surrounding areas, but also will play a positive role to social development of this area. Firstly, population and workforce of other areas can be attracted to assemble in these economic belts, promoting population and workforce moving from countryside to cities and towns, from agriculture to non-agriculture, from primary industry to secondary and tertiary industry; Secondly, it will closely connect several big cities, promoting town construction and development along the route and accelerating the integration of urban and rural areas; Thirdly, it will influence people's social consciousness, change people's ideology, strengthen the opening concept, pioneering ideas, competition and efficiency consciousness of cadres and masses along the route; Fourthly, it will shorten the temporal and spatial distance between enterprises and areas, and will compel leaders at all levels to jump out of the narrow circle into wider perspective for designing future development blueprint.

4.5.3 Impact analysis of interference with local infrastructure

The proposed highway will have some interference with existing infrastructure along it during construction. In the project preliminary stage, the designing unit has consulted fully with local governments concerning interference with infrastructure along the route and has designed interchanges, grade separations, viaducts, bridges and culverts, has designed measures to realign Individual River and road so as to fully guarantee noncongestion of existing roads and non-destruction of water conservancy, electricity and telecom facilities.

(1) Interference with classified roads

The proposed highway’s intersections with classified roads along-the-route will be solved mainly by establishing 6 interchanges and some grade separations. The whole route will establish 6 interchanges, namely the K50+248 Huichang interchange which intersects with Huichang~Shanshupai road, the K78+181 Hefeng interchange which intersects with Yudu~Pangushan road, the K90+225 Yudu interchange, the K101+230Luo'ao interchange, and the K124+244 Ganxian interchange, which all intersect with G323 respectively, and the K139+377 Ganzhou north interchange which intersects with G105. Moreover, 6 grade separations are designed to intersect with G323 (twice), Gan-Long railroad (twice), and Beijing-Kowlon Railway (once). This project will set up 6 interchanges and 6 grade separations which can solve the interference with existing classified roads, railroad and planned roads.

⑵ Interference with rural roads and tractor roads

This project's intersection with existing rural road is solved by setting up 43 grade separations; its intersection with tractor roads and pedestrian overpasses is solved by setting up 203 passageways. Setting up 43 grade separations can guarantee all the rural roads intersected with this project unimpeded and setting up 203 passageways can meet the need of inhabitants for normal movement. The route designing unit has aligned the route in harmony with tractor roads so to facilitate the inhabitant's normal movement and agricultural production.

⑶ Interference with rivers (canals)

Setting up super-large, large, median bridges and culverts can prevent the original surface water system and farmland irrigating facility from being destroyed.

This project overcrosses Gongjiang River 4 times, and Ganjiang River 1 time. In K63+025, K100+424, K114+940, K118+920 and K135+491, large and super-large bridges are designed to overcross Gongjiang River and Ganjiang River. In addition, the proposed highway will set up 45 large bridges, 25 median bridges, 3 small bridges and 170 culverts in small rivers, reservoirs, canals and big ditches intersected by this project. The above bridges and culverts of this project can guarantee that the surface river system intersected by the road is unimpeded and they can meet agricultural irrigation and drainage purposes along the route. The setting up of river-crossing large and super-large bridges has also considered flood prevention requirement.

⑷ Interference with power and telecom facilities along the route

For important electricity and telecommunication lines, the principle of "least relocation with the prerequisite of not deviating from the route" is followed to avert them in the course of route selection. If due to landform constraints, some electricity and telecommunication lines must be relocated, crossed or lifted, relevant departments are consulted for relocation arrangements, the cost required is made into budget. The electricity and telecommunication lines to be relocated by each alignment of this project are listed in Table 4.5.3-1.

Table 4.5.3-1 Quantity of relocated electricity and telecommunication facilities

County or city belonged to	Power transmission			Telecom	
	Relocated length (m)	Number of poles (piece)	Transformer (piece)	Relocated length (m)	Number of poles (piece)
Ruijin City	960	25	0	494	15
Huichang County	9760	214	1	5350	116
Yudu County	14040	201	0	8320	138
Ganxian County	12840	163	2	8650	101
Zhanggong District	9170	121	1	5030	61
Huangjinlong District	840	11	0	0	0
Total for whole line	47610	735	4	27844	431

4.5.4 Impact analysis on tourism, cultural relics and mineral resource development and utilization

4.5.4.1 Tourism resource and cultural relics

(1) Tourism resource

The proposed project region Ganzhou Prefecture is situated at the origin of Ganjiang River, it has a history of more than 2100 years, and it is the country's historical and cultural city with green waters and green hills dotted there. It is a landscape tour city featuring history and culture with very rich tour resources. The whole prefecture possesses 4 national-level cultural relic preservation units (18 spots), 2 national forest parks, 9 provincial-level scenic spots, 49 provincial-level cultural relic preservation units and 94 county-level cultural relic preservation units. Ganzhou City is the nation's unique Song city possessing cultural relics from Song Dynasty in best preservation, largest quantity and highest status, renowned as "the Song City Museum". Ganzhou also features the rich Hakkas culture, it is Hakkas centered community, and also the birthplace for Hakkas culture, it is the biggest city in Hakkas region. Ganzhou also has rich Red Rour resources, for it is the central revolutionary base during the Second Revolutionary Civil War, the Chinese soviet temporary central government is located in Ruijin of Ganzhou Prefecture, the Long March also started from there. At present, the National Tourism Bureau and other concerned departments have officially initiated the "red travel 121 project" with a plan to construct, within 5 years, 10 "red tour bases", 20 "red tour famous cities", 100 "red tour classical scenic spots", thus forming "the red tour" backbone system in the country. Of which the "republic cradle - central Soviet region red tour base" containing scenic spots within Jinggangshan city, Ruijin City, Yongxing County, Xingguo County, and Yudu County is listed in the top of the "ten big bases".

Construction of the proposed project will promote formation of express channels along the route, will satisfy tourism's requirements for speed and comfort, will be advantageous to more tourists lengthening their staying time, and will promote the reputation and brand image of tour spots. Therefore, construction of the proposed project will certainly speed up local tour resource development along the route, and will foster economical development in the project region and areas along the route.

⑵ Cultural relics resource

According to the findings of the《*Cultural Relics Assessment Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China*》prepared by Jiangxi Provincial Archaeological Institute on Oct 2005, each route scheme, interchange, linking-up road, earth borrow pit and waste bank for the Ruijin-Ganzhou Highway are all located outside of the protection scope and construction control scope of city, provincial and national relics protection units, thus the highway will not threaten their safety, complying with the stipulations and requirements of《*People's Republic of China on Relics Protection*》.

The distances between the proposed highway to these cultural relics along the route are listed in Table 4.5.4.1-1.

Table 4.5.4.1-1 List of cultural relics along the route

No	Name of relics	Cultural nature	Age	Protection class	Jurisdiction	Distance to the route (km)
1	Former site of working people's committee of temporary central government in Yunshishan	Former revolutionary site	1934	City-level	Ruijin City	About 1.5
2	Former site of national bank of temporary central government in Yunshishan	Former revolutionary site	1934	City-level	Ruijin City	About 2.5
3	Former site of national politics protection bureau of temporary central government in Yunshishan	Former revolutionary site	1934	City-level	Ruijin City	About 0.5
4	Former site of finance committee of temporary central government in Yunshishan	Former revolutionary site	1934	City-level	Ruijin City	About2.5
5	Former site of CCP central bureau in Madaokou	Former revolutionary site	1934	City-level	Ruijin City	About1.5
6	Former residence of central	Former	1934	City-level	Ruijin City	About 4

No	Name of relics	Cultural nature	Age	Protection class	Jurisdiction	Distance to the route (km)
	revolutionary military committee of Chinese Soviet Republic in Yanbei	revolutionary site				
7	Former residence of Li De (Otto Braun)	Former revolutionary site	1934	City-level	Ruijin City	About 4
8	Former site of CCP central school in Shegongbei	Former revolutionary site	1934	City-level	Ruijin City	About 2
9	Former site of central youth communist league in Tianxin	Former revolutionary site	1934	City-level	Ruijin City	About 4
10	Former site of working people's inspection committee of temporary central government in Huangzhubei	Former revolutionary site	1934	City-level	Ruijin City	About 1.5
11	Former site of China trade union central executive bureau in Shapai	Former revolutionary site	1934	City-level	Ruijin City	About 3.5
12	Former site of armament division of central revolutionary military committee	Former revolutionary site	1934	City-level	Ruijin City	About 4.5
13	Former site of printing factory of temporary central government	Former revolutionary site	1934	City-level	Ruijin City	About 0.3
14	Former site of post bureau of temporary central government	Former revolutionary site	1934	City-level	Ruijin City	About 1.5
15	Luotianyan stone carvings	Ancient stone sculpture	Song－Qing Dynasty	Provincial-level	Yudu County	About 3.5
16	Qili kiln site	Ancient kiln site	Tang－Yuan Dynasty	Provincial-level	Zhanggong District	About 7
17	Li Bo ancestral temple	Ancient architecture	Ming Dynasty	City-level	Zhanggong District	About 0.5
18	Baita bridge	Ancient architecture	Qing Dynasty	City-level	Zhanggong District	About 7
19	Xianniang temple	Ancient architecture	Qing Dynasty	City-level	Zhanggong District	About 6.8
20	Wanshou palace	Ancient architecture	Qing Dynasty	City-level	Zhanggong District	About 4
21	Chi's ancestral temple	Ancient architecture	Qing Dynasty	City-level	Zhanggong District	About 7.5
22	Mazuyan stone carvings	Ancient stone sculpture	Yuan Dynasty	City-level	Zhanggong District	About 4
23	Yuhong Pagoda	Ancient architecture	Ming Dynasty	Provincial-level	Zhanggong District	About 1.5
24	Tongtianyan stone cave	Ancient stone sculpture	North Song－Minguo	National-level	Zhanggong District	About 1.5
25	Liyuan civilian architecture	Ancient architecture	Qing Dynasty	City-level	Zhanggong District	About 0.4
26	He Huanwen's tomb	Martyr tomb	1942	City-level	Zhanggong District	About 0.35

4.5.4.2 Mineral resources

The project region Ganzhou Prefecture is very rich in mineral resources with 99 kinds discovered, in which 33 kinds are identified with reserves. Tungsten, rare earth and other non-ferrous metals occupy an important role in the nation, it is one of the national key non-ferrous metal producers. Ganzhou Prefecture has a history to mine various kinds of mineral resources, and mining has become the most important pillar industry in Ganzhou.

Ruijin, Huichang, Yudu, Ganxian, and Zhanggong District the proposed highway passes through are abundant in many kinds of mineral ores with big reserves; mining industry occupies an important role in local economy development. The alignment of the proposed highway maintains a certain distance to most mining areas along the route. According to investigation, the nearest mines to the proposed highway are Maozizhai and Aokou mines located in Ruijin territory. This project passes between these two mining areas without impact on their mineral resources, at the same time the control safe distance required by mining blasting is considered.

Although mining industry is a pillar industry in Ganzhou Prefecture and the counties (city, district) the route passes, but further exploitation, utilization and development of mineral resources in the project region are seriously hindered by transportation conditions. For example, in the Bai'e Township of Huichang County where the proposed highway runs by, its mining ability is restricted by transportation condition to a great degree, which at current mainly depends on Huichang ~ Shanshupai second-class road for outward transportation. This project will establish an interchange near Shanshupai to link with the existing Huichang ~ Shanshupai road, which will create more convenient transportation conditions for mineral resource development and utilization in Huichang County. Setting up of Huichang interchange will greatly reduce the driving time and distance between Huichang and Ganzhou, and Hunan Province. Also within Yudu County, the underground mineral resources are very rich with 28 metallic minerals discovered such as tungsten, iron, manganese, lead, copper, rare earth and so on, of which tungsten ore ranks first; there are 7 large and medium-sized mining areas as well as many non-ferrous ores. This project will set up 3 interchanges in Yudu County: Hefeng, Yudu and Luo'ao, which will reduce driving time and distance to Ganzhou and Xiamen. Construction of this project will provide good transportation infrastructure condition for the economic development, especially resource development, in Huichang and Yudu where the transportation is backward.

4.5.5 Impact analysis of land acquisition and removal

⑴ To acquire responsibility-contracted fields

This project will permanently take up a land size of 12535.42 mu, of which farmlands of 3934.73 mu, orchard fields of 377.8 mu, forestlands of 6903.65mu. This project will take up 265.6 mu, 572.98 mu, 1765.25 mu, 617mu and 713.9 mu of farmlands in Ruijin City, Huichang County, Yudu County, Ganxian County and Zhanggong District respectively. This project will take up 30.8 mu, 1.5 mu, 196 mu and 149.5 mu of orchard fields in Ruijin City, Huichang County, Yudu County and Ganxian County respectively. This project will take up 48.3 mu, 1534.68 mu, 2592.7 mu, 1729.27mu and 998.7 mu of forestlands in Ruijin City, Huichang County, Yudu County, Ganxian County and Zhanggong District respectively.

After farmers' lands are acquired for use, their responsibility-contracted fields will be readjusted by local township government.。Extra labor force resulting from land acquisition and reduction are generally settled locally. Because every village and group that the route passes are varied in their acquired land size, so their impacts will be also different. Villages and groups that have more acquired land size will encounter more problems in land adjustment and workforce resettlement, the families with land acquired will have greater impact too. But because in places the highway passes, floating population is usually large, commodity flow is active, new industry will rise too. So, although some lands are lost due to acquisition, but people's life can be improved progressively through adjusting industrial structure and employment arrangement.

⑵ Removal of civilian houses

The removal of civilian houses by this project is shown in Table 4.5.5-1.

Table 4.5.5-1 Civilian house removal quantity by the proposed highway

County	Township	Administrative village	Building removal(m^2)					Households
			Brick and tilt Houses	Brick and concrete houses	Earth brick andtilt house	Simple-structured house	Total	
Ruijin City	Yunshishan Township	Pixia	46.41	4865.27	1984.8	0	6896.48	31
		Huilong	0	172.21	3402.35	475.62	4050.18	24
		Shishan	0	144.08	131.58	0	275.66	1
		Whole township	46.41	5181.56	5518.73	475.62	11222.32	56
	Whole city		46.41	5181.56	5518.73	475.62	11222.32	56
Huichang County	Xijiang Township	Hongxing	2118.89	996.2	2681.85	68	5864.94	34
		Yantanbei	57.38	122.4	581.57	12.75	774.1	5
		Qiangong	422.67	3271.91	2465.48	439.03	6599.09	36
		Wanxing	0	2429.82	6130.2	137.7	8697.72	45
		Datian	467.93	3336.76	4911.06	362.57	9078.32	54
		Huoxing	357	0	1474.92	259.74	2091.66	11
		Whole township	3423.87	10157.09	18245.08	1279.79	33105.83	185
	Xiaomi Township	Shanbei	8127.28	1797.76	2879.21	917.15	13721.4	80
		Whole township	8127.28	1797.76	2879.21	917.15	13721.4	80
	Baie Township	Shuidong	0	2759.36	3278.11	530.36	6567.83	35
		Baie	0	4243.9	7933.16	924.12	13101.18	71
		Whole township	0	7003.26	11211.27	1454.48	19669.01	106
	Whole county		11551.15	18958.11	32335.56	3651.42	66496.24	371
Yudu County	Huanglin Township	Qiantang	749.7	730.8	0	21.6	1502.1	10
		Yuyang	1949.19	807.6	0	61.2	2817.99	18
		Whole township	2698.89	1538.4	0	82.8	4320.09	28
	Hefeng Township	Shijing	1966.73	3980.46	6073.25	585.39	12605.83	75
		Kuxin	102	656.97	334.05	151.94	1244.96	7
		Huangtian	252.45	6301.9	6815.51	1356.6	14726.46	82
		Yinqian	204	3731.5	3695.8	538.05	8169.35	47
		Zhongfang	122.4	2142	1438.2	258.4	3961	22
		Yaokou	188.7	3721.3	3391.5	935.85	8237.35	50

County	Township	Administrative village	Building removal(m^2)					Households
			Brick and tilt Houses	Brick and concrete houses	Earth brick andtilt house	Simple-structured house	Total	
		Dalong	0	285.6	1115.2	93.5	1494.3	9
		Pijiao	0	377.4	952	163.2	1492.6	9
		Dawan	0	0	1672.8	452.2	2125	11
		Whole township	2836.28	21197.13	25488.31	4535.13	54056.85	312
	Licun Township	Shanglong	46	2889.4	0	513.4	3448.8	26
		Xialong	125.8	2274.6	2472.4	893.2	5766	44
		Liren	0	2400.4	530.4	319.6	3250.4	22
		Whole township	171.8	7564.4	3002.8	1726.2	12465.2	92
	Xinpi Township	Jingkeng	822.8	1999.2	0	199.75	3021.75	17
		Mikeng	652.8	537.2	1142.4	746.3	3078.7	19
		Jiaocun	0	0	2614.6	217.6	2832.2	16
		Miaobei	95.2	605.2	0	513.4	1213.8	6
		Whole township	1570.8	3141.6	3757	1677.05	10146.45	58
	Luojiang Township	Shangxi	283.9	5111.06	768.4	583.1	6746.46	41
		Gaotan	105.4	700.4	2233.8	425	3464.6	19
		Whole township	389.3	5811.46	3002.2	1008.1	10211.06	60
	Luoao Township	Shuiduan	319.1	3334.7	4912.9	1371	9937.7	49
		Maoping	1059.1	3250.4	5559	1285.2	11153.7	62
		Sanmen	737.6	4701.6	3784.35	1673.8	10897.35	54
		Xiashan	499.8	2934.2	1434.8	548.25	5417.05	32
		Whole township	2615.6	14220.9	15691.05	4878.25	37405.8	197
	Whole county		10282.67	53473.89	50941.36	13907.53	128605.5	747
Ganxian County	Jiangkou Township	Jiaolin	553.35	714	1559.75	739.5	3566.6	20
		Santuan	0	0	130.9	91.8	222.7	1
		Ankeng	0	0	130.9	56.1	187	1
		Dunshang	0	25.5	960.5	502.35	1488.35	6
		Whole township	553.35	739.5	2782.05	1389.75	5464.65	28
	Maodian	Shangba	0	1890.34	3265.4	468.8	5624.54	20

County	Township	Administrative village	Building removal(m^2)					Households
			Brick and tilt Houses	Brick and concrete houses	Earth brick andtilt house	Simple-structured house	Total	
	Township	Huanglong	149.6	3830.1	703.8	595.85	5279.35	32
		Dongtian	270.3	3573.4	1985.6	919.7	6749	35
		Wansong	30.6	1502.8	374	224.4	2131.8	12
		Taiyangping	452.2	2505.8	2153.9	1327.7	6439.6	35
		Whole township	902.7	13302.44	8482.7	3536.45	26224.29	134
	Chutan Township	Tianxin	218.45	2980.1	895.05	764.15	4857.75	27
		Whole township	218.45	2980.1	895.05	764.15	4857.75	27
	Whole county		1674.5	17022.04	12159.8	5690.35	36549.69	189
Zhanggong District	Shuixi Township	Huangsha	248.2	3140.75	5901.55	1541.9	10832.4	61
		Luobian	0	1132.2	3828.4	359.55	5320.15	27
		Whole township	248.2	4272.95	9729.95	1901.45	16152.55	88
	Hubian Township	Shanbian	2837.3	2504.95	1686.4	543.15	7571.8	45
		Gangbian	1475.6	989.4	457.3	301.75	3224.05	18
		Hubian	0	175.95	0	0	175.95	1
		Sheqian	68	392.7	183.6	61.2	705.5	4
		Guantian	24.65	671.5	198.9	23.8	918.85	8
		Yongquan	0	76.5	801.55	112.2	990.25	5
		Yeshan	0	373.15	122.4	56.1	551.65	2
		Whole township	4405.55	5184.15	3450.15	1098.2	14138.05	83
	Panlong Township	Chetou	0	163.2	901	144.5	1208.7	7
		Whole township	0	163.2	901	144.5	1208.7	7
	Whole district		4653.75	9620.3	14081.1	3144.15	31499.3	178
Whole line			28208.48	104255.9	115036.6	26869.07	274370	1541

This project needs to remove civilian houses with a total size of 274370m^2, it is estimated that about 1541 households will be involved with about 7705 influenced people. On the premise of not influencing town development planning and resettling nearby, the resettlement of these households to be relocated will be organized by local township government so as to take into account environmental planning and not disrupt the original organizational system.

Among the removed families, because their housing conditions and population composition differ, so the impact degree produced from removing and resettlement is not the same. So local governments at each level should carry out good resettlement work for removed families and people according to local actual conditions. Mainly the following jobs shall be well done:

① Road administrations shall utilize effective publicity means to forcefully release relevant policies of economic compensation under assistance from local People's Congress, Political Consultancy and other grassroots organization along the route.

② Construction unit should pay in due time every subsidy for land acquisition and removal and resettlement to concerned local government according to the agreement signed.

③ Subsidy expenses must be allocated for its specified purpose, and distributed to concerned groups and individuals in time according to regulations, citizen’s fundamental right and democracy shall be respected to make sure that each subsidy money is distributed and used correctly.

④ The cultivated lands shall be reasonably allocated and labor settled to implement various policies such as agricultural tax policy.

⑤ It is required to carry out investigation of households whose lands are to be acquired or houses to be removed, according to village construction planning, residence bases shall be assigned them in time, the land acquisition, removal and resettlement compensation money shall be paid to them in time so as to guarantee their living standard not reduced.

4.6 Hazardous cargo transportation risk analysis during operation stage

The proposed Ailing (Jianxi and Fujian border)-Ruijin Highway in Jiangxi Province of national key Xiamen-Chengdu Expressway basically aligns along existing National Road 323 in parallel and intersects for several times in Ganzhou Prefecture. After completion and operation of this highway, certainly it will attract traffic from National Road 323, so hazardous chemical cargo transportation risk analysis for the proposed highway is based on the investigation data on hazardous cargo transportation risk analysis and traffic accident of National Road 323 to predict the traffic accident probability of hazardous cargo transportation on the proposed highway through computational analysis, especially the traffic accident probability on bridge sections crossing Gongjiang River. Their danger will be briefly analyzed and transportation management measures will be suggested. This risk analysis is mainly to analyze traffic accident probability.

4.6.1 Chemical hazardous substance production and transportation in project region

According to the statistical data, in 2003 the variety and output of chemical hazardous substances in Ganzhou Prefecture are listed in Table 4.6.1-1.

Table 4.6.1-1 2003 chemical hazardous substance production in Ganzhou Prefecture

Coal gas (10,000 m^3)	Sulphuric acid (ton)	Sodium-hydroxide (ton)	Chemical pesticide(ton)	Rosin (ton)	Explosive (ton)	Detonator (10,000)	Match (case)
1656	5331.8	9314	551	1480	7898	3256	151082

According to investigation, the major varieties of chemical hazardous substances transported on G323 in the project region include gasoline, liquid gas, liquid ammonia, sulfuric acid, hydrochloric acid, matches, fireworks, firecracker and explosive device (detonator, blasting explosive). Of which, the transportation volume of gasoline and liquid gas accounts for the majority of hazardous substances transportation quantity, approximately 70~80%.

4.6.2 Traffic accident probability calculation of hazardous cargo vehicles

(1) Calculation formula

After the proposed highway is put into operation, the traffic accident probability estimation of hazardous cargo vehicles in each section and Gongjiang River bridge section is mainly based on G323's traffic accident rate in Huichang and Yudu sections, and the traffic volume of each predicting year and length of highway section under estimation of the proposed highway.

In the proposed highway, the traffic accident probability of hazardous cargo vehicles in the whole section or in its large bridge sections in a given predicting year can be calculated by the following formula:

$$P_{ij} = \frac{A \cdot B \cdot C \cdot D \cdot E}{F}$$

In which：

P_{ij}——in the proposed highway, the traffic accident probability of hazardous cargo vehicles in the whole section or its specific section in a given predicting year, times/year.

A——traffic accident rate in a certain section of National Road 323 in a certain base year, time/a million trucks•Kilometer.

B——the percentage of vehicles transporting hazardous cargo in National Road 323, %;

C——average annual traffic volume of the whole proposed highway in a predicting year, million vehicles/year;

D——length of highway section to be examined(the whole highway section or the bridge, tunnel section), km;

E——under comparable condition, because highway operation, percentage of possible traffic accident reduction, %;

F——safety coefficient of vehicle transporting hazardous cargoes.

⑵ Determination of each parameter

① Traffic accident rate in National Road 323 in Huichang and Yudu sections

The sections of G323 in Huichang and Yudu are 27.3km and 61.2km long respectively with road grade of 2. From 2001 to 2003, the traffic accidents of G323 in Huichang and Yudu sections are listed in Table 4.6.2-1.

Table 4.6.2-1 Traffic accidents of G323 in Huichang and Yudu sections in recent years

Area	Year	Accident times (times/year)	Of which number of serious and very serious accidents
Huichang County	2001	161	Serious and very serious accidents 27 times accounting for 26%
	2002	153	Serious and very serious accidents 25 times accounting for 16%
	2003	150	Serious and very serious accidents 19 times accounting for 12%
Yudu County	2001	—	—
	2002	195	Serious accidents 34 times, very serious accidents 1 times, accounting for 18%
	2003	148	Serious accidents 24 times, no very serious accidents, accounting for 16.2%

According to investigation, the traffic volumes of G323 in Huichang and Yudu sections in 2002 and 2003 are listed in Table 4.6.2-2.

Table 4.6.2-2 Traffic volumes of G323 in Huichang and Yudu sections(absolute value, vehicle/day)

Year	Huichang section	Yudu section
2002	3653	4457
2003	4014	5006

Based on G323's annual average traffic accidents in Huichang and Yudu sections in 2001～2003 and its traffic volumes in 2002 and 2003, the average traffic accident rate of G323 in Huichang and Yudu sections in recent years is calculated at 2.832×10^{-6}times/km, that is A=2.832times/million vehicle•km.

② Percentage of vehicles transporting hazardous cargoes

Among G323 traffic volume, the percentage of hazardous cargo transportation vehicles is about 0.5% in the total vehicle number, that is B=0.5%.

③ Traffic volume in each characteristic year

The annual traffic volumes of each predicting year are listed in Table 4.6.2-3.

Table 4.6.2-3 Annual traffic volumes of each predicting year unit: 10^6pcu/year

Road section \ Predicting year	Short-term	Mid-term	Long-term
Yunshishan～Huichang (K31+012.977～K50+248)	3.763150	6.165726	9.452770
Huichang～Hefeng (K50+248～K78+181)	4.104121	6.666652	10.121815
Hefeng～Yudu (K78+181～K90+225)	4.228099	6.867986	10.328770
Yudu～Luo'ao (K90+225～K101+230)	4.468452	7.258098	10.915690
Luo'ao～Ganxian (K101+230～K124+244)	4.903349	7.812241	11.550425
Ganxian～Ganzhou north (K124+244～K139+377)	5.404798	8.464642	12.333715
Ganzhou north～Huangjin (K139+377～K149+728)	5.703550	8.932280	13.015170
Average for whole route	4.447403	7.168600	10.751805

④ Length of highway section to be examined

In addition to the whole road section of the proposed highway, the section to be examined is mainly Gongjiang River bridge section, Ganjiang River bridge section and tunnel section, see Table 4.6.2-4 for details.

Table 4.6.2-4 Length of highway section to be examined unit: km

Total length of road	Total length of river-crossing bridge sections	Crossing Gongjiang River 4 times, average length of each crossing	Super-large bridge section crossing Ganjiang River	Section along Gongjiang River in Yudu south line alignment	Total tunnel length	Zhonggongzhang tunnel length
116.64	8.27	1.08	1.37	约 11.00	9.55	4.16

⑤ Reduced traffic accident percentage by highway

Under comparable conditions, the reduced traffic accident percentage by highway operation is set at 50%, namely E is 0.5.

⑥ Transportation safety coefficient of hazardous cargo vehicle

This coefficient means that vehicles engaged in hazardous cargo transportation, no matter from the driver's security consciousness, or its special sign of the vehicle itself, will generally have less traffic accident possibilities than ordinary vehicles. Generally the coefficient F is set at 1.5.

⑶ Traffic accident probability of hazardous cargo vehicles

the traffic accident probabilities of hazardous cargo vehicles in predicting year in each examined section are listed in Table 4.6.2-5。

Table 4.6.2-5 Traffic accident probabilities of hazardous cargo vehicles unit：times/year

Examined section / Predicting year	Whole section	River bridge section (reservoir)	Bridge section crossing Gongjiang River for 1 time	Super-large bridge section crossing Ganjiang River	Tunnel section	Zhonggongzhang tunnel section	Section in parallel to Gongjiang River
Short-term (2009)	2.47	0.22	0.03	0.03	0.25	0.21	0.08
mid-term (2015)	4.00	0.35	0.05	0.05	0.40	0.33	0.14
Long-term (2022)	5.97	0.53	0.08	0.08	0.60	0.49	0.19

4.6.3 Brief analysis of hazardous cargo transportation risk

According to the data provided from Huichang and Yudu County traffic police, during 2001～2003 there occurred 807 accidents, of which 130 grave and fatal accidents, others are ordinary and slight accidents. The percentage of grave and fatal accidents accounts for 16% in the total accidents. So in the traffic accident probability in Table 4.6.2-5, the possibly influencing probability is 16%.

In summary, after the proposed highway is open to traffic, the possibly influential traffic accident probability of hazardous cargo vehicles on the whole road in each forecasting year is approximately 0.39~0.95times/year. However, statistics indicates that the traffic accident probability of hazardous cargo transportation vehicle is not zero, so the emergence of grave traffic accidents can't be eliminated. There is still possibility that hazardous cargo transportation vehicle may occur traffic accident in the proposed highway and may seriously pollute the environment such as diffusion of poisonous gas or harmful liquid flow into river system. And probability of such accident occurring within tunnels still exists. So, in order to prevent pollution risk of hazardous cargo transportation, effective precaution and emergency measures must be taken.

4.7 Environmental impact of roadbuilding material excavation and transportation

The roadbuilding materials along the route are mainly transported by automobiles.

(1) Impact on existing road transportation

Sand and gravel materials necessary for this project construction are self-excavated along the route or purchased outside, generally not transported by major roads (such as National Road 323) rather by existing county or rural road or detour roads to construction site. But some volume of stone needs to be transported through National Road 323. In addition, the transportation of cement, timber, steel and asphalt will be transported through G323. Because the major roads in this region (such as G323) has a busy and heavy traffic already exceeding its design traffic capacity, so roadbuilding material transportation may cause traffic jam on the existing road thus influencing traffic safety. Therefore, during construction stage, traffic administration must be enhanced over existing roads, for example to transport materials at night and in leisure season. Contractors shall formulate transportation management plan so as to guarantee transportation requirements for construction materials.

(2) Ecological destruction

Stone excavation mainly adopts drilling and blasting method to explode the large-scale quarry, to crush and assort the stone, which is finally delivered to highway construction site. The newly-built construction detour roads and stone excavation will destroy the existing surface vegetation, will change terrain and landform in partial places, will form new soil erosion, thus creating environment landscape imbalance

(3) Impact on inhabitants' quality of life

Stone excavation and transportation can produce flying dust, noise, vibration, blasting hidden danger, and traffic jam and so on.

Stone quarries for this project are all located in hillocks and waste slopes with rich stone reserves, far away from towns, villages, schools and other sensitive locations. The flying dust, noise, vibration and blasting danger produced from stone excavation will not exert impact on the inhabitants, but attention must be paid to stone workers' health care and personal safety.

Transportation of roadbuilding materials on existing road may produce some impact on the inhabitants' life and rest and on the schooling at two sides. The road flying dust and material spillage due to improper coverage will produce certain adverse impact on the periphery and people's living conditions, particularly in arid season.

Moreover, the transportation of roadbuilding materials may intensify the traffic pressure on the existing road, causing traffic jams and making the inhabitants inconvenient in access, also increasing the possibility of hidden traffic accidents.

Chapter 5 Water and Soil Conservation Plan

This chapter is an excerpt from the《*Water Conservation Scheme for World Bank Loan Jiangxi Road Project No. 3 Ruijin-Ganzhou Section of Xiamen-Chengdu National Expressway in People's Republic of China*》(for submission) prepared by Jiangxi Provincial Water Conservation Research Institute on October 2005.

5.1 Survey of current soil erosion status

According to national soil erosion zoning, the project area is located in the red earth (loam) erosion terrain in South China with its major soil erosion form being hydraulic (water power) erosion and the allowable soil erosion modulus in the project construction area is 500t/km^2·a. The soil erosion in the project area is mainly distributed in earth borrow pits, waste banks, embankments, cutting slopes, management and service areas, and lands for temporary uses. The soil erosion in cutting slopes formed by earth excavation, in heaping slopes formed by waste earth piling, and in embankments and cutting slopes are mainly gully erosion followed by surface erosion as well as some gravity erosion（such as slumping and landslide） in partial areas；the soil erosion in cutting stage formed by earth excavation, in heaping stages formed by waste earth piling and in management and service areas, in denuded surface grounds formed by construction ground leveling are mainly dominated by surface erosion.

According to remote sensing investigation of soil erosion and by field survey, the existing soil erosion size within this project's construction area is 290.87hm^2 accounting for 29.2% in the total project construction area (996.23hm^2). Of which: the slightly eroded size is 102.67hm^2 accounting for 35.3% in the total eroded size, the moderately eroded size is 100.32hm^2 accounting for 34.5% in the total eroded size, the intensely eroded size is 62.17hm^2 accounting for 21.4% in the total eroded size, the very intensely eroded size is 20.18hm^2 accounting for 6.9% in the total eroded size, and the violently eroded size is 5.53hm^2 accounting for 1.9% in the total eroded size. The average soil erosion modulus in the project construction area is 1639t/km^2 with annual average soil erosion quantity of 16325t. The current status of soil erosion refers to Table 5.1-1).

Table 5.1-1 Current status of soil erosion in the project region

Zone	Land use size (hm^2)	Soil erosion size (hm^2)	Percentage of soil erosion size in land use (%)	Soil erosion size of each level（hm^2）					Average soil erosion modulus (t/km^2·a)	Total annual average soil erosion volume(t)
				Slight	Median	Intense	Very intense	Violent		
Main project area	819.94	239.23	29.2	76.21	83.66	55.18	18.65	5.53	1706	13991
Earth borrow pit	32.61	14.40	44.2	8.00	3.60	2.80	--	--	1681	548
Waste bank	43.30	10.38	24.0	6.70	1.29	0.86	1.53	--	1298	562
Management and service area	29.57	7.65	25.9	2.71	4.08	0.86	--	--	1194	353
Temporary construction land	70.81	19.21	27.1	9.05	7.69	2.47	--	--	1230	871
Total	996.23	290.87	29.2	102.67	100.32	62.17	20.18	5.53	1639	16325

5.2 Prediction of soil erosion impact

5.2.1 Soil erosion forecasting zoning and division of forecasting duration

5.2.1.1 Forecasting zoning

According to the nature and characteristics of the engineering construction and its impact degree on soil erosion, the soil erosion forecasting for this project identified 5 zones: main project zone, earth borrow zone, waste disposal zone, management and service zone, and temporary construction land zone.

5.2.1.2 Division of forecasting duration

The soil erosion forecasting duration for this project can be divided into three periods: construction preparation period, construction period and vegetation restoration period.

(1) Construction preparation period：the construction preparation period for this project is July of 2006 with a forecasting duration of 1 month, in which it is mainly to forecast the possible soil erosion produced by construction ground leveling, detour road construction, and campsite construction, etc.

(2) Construction period：the construction period for this project is from August of

2006 to June of 2009 with a forecasting duration of 35 month, in which it is mainly to forecast the possible soil erosion produced by subgrade construction, earth excavation, waste earth piling and construction of management and service facilities, etc.

(3) Vegetation restoration period: the main project zone and management and service zone are mainly for the forecasting of landscaping and planting whose vegetation restoration period is identified to be 1 year after the project is finished; the earth borrow zone, waste disposal zone, and temporary construction land zone are mainly for the forecasting of ecological public forest whose vegetation restoration period is identified to be 2 years after the project is finished.

According to construction scheduling, the soil erosion forecasting durations for each zone are identified as shown in Table 5.2.1.2-1.

Table 5.2.1.2-1 Soil erosion forecasting durations

No	Forecasting zoning	Forecasting durations(a)		
		Construction preparation period	Construction period	Vegetation restoration period
1	Main project zone	--	2.2	1.0
2	Earth borrow zone	--	2.2	2.0
	Of which : temporary waste disposal	--	2.2	--
3	Waste disposal zone	--	2.4	2.0
4	Management and service zone	--	2.9	1.0
5	Temporary construction land zone	0.1	2.9	2.0

5.2.2 Forecasted soil erosion volume

5.2.2.1 Sizes of disrupted original topography, damaged land and vegetation

The total size of disrupted original topography, damaged land and vegetation by construction of this project amounts to 996.23hm^2, of which 294.92hm^2 for paddy fields, 41.35hm^2 for non-irrigated fields, 578.51hm^2 for forestlands, 40.69hm^2 for waste hills and waste lands, 25.32hm^2 for water bodies, 0.64hm^2 for vegetable gardens, 10.18 hm^2 for houses and grounds, 4.55hm^2 for lands for transportation, 0.07hm^2 for lands for housing. The sizes of disrupted original topography, damaged land and vegetation by this project in each zone are listed in Table 5.2.2.1-1.

Table 5.2.2.1-1 Forecasted sizes of disrupted original topography, damaged land and vegetation(hm^2)

Item	Land use type and size									Subtotal
	Paddy fields	Non-irrigated fields	Forestlands	Waste hills and waste lands	Water bodies	Vegetable gardens	Houses and ground lands	Lands for transportation	Lands for housing	
Main project zone	246.23	35.32	466.74	32.36	24.01	0.64	10.05	4.52	0.07	819.94
Earth borrow zone	0.67	--	31.94	--	--	--	--	--	--	32.61
Waste disposal zone	21.68	1.45	17.50	1.78	0.89	--	--	--	--	43.30
Management and service zone	2.62	2.15	19.84	4.71	0.09	--	0.13	0.03	--	29.57
Temporary construction land zone	23.72	2.43	42.49	1.84	0.33	--	--	--	--	70.81
Total	294.92	41.35	578.51	40.69	25.32	0.64	10.18	4.55	0.07	996.23

5.2.2.2 Size and quantity of damaged water conservation facilities

The damaged water conservation facilities by construction of this project are all biological facilities with a total size of 619.20hm^2. The sizes of damaged water conservation facilities in each zone are listed in Table 5.2.2.2-1.

Table 5.2.2.2-1 Forecasted size of damaged water conservation facilities unit：hm^2

Zone	Water conservation type		
Main project zone	Forestlands	Waste hills and waste lands	Subtotal
Main project zone	466.74	32.36	499.10
Earth borrow zone	31.94	--	31.94
Waste disposal zone	17.50	1.78	19.28
Management and service zone	19.84	4.71	24.55
Temporary construction land zone	42.49	1.84	44.33
Total	578.51	40.69	619.20

5.2.2.3 Volumes of waste earth, waste stone and waste slag

Construction of this project will produce a waste earth (stone and slag) volume up to 3.4284 million m^3, of which 3.2653 million m^3 for permanent waste earth (stone and slag) and 163100 m^3 for temporary waste earth (stone and slag). Permanent waste earth (stone and slag) comes from the waste produced from subgrade earth and stone works after long-distance transit and utilization, while the temporary waste earth comes from the topsoil stripped from earth borrow pits along the route which cannot meet subgrade filling earth requirement but can be used in land reclaiming after earth borrowing is finished or comes from the topsoil reserved for protecting land resource and for rebuilding land productivity.

The forecasted volumes of waste earth (stone and slag) produced from this project construction are listed in Table 5.2.2.3-1.

Table 5.2.2.3-1 Forecasted volumes of waste earth, waste stone and waste slag produced from this project construction unit: 10,000 m^3

Source of waste earth		Volumes of waste earth, waste stone and waste slag		
		Permanent waste earth (stone and slag)	Temporary waste earth	Subtotal
Total for the whole route		326.53	16.31	342.84
Of which	Earth borrow pits	--	16.31	16.31
	Waste earth banks	326.53	--	326.53

5.2.2.4 Possible soil erosion size and volume

1. Determination of soil erosion modulus

① Determination of soil erosion modulus background value

According to the investigations of current soil erosion in the project region, the soil erosion modulus background value is 1706t/km^2.a in main project zone, 1681t/km^2.a in earth borrow zone, 1298t/km^2.a in waste disposal zone, 1194t/km^2.a in management and service zone and 1230t/km^2.a in temporary construction land zone, respectively.

② Determination of soil erosion modulus during construction preparation period, construction period and vegetation restoration period

This project adopts analogical forecasting method to predict the soil erosion volume possibly caused by this project construction. The analogy project is selected to be the Ganzhou-Dingnan section (new construction project) of Jiangxi-Guangdong Highway in the nearby region which has similar natural conditions and similar soil erosion characteristics.

Through analogical forecasting, the soil erosion modulus in each zone of this project is shown in Table5.2.2.4-1:

Table 5.2.2.4-1 List of soil erosion modulus in each zone (t/km^2.a)

No	Zone	Construction preparation period	Construction period	Vegetation restoration period
1	Main project zone	--	11800	850
2	Earth borrow zone	--	13500	1000
	Of which : temporary waste disposal	--	17600	--
3	Waste disposal zone	--	20600	1000

No	Zone	Construction preparation period	Construction period	Vegetation restoration period
4	Management and service zone	--	7500	850
5	Temporary construction land zone	7500	7500	1000

2. Possible soil erosion volume

The possible soil erosion volume caused by this project construction mainly comes from two sources, one is the project construction's disturbance and damage on the original landform, land and vegetation, which will reduce or even deprive of the existing water conservation function in main project zone, earth borrow zone, management and service zone and temporary construction land zone, thus leading to soil erosion aggravation and soil erosion volume increase; another source is that the waste earth piled in waste banks may form denuded surface, which will possibly produce new water and soil erosion volume.

① Calculation formula of newly-added soil erosion volume:

A. Soil erosion volume produced from disrupted surface ground

$$W_{s1} = \sum_{i=1}^{n}(F_i \times (M_{s1} - M_0) \times T_i) \qquad (1)$$

B. Soil erosion volume produced from waste earth and slag

$$W_{s2} = \sum_{i=1}^{n}(S_i \times M_{s2} \times T_i) \qquad (2)$$

In which：

Ws_1： total newly-added soil erosion volume produced from disrupted surface ground, unit：t；

Ws_2：total waste slag erosion volume, unit：t；

n：forecasting unit, 1, 2, 3……, n-1, n；

F_i：surface size of forecasting unit *I*, unit：hm^2；

S_i： exterior surface size of waste slag heaping in forecasting unit *I*, hm^2；

Ms_1: soil erosion modulus of different forecasting unit after being disrupted, unit：t/（km^2.a）；

Ms_2: soil erosion modulus of waste slag face, determined by actually measured data from analogical project in accordance with the waste slag location's flood condition, rainfall parameter, waste earth/slag composition, and heaping face's landform, topography, heaping thickness, bottom slope and exterior slope, etc, unit：t/（km^2.a）;

M_0: soil erosion modulus background value of different forecasting unit, unit：t/（km^2.a）;

T_i：forecasting duration, unit：a。

② Possible soil erosion volume produced in each zone

From the soil erosion calculation according to analogical forecast and comparative analysis, it can be seen that when no water conservation measures are taken, construction of this project may possibly produce a total soil erosion volume of 270111t and a newly-added soil erosion volume of 229838t. The soil erosion volumes possibly created by this project construction are listed in Table 5.2.2.4-2; the forecasted soil erosion volumes possibly created by construction in each zone are listed in Table 5.2.2.4-3.

Table 5.2.2.4-2 Total soil erosion volume and newly-added soil erosion volume

No	Forecasting zoning	Soil erosion size (hm^2)	Newly-added soil erosion volume(t)	Total soil erosion volume(t)
1	Main project zone	819.94	182082	213950
2	Earth borrow zone	32.61	8970	10653
3	Waste disposal zone	43.30	20059	22194
4	Management and service zone	29.57	5408	6532
5	Temporary construction land zone	70.81	13319	16782
	Total	996.23	229838	270111

Table 5.2.2.4-3 Forecasted soil erosion volumes possibly created by construction in each zone

No	Zone	Forecasting period (a)	Erosion size (hm^2)	Forecasting duration (a)	Soil erosion modulus background value (t/km^2.a)	Forecasted soil erosion modulus (t/km^2.a)	Total newly-added soil erosion volume (t)	Total soil erosion volume (t)
1	Main project zone	Construction period	819.94	2.9	1706	11800	182082	212856
		Vegetation restoration period	128.67	1.0	1706	850	--	1094
		Subtotal	819.94				182082	213950

No	Zone	Forecasting period (a)	Erosion size (hm^2)	Forecasting duration (a)	Soil erosion modulus background value ($t/km^2.a$)	Forecasted soil erosion modulus ($t/km^2.a$)	Total newly-added soil erosion volume (t)	Total soil erosion volume (t)
2	Earth borrow zone	Construction period	27.17	2.2	1681	13500	7065	8069
		Vegetation restoration period	23.90	2.0	1681	1000	--	478
	Of which：temporary waste earth disposal	Construction period	5.44	2.2	1681	17600	1905	2106
		Subtotal	32.61				8970	10653
3	Waste disposal zone	Construction period	43.30	2.4	1298	20600	20059	21408
		Vegetation restoration period	39.30	2.0	1298	1000	--	786
		Subtotal	43.30				20059	22194
4	Management and service zone	Construction period	29.57	2.9	1194	7500	5408	6431
		Vegetation restoration period	11.83	1.0	1194	850	--	101
		Subtotal	29.57				5408	6532
5	Temporary construction land zone	Construction preparation period	70.81	0.1	1230	7500	444	531
		Construction period	70.81	2.9	1230	7500	12875	15401
		Vegetation restoration period	42.50	2.0	1230	1000	--	850
		Subtotal	70.81				13319	16782
Total			996.23				229838	270111

5.2.3 Possible soil erosion hazards

Along the Ganzhou-Ruijin Highway of Xiamen-Chengdu Expressway in Jiangxi Province, there are radiating rivers, and numerous natural and cultural landscapes, moreover the route adjoins to the famous Red Former Capital and Song City scenic spot in south China. During the construction process of the project, if no reasonable and effective water conservation measures are taken to timely prevent possible soil erosion, some negative impacts may be produced: the first impact is that it can produce some adverse effects on the operation safety of the road; the second impact is that it can damage to a certain degree the land resource and ecological environment along the route, and can produce disadvantageous influences to industrial and agricultural production, people's life, and flood control in downstream sections; the third impact is that it can bring some negative influence to the ecological landscape and humanity landscape of scenic spots along the route, affecting tour resource development and construction.

5.2.4 Comprehensive analysis

According to the above forecasting, the following guiding comments can be arrived:

(1) The main project zone, earth borrow pits and waste banks are the key areas of soil erosion in this project, which will be considered as the key prevention zone in this scheme. During the construction of the main project, it is required to adopt retaining and arresting measures and provisional protection measures in time, to do good work in water drainage, to try to shorten the exposure time of fresh slopes so as to prevent the slopes from being emerged and eroded by rain water, thus leading to collapse. According to the project scheduling, it is required to reclaim the earth borrow pits and waste banks by covering topsoil for growing crops and planting trees so as to reconstruct land productivity and to restore vegetation.

(2) The design of water and soil conservation scheme will implement a principle of combining engineering measures with planting measures and combining temporary measures with permanent measures; the retaining/arresting measures and drainage measures will go first and the planting measures will be advanced as earlier as possible; at the same time construction management will be strengthened, construction processes will be arranged rationally, the denuded time and size of surface ground will be shortened, construction in rainy season will be avoided as much as possible so as to reduce occurrence of soil erosion.

(3) During the construction sage, the large cut and fill areas of main project, the excavation areas in earth borrow pits and piling areas in waste banks are sensitive to soil erosion, these areas will be the key areas for water and soil conservation monitoring for this project construction.

Although construction of this project involves large volumes of cut/fill earth and stone works, and involves large-scale perturbation and damage to the original landform, land, and vegetation, which may produce soil erosion, but as long as planning is coordinated, construction is reasonable, prevention measures are designed so to promptly and effectively prevent possible new soil erosion, new soil erosion and its adverse impacts can be avoided and prevented during the engineering construction stage.

5.3 Prevention scheme for water and soil erosion

5.3.1 Soil erosion prevention zoning

According to project construction characteristics, main project layout, possible soil erosion, soil erosion preventing responsibility and objectives in each construction area, the responsible scope for soil erosion prevention for this project is divided into 5 zones, namely: main project prevention zone, earth borrow pit prevention zone, waste bank prevention zone, management and service area prevention zone and temporary construction land prevention zone.

(1) Main project prevention zone

The main project prevention zone includes road subgrade, bridges, culverts, and intersections with a total size of 819.94hm^2. The key content for soil erosion prevention in this zone is to well conduct road slope protection, subgrade and pavement drainage, and afforestation and beautification for subgrade and pavement.

(2) Earth borrow prevention zone

There are a total of 12 earth borrow pits involving a earth borrowing volume of 3.7106 million m^3 and occupying a total land size of 32.61hm^2. The key content for soil erosion prevention in this zone is to well protect the waste piling for temporary waste disposal, to build water drainage system for earth borrow pits, to protect cutting slopes formed after earth excavation, and to remedy and utilize the excavation stage and face.

(3) Waste disposal prevention zone

There are a total of 24 waste banks involving a planned waste earth disposal volume of 3.2653 million m^3 and occupying a total size of 43.30hm^2. The key content for soil erosion prevention in this zone is to well retain and arrest the waste earth, to well build drainage system in waste banks, to well protect side slope of waste earth piling, and to remedy and utilize waste earth piling stage.

(4) Management and service area prevention zone

This zone includes service areas, tollgate stations, management centers and maintenance divisions occupying a total land size of 29.57hm^2. The key content for soil erosion prevention in this zone is to build drainage system and to protect slopes in this prevention zone on the basis of structure construction, and to plant and beautify denuded places so as to form a beautiful landscape environment while preventing and controlling soil erosion.

(5) Temporary construction land prevention zone

This zone includes the construction sites for large and median bridges, tunnels, pre-fabrication grounds and detour roads, which occupy a total land size of 70.81hm^2. The key content for soil erosion prevention in this zone is to build temporary drainage system, to protect slopes and to timely remedy and utilize the lands temporarily occupied after the completion of the project construction.

5.3.2 Prevention measure system for soil erosion

The prevention measure system for soil erosion for this project is diagrammed in Fig. 5.3.2-1.

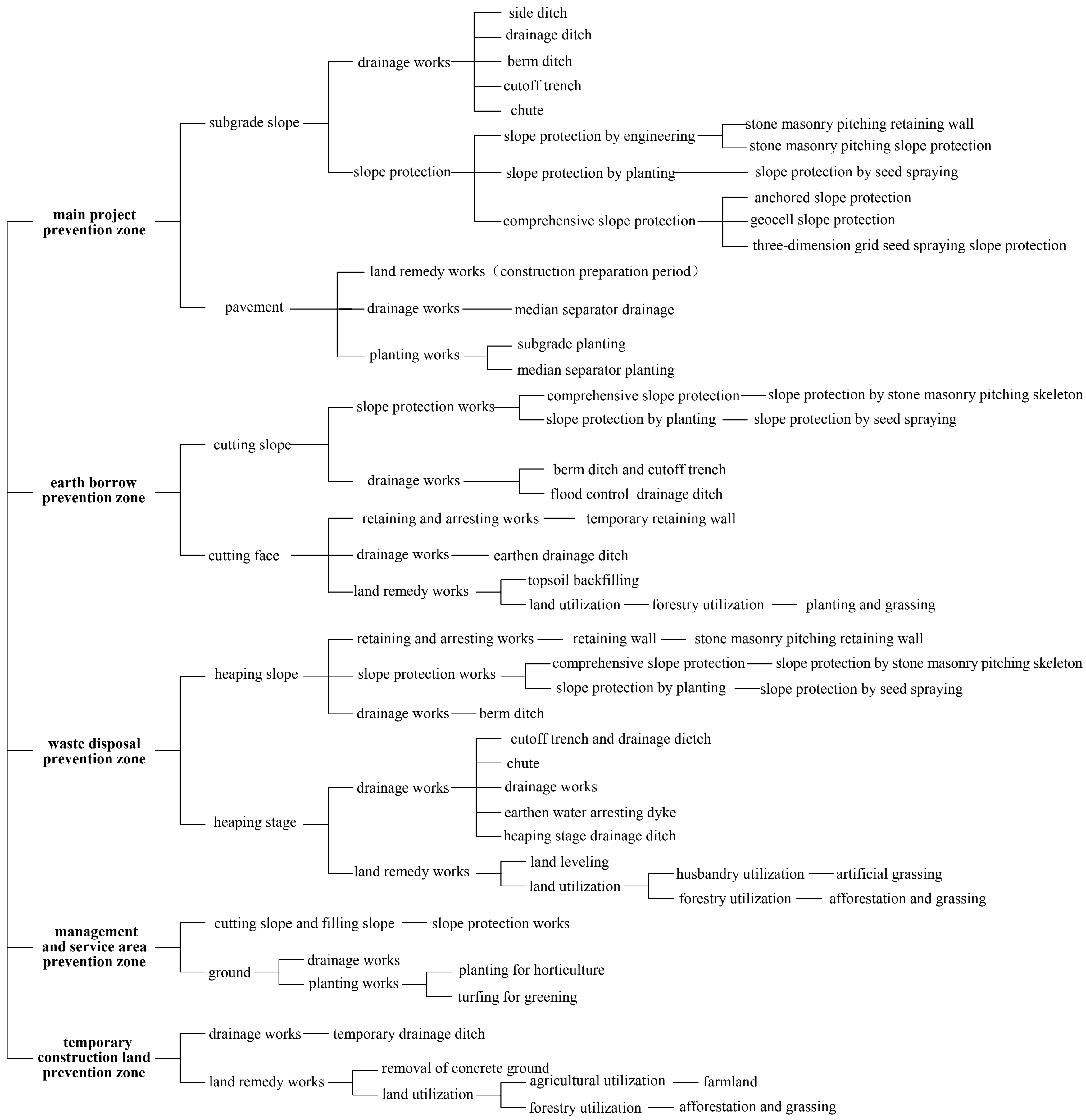


Fig. 5.3.2-1 Chart of prevention measure system for soil erosion

5.3.3 Overall arrangement and design of prevention measures

5.3.3.1 Earth borrow prevention zone

(1) Temporary waste earth produced from earth excavation should be collectively piled on the working stage formed by earth borrowing. The waste earth heap shall be less than 3m high with side slope gradient controlled within 1:1.5; the toe of slope uses earth strawbag to retain temporarily, exposed face shall be covered by grass.

(2) The slope gradient produced from earth excavation shall be controlled during earth excavation. When the slope height is less than 6m, the side slope gradient shall be controlled within 1:1.5; when the slope height is larger than 6m, the side slope gradient shall be controlled within 1: 2.0, and starting from the toe of slope, a 2-3m wide slope stage shall be set up every 6m, which inclines inside and shall be no less than 4% in inclinity.

(3) After earth borrowing is finished, the cutting slope shall be promptly protected. Generally when the slope height is smaller than 20m, seed spraying shall be adopted to protect the slope; when the slope height is larger than 20m, stone masonry pitching skeleton and grass planting within the skeleton shall be adopted below 6m to protect slope and seed spraying shall be adopted above 6m to protect the slope.

(4) It is required to timely build drainage system for earth borrow pits. Before earth excavation, according to the catchment size in front of the pit, cutoff trench shall be set up 5m from the excavation boundary line in the pit; the stage formed by earth excavation shall be timely remedied and masonry pitching stone berm ditch shall be build in the inner side of the stage, which links with the nearby cutoff trench; after earth excavation, flood control drainage ditch shall be built in 1m from the toe of cutting slope to clear (dredge) the rain water gathered in the slope toe and according to the rain runoff gathered in cutting stage after leveling, earthen drainage ditches with spacing of 50m shall be dug to collect and clear the surface runoff in the stage face, and in the water outlet of the pit, sand settling basin shall be set up to filter and settle rain runoff before discharging outside.

(5) After earth borrowing is finished, the excavating stage face shall be remedied and covered with earth and the land-use purposes shall be determined according to the borrow pit's location, slope and quality.

5.3.3.2 Waste disposal prevention zone

(1) According to the quantity and type of produced waste earth, the waste earth shall be dumped collectively in waste slope or low-lying place which are advantageous to waste disposal, and retaining works shall be built before waste earth heaping, whose engineering form depends on waste volume, heaping location and terrain characteristics. The waste earth shall be piled in layers and compacted in each layer. When piling waste earth, humus soil and weathering matters shall be piled in the surface layer.

(2) The waste earth heap's slope gradient shall be controlled within 1:2.0; When the waste earth heap's slope height is H>6m, starting from toe of slope, an inside-inclined heaping stage shall be set up every 6m, which is no less than4% in inclinity and generally 2m wide.

(3) After the waste bank terminates its use, the waste heap slope shall be promptly protected. Generally when the slope height is smaller than 20m, seed spraying shall be adopted to protect the slope; when the slope height is larger than 20m, stone masonry pitching skeleton and grass planting within the skeleton shall be adopted below 6m to protect slope and seed spraying shall be adopted above 6m to protect the slope.

(4) It is required to timely build drainage system for waste earth banks. First, before waste earth heaping, according to the land size occupied by waste earth and slag, and the final heaping stage elevation, cutoff trench (drainage ditch), chute and sand settling basin shall be set up in its surroundings; second, during the process of waste earth heaping, the formed heaping stage shall be timely remedied and masonry pitching berm ditches shall be built in the inside of the stage which directly link with chutes; finally, the heaping stage face formed after waste earth disposal shall be remedied promptly and water arresting dyke shall be built in the top of heaping slope and masonry pitching drainage ditch with spacing of 50m shall be built in the heaping stage face which links to cutoff trench (drainage ditch), or chute.

(5) According to the waste earth (stone) quality condition, remedied heaping stage can be renovated into forestland or meadowland by planting trees and grass for reconstructing vegetation.

5.3.3.3 Temporary construction land prevention zone

(1) Before temporarily using lands for construction, the plain earth shall be ramped and hardened, temporary protection drainage works shall be set up; slopes formed from building detour roads shall be protected by sodding and masonry pitching skeleton.

(2) After the temporary construction land terminates its use, it is required to

remove the hardened concrete surface floor which needs to renovate and utilize, and it is required to clear up the site and debris.

(3) The remedied temporary construction lands shall be further treated on their surface, innovated and utilized according to their quality condition and the original land use condition. The temporary construction lands with good local growth condition can be transformed into farming land; those with bad local growth condition can be transformed into forestland.

5.3.4 Quantity of water conservation measures

The quantities of water conservation measures in each prevention zone for this project are listed in Table 5.3.4-1~Table5.3.4-3.

Table 5.3.4-1 Quantities of water conservation measures in earth borrow prevention zone

Item	Slope protection by stone masonry pitching skeleton		Slope protection by seed spraying	Cutoff trench		Berm ditch		Drainage ditch for flood control	
	Stone masonry pitching (m^3)	Seed spraying (m^2)	Seed spraying (m^2)	Stone masonry pitching (m^3)	Earth works (m^3)	Stone masonry pitching (m^3)	Earth works (m^3)	Stone masonry pitching (m^3)	Earth works (m^3)
Total	578.1	3490.2	48052.6	1726.4	2535.6	1367.7	1710.3	1692.9	2982.8

Item	Earthen drainage ditch	Sand settling basin	Temporary retaining wall	Topsoil backfilling	For forestry (hm^2)	
	Earth works(m^3)	Earth works(m^3)	Earth strawbag (m^3)	Earth works (10,000 m^3)	I	II
Total	4367.1	552.2	3778.4	14.6	16.0	7.9

Table 5.3.4-2 Quantities of water conservation measures in waste disposal prevention zone

Item	Stone masonry pitching retaining wall	lope protection b stone masonry pitching skeleton		Slope protection by seed spraying	Cutoff trench (drainage ditch)		Chute		Sand settling basin	
	Earth excavation (m^3)	Stone masonry pitching (m^3)	Stone masonry pitching (m^3)	Seed spraying (m^2)	Seed spraying (m^2)	Stone masonry pitching (m^3)	Earth excavation (m^3)	Stone masonry pitching (m^3)	Earth excavation (m^3)	Stone masonry pitching(m^3)	Earth excavation (m^3)
Total	2106.9	3817.2	439.5	2653.7	102383.3	9775.5	14433.7	4036.6	5309.8	352.5	723.3

Item	Berm ditch		Water arresting dyke	Drainage ditch in stage face		Ground leveling	Earth covering	For husbandry	For forestry
	Stone masonry pitching(m^3)	Earth excavation (m^3)	Earth filling (m^3)	Stone masonry pitching(m^3)	Earth excavation (m^3)	Leveling of heaping stage face (m^2)	Earth works (10,000 m^3)	Artificial grassing (hm^2)	Afforestation and grassing (hm^2)
Total	3587.3	4484.1	1130.4	4880.1	7398.3	393546.0	7.0	13.7	25.6

Table 5.3.4-3 Quantities of water conservation measures in temporary construction land prevention zone

Item	Drainage works(m^3)	Removal of concrete floor (m^3)	Forestry utilization (hm^2)	Agricultural utilization (hm^2)
Total	4263.0	6303.4	42.50	28.31

5.4 Water conservation investment estimate

The total static investment for this project's water conservation measures is 320.1901 million yuan (including those already incorporated into the main project investment budget: 300.8420 million yuan), and the total investment is 346.5437 million yuan (including those already incorporated into the main project investment budget: 319.7852 million yuan). Among the total investment, the cost for engineering measures is 269.861 million yuan (including those already incorporated into the main project investment budget: 260.1192 million yuan), the cost for planting measures is 16.5543 million yuan (including those already incorporated into the main project investment budget: 11.7424 million yuan), the cost for temporary works is 5.975 million yuan (including those already incorporated into the main project investment budget: 5.3198 million yuan), the independent cost is 18.4739 million yuan (including those already incorporated into the main project investment budget: 14.8982 million yuan).

Chapter 6 Public Participation

6.1 Public participation survey

Under the energetic cooperation of the construction unit and local government along the route, the assessment unit has carried out the first time public participation survey in March-April of 2005. With the progress of this project, we conducted the second public participation investigation on Sept 2005. Furthermore, public consultation has been carried out during December 2004 when prepared for the EIA outline.

The public participation survey were carried in two forms: filling in family investigation form and group interview. Before investigation, the public participation investigation form was printed with contents to be investigated. A sample investigation form is shown in Attachment 3.On the basis of filling in two types of investigation forms, this public participation investigation made a statistics and summary on the investigated information, which was finally summarized into the public participation investigation results for this project and corresponding opinions and suggestions are proposed.

In addition, according to the "Resettlement Action Plan" of this project(The World Bank Loan Project Office of JPCD, November 2005), PRO organized design unit, consulting organization, local ROs and DPs to disclose and discuss the major issues involved in the stage of resettlement planning.

The main activities of information disclosure, public participation and consultation conducted are listed in Table6.1-1.

Table6.1-1 Main activities of information disclosure, public participation and consultation conducted

<table>
<tr><th>No.</th><th>Date</th><th>Contents</th><th>Participants</th><th>Organizer</th><th>Report</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Mar.~Apr.2005</td><td rowspan="2">Direction of alignment,
Environmental protection measures,
Public opnion survey</td><td>260 persons
The administrative villages and units involved are: Yanba, Chaotian, Yunshishan, Tiancun, Xiacun, the farm machinery station in Yunshishan Township; Jiuling, Yangkou, and Bai'e in Bai'e Township; Banjing, Shanbei in Xiaomi Township; Xiashan, Shuiduan, Yanbei, Sanmen primary school, Maoping, and Luo'ao in Luo'ao Township; Dawan, Kuxin, Yaokou, Beijiao, Yingqian, and Zhongchang in Hefeng Township; Dunshang in Jiangkou Township;Maodian, Yangtang, Dongtian, Shangba, Wangao, Huanglong and Taiyangping in Maodian Township; Luobian, Huangsha and Hele in Shuixi Township.</td><td rowspan="4">Research Institute of highway, the Ministry of Communications</td><td rowspan="4">EIA</td></tr>
<tr><td>65 persons, 6 group interviews
Huichang County's Bai'e Township and Xiaomi Township; Yudu County's Hefeng Township, Luo'ao Township; Ganxian County's Maodian Township; Zhanggong District's Shuixi Township.</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Sep. 2005</td><td rowspan="2">Direction of alignment,
Environmental protection measures,
Public opnion survey</td><td>386 persons
Miaobei, Gaotian and Juecun in Xinbei Township; Liren, Shanglong and Xialong in Licun;Yuyang, Qiantang and Daling in Huanglin Township; Dunshang, Ankeng, Santuan, Longse and Jiaolin in Jiangkou Township; and Hongxing, Huoxing, Wanxing, Qiangong, Datian, Hebei, and Sanmen middle school in Xijiang Township</td></tr>
<tr><td>40 persons, 3 group interviews
Huichang County's Xijiang Townshi;Yudu County's Xinpi township; Ganxian County's Jiangkou Township;</td></tr>
<tr><td>3</td><td>Jan.~Oct.2005</td><td>Direction of alignment</td><td>Design Institute, local ROs, Village Administration and representatives of DPs</td><td rowspan="7">PRO, local ROs</td><td rowspan="7">RAP</td></tr>
<tr><td>4</td><td>May~Oct.2005</td><td>Location of Passage, culvert, overpass</td><td>Design Institute, PRO, local ROs, Village Administration, representatives of DPs</td></tr>
<tr><td>5</td><td>May~Jul.2005</td><td>Quantity of land acquisition and house relocation,
Ways and willingness of resettlement</td><td>497 persons,
Wuhan University, PRO, local ROs, affected enterprises and enterprises, DPs</td></tr>
<tr><td>6</td><td>Apr.~Jul.2005</td><td>Land compensation rates</td><td>PRO, local ROs, Village Administration, representatives of DPs</td></tr>
<tr><td>7</td><td>May~Jul.2005</td><td>House compensation rates</td><td>PRO, local ROs, affected enterprises and undertakings, villages, team collectives and DPs</td></tr>
<tr><td>8</td><td>May 2005</td><td>Social impact of the Project</td><td>Zhongshan University, PRO, local Rosand DPs</td></tr>
<tr><td>9</td><td>May~Jul.2005</td><td>Resettlement of enterprises and undertakings</td><td>PRO, local ROs, affected enterprises and undertakings</td></tr>
</table>

6.2 Individual investigation and household interview

6.2.1 Goal and method

Individual investigation and household interview is to comprehend the basic attitude to this engineering construction, familiarity with policies on land acquisition of aquatic production fields, removal and resettlement for road project, and understanding degree to possible environmental impact, of people along the project, especially those people who may be subject to land acquisition, removal and resettlement, and to solicit their suggestions for adopting measures to mitigate these adverse effects. Meanwhile, the survey result is fedback to the construction unit and designing unit for adoption or proper solution at the time of design and construction.

In conducting individual investigation and household interview, the investigation table is directly sent to each subject and the content, requirement and goal of the investigation are explained to them, then the investigated subjects fill in the table.

6.2.2 Investigated subjects and number

This investigation scope covers 12 townships: Ruijin City’s Yunshishan Township; Huichang County’s Bai’e Township and Xiaomi Township; Yudu County’s Hefeng Township, Luo’ao Township, Xinpi township, Licun Township and Huanglin Township; Ganxian County’s Jiangkou Township and Maodian Township; Zhanggong District’s Shuixi Township and Huichang County’s Xijiang Township. The administrative villages and units involved are: Yanba, Chaotian, Yunshishan, Tiancun, Xiacun, the farm machinery station in Yunshishan Township; Jiuling, Yangkou, and Bai’e in Bai’e Township; Banjing, Shanbei in Xiaomi Township; Xiashan, Shuiduan, Yanbei, Sanmen primary school, Maoping, and Luo’ao in Luo’ao Township; Dawan, Kuxin, Yaokou, Beijiao, Yingqian, and Zhongchang in Hefeng Township; Miaobei, Gaotian and Juecun in Xinbei Township; Liren, Shanglong and Xialong in Licun Township; Yuyang, Qiantang and Daling in Huanglin Township; Dunshang, Ankeng, Santuan, Longse and Jiaolin in Jiangkou Township; Maodian, Yangtang, Dongtian, Shangba, Wangao, Huanglong and Taiyangping in Maodian Township; Luobian, Huangsha and Hele in Shuixi Township; and Hongxing, Huoxing, Wanxing, Qiangong, Datian, Hebei, and Shimen middle school in Xijiang

Township. The distribution of investigation scope for this project is shown in Fig. 6.2.2-1.

This investigation recovered 646 household interview questionnaires and interviewed 646 people, of which 530 farmers, accounting for 82.05% in the total subject number for household interview. The households interviewed make their living mainly from growing crops accounting for 53% followed by other sideline productions and breeding, accounting for 25% and 15% respectively. Among those subjects for household interview, 17 people have college and above education, 146 people have high school and specialized technical school education, 331 people have junior school education, 143 people have elementary school education. For details see Fig. 6.2.2-1a, 6.2.2-1, and 6.2.2-1c.

Fig. 6.2.2-1a Educational compostion of subjects in household interview

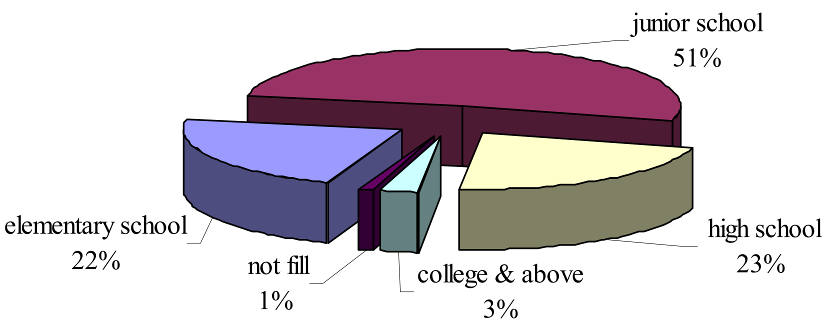


Fig. 6.2.2-1b Annaul income of household in household interview

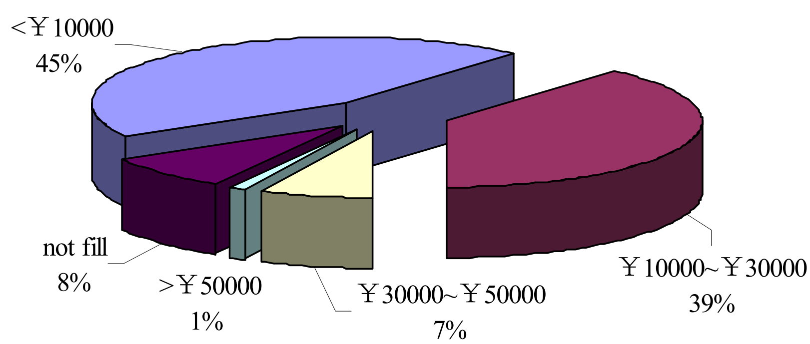
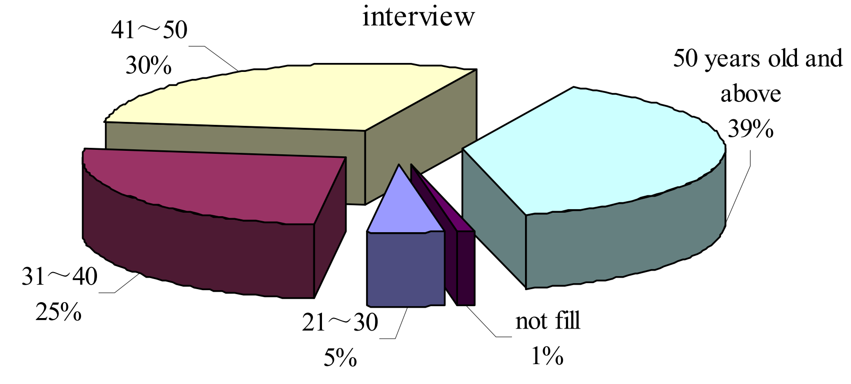


Fig. 6.2.2-1c Age composition of subjects in household interview



6.2.3 Results of individual investigation and household interview

The results of individual investigation and household interview are shown in Table 6.2.3-1.

Table 6.2.3-1 Result summary of household interview

Type			Person number	Percentage（%）
Do you agree with construction of this highway?		Yes	548	84.83
		No	16	2.48
		Whatever	67	10.35
		Unfilled	15	2.32
Direct impact on your family by construction of this highway		Land acquisition	192	29.67
		Removal	20	3.07
		Land acquisition and removal	177	27.36
		No land acquisition and no removal	124	19.18
		Other	26	4.04
		Unfilled	109	16.89
Whether construction of this highway will produce impact on your family		Serious impact	88	13.56
		Some impact	212	32.85
		Slight impact	116	18.03
		No impact	114	17.63
		Unfilled	116	17.93
On which aspect the impact will be exerting	Positive impact	Economic income	234	36.21
		Life quality	165	25.55
		Production and labor	191	29.64
		Daily movement	307	47.51
		Others	25	3.85
	Negative impact	Economic income	94	14.58
		Life quality	100	15.54
		Production and labor	87	13.51
		Daily movement	89	13.72
		Others	55	8.45
	Unfilled		113	17.51
If your family is subject to land acquisition, removal and resettlement, do you have objection?		Yes	137	21.16
		No	359	55.62
		Whatever	85	13.16
		Unfilled	65	10.07

Type		Person number	Percentage（%）
Do you know the compensation policies on land acquisition, removal and resettlement?	Yes	23	3.60
	Some	175	27.02
	No	345	53.42
	Unfilled	103	15.96
Are you satisfied with the compensation policies?	Yes	77	11.96
	Basically yes	115	17.79
	No	86	13.39
	Whatever	61	9.40
	Unfilled	307	47.46
What kind of environmental pollution do you think will exert relatively big impact on you during construction stage?	Noise	364	56.38
	Flying dust	343	53.13
	Water pollution	260	40.18
	Other	35	5.45
	Unfilled	147	22.83
What kind of environmental pollution do you think will exert relatively big impact on you during operation stage?	Noise	375	58.10
	Flying dust	221	34.21
	Automobile exhaust	236	36.60
	Other	26	4.04
	Unfilled	163	25.25
What kind of measures do you propose to eliminate such impacts?	Road planting	429	66.48
	Sound barrier	268	41.48
	Route adjustment	78	12.00
	Other	10	1.58
	Unfilled	107	16.52
Do you have any other suggestions?	(1) Before construction the rural roads shall be built up first for convenient construction. Water and electricity shall be kept available to the villages. Agricultural water conservancy facilities shall be kept smooth during construction and the constructed electric power facilities （electricity-powered drainage and irrigation station）shall not be influenced. The original ditches and roads should be kept noncongested. (2) Major entrances, exits and underpasses (passageways) shall be set up for convenience of people's trip. More underpasses shall be set up and the underpasses shall be set up locally for convenience of people's trip. It is suggested to build pedestrian underpasses in Zhangkeng and Xianankeng, and to reserve entrance and exit in Zhaixiamen, Xijiang Township and Hefeng Township. (3) Road construction is beneficial to the country and the people, so there is full support. Road construction is development, but it will produce some impact on villagers. As the old saying goes that people living in mountains make a living from the mountains and people living in countryside make a living from the countryside. So the villagers' interests shall not be affected, particular attention shall be given to noise. It is required to begin the construction earlier so to serve local economy. (4) Because Yunshishan village has more people than land, it is suggested that the route not take cultivated land and remove houses as few as possible. To guarantee residents' daily movement, before dismantling houses the government shall arrange land for new houses and people's life. The route should avoid densely-populated residences. (5) It is suggested to move the route northward by 300～500m and to build a bridge passing floodplain areas of Qiangong village and Datian village. It is suggested that the highway pass along rivers or in areas with many waste hills. (6) it is suggested to build an auxiliary bridge when building the Gongjiang River bridge in Jiangkou for the convenience of traffic and people. (7) Compensation policy should be clear and adjusted according to national standard, compensation fee should be sent to families, should not be diverted and annexed. Compensating fund should be open in public bulletin and transparent. Village collective shall be compensated at the same time. Acquisition of tomb land shall be compensated, especially the ancestral tombs. (8) To pay attention to soil erosion, highway afforestation, noise, wind-borne dust, etc; to strengthen highway afforestation and to build sound insulating wall. Emphasis shall be given to the construction and planning of access roads in villages and farmer housing planning shall also be combined. (9) Local resources shall be utilized and local labor force shall be hired. Job opportunities shall be given preferentially to local farmers and some construction works shall be contracted to local people.		

6.3 Group interview

6.3.1 Theme of group interview

The theme of group interview is as follows: positive impact of construction of the proposed highway to local social economic development; which kinds of adverse impact caused by construction of this project, any mitigation measures and suggestions.

6.3.2 Group interview subjects

The Project convened 9 group interviews with their subjects and number shown in Table 6.3.2-1.

Table 6.3.2-1 Group interview subjects

Place	Interviewed subjects and number
Bai'e Township	Township government 5 persons, township land management station 1 person, township forest management station 1 person, Bai'e village 1 person, Yangkou village 1 person, Jiuling village 1 person, a total of 10 persons.
Xiaomi Township	Township government 4 persons, township land management station 1 person, township forest management station 1 person, township mineral management station 1 person, township party office 1 person, Shanbei village 1 person, Banjing village 1 person, a total of 10 persons.
Luo'ao Township	Township government 2 persons, township water management station 1 person, township land management station 1 person, township forest management station 1 person, township agricultural station 1 person, township water conservancy station 1 person, township women association 1 person, township planning office 1 person, Yanbei village secretary 1 person, Luo'ao village secretary 1 person, Shuiduan village secretary 1 person, Xiashan village secretary 1 person, Maoping village secretary 1 person, Sanmen village secretary 1 person, a total of 15 persons.
Hefeng Township	Township government 2 persons, township forest management station 1 person, township water management station 1 person, township land management station 1 person, township agricultural station 1 person, township water conservancy station 1 person, township women association 1 person, Zhongchang village secretary 1 person, Yingqian village secretary 1 person, Kuxin village director 1 person, Beijiao village secretary 1 person, Dawanvillage 1 person, Yaokou village secretary 1 person, a total of 14 persons.
Maodian Township	township land management station 1 person, township water management station 1 person, township water conservancy station 1 person, Shangba village secretary 1 person, Yangtang village director 1 person, Taiyangping village director 1 person, Maodian village director 1 person, Dongtian village director 1 person, Huanglong village director 1 person, Wanhao village secretary 1 person, a total of 10 persons.
Shuixi Township	Township government 2 persons, township people's representative 1 person, township land management station 1 person, Huangsha village secretary 1 person, Luobian village secretary 1 person, a total of 6 persons.
Jiangkou Township	Vice township government director 1 person, vice chairman 1 person, township government workers 3 persons, Ankeng village secretary 1 person, Santuan village secretary 1 person, Longshe village secretary 1 person, Jiaolin village secretary 1 person, Dunshang village secretary 1 person, forest management station director 1 person, a total of 11 persons.
Xinbei Township	Vice township government director 1 person, township government workers 3 persons, forest management station director 1 person, water management station director 1 person, water conservancy station director 1 person, agricultural machinery station director 1 person, land management station director 1 person, Miaobei village secretary 1 person, Juecun village secretary 1 person, Gaotian village secretary 1 person, Yudu county highway office 2 persons, MOC highway research institute 2 persons, a total of 16 persons.
Xijiang Township	Vice township government director 1 person, land management station vice director 1 person, water management station director 1 person, forest management station director 1 person, Huichang transportation bureau vice director 1 person, Huoxing village secretary 1 person, Hongxing village

Place	Interviewed subjects and number
	secretary 1 person, Hebei village secretary 1 person, Wanxing village secretary 1 person, Qiangong village secretary 1 person, Datian village accountant 1 person, MOC highway research institute 2 persons, a total of 13 persons.

There are105 participants in the above 9 group interviews.

6.3.3 Summary of group interview memorandum

Positive impact of construction of the proposed highway to local social economic development

All cadres and people in each village and township support the construction of this highway, and hope this project to be built as soon as possible. They think that the proposed highway is a link and bridge connecting with the east coastal regions and its construction is good to economic development, people's life and production along the route. Road construction helps to promote the gathering and movement of local people, logistics, and information, and improves the ability to invite outside investment.

⑵ Possible adverse impacts on local area by construction of the highway and their mitigation measures and suggestions

① Because of local concentrated residence, it is hoped that the transportation design department build an access within the territory of Bai'e Township in order to facilitate transportation and quicken local development. It is required to set up an access and culvert in Hefeng Township.

② Jiangkou Township proposed that specific attention shall be given to building detour roads for the two river-crossing bridges for the convenience of movement of people living in the south bank of Gongjiang River. It is suggested that the construction unit shall enhance connection with local government and villages and shall respect farmers' opinions and suggestions.

③ For the sake of people's movement, village roads shall be well maintained.

④ Because road construction involves large volume of earth works, so it is required to do good work in acquiring national public forestlands and to try to avoid national class 2 protection plants （camphor tree）, all fire use in the open is forbidden so to prevent forest fire. It is suggested that after construction the vegetation restoration of earth borrowing shall be planted by grass and trees, and the opinions of mountain owners shall be solicited to well conduct the vegetation restoration. Land acquisition and removal and resettlement shall be open and transparent in strict accordance with applicable standard so as to prevent fake and dishonest behavior from happening.

⑤ Road construction will take up lands. Land should be saved to one's best by building bridges in every possible places. Reclaiming of temporary land use shall be well solved.

⑥ Road construction will bring water pollution, air pollution, noise pollution and ecological environmental damage during the construction and operation stages. After the project is built up, the air, noise, water, and ecological environment, etc. should be up to standard according to national requirement, and it is required to conduct noise prevention and planting in advance.

⑦ Road construction will also exert an influence on village planning, water conservancy facilities and new rural construction and other respects. It is required to well protect the existing water conservancy facility, it is required to consider the height of river section crossing Chengjiang River and to consider farmland irrigation and prevention of floodplain. Local water conservancy department should get involved ahead of time, and it is forbidden to dispose of waste residues arbitrarily. It is proposed to do good water conservancy repair, passageway repair and road afforestation. If damaged, they should be restored to original appearance after the project is completed. In addition, for the soil erosion produced, planting expense subsidy should be considered.

⑧ House removal must go simultaneously with resettlement planning and village/town construction. For people’s house removal, it is suggested to further consider the relocating problem, compensation standard, newly-built house land, sidewalk problem, etc. so as to protect the interests of involved farmers and try to improve land acquisition and removal compensation standard.

⑨ Farmlands, houses, trees, ancestral graves, water conservancy projects, water protection works, and environmental protection facility involved in the road construction shall be compensated or restored according to national standard.

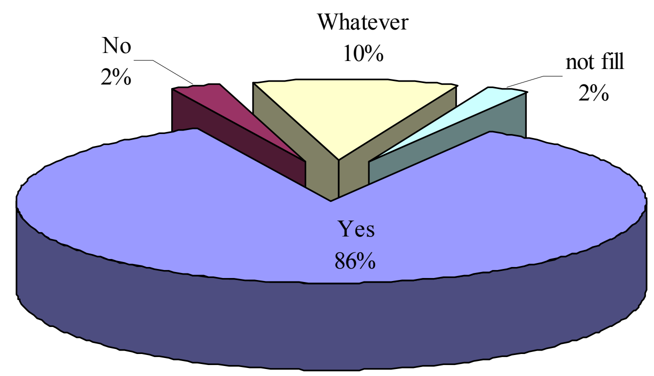
6.4 Major opinions and adoption

6.4.1 Major opinions

Through comprehensive analysis of public opinions, the opinions proposed by the inhabitants and government along the route on this highway construction are mainly embodied in the following several aspects:

(1) Along the proposed highway, the local governments of villages and townships all support construction of this road very much, most inhabitants approve of construction of this road, approximately 84.83% of the investigated subjects approve this engineering construction, believing that construction and operation of this road can promote local economic development, can help commodity circulation, can raise their living standard, they indicated that they agree, or conditionally agree to the land acquisition, removal and resettlement. 10.35% of the investigated subjects thought that construction of this road does not concern them very much, and 2.48% of them worried that the road construction may bring inconvenience to their life, therefore do not approve construction of this road. For details, see Fig. 6.4.1-1

Fig. 6.4-1 Do public agreement with construction of this highway?



(2) Approximately 60.1% of households involved in this public participation and investigation are to be removed and resettled. About 64.4% of the households thought that the road construction would influence their lives. Approximately 30% are satisfied and basically satisfied with the compensation policy of the government and most of them understand poorly the compensation policy. The investigation indicated that about 36% and 30% of the subjects thought that this highway construction can enhance their income and bring convenience to their production respectively; about 26% and 48% of the subjects thought that the road can improve their quality of life and access conditions respectively; still there are 19% of the subjects who pointed out that the highway construction can possibly reduce the living standard of some people along the route and

can affect their movement, they suggested to raise compensation standard for land acquisition if possible, and such compensation should be sent directly to the households in time.

(3) The local governments and people along the route are very concerned with the flying dust, noise, and water pollution problems caused by this project during construction stage. About 56.4% of the subjects thought that the road construction would produce noise pollution; about 53.1% thought that the construction might produce flying dust; about 40.2% pointed out that the water pollution during construction stage could also impact their life. Therefore, supervision and management should be strengthened over the construction; emphasis shall be given to provide a normal production and living condition to people along the route.

(4) After construction and operation of the proposed highway, people are all concerned with the pollution problems such as traffic noise, road dust and automobile exhaust discharge. 66.5% of the subjects suggested to adopt highway planting to mitigate the adverse impacts, moreover, about 41.5% of the subjects suggested to adopt "sound-proofing wall" to reduce traffic noise. Therefore, in addition to earnestly adopting the environmental protection measures proposed in this report, this project must also conduct construction of highway planting belt, msu control the traffic noise, automobile exhaust and road surface dust pollution produced from this project in a permissible scope.

(5) Selection of highway route alignment can have certain influence on the inhabitants along the route. About 12% of the subjects proposed to adjust the route so to reduce adverse impacts on the people, and they proposed an adjustment plan that they believe to be more appropriate. This assessment will truthfully feedback the actual circumstances proposed from people along the route to the design unit and the owner, who should fully consider the inhabitant's actual interests, and if permitted by the project, satisfy local people’s demands as much as possible.

6.4.2 Adoption of opinions

Concerning the above problems addressed by the public, the route design has fully adopted the opinions of local people and governments long the route and comprehensively considered various impacting factors. The adoption of major opinions is as follows.

(1) The route sets up Yudu interchange in the territory of Yudu County. The original Yudu interchange in the "Feasibility Study Report" links with Yudu-Pangushan road, and then links with National Road 323 and the Yudu County town through innovating the Yudu-Pangushan Road. This connection scheme was firmly opposed to by Yudu County who believes that this is disadvantageous to the transportation and access of Yudu County town and the Chalin Industrial Park. The current design document has made some adjustments on the connection scheme for Yudu interchange, which will link with the constructed roads in the Chalin Industrial Park of Yudu County, and by these constructed roads and by the Red Army Bridge it will link with Yudu County town and National Road 323, thus in this way the Yudu interchange can conveniently connect the Industrial Park, the Yudu County town and National Road 323 simultaneously, and this is also beneficial to traffic control in Yudu county town and to resettlement of immigrants.

(2) The route will overpass Ganjiang River for one time and Gongjiang River for three times, the people living in the two river banks near the bridge sites requested to add pedestrian and bicycle sidewalks in the two sides of bridges. The designing unit has considered this request of local people and has designed pedestrian and bicycle sidewalks of 1.5m wide each in the two sides of bridges.

6.5 Public opinions survey on resettlement

According to the "Resettlement Action Plan" of Third Jiangxi Highway Project (The World Bank Loan Project Office of JPCD, November 2005), PRO conducted a survey on the recommended alignment during May~July 2005, 497 persons over 15 years old were selected from 497 affected households (one for each household) for a questionnaire survey on the construction of the highway, the results of the survey are shown in Table 6.5-1.

Table6.5-1 DPs' Opinions and Recommendations

Survey Content	Opinion or recommendation	Responding proportion %
I.If knowing the construction of expressway? (single choice)		
	1. Yes	42
	2. Not much	38
	3. No	20
II.If agreeing construction of expressway? (single choice)		
	1.Yes	96
	2. No	1

Survey Content	Opinion or recommendation	Responding proportion %
	3. Not care	3
III.Who can get benefit from the construction of expressway? (multiple choice)		
	1. Nation	98
	2. Collective	95
	3. Individual	94
IV.If knowing the policies of land acquisition and house relocation? (single choice)		
	1.Yes	45
	2. No	55
V.If obeying land acquisition and house relocation? (single choice)		
	1.Yes	98
	2. No	2
VI.What recommendations for the construction of expressway? (multiple choice)		
	1.Greening	80
	2. Sound barrier	60
	3. away from villages	34
	4. more passages	90
VII.What are claims for resettlement? (multiple choice)		
	1.directly disburse compensation funds	56
	2.land redistribution	92
	3. providing chances of transferring agricultural population to non-agricultural one	10

Data Source: RAP of Third Jiangxi Highway Project.

PRO organized large-scale public participation and consultation. Opinions and recommendations raised by DPs were summarized and reported timely to the design unit, and were fully considered when preparing RAP. Table6.5-2 shows the feedback to the opinions and recommendations of DPs up to now.

Table 6.5-2 Comments from Public Participation and Consultation of Jiangxi 3 Highway project and Feedbacks Thereof

Items	Problem	Causes and aftermath	Improvement measures
Land acquisition and house relocation	Large quantity of farmland to be occupied by RGE	Farmers lose farmland and their ways of production and living will be changed	Try best to avoid passing the populated villages during the design. Loujiang Town tends to the Along-the-River Plan of RGE, because the farmland along the river is always flooded, the land acquisition cost is low and the resistance to the land acquisition is comparatively weaker.
	Information disclosed not timely. Most of farmers have not officially gotten the information on the Project.	Affect DPs' arrangement of their living and production.	Determine the alignment as soon as possible, and inform timely the villagers in order to allow the relocated households to have time to build new houses. Suggest disclosing widely the information on the Project over broadcast, television, or through the shows of local opera, soap opera, songs and regular meetings and etc to let them fully know the Project.
	Relocated households worry about the Town Governments may request them to apply the residential foundation sites again.	Cause the loss of money and time.	Complicated approval procedures of building new houses are not needed.
	The households to be relocated worry about moving to the new community.	In the new community they may be discriminated and the mutual relationship with their relatives may be broken.	To resettle them nearby.
Compensation cost	DPs worry about the compensation rates and disbursement way.	Compensation rates and disbursement way will affect the DPs' future living.	Governments and highway sectors will inform DPs of the compensation rates and disbursement way.
	DPs generally desire that the compensation rates of land acquisition and house relocation for RGE will be higher than those for the Railway.	The construction standard of expressway is higher than that of railway and more land will be acquired by expressway.	Higher compensation rates than that of the railway will be properly provided.
	Disbursement way of compensation funds.	DPs concern that the compensation funds will not be disbursed fully or be detained.	Suggest carrying out strictly financial system, such as disclosure of compensation rates, measured quantity, evaluation class, determined compensation amounts of DPs. And compensation funds will be disbursed directly to DPs or Village Committee by means of sending them the deposit book.
Common facilities and environment	The construction of RGE will cause some damages to the infrastructures.	RGE will cause some damages to the irrigation facilities and a negative impact on agricultural production and DPs' living.	Minimize the damage to the existing irrigation facilities, the damaged facilities during the construction will be rehabilitated or shifted in order to avoid unnecessary conflict. Try best to rehabilitate or rebuild the damaged rural roads or farming paths.
	The access-controlled and separated RGE will isolate the DPs' living area from farmland.	Affect the DPs' farming and trip.	Underpasses will be built when RGE passing villages.
	Noise pollution	Comparatively loud noises from RGE will affect the regular living of	House relocation will extend properly to avoid the impact of noise, if there are some difficulties in house relocation, sound barrier will be built, or

Items	Problem	Causes and aftermath	Improvement measures
		households close to the RGE.	appropriate compensation cost will be paid to DPs.
	Damage to environment	The construction of the Project will inevitably cause damages to the trees, pasture and hills and thus result in soil erosion and environmental deterioration.	The construction units will pay much attention to protect the environment, and educate the staff on the environmental protection. To rehabilitate the vegetations damaged.
	Protect the historic & cultural relics.	There are many interest historic sites, old trees, revolutionary sites, stone inscription in the cliffs and etc. the construction perhaps cause damages to them.	During the design of alignment, the design unit will detour the historic & cultural relics and famous architectures.
	Defer to the local historical and cultural tradition.	Villagers very concern the relocation of ancestral temples and tombs.	Any relocation of the ancestral temple and tombs involved will be conducted after patient persuasion and full compensation in order to avoid the conflicts.
Safety	Some risks may be occurred during the construction of Project.	Threat the safety of DPs and their livestocks.	Strengthen the safety education for the construction staff and DPs. During the construction, more temporary access roads will be set at proper places for the convenient trip of DPs.
	Safety risks may be occurred after completion of RGE.	Villagers especially children who lack of safety awareness climb over the separated fences to RGE.	Strengthen the education of safety awareness for the villagers especially children. Some effective measures such as setting of grade separation, signals and speed limit signs near the school and the kindergarten.
Auxiliary facilities	Build some facilities.	For the convenience of DPs' trip, traffic farming vehicles and non-motori vehicles.	Suggest building side passages on both sides of bridges. More culverts, flyovers will be built in the densely populated areas.
Establish DPs' participation mechanism	DPs' participation through the whole process of the Project.	DPs' share in the benefit of the Project v enhance the enthusiasm to support Project.	Establish the complaint and feedback mechanism such as complaint telephone and box. Establish the consultation system. Rap session will be conducted frequently among Project Office, Town Governments, representatives of Village Committees and DPs to work out countermeasures to the problems.
	Take some measures to ensure the DPs especially in the poor areas to participate the construction of the Project.	Being in favor of solving the problems such as an increase in farmers' income, difficulty in taking care of the children and old people kept at home.	During the construction, when employing unskilled workers, more priority will be given to the poor DPs, and absorb the immigrant worker back home to participate the construction of the Project.

Data Source: RAP of Third Jiangxi Highway Project.

6.6 Information releasing and feedback

⑴ In the next stage, it is to use television, broadcast, publication, and bulletin to release information to the public on such questions as the significance of the project, route alignment, immigration resettlement and environment.

⑵ All environmental documents such as the environmental impact report, the environmental management plan, and the environmental assessment summary will be open to the public. The construction unit will put all environmental documents related to this project in concerned reference offices and resettlement offices of Ruijin City, Huichang County, Yudu County, Ganxian County, Zhanggong District and Ganzhou City, and at the same time will announce the storing places for the environmental documents in newspapers. In this situation, the public can access to the related information without going to the governmental department.

⑶ The construction unit will set up environmental protection complaint telephone in the immigrant resettlement organizations of all levels so to collect and record the public's suit and complaint on environmental protection aspect of highway construction. After receiving such suit and complaint, the construction unit will go to the site for a solution jointly with local environmental protection department within 48 hours.

⑷ According to the various environmental protection measures put forward in this assessment report, Jiangxi Provincial Expressway Administration will carry out trace investigation during the design, construction, and operation stages, for example, to investigate people along the route who are subject to environmental impact or to collect public's opinion.

⑸ Jiangxi Provincial Environmental Protection Agency will carry on sampling inspection to the implementation of the environmental protection measures.

6.7 Summary of public participation

Regarding the public's opinion, the construction unit and designing unit have paid great attention and will take into consideration during route design.

For the possible environmental problems caused by this project, the environment assessment unit and the design unit have proposed corresponding environmental protection measures, and will obtain agreement from the affected people.

In the preliminary preparation and design stage, this project has conducted full consultation and exchange with local governments, social organizations, and the public from all walks of life, as a result, the route selection, setting-up of interchange. Linking-up roads, environmental protection, immigrant resettlement and so on have all reflected the public's opinion. Therefore, this project has won the public's support.

Chapter 7 Comparison and Selection of Route Alternative Alignments

7.1 Analysis of“without this project”

The old road basically parallel to the proposed project is National Road 323, according to the statistical data from National Road 323’s observation stations in Ruijin Chaotian, Huichang Shanshupai, Ganxian Jiangkou and Meilin, the 2003 mixed traffic volume of National Road 323 Ruijin-Ganzhou section was 8826 vehicles/day, of which the 2003 mixed traffic volume of Ganxian Meilin section was 15257 vehicles/day. Moreover, the existing road has person and vehicle mixed traffic in some township sections, some road sections are steep and curved in mountainous area, which seriously disturb the road transportation and greatly affect the capacity of trunkway road, and cause frequent traffic accidents and heavy property damage. According to traffic volume forecasting, the annual average traffic volume in 2029 in the proposed project will be 35,684 vehicles/day, the existing road is difficult to satisfy the daily increasing traffic volume demand brought about by the rapid social economic development. At the same time traffic volume growth also obviously reduces the acoustic and ambient air environmental quality along the route. Construction of this project, while alleviating National Road 323’s traffic pressure, can also obviously improve G323’s environmental quality along it. Therefore, construction of high-grade roads must be sped up so to enhance highway network technology rank, to develop express transportation, to perfect and optimize transportation network, to improve people’s movement condition, to reduce traffic accident, and to adapt to transportation development. Construction of this project is very essential to improving regional transportation condition and to alleviating regional traffic pressure.

7.2 Procedure of route scheme selection

The determination of route scheme for this project has undergone the scheme comparison and optimization in three stages namely the《*Feasibility Study*》(Sept 2004), the《*Feasibility Study*》(May 2005) and the《Preliminary Design》(Sept 2005), the procedures for route scheme selection and optimization are shown in Fig. 7.2-1.

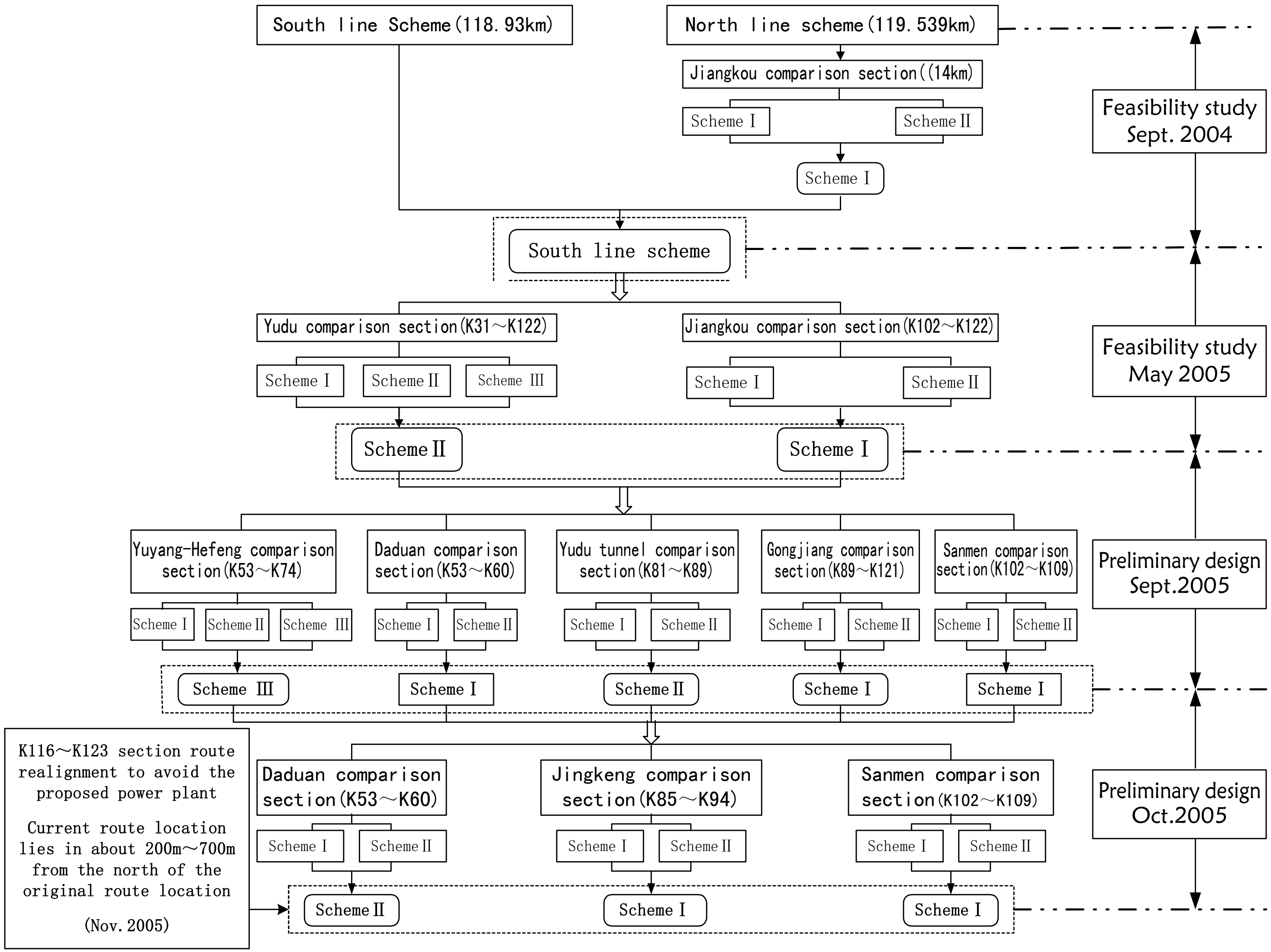


Fig.7.2-1 the procedures for route scheme selection and optimization

7.3 Comparison and selection of route corridors

7.3.1 Setting up of route corridors

According to the《*Feasibility Study Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Highway) in People's Republic of China*》prepared by Jiangxi Provincial Transportation Design Institute on Sept 2004, this project identified two corridor schemes running the whole route schemes at this stage, that is the south line scheme and north line scheme. The north line scheme sets up Jiangkou comparison section for partial comparison considering that the route is subject to many factors in Jiangkou Township such as town planning, Gongjiang River and railway. The setting-up of route schemes is shown in Table 7.3.1-1, the route alignment is shown in Fig. 7.3.1-1.

Table 7.3.1-1 Setting up of route schemes(proposal of Sept. 2004)

<table>
<tr><th colspan="2">Name of scheme</th><th>Length（km）</th><th>Major controlling points</th></tr>
<tr><td colspan="2">South line scheme (recommended)</td><td>118.930</td><td>Yunshishan of Ruijin; Shanshupai and Bai'e of Huichang; Licun, Xinbei and Luojiang of Yudu; Luo'ao of Ganxian; Huangjin interchange of Zhanggong District（destination）</td></tr>
<tr><td colspan="2">North line scheme</td><td>119.539</td><td>Yunshishan of Ruijin; Xijiang and Xiaomi of Huichang; Huanglin, Zishan and Liren of Yudu; Luo'ao of Ganxian; Huangjin interchange of Zhanggong District（destination）</td></tr>
<tr><td rowspan="2">Jiangkou comparison section in north line scheme</td><td>Scheme Ⅰ</td><td>14.079</td><td>Gaolongdong, Xiewupai, Xiaba, Shangba, Yangwu and Shangying of Jiangkou of Ganxian County</td></tr>
<tr><td>Scheme Ⅱ (recommended)</td><td>15.712</td><td>Aobei, Jiangkou town, Laohukeng, Yangwu and Shangying of Jiangkou of Ganxian County</td></tr>
</table>

7.3.2 Justification and selection of route corridors

7.3.2.1 Comparison and selection of route corridor schemes（south line scheme and north line scheme）

⑴ Route alignment and controlling points of south line scheme（K27+500～K146+430.448）

The origin starts from the north side of Xinwujia village of Yunshishan Township in Ruijin City where it links with the destination of Ailing (Jiangxi and Fujian border)-Ruijin Highway of Xiamen-Chengdu Expressway. At the origin, the route will set up Yunshishan interchange to link with national road 323 and nearby townships. The route passes by Shabei, Heba, Shixiawan, Gaowei and Guantiannao, and enters into Huichang County territory.

The route runs by Baxia, Wuwu, and crosses National Road 323 near Aozixia

(K38+900); the route crosses Gan-Long railroad nearby Maogan (K39+500); after running by Xinwuzi, Tongluoqiu, Yagongxia, Datian, Manwujia, Shegongbei, Luowu, Dahekeng, Zhongtianduan, Beikeng, it crosses Huichang-Shanshupai road nearby Shanshupai, where Huichang interchange is established to link with. After running by Huangtiankeng, it crosses the Dongfeng reservoir; after running by Shibei, Yuyang, Shebei, Daduan, it crosses the Gongjiang River nearby Yangkou (K60+410); after Bai'e, Wuxianpai, Luyuting, it passes from the northern side of Jiuling reservoir, and passes through Huichang and Yudu border in a tunnel nearby Xiapai to enter within the boundaries of Yudu County.

Zhonggongzhang tunnel exit lies nearby Shijing village within the territory of Yudu County, after running by Yuanling, Zaopai, it sets up Hefeng interchange nearby Yangmeikeng to link with nearby villages and townships; after running by Zhongfang, Yingqian, Linwujiao, Shangguan, and Miaoqian, it crosses Yudu-Pangushan road near Shuigekou (K80+270); after Zaohebei, it crosses Yudu-Pangushan road again near Xinliwu（K83+000）; after passing Wanli, Duankengkou and Shishixia, it sets up Yudu interchange and Yudu linking-up road near Anqian (K88+000) to link with Yudu County town. After passing Matian, Xinbei, Huangwu, Malingxia, Manaozhai, Miaogang, Hetou and Fengshuxia, it aligns along the south bank of Gongjiang River from nearby Lingzinao; after passing Zhongpenghsna, Hekou, Songshanpai and Xiajiaokeng. It enters within the territory of Ganxian County

The route aligns along with Gongjiang River and passes by Xiacun and Lizibei to reach Qikeng. The route leaves the south bank of Gongjiang River and passes Dakeng, Changkengzi and Zhangmulong and overcrosses the Gongjiang River near Shangba (K115+625) and sets up Jiangkou interchange near Xinwugao（K117+050）to link with national road 323 and Jiangkou Township; it overcrosses Yangtang reservoir nearby Huangniupo and after Yaoxia the route overcrosses the Beijing-Kowlon Railway, Gan-Long Railway and National Road 323 near Yangwu (K119+800). After passing by Pengxia, Shanzuxia, Dakengkou, Xiba, and Zhaijiaoxia, the route sets up Ganxian interchange near Aoshang（K127+250）to link with Ganxian county town; after passing Anziqian, Shangtianxin, Heshu’ao, Shanggaowu, the route overcrosses Ganjiang River nearby Xizhou (K132+150), and enters within the territory of Zhanggong District.

After the route overcrosses Ganjiang River and Shanlong, it overcrosses National Road 105 nearby Huangqiao (K135+115) and sets up Ganzhou north interchange nearby Luobian (K136+400) to link with National Road 105; after running by Gangbian, Shangwu, Lizitang, Zhougongkeng, Yeshan, Doufuwo, and Changkengzi, the route ends at Yanfenggang village of Panlong Township in Zhanggong District to link with the origin (Huangjin interchange) of Ganzhou west section of the Xiamen-Chengdu Expressway, which is already completed.

The whole length of the south line scheme is 118.93km, passing through 5 counties (cities) and 16 townships such as Yunshishan of Ruijin City, Xijiang, Xiaomi and Bai'e of Huichang County, Hefeng, Licun, Xinbei, Luojiang and Luo'ao of Yudu County, Jiangkou, Maodian and Chutang of Ganxian County, Shuidong, Shuixi, Hubian and Panlong of Zhanggong District.

⑵ Route alignment and controlling points of north line scheme（K27+500～K147+039.436）

The origin of scheme II is same as scheme I, the origin starts from the north side of Xinwujia village of Yunshishan Township in Ruijin City where it links with the destination of Ailing (Jiangxi and Fujian border)-Ruijin Highway of Xiamen-Chengdu Expressway. At the origin, the route will set up Yunshishan interchange to link with national road 323 and nearby townships. The route passes by Shabei, Heba, Shixiawan, Gaowei and Guantiannao, and enters into Huichang County territory.

The route runs by Daheba, Hongxing, Pengwu, Fushan, Lantianduan, Xinwujia, Tangwu, and Datang, then it sets up Xijiang interchange near Niche (K43+050) to link with G323 and townships such as Xijiang. After passing Jiangbei, it overcrosses Xijiang River near Jiantan (K45+340) and undercrosses Yajidong Mountain in tunnel near Yunlong; after passing by Wanshikeng, Xinwu, Kengwei and Hepingnao, it enters into the territory of Yudu County.

After passing by Anbei, the route overcrosses Gan-Long railroad, G323 and Xijiang River in a viaduct near Bajiaokeng (K54+640). After passing by Baishitang, Jingtang, Luoxi, Laocun, the route sets up Huanglin interchange near Diaolou (K61+700) to link with G323 and townships such as Huanglin., After passing by

Shangshukeng, it overcrosses Gongjiang River near Zhutoukeng (K64+120), after passing by Songshangang, Fengshuxia, Pingshan, Yuantangwei, Shangwangwu, Painao, Xiaxiaowu, Lingjiaoxia, Shibei, Guyuan, Xipian, Shigu, Luoshidun, and Zuoma, it crosses Yudu-Pangushan road near Lirenyu (K85+870), and sets up Yudu interchange and Yudu linking-up road nearby Tongluoping（K89+050）to connect with Yudu County town; after passing by Mikeng, Yugongtang, Tianyuan, it overcrosses Gongjiang River near Tangkan (K94+880); after passing by Xinbeimian, Jiuqu and Dalingkeng, it overcrosses Gan-Long Railway and G323 in a viaduct near Huangnitang（K100+520）, then it passes Zhaijiaoxia, Dongtiankeng, Xiashan and Jiaokeng and enters into the territory of Ganxian County.

After passing Gaolongdong and Lingxia, the route overcrosses national road 323 near Xiewupai（K111+240）and overcrosses Gongjiang River near Xiaba（K112+250）; after passing Dakeng, it overcrosses Gongjiang River near Shangba（K116+210）and sets up Jiangkou interchange near Xinwugao（K117+570）to link with national road 323 and Jiangkou Township. The route proceeds and overcrosses Yangtang reservoir nearby Huangniupo in which the north line joins with the south line, their locations are same, only differ in stake number. The route overcrosses the Beijing-Kowlon Railway, Gan-Long Railway and National Road 323 in a bridge near Yangwu (K120+400). After running by Pengxia, Shanzuxia, Dakengkou, Xiba, and Zhaijiaoxia, the route sets up Ganxian interchange near Aoshang（K127+850）to link with Ganxian county town; after passing Anziqian, Shangtianxin, Heshu'ao, Shanggaowu, the route overcrosses Ganjiang River nearby Xizhou (K132+750), and enters within the territory of Zhanggong District.

After the route overcrosses Ganjiang River and Shanlong, it overcrosses National Road 105 nearby Huangqiao (K135+715) and sets up Ganzhou north interchange nearby Luobian (K137+000) to link with National Road 105; after running by Gangbian, Shangwu, Lizitang, Zhougongkeng, Yeshan, Doufuwo, and Changkengzi, the route ends at Yanfenggang village of Panlong Township in Zhanggong District to link with the origin (Huangjin interchange) of Ganzhou west section of the Xiamen-Chengdu Expressway, which is already completed.

The total length of the north line scheme is 119.539km, passing through 5 counties (cities) and 13 townships such as Yunshishan of Ruijin City, Xijiang and Xiaomi of

Huichang County, Huanglin, Zishan, Gongjiang, and Luo'ao of Yudu County, Jiangkou, Maodian and Chutang of Ganxian County, Shuidong, Shuixi, Hubian and Panlong of Zhanggong District.

⑶ Comparison of route corridor schemes（south line scheme and north line scheme）

Through comprehensive comparison, the south line scheme is recommended, their comparisons are shown in Table 7.3.2.1-1.

Table 7.3.2.1-1 Comparison of route corridor schemes

No	Item	Unit	South line scheme（recommended scheme）	North line scheme
1	Route length	km	118.93	119.539
2	Subgrade earth/stoneworks	$1000m^3$	25543.358	27174.252
3	Drainage and protection works	M^3	829234.9	804998
4	Super-large bridge	m/place	8741/5	9177/8
5	Large bridge	m/place	8435/25	9309/22
6	Median bridge	m/place	1611/24	1719/27
7	Culvert	place	319	325
8	Tunnel	m/place	8280/10	6690/9
9	Interchange	place	7	7
10	Grade separation	m/place	4274/63	3683/59
11	Passageway	place	136	135
12	Land occupied	mu	13743.92	13416.41
13	Farmland occupied	mu	5241.33	5442.347
14	Investment estimate	10,000 yuan	548307.1695	550755.0609
15	Advantages and disadvantages of each scheme	—	★ advantages ⑴ the route mileage is 0.61 shorter. ⑵ engineering cost is 24.48 million yuan less. ⑶ fewer times of overpassing Gongjiang River, national road 323 and Gan-Long Railway. ⑷selecting a new corridor, the road functional distribution in the region is more reasonable ⑸ the route alignment is complying with local government's opinion. ● disadvantages ⑴ more tunnel works, Zhonggongzhang tunnel is 3670m long, a very huge project. ⑵ bad transportation conditions for construction.	★ advantages ⑴ smaller difficutly in engineering construction, the whole route does not have very difficutlt project, and transportation conditions are better. ⑵ fewer tunnel works. ● disadvantages ⑴ engineering cost is 24.48 million yuan more. ⑵ the route mileage is 0.61 longer. ⑶ more times of overpassing Gongjiang River, national road 323 and Gan-Long Railway. ⑷ the route alignment is not complying with local government's opinion, thus smaller promotion to local economy.
16	Scheme selection	—	Recommended	

7.3.2.2 Comparison of schemes in partial section（Jiangkou comparison section in the north line scheme）

⑴ Route alignment and controlling points of scheme I（K107+242.362～K121+321.316）

The recommended scheme of Jiangkou comparison section is a part of the north line scheme in Jiangkou, the comparison alternative line starts from Jiaokeng, after passing by Gaolongdong and Lingxia, the route crosses G323 near Xiewupai (K111+240), and overcrosses Gongjiang River near Xiaba (K112+250); after passing by Dakeng, it overcrosses Gongjiang River near Shangba (K116+210) and it sets up Jiangkou interchange nearby Xinqugao（K117+570）to link with national road 323 and Jiangkou Township. The route overcrosses Yangtang reservoir near Huangniupo and overcrosses Beijing-Kowlon Railway, Gan-Long Railway and G323 in one bridge form near Yangwu (K120+400), the destination is located near Shangying.

⑵ Route alignment and controlling points of scheme Ⅱ（K107+242.362～K122+954.333）

The comparison alternative line scheme of Jiangkou comparison section starts from Jiaokeng, it passes by Aobei and sets up Jiangkou interchange near Zengwu（K111+000）to link with G323 and Jiangkou Township. After passing Xialikeng, the route overcrosses Pingjiang River near Jiangkou Township (K113+740) and overcrosses Jiangkou-Xingguo road near Qiaobei (K114+550); after passing Xibianpai, Fengwu, Xinwuxia and Dianqian, it overcrosses Beijing-Kowlon Railway near Laohukeng (K118+240); then aligning along the north side of national road 323, the route passes by Youziling, Tianxinbei and Yangwu, and joins with the recommended scheme near Shangying.

⑶ Scheme comparison

Through comprehensive comparison, the scheme I is recommended, their comparisons are shown in Table 7.3.2.2-1.

Table 7.3.2.2-1 Comparison of schemes in Jiangkou comparison section

No	Item	Unit	Scheme I (Recommended scheme)	Scheme II
1	Route length	km	14.079	15.712
2	Subgrade earth/stoneworks	$1000m^3$	3430.041	3694.022
3	Drainage and	M^3	115274	124528.1

No	Item	Unit	Scheme I (Recommended scheme)	Scheme II
	protection works			
4	Super-large bridge	m/place	2364/2	No
5	Large bridge	m/place	277/1	704/2
6	Median bridge	m/place	203/3	268/4
7	Culvert	place	39	53
8	Tunnel	m/place	1050/1	1300/2
9	Interchange	place	1	1
10	Grade separation	m/place	777/7	1300/2
11	Passageway	place	17	27
12	Land occupied	mu	1662.85	1795.82
13	Farmland occupied	mu	485.75	817.37
14	Removed buildings	M^2	15746	48032
15	Cost of construction and erection	10,000 yuan	73385.8669	64884.0349
16	Advantages and disadvantages of each scheme	—	★ advantages (1) the route mileage is 1.6333km shorter. (2) less land occupied, especially farmland. (3) small removal of buildings. (4) small interference from 323 and Gan-Long Railway. ● disadvantages (1) more super-large bridges. (2) engineering cost is 85 million yuan more. (3) overpassing Gongjiang River twice. (4) distance to the highway for vehicles from Xingguo is 4km longer.	★ advantages (1) engineering cost is 85 million yuan less. (2) not overpassing Gongjiang River. (3) distance to the highway for vehicles from Xingguo is 4km shorter. (4) no super-large bridge. ● disadvantages (1) the route mileage is 1.6333km longer. (2) one more tunnel. (3) big interference from 323 and Gan-Long Railway. (4) more land occupied, especially farmland. (5) large removal of buildings, $32286m^2$ more.
17	Scheme selection	—	Recommended	

7.4 Comparison and selection of route alternative alignments during the Feasibility Study stage

7.4.1 Setting up of route schemes

On Feb 2005, the World Bank mission carried out project identification for Jiangxi No. 3 project, and Jiangxi Provincial Transportation Design Institute, based on relevant suggestions and opinions of the World Bank mission, revised and supplemented the FS report prepared on Sept 2004, and compiled the 《*Feasibility Study Report for World Bank Loan Jiangxi Road Project No. 3 (Ruijin-Ganzhou Section of Xiamen-Chengdu National Expressway) in People's Republic of China*》 on May 2005.

This stage has put forward a big corridor alternative alignment, namely Yudu comparison section with its scope from the origin to Jiangkou of Ganxian County.

Yudu comparison section sets up three alignments: north line(scheme Ⅰ), middle line(scheme Ⅱ), and southern line(scheme Ⅲ). The route in Ganxian Jiangkou section is subject to many factors such as Jiangkou town planning, Gongjiang River, and the railroad, it sets up the Jiangkou comparison section to carry out partial alignment comparison.

The setting up of route schemes is listed in Table 7.4.1-1, the route alignment refers to Fig. 7.4.1-1.

Table 7.4.1-1 Setting up of route schemes during the《Feasibility Study》stage（proposal of May 2005）

Name of scheme		Length （km）	Major controlling points
Yudu comparison section	Scheme Ⅰ	90.251	Yunshishan of Ruijin; Xijiang and Xiaomi of Huichang; Huanglin, Zishan, Liren, Luo'ao and Xiashanbei of Yudu; Maodian of Ganxian
	Scheme Ⅱ (recommended)	91.200	Yunshishan of Ruijin; Shanshupai and Bai'e of Huichang; Hefeng, Liren, Luo'ao and Xiashanbei of Yudu; Maodian of Ganxian
	Scheme III	91.125	Yunshishan of Ruijin; Shanshupai and Bai'e of Huichang; Hefeng, Licun, Luojiang and Xiashannan of Yudu; Maodian of Ganxian
Jiangkou comparison section	Scheme Ⅰ (recommended)	19.711	Xiashan of Yudu, Shangba and Xiaba of Jiangkou in Ganxian where the Gongjiang River is overcrossed twice, Yangwu
	Scheme Ⅱ	20.598	Xiashan of Yudu, Jiaokeng, Tianziyin and Yangwu of Jiangkou in Ganxian

7.4.2 Justification and selection of route scheme

7.4.2.1 Yudu comparison section

⑴ Route alignment and controlling points of scheme I of Yudu comparison section（K31+000～K121+251.012）

The origin（K31+000）of scheme I is same as the origin of this project, which starts from the east side of Huangzhubei village of Yunshishan Township in Ruijin City where it links with the destination of Ailing (Jiangxi and Fujian border)-Ruijin Highway of Xiamen-Chengdu Expressway. The route passes by Shabei, Heba, Shixiawan, Gaowei and Guantiannao, and enters into Huichang County territory.

The route runs by Baxia, Wuwu, and crosses National Road 323 near Aozixia (K38+900); the route crosses Gan-Long railroad nearby Maogan (K39+500); after running by Xinwuzi, Tongluoqiu, Yagongxia, Datian, Manwujia, Shegongbei, Luowu, Dahekeng, Zhongtianduan, Beikeng, it crosses Huichang-Shanshupai road nearby Shanshupai, where Huichang interchange is established to link with. After running by Huangtiankeng, it crosses the Dongfeng reservoir; after running by Shibei, Yuyang, Shebei, Daduan, it crosses the Gongjiang River nearby Yangkou (K60+410); after Bai'e, Wuxianpai, Luyuting, it passes from the northern side of Jiuling reservoir, and passes through Huichang and Yudu border in a tunnel nearby Xiapai to enter within the boundaries of Yudu County.

Zhonggongzhang tunnel exit lies nearby Shijingcun within the boundaries of Yudu County, after running by Yuanling, Zaopai, it sets up Hefeng interchange nearby Yangmeikeng to link with nearby villages and townships; after running by Zhongfang, Zaotang, Chezhu, Shibei, Xiawan, Wufengshan, Zhangkeng, and Longtian, it crosses Yudu- Pangushan road near Dabeinao (86+600); after Beizhuwan, it sets up Yudu interchange and Yudu linking-up road near Tangwei (K88+580) to link with Yudu County town. After running by Pingling, Yanxia, Laohuxing, Yangwu, Likeng, it crosses the Gongjiang River nearby Gaotan (K98+750); after running by Xinwuxia, it sets up Luo'ao interchange nearby Xiuduan (K101+040) to link with National Road 323 as well as townships such as Luo'ao. Nearby Lingbei (K101+800) it crosses National Road 323 and crosses Gan-Long railroad nearby Shitoutang; after running by Zhaijiaoxia, Longkeng, Xiashan village, Wanzibei, it enters within the boundaries of Ganxian County.

The route runs by Wangwu and Xinanqian, and crosses National Road 323 nearby Xiewupai (K112+200), crosses the Gongjiang River nearby Xiaba (K113+350); after Dakeng, it crosses Gongjiang River nearby Shangba (K117+000); after Xinwugao, it crosses Yangtang reservoir nearby Huangniupo and crosses National Road 323 and the Beijing-Kowlon Railway near Yaoxia (K121+400). The Yudu comparison section (K122+199.827)ends at Fengshugang of Maodian in Ganxian County.

⑵ Route alignment and controlling points of north line alignment(K31+000～K121+251.012)of Yudu comparison section

The origin (K31+000) of north line alignment is same as scheme I , the route runs by Shabei, Heba, Shixiawan, Gaowei and Guantiannao, and enters into Huichang County territory.

The route runs by Daheba, Hongxing, Pengwu, Fushan, Lantianduan, Xinwujia, Tangwu, and Datang, then it sets up Xijiang interchange near Niche (K43+050) to link with G323 and townships such as Xijiang. After passing Jiangbei, it overcrosses Xijiang River near Jiantan (K45+340) and undercrosses Yajidong Mountain in tunnel near Yunlong; after passing by Wanshikeng, Xinwu, Kengwei and Hepingnao, it enters within the territory of Yudu County.

After passing by Anbei, the route overcrosses Gan-Long railroad, G323 and Xijiang River in a viaduct near Bajiaokeng (K54+640). After passing by Baishitang, Jingtang, Luoxi, Laocun, the route sets up Huanglin interchange near Diaolou (K61+700) to link with G323 and townships such as Huanglin., After passing by Shangshukeng, it overcrosses Gongjiang River near Zhutoukeng (K64+120), after passing by Songshangang, Fengshuxia, Pingshan, Yuantangwei, Shangwangwu, Painao, Xiaxiaowu, Lingjiaoxia, Shibei, Guyuan, Xipian, Shigu, Luoshidun, and Zuoma, it crosses Yudu-Pangushan road near Lirenyu (K85+870), and sets up Yudu interchange and Yudu linking-up road to connect with Yudu County town; after passing by Mikeng, Yugongtang, Tianyuan, it overcrosses Gongjiang River near Tangkan (K94+880); after passing by Xinbeimian, Shibei, it sets up Luo’ao interchange near Jiuqu village (K98+900) to link with G323 and townships such as Luo’ao. After passing by Tianzijian and Xiuduan, the route overcrosses G323 near Lingbei (K100+800) and overcrosses Gan-Long Railway near Shitoutang, then it coincides with the middle line alignment and also ends at Fengshugang (K121+251.012) of Maodian in Ganxian County.

⑶ Route alignment and controlling points of south line alignment(K31+000～K122+125.438)of Yudu comparison section

The origin (K31+000) of south line alignment is same as scheme I, the route from Ruijin Yunshishan to Yudu Hefeng is same as the middle alignment.

The south line separates from the middle line nearby Xiawna village of Hefeng at Yudu County; after passing by Shijiao, Wangwuduan, it overcrosses Yudu-Pangushan road near Jingkou (K85+200); after passing by Bankeng, it sets up Yudu interchange and and Yudu linking-up road to connect with Yudu County town near Juntiannao (K88+600). After passing by Shanxia, Wushilong, Miaobei, Laowuchang, Yangkeng, Muzipai, Aixia, Hengkeng, and Miaogang, it sets up Luojiang interchange to connect with G323 and townships such as Luojiang near

Hezikou. After passing by Hetou, Fengshuxia, it aligns along the south bank of Gongjiang River near Lingzinao, after passing by Zhongpengshan, Hekou, Songshanpai and Xiajiaokeng, it enters into Ganxian County.

The route continues to align along Gongjiang River to Qikeng via Xiacun and Lizibei. Leaving Gongjiang River south bank, the route passes by Dakeng, Changkengzi, and Zhangmulong, then overcrosses Gongjiang River nearby Shangba (K117+000); after passing by Xinwugao, it overcrosses Yangtang reservoir near Huangniupo, and overcrosses G323 and Beijing-Kowlon Railway near Yaoxia (K121+400), the destination (K122+125.438) is located nearby Fengshugang of Maodian in Ganxian County.

⑷ Works volume and environmental protection comparison of each alternative scheme

The works volumes and environmental protection comparison of alternative schemes in Yudu comparison section are listed in Table 7.4.2.1-1.

Table 7.4.2.1-1 Works volume and environmental protection comparison of Yudu comparison section

No	Item	Unit	Scheme Ⅰ	Scheme Ⅱ （recommended）	Scheme III
1	Route length	km	90.251	91.200	91.125
2	Subgrade earth/stoneworks	1000m^3	18358.089	17122.732	17441.622
3	Drainage and protection works	m^3	632733	518893	594741
4	Super-large bridge	m/place	5665/5	4813/4	7453/4
5	Large bridge	m/place	9302/21	7757/21	9092/26
6	Median bridge	m/place	1199/20	893/14	913/14
7	Culvert	place	237	242	240
8	Tunnel	m/place	7110/9	10650/10	7590/7
9	Interchange	place	4	4	4
10	Grade separation	m/place	3265/50	3377/48	3040/43
11	Passageway	place	109	110	104
12	Land occupied(farmland)	mu	10683(3310)	10405(2916)	10716(3272)
13	Investment estimate	10,000 yuan	388559.5669	392373.806	391478.4693
14	Per km	10,000 yuan	4305.3215	4302.3444	4296.0600
15	Scheme comparison	—	Occupying larger land size, especially occupation of farmland is the largest among the three schemes.	Least occupation of land and farmland.	Occupying larger land size, and occupation of farmland is also larger.

No	Item	Unit	Scheme Ⅰ	Scheme Ⅱ（recommended）	Scheme III
			Largest volume of subgrade earth/stone works, unhelpful to water and soil conservation.	Least volume of subgrade earth/stone works, better than other two schemes.	Larger volume of subgrade earth/stone works, unhelpful to water and soil conservation.
			Impacts on water environment are in the middle between the other two schemes.	Compared with other two schemes, this scheme has fewest bridge number and shortest bridge length, smallest pavement runoff, thus least disturbance and impact on water environment.	Largest bridge number and length, and another 5 kilometers' road sections align along the south bank of Gongjiang River, largest impact on water environment.
			Due to G323 and Gan-Long railroad construction, the land acquisition and immigrant resettlement along the route are more difficult.	Least house removal quantity, immigrant resettlement difficulty is smallest.	House removal quantity, immigrant resettlement difficulty is between the other two schemes.
			Most road sections are in the same corridor belt with G323 and Gan-Long railroad, have certain influence to the route alignment and engineering construction.	Choosing a new corridor belt, the regional road distribution is more reasonable.	Choosing a new corridor belt, the regional road distribution is more reasonable. Crossing times with Gongjiang River, G323 and Gan-Long railroad is the least.
			The route alignment does not conform to local government's opinion, small impetus to local economy.	The route alignment has given dual attention to local government's opinion, greater impetus to local resources development and economical development.	The route alignment conforms to local government's opinion, but may have certain influence on the planned Xiashan hydro-project dam site.
Comprehensive selection	⑴Among three schemes, the scheme III has 5 kilometers' section aligning along Gongjiang River and thus producing larger disturbance on water environment, larger difficulty in design and construction, and larger environmental pollution risk during operation, therefore it is worse than the other two schemes. ⑵ Compared to the scheme II, the scheme I's most road sections are in the same corridor belt with G323 and Gan-Long railroad, which will have certain influence to the route alignment and engineering construction. Due to G323 and Gan-Long railroad construction, the land acquisition and immigrant resettlement along the route are more difficult. ⑶ To sum up, the scheme II is selected as the recommended scheme.				

7.4.2.2 Jiangkou comparison alignment

⑴Route alignment and controlling points of recommended alignment

(K102+489.187 ~K122+199.827)of Jiangkou comparison section

The recommended alignment of Jiangkou comparison section is a part of the overall recommended alignment in Jiangkou, the comparison line starts from Shitoutang of Luo'ao at Yudu, after passing by Zhaijiaoxia, Longkeng, Xiashanwcun, Wanzibei, it enters into Ganxian County. After passing by Wangwu and Xinanqian, the route crosses G323 near Xiewupai (K112+200), and overcrosses Gongjiang River near Xiaba (K113+350); after passing by Dakeng, overcrosses Gongjiang River near Shangba (K117+000); after passing by Xinwugao it overcrosses Yangtang reservoir near Huangniupo and overcrosses G323 and Beijing-Kowlon Railway near Yaoxia (K121+400), the destination (K122+199.827) is located nearby Fengshugang of Maodian in Ganxian County.

⑵Route alignment and controlling points of comparison alignment (K102+489.187~K123+080.340)of Jiangkou comparison section

The origin of the comparison alignment of Jiangkou comparison section is the same as that of the recommended alignment. Starting from Shitoutang of Luo'ao at Yudu, it passes by Tangwu, Xiashancun, Jiaokeng, Gaolongdong, Bankeng and crosses G323 near Tianliaoxia (K113+200) and overcrosses Pingjiang River (tributary of Gongjiang River) near Zhongaozi (K114+100); after passing by Jiangkou village, it overcrosses Jiangkou-Xingguo road near Miaobeikeng (K116+500) and overcrosses Beijing-Kowlon Railway near Hengkengzi (K116+800); after passing by Laohukeng, Yuziling, Tianxinbei, Huanglong and Yangwu, it ends at Fengshugang of Maodian in Ganxian County with destination (K123+080.340) same as that of the recommended alignment.

⑶ Works volume and environmental protection comparison of each alternative scheme

The works volume and environmental protection comparison of Jiangkou comparison section is listed in Table 7.4.2.2-1。

Table 7.4.2.2-1 Works volume of Jiangkou comparison section

No	Item	Unit	Scheme I (Recommended scheme)	Scheme II
1	Route length	km	19.711	20.598
2	Subgrade earth/stoneworks	$1000m^3$	3435.849	3367.738
3	Drainage and protection works	M^3	125072	120672

No	Item	Unit	Scheme I (Recommended scheme)	Scheme II
4	Super-large bridge	m/place	2364/2	no
5	Large bridge	m/place	2185/5	3836/8
6	Median bridge	m/place	118/2	280/4
7	Culvert	place	49	56
8	Tunnel	m/place	2980/3	4640/3
9	Interchange	place	no	no
10	Grade separation	m/place	724/7	445/5
11	Passageway	place	20	23
12	Land occupied	mu	1444	1480
13	Farmland occupied	mu	302	450
14	Removed buildings	M^2	16402	26806
15	Investment estimate	10,000 yuan	107310.658	112100.5134
16	Per km	10,000 yuan	5444.2016	5442.3009
17	Scheme comparison	—	Least occupation of land and farmland	Most occupation of land and farmland
			Large volume of subgrade earth/stone works, unhelpful to water and soil conservation.	Small volume of subgrade earth/stone works, helpful to water and soil conservation.
			Set up 2 super-large bridges, but the total number of bridges is smaller than comparison scheme, so less impact on water environment	Align along G323 near Jiangkou, no crossing of Gongjiang River, so no super-large bridge, but total number of bridges is large, so larger impact on water environment
			Least volume of land acquisition, house removal quantity, and immigrant resettlement, the difficulty is smallest.	Large volume of land acquisition, house removal quantity, and immigrant resettlement, the difficulty is large.
			Small impact on alignment from G323 and Gan-Long railroad	Large impact on alignment from G323 and Gan-Long railroad
			The route may have some mutual impact with the planned Jingkou Power Plant	Difficult connection with the planned Ganzhou south ring road
			in corresponding road section of the recommended scheme, there are 5 acoustic environment sensitive locations, of which 2 exceed standard, no sensitive location exceeds by 3 dB in mid-term operation stage, with noise increase of 0.7～15.5 dB in day and 10.3～20.4 dB at night.	in road section corresponding to recommended scheme, there are 4 acoustic environment sensitive locations, of which 2 exceed standard, no sensitive locations exceed by 3 dB in mid-term operation stage, with noise increase of 12.8～20.2 dB in day and 10.5～17.8 dB at night.
Comprehensive selection	Considering the comparison scheme has larger impact from G323 and Gan-Long railroad in alignment, has larger difficulty in land acquisition, house removal quantity, and immigrant resettlement, and has more difficult connection with the planned Ganzhou south ring road, the recommended scheme is selected.			

7.4.3 Alignment comparison conclusion in "Preliminary Design"stage

(1) Route selection principle

To conform to national east-west big channel planning direction as much as possible so to make the route smooth and short.

To link with cities and counties along the route as many as possible, the route shall come close to these cities, county towns and important townships but not directly passing through them.

To correctly handle the relation between the alignment and terrain/culture, do not blindly pursue high standard. To reasonably use the landform so not to occupy farming lands and cash forestlands as much as possible; to protect existing water conservation and hydro power facilities. To avoid enterprises, mines, and residences as much as possible so to reduce removal quantity, but at the same time not to excessively reduce the road technical standard because of partial removal.

Interchanges shall link with existing transportation network so to form a regional comprehensive transportation system and to fully exploit highway skeleton function.

To fully consider the demand and suggestions of local governments and concerned departments on route alignment and interchange locations so to coordinate the road with local town construction, with local economical development for benefiting the locality.

To strictly enforce the Ministry of Communications' document [2004] No. 164-"*Notice on Most Rigid Implementing Cultivated Land Protection in Road Construction*" so to reduce land occupation as much as possible in route alignment and to avoid basic farmlands and cash crop lands as much as possible.

(2) Selection of the alignment

After comprehensive study and analysis, the scheme Ⅱ is recommended; the major reasons are as follows:

Among the three alignments, the scheme Ⅱ has the least land occupation and least farmland occupation quantity, and has the least house removal quantity, and least immigrant resettlement difficulty.

Compared to the scheme Ⅰ, the route corridor belt of scheme Ⅱ is more reasonable without long road section in the same corridor belt with G323 and Gan-Long railroad, which will reduce adverse influence to the route alignment from G323 and Gan-Long, and will make the regional transportation function distribution more reasonable.

Compared to the schemeⅢ, the schemeⅡavoids aligning with Gongjiang River for a long distance near Xiashan, thus reducing impacts on peripheral environment.

The route alignment of schemeⅡhas given due attention to local government's opinion, thus providing greater impetus to local resources development and economical development.

After the alignment comparison and selection at "*Feasibility Study Report*" stage, overallly the recommended alignment is superior to the alternative alignments in terms of environmental protection, so after comparing the environmental factors this report still recommends the recommended alignment for the project.

7.5 Comparison and selection of route alternative alignments during preliminary design stage

7.5.1 Setting up of route schemes

The overall route alignment identified in the preliminary design stage for this project is basically consistent with that identified in the recommended scheme in the "*Feasibility Study Report*" submitted in May 2005. During this stage, optimization and comparison among alternative schemes were conducted in accordance with the landform, topography, urban planning, road network layout, engineering construction conditions, and mileage in this region, and in accordance with the findings of field reconnaissance and the solicited opinions from transportation, railroad, and water conservation departments as well as local governments so as to adjust and optimize partial schemes in the "*Feasibility Study Report*".

In the preliminary design documents in Sept of 2005, the whole route has set up: Yuyang-Hefeng comparison section (K53+316.870~K74+178.981), Daduan comparison section (K53+316.870~K60+854.987), Yudu tunnel comparison section (K81+204.569~K89+267.512), Sanmen comparison section (K102+275~ K109+198.327), and Gongjiang River comparison section (K81+204.569 ~K121+932.334), a total of five comparison sections for partial route alternative schemes. The scheme setting-up is shown in Table 7.5.1-1, the route alignment refers to Fig. 7.5.1-1.

Table 7.5.1-1 List of alternative route scheme setting-up during preliminary design（Sept. 2005）

Route alternative scheme		OD stake No	Route length	Scheme selection
Yuyang-Hefeng comparison section	Scheme I	K53+316.87~ K75+050.890	21.734km	
	Scheme II	K53+316.87~ K73+719.454	20.403km	
	Scheme III	K53+316.87~K74+178.981	20.862km	Recommended
Daduan comparison section	Scheme I	K53+316.870～K60+854.987	7.538km	Recommended
	Scheme II	K53+316.870～K60+564.947	7.248km	
Yudu tunnel comparison section	Scheme I	K81+197.553～K89+702.931	8.375km	
	Scheme II	K81+204.569～K89+267.512	8.063km	Recommended
Sanmen comparison section	Scheme I	K102+275～K109+198.327	6.923km	Recommended
	Scheme II	K102+275～K107+171.490	6.896km	
Gongjiang River comparison section	Scheme I	K81+204.569～K121+932.334	40.292km	Recommended
	Scheme II	K81+204.569～K120+987.740	39.783km	

After comparison and justification, scheme III of Yuyang-Hefeng comparison section, scheme II of Yudu tunnel comparison section and scheme I of Gongjiang River comparison section are selected as the recommended schemes.

In the preliminary design documents of October 2005, the route schemes of Daduan comparison section and Sanmen comparison section are further compared and justified, and the Jingkeng comparison section (scheme I and scheme II) was newly added in section K83+455.138～K93+226.5 for comparison and justification. The scheme setting-up is shown in Table 7.5.1-2, the route alignment refers to Fig. 7.5.1-1.

Table 7.5.1-2 List of alternative route scheme setting-up during preliminary design（Oct. 2005）

Route alternative scheme		OD stake No	Route length	Scheme selection
Daduan comparison section	Scheme I	K53+316.870～K60+854.987	7.538km	
	Scheme II	K53+316.870～K60+564.947	7.248km	Recommended
Jingkeng comparison section	Scheme I	K85+445.138～K93+226.5	7.771km	Recommended
	Scheme II	K85+455.138～K94+136.205	8.246km	
Sanmen comparison section	Scheme I	K102+275～K109+198.327	6.923km	Recommended
	Scheme II	K102+275～K107+171.490	6.896km	

7.5.2 Analysis of K31~K34 section route scheme

The preliminary design in October 2005 has made some adjustments on the corridor of K31~K43 section with the route aligned in the north side of the feasibility study scheme in September 2004 and the feasibility study scheme in May 2005, as shown in Fig. 7.5.2-1. The adjusted route will pass a 2.3km long floodplain in

Yunshishan Township of Ruijin City. According to the preliminary design document for this project (November 2005), the alignment scheme of the route passing Yunshishan floodplain is to build a 16-hole Jiubao river bridge with span of 20m and length of 327m to overpass the Jiubao River, and the other road section in the floodplain is filled subgrade.

According to the calculation and analysis of Jiangxi Provincial Transportation Design Institute, the main reason forming a floodplain in Jiubao river bridge site is that in the south of Luanshi village downstream the proposed Jiubao river bridge there is an overflow dam with its elevation in dam top of 184.385m and overflow cross-section of 81.2 m^2, while the flood level of one-hundred-year recurrence in Jiubao river bridge is 187m and the bridge overflow cross-section is 492.3 m^2, thus 6 times more than the overflow cross-section in the overflow dam, so the overflow cross-section in Jiubao river bridge is far larger than that of the overflow dam, the controlling factors producing flooding and backwater are the elevation in dam top and the length of the downstream overflow dam.

Under different flood frequencies, the max backwater height in front of Jiubao river bridge and the flood discharging time before and after the bridge construction are listed in Table 7.5.2-1. The flood inundated scope before and after construction of the Jiubao river bridge is listed in Table 7.5.2-2.

Table 7.5.2-1 Max backwater height in front of Jiubao river bridge under different flood frequencies and the corresponding flood discharging time before and after the bridge construction

Recurrence period	Max backwater height (m)	Flood discharging time before bridge construction (hour)	Flood discharging time after the bridge construction (hour)	Expansion time (hour)
1/10	0.04	8.7	9.54	0.84
1/50	0.15	12.2	14.8	2.6
1/100	0.16	12.7	15.9	3.2

Table 7.5.2-2 Flood inundated scope before and after construction of the Jiubao river bridge

Recurrence period	Before bridge construction	After bridge construction		
	Flood inundated area upstream the bridge site (km^2)	Flood inundated area upstream the bridge site (km^2)	Added flood inundated area upstream the bridge site (km^2)	Influenced villagers
1/10	0.375	0.380	0.005	3 households, 5persons
1/50	0.544	0.572	0.028	5 households,24persons
1/100	0.556	0.590	0.034	6 households,28persons

The route passes the floodplain mainly in the form of subgrade which divides the floodplain into two zones, that is, the upstream zone and downstream zone of the proposed bridge site. When flood comes, because of the subgrade, the flood discharge will become difficult and the flood level will increase which will inevitably enlarge the size of flooding area. Therefore it is suggested to increase the length of the viaduct section to ensure smooth flood discharge and to reduce the time for flood residence, and the Jiangxi Provincial Transportation Institute has planned to increase the length of Jiubao river bridge to 407m in the next design stage.

According to the current route scheme and the calculation and analysis of Jiangxi Provincial Transportation Design Institute, after construction of the Jiubao river bridge, under flood of one-hundred-year recurrence, the flood inundated area upstream the bridge site will be increased by 0.034km^2, involving 6 households and 28 people to be influenced. For these households, compensation measures shall be made.

7.5.3 Analysis of K116～K123 section route realignment

Because there is a contradiction between the K116~K123 section location and the proposed Ganzhou Power Plant, the preliminary design in November 2005 has adjusted the road route, the current route location lies in about 200m~700m from the north of the original route location, as shown in Fig. 7.5.3-1. The works volumes and environmental comparison between the adjusted route scheme and the original route scheme are shown in Table 7.5.3-1.

Table 7.5.3-1 Works volumes and environmental comparison in the power plant comparison section

No	Item name	Unit	Original route scheme	Scheme of avoiding the power plant
1	OD stake No		K116+314.528～K123+253.382	K116+314.528～K123+431.509
2	Route length	km	6.939	7.117
3	Subgrade earth/stoneworks	1000 m	1303.988	1165.12
4	Large and median bridge	m/place	2165/5	2265/5
5	Culvert	place	6	5
6	Passageway	place	9	10
7	Land occupied	mu	601.73	611.90
	Of which farmland occupied	mu	109.71	113.86
8	Building removal	m^2	5821	11344 8 more households to be influenced than the original scheme

No	Item name	Unit	Original route scheme	Scheme of avoiding the power plant
9	Acoustic sensitive locations		2 natural villages belonging to Shangba Village of Maodian Township of Ganxian County Chenwu (K119+450~K119+640) Laohutang (K119+470~K119+690) Chenwu：noise excess in daytime during long-term operation stage is 0.2dB, noise excess in nighttime during long-term operation stage is 1.9～5.9dB Laohutang：noise excess in nighttime during mid/long-term operation stage is 1.5～5.5dB	2 natural villages belonging to Shangba Village of Maodian Township of Ganxian County Pingzigao (K119+600～K119+860) Xiaomenkou (K119+580～K120) Pingzigao：noise excess in daytime during long-term operation stage is 0.2dB, noise excess in nighttime during long-term operation stage is 1.9～5.9dB Xiaomenkou：noise excess in nighttime during mid/long-term operation stage is 1.5～5.5dB
10	Water environment		Overpassing Yangtang reservoir	Not overpassing Yangtang reservoir
Comprehensive comparison and selection	The route scheme of avoiding power plant after route realignment is 178m more in length than the original route scheme, involving slightly less subgrade earth and stone works but more removal surface areas of buildings than the original scheme, and involving 8 more households to be influenced than the original scheme; the acoustic sensitive locations for the two schemes are both 2 with similar acoustic environment; the route scheme of avoiding power plant does not overpass the Yangtang reservoir thus reducing its impact on the reservoir. Overall, there is no big difference on environmental impact for the two schemes.			

After the realignment of the route, the current route location avoids the proposed Ganzhou Power Plant. There is no significant difference on environmental impact for the adjusted route scheme and the original route scheme.

7.5.4 Overview of route schemes in preliminary design stage

7.5.4.1 Yuyang-Hefeng comparison section

According to the overall route strike, laying-out of Zhonggongzhang tunnel, mineral resource distribution, bridge site overpassing Gongshui River, setting-up of viaducts along the route as well as conditions of landform, topography, geology and ecology along the route, this comparison section is designed.

The works volume and environmental protection comparison of each alternative scheme for Yuyang-Hefeng comparison section is shown in Table 7.5.4.1-1.

Table 7.5.4.1-1 List of works volumes for Yuyang-Hefeng comparison section and environmental protection comparison

No	Item	Unit	Scheme Ⅰ	Scheme Ⅱ	SchemeⅢ (recommended scheme)
1	OD stake No of route		K53+316.87~ K75+050.890	K53+316.87~ K73+719.454	K53+316.87~ K74+178.981

No	Item	Unit	Scheme Ⅰ	Scheme Ⅱ	SchemeⅢ (recommended scheme)
2	Route length	km	21.73402	20.402584	20.862111
3	Subgrade earth/stoneworks	1000 m^3	3159.214	2362.805	4743.207
4	Drainage and protection works	m^3	63206.29	52199.52	109845.8
5	Bituminous concrete pavement	1000 m^2	347.2529	299.0764	359.593
6	Super-large bridge	m/place	3134/2	1447/1	1407/1
7	Large, mid and small bridge	m/place	587/2	1391/5	3457/12
8	Culvert and passageway	place	61	45	46
9	Tunnel	m/place	5020/3	6765/3	5005/3
10	Land occupied	mu	1771.37	1190.14	1443.33
11	Removed buildings	m^2	44824.78	38992.788	39847.52
12	Removed power and telecom lines	m	17790	12680	11890
13	Road realignment	km	0.7268	1.136	0.6791
14	Advantages	—	Better bridge site over Gongshui River Fewer sections with large filling and cutting, smaller impact on surrounding environment Better route location passing Zhonggongzhang tunnel	Shorter total route mileage Fewer sections with large filling and cutting, smaller impact on surrounding environment	Within the route area there is no mining area, thus no hidden danger of mine pressing. Zhonggongzhang tunnel mileage is shortest, relatively easy to construct and the maintenance and operation cost is low
	Disadvantages	—	The route may produce the danger of mine pressing in the mining area Longer total route mileage	Zhonggongzhang tunnel mileage is long, relatively difficult to construct, shaft ventilation is needed, and the maintenance and operation cost is high There is an old landslide in the Zhonggongzhang tunnel entrance, thus easy to produce collapse accident	The route bridge site over Gonghsui River is worse than scheme I and II; The route longitudinal and horizontal alignment is slightly bad, there exist continuous down-slope section(5.4 km, but the composite longitudinal gradient still meets requirement)
15	Comparison of alternative	—	Most quantity of land occupation	Least quantity of land occupation	Relatively large quantity of land

No	Item	Unit	Scheme Ⅰ	Scheme Ⅱ	SchemeⅢ (recommended scheme)
	schemes				occupation
			Relatively large volume of earth and stone works for subgrade, disadvantageous to water conservation	The volume of earth and stone works for subgrade is smaller than the other 2 schemes	Largest volume of earth and stone works for subgrade, disadvantageous to water conservation
			To set up 2 super-large bridges, having relatively large impact on water environment	To set up 1 super-large bridge to overpass Gongjiang River, having relatively small impact on water environment	To set up 1 super-large bridge to overpass Gongjiang River, having relatively small impact on water environment
			Largest volume of building removal, and largest volume of immigrant resettlement	Smallest volume of building removal, and relatively small volume of immigrant resettlement	Relatively large volume of building removal, and relatively large volume of immigrant resettlement
			11 acoustic environment sensitive locations	11 acoustic environment sensitive locations	5 acoustic environment sensitive locations
Comprehensive selection	Compared to the other two schemes, the scheme III has a biggest advantage, that is, the project's key element, Zhonggong tunnel, is shortest in mileage with small difficulty in construction and scheme III involves least number of acoustic sensitive locations; scheme I needs to set up 2 super-large bridges to overpass Gongjiang River, having relatively large impact on water environment and its land acquisition and removal volumes are the largest; as for scheme II, the Zhonggong tunnel has a long mileage and bad geology condition, so after comprehensive comparison, scheme III is recommended.				

7.5.4.2 Yudu tunnel comparison section

Yudu tunnel comparison section is to compare two tunnel locations and their exit directions for the Yudu tunnel. The origin of the comparison section starts from the entrance connecting line of Yudu tunnel and north of Wanli village, and ends at K89+702.931of the river-crossing scheme, which is located in approximately 300 meters west of the Guanzhaixia village.

(1) Route alignment and controlling points for Yudu scheme I（K81+197.553～K89+702.931）

The route enters into the tunnel in 300 meters north of Annao village and leaves the tunnel in the back of Zhangkeng village, then it aligns in a relatively wide ridge along

Zhangkeng to Nanshixia, and overcrosses Yudu-Pangushan road in Beizhuwan village; after the north of Guanzhaixia, the route ends at K89+702.931 of the river-crossing scheme, this route section is 8.375 kilometers long.

(2) Route alignment and controlling points for Yudu scheme II（K81+204.569～K89+267.512）

The route enters into the tunnel in 100 meters north of Annao village and leaves the tunnel in about 400 meters east of Yikeng village, then it sets up a viaductin aligns in Yikeng; after that, the route aligns along the mountain in south of Maqimian reservoir and overcrosses Yudu-Pangushan road in the south of Jingkou village; after passing by the north of Bankeng village and the south of Baiyashi village, the route joins with K89+702.931 of river-crossing scheme in the north of Guanzhaixia village, the destination stake number of the scheme II for Yudu tunnel comparison section is K89+237.512; this route section is 8.063 kilometers long.

(3) Works volumes and environmental protection comparison of each scheme

The works volumes and environmental protection comparison of Yudu comparison section are listed in Table 7.5.4.2-1。

Table 7.5.4.2-1 List of works volumes for Yudu comparison section and environmental protection comparison

No	Item	Unit	Scheme I	Scheme II (recommended scheme)
1	Route length	km	8.375	8.063
2	Min radius of horizontal curve	m	800	2000
3	Max longitudinal gradient	%	2.07	3.5
4	Subgrade earth/stoneworks	1000 m^3	1232.842	1716.96
5	Large and median bridge	m/place	1046/6	1203/5
6	Culvert	place	5	8
7	Passageway	place	14	10
8	Grade separation	place	1	2
9	Tunnel	m/place	2161/1	1805.5/1
10	Land occupied	mu	846.49	694.48
	Farmland occupied	mu	302.68	157.08
11	Advantages	—	Tunnel exit section lies in a broad and open corridor belt, thus easier construction	Shorter route mileage and tunnel length Better route location of the tunnel scheme

No	Item	Unit	Scheme I	Scheme II (recommended scheme)
	Disadvantages	—	Slightly lower tunnel entrance route alignment indicators	The route is mainly located in mountains, thus difficult to construct; More viaducts thus larger works volume
12	Comparison of alternative schemes	—	Relatively large quantity of land occupation and farmland occupation	Relatively small quantity of land occupation and farmland occupation
			Relatively small volume of earth and stone works for subgrade	Relatively large volume of earth and stone works for subgrade, disadvantageous to water conservation
			Relatively long length of tunnels	Relatively short length of tunnels
Comprehensive selection	The two schemes are designed for the location of Yudu tunnel, the scheme II has the advantage of occupying smaller lands, especially farmlands, so scheme II is recommended.			

7.5.4.3 Gongjiang comparison section

Among the two alternative schemes, the scheme Ⅰ is located in the north of Gongjiang river in K100~K115 and overcrosses Gongjiang River two times more near K100 and K115, between which two tunnels will be built; while the scheme Ⅱis continuously located in the south of Gongjiang river in K97~K113 and overcrosses Gongjiang River two times fewer, because the route aligns along the river direction and is close to it, thus there will be many dry bridges, especially the K104 ~ K109 section is very close to the river, needing to build viaducts with length of more than 4 kilometers.

(1) Route alignment and controlling points for schemeⅠ(K89+702.931～K121+932.334)

The route enters into the Yudu tunnel in 300 meters north of Annao village and leaves the tunnel in the back of Zhangkeng village, then it aligns in a relatively wide ridge along Zhangkeng to Nanshixia, and overcrosses Yudu-Pangushan road in Beizhuwan village; after passing the north of Guanzhaixia, the route passes westwards through Liuwu and Changkeng, it sets up the Yudu interchange in the northwest of Pingling; after passing by the north of Yanxia village, north of Miaobei village, south of Yangwu village and south of Likeng village, the route overcrosses Gongjiang river in the southwest of Shangwu village and sets up Luo’ao interchange in the north of Pengwu village; after overcrossing Gan-Long Railway in the south of Shitoukeng, the route passes by Xiashan Mountian in a tunnel, after leaving the tunnel, the route passes by the south of Longkeng village and sets up a viaduct in Dingwu, then the route aligns in a mountain in the north of Gan-Long Railway near K110 to K112, then it again overcrosses Gan-Long Railway and Gongjiang river in the north of Xiaba village, and overcrosses Gongjiang river for the third time in Zhangmulong and Chenwu, finally after overcrossing Yangtang reservoir it links with the route of along-river scheme. The route mileage of along-river scheme is 40.292 kilometers long.

(2) Route alignment and controlling points for scheme Ⅱ(K81+204.569～K89+267.512)

The route enters into the Yudu tunnel in 100 meters north of Annao village and leaves the tunnel in about 400 meters east of Yikeng village, then it sets up a viaduct in Yikeng; after that, the route aligns along the mountain in south of Maqimian reservoir and overcrosses Yudu-Pangushan road in the south of Jingkou village; after passing westwards by the south of Bankeng village and the north of Juntiannao village, it sets up an interchange in the northeast of Shanxia village; after passing by the south of Miaobei village, south of Laowuchang village, north of Muzipai village, south of Shuikou village, south of Laowuchang village and south of Xinwuli, the route aligns along hillside in the south of Gongjiang river and sets up a viaduct to pass; afterwards it passes by the south of Shangcun and north of Ankeng, and overcrosses Gongjiang river in Miaobei and Laohutang; finally after overcrossing Yangtang reservoir it links with the route of along-river scheme. The route mileage of along-river scheme is 39.783 kilometers long.

(3) Works volumes and environmental protection comparison of each scheme

The works volumes and environmental protection comparison of Gongjiang comparison section are listed in Table 7.5.4.3-1。

Table 7.5.4.3-1 List of works volumes for Gongjiang comparison section and environmental protection comparison

No	Item	Unit	Scheme I（recommended scheme ）	Scheme II
1	Route length	km	40.292	39.783
2	Min radius of horizontal curve	m	1250	1000
3	Max longitudinal gradient	%	3.5	3.5
4	Subgrade earth/stoneworks	1000 m^3	8690.762	9868.473
5	Large and median bridge	m/place	8142/25	11823/23
6	Culvert	place	42	29
7	Passageway	place	63	56
8	Grade separation	place	13	8
9	Interchange	place	2	2

No	Item	Unit	Scheme I （recommended scheme ）	Scheme II
10	Tunnel	m/place	4148.5/3	1805.5/3
11	Land occupied	mu	4734.43	4729.84
	Farmland occupied	mu	1300.48	1516.98
12	Advantages	—	The route location can conveniently link with local roads, the setting-up of Luo'ao interchange is convenient to people's satisfaction	Relatively shorter route mileage Shorter tunnel mileage
	Disadvantages	—	Relatively longer route mileage Longer tunnel length with addition of Xiashan tunnel and Baishan tunnel Overcrossing Gan-Long Railway and Gongjiang River many times	Needs to set up long-distance viaducts with big difficulty in construction; there exist hidden danger of safety The scheme may impact the planned Xiashan Water Project Dam site It is impossible to set up the Luojiang interchange
13	Comparison of alternative schemes	—	The two schemes do not differ very much in land occupation, but scheme I occupies smaller quantity of farmlands	Relatively large quantity of farmland occupation
			Relatively small volume of earth and stone works for subgrade	Relatively large volume of earth and stone works for subgrade, disadvantageous to water conservation
			2 more tunnels than the scheme II	Fewer tunnels
			More bridges than scheme II, but the total length of bridges is smaller	Needs to build a long-distance viaduct, causing larger potential impact on river course and water environment
Comprehensive selection	The biggest disadvantage of scheme II is that it needs to build a long-distance viaduct along the river, causing larger potential impact on river course and water environment, besides its earth and stone works volume for subgrade is relatively large; so after comprehensive comparison, scheme I is recommended.			

7.5.4.4 Daduan comparison section

(1) Route alignment and controlling points for Daduan scheme I（K53+316.870～K60+854.987）

The origin stake number is K53+316.870, the destination stake number is K60+854.987. The route starts from Shibei village and turns right to Qiantang and sets up Zhujing tunnel (300 meters long) in K57+037.5; after 80 meters north of Shang'ao village and 120 meters north of Shawan village, the scheme I and scheme II join together in Longtanmian, this route section is 7538.117 meters long in total.

(2) Route alignment and controlling points for Daduan scheme II（K53+316.870～K60+564.947）

The origin stake number is K53+316.870, the destination stake number is K60+564.947. The route starts from Shibei village and turns right to Yuyang, Dianqian, Shebei and Heliaoxia, it sets up Heliaoxia tunnel (420 meters long) in K57+720; after Daduan, the scheme I and scheme II join together in Longtanmian, this route section is 7248.077 meters long in total.

(3) Works volumes and environmental protection comparison of each scheme

The works volumes and environmental protection comparison of Daduan comparison section are listed in Table 7.5.4.4-1.

Table 7.5.4.4-1 List of works volumes for Daduan comparison section and environmental protection comparison

No	Technical and economic indicator	Unit	Scheme I	Scheme II （recommended scheme）
1	OD stake No of route		K53+316.870～K60+854.987	K53+316.870～K60+564.947
2	Route length	km	7.538117	7.248077
3	Subgrade earth/stoneworks	1000 m^3	1848.8	1485.905
4	Drainage and protection works	m^3	17465.36	12683.79
5	Bituminous concrete pavement	1000 m^2	163.389	154.187
6	Large, mid and small bridge	m/place	1141/3	679/4
7	Culvert and passageway	place	22	17
8	Tunnel	m/place	305/1	420/1
9	Land occupied	mu	704.018	586.6
10	Removed buildings	M^2	5152.7	14749.3
11	Removed power and telecom lines	m	5640	3020
12	Road realignment	km	0	0.348
13	Cost/km	10,000 yuan /km	4041.8545	3281.9312
13	Advantages	—	Within the route area there is no mining area, thus no hidden danger of mine pressing. Shorter tunnel length	Good landform conditions, small cut volume, smaller impact on ecological environment; 290.04 m shorter than scheme I; Smaller earth and stone works volume

No	Technical and economic indicator	Unit	Scheme I	Scheme II （recommended scheme）
	Disadvantages	—	bad landform conditions, large cut volume, bigger impact on ecological environment; 290.04 m longer than scheme II; In the upper left of Zhujing tunnel there is a water pond, so water prevention and drainage within the tunnel is relatively difficult.	The route may produce the danger of mine pressing in the mining area Longer tunnel length Larger occupation size of farming fields and larger volumes of removal and resettlement
14	Comparison of alternative schemes	—	Relatively large quantity of land occupation	Relatively small quantity of land occupation
			Relatively small volume of building removal	large volume of building removal
			Relatively large volume of earth and stone works for subgrade, disadvantageous to water conservation	Relatively small volume of earth and stone works for subgrade
			Relatively short length of tunnels	Relatively long length of tunnels
Comprehensive selection	The advantages of scheme II are: it has good landform conditions, does not involve large fill and cut, its subgrade earth and stone volumes are small, destruction on ecological environment is small and the engineering cost is low; its disadvantages are: its building removal volume is much larger than scheme I and it needs large scale of resettlement. so the two schemes each have their advantages and disadvantages in terms of environment protection, there is no significant prevalence between them.			

7.5.4.5 Sanmen comparison section

Setting-up of the Sanmen comparison section is due to that the route intersects with Gan-Long Railway in about K104+300, two intersection forms are designed: scheme Ⅰ is to make the highway overcross the Gan-Long Railway, scheme Ⅱis to make the highway to undercross the Gan-Long Railway by using the existing railway bridge. The schemeⅠof overcrossing railway is to select a suitable location to overcross the Gan-Long Railway in a higher place; for the scheme Ⅱ of undercrossing railway, about 250 meters west of the railroad, the Gan-Long Railway builds a 5-span bridge with length of 32 meters and height of 10~15meters, which overcrosses a drainage ditch, this scheme makes use of existing bridge height to undercross railroad bridge, the route passes through different bridge span separately according to its right and left roadways, and the drainage ditch under the bridge will be relocated. The origin for comparison section starts from the north of Pengwu village in K12+275, afterwards it intersects with National Road 323 and Gan-Long Railway and passes through Xiashan mountain body be building the Xiashan tunnel, and finally the route combines the separated subgrade of

Xiashan tunnel connecting line into integrated subgrade and the comparison between the two schemes is finished. Sanmen comparison section is a part of scheme Ⅰ for Gongjiang comparison section and the recommended scheme is adopted to converge into the scheme Ⅰ for Gongjiang comparison section. The plane drawing of alternative schemes for Sanmen comparison section is shown in Fig. 7.5.4.5-1.

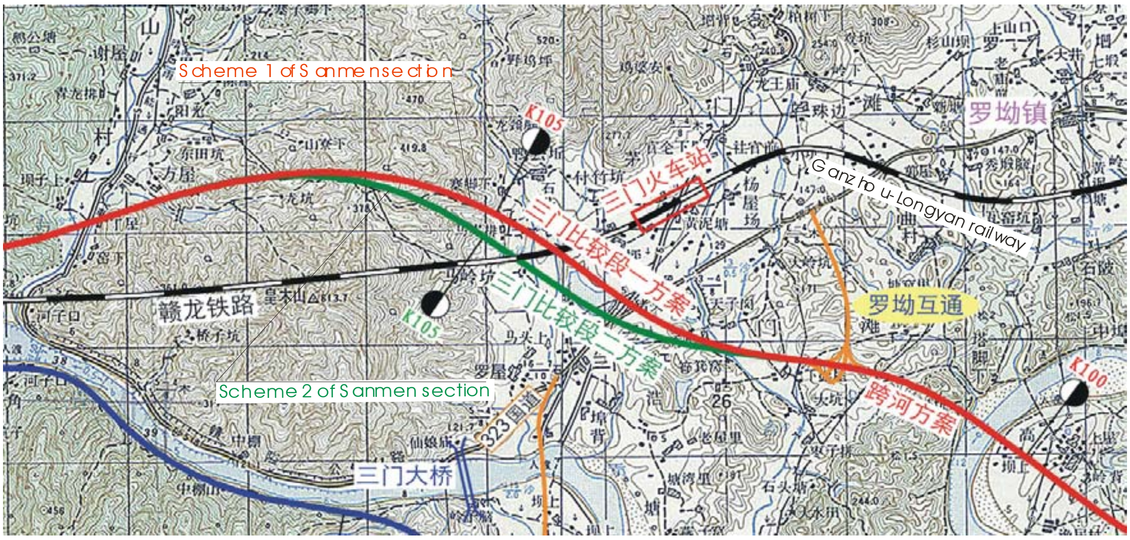


Fig.7.5.4.5-1 The plane drawing of alternative schemes for Sanmen comparison section

(1) Route alignment and controlling points for scheme I(K102+275～K109+198.327)

The origin starts from in K102+275 which is located in the north of Pengwu Village, after passing by the south of Shuiduan village, the route overcrosses National Road 323 in Xiamaoping, after Maoping village, the route overcrosses Gan-Long Railway in a mountain top north of Maoping village; after passing Shitoukeng and Zhaijiaoxia, the route sets up the Xiashan tunnel; after passing the south of Longkeng and Dingwu, the route combines the separated subgrade of the Xiashan tunnel connecting line into integrated subgrade in the southwest of Bazishang village and the comparison section is finished. The destination stake number is K109+198.327, and this route section is 6.923 kilometers long.

(2) Route alignment and controlling points for scheme II(K102+275～K109+171.490)

The origin starts from in K102+275 which is located in the north of Pengwu Village, after passing by the south of Shuiduan village and Sanmen horticulture garden, the route overcrosses National Road 323 in Sanmen; after passing Fengchan reservoir and east of Sanmen Middle School, the route undercrosses Gan-Long Railway under its railway bridge; after passing Malingpai village, the route sets up the Xiashan tunnel; after passing the south of Longkeng and Dingwu, the route combines the separated subgrade of the Xiashan tunnel connecting line into integrated subgrade in the southwest of Bazishang village and the comparison section is finished. The destination stake number is K109+171.490 and this route section is 6.896 kilometers long.

(3) Works volumes and environmental protection comparison of each scheme

The works volumes and environmental protection comparison of Sanmen comparison section are listed in Table 7.5.4.5-1。

Table 7.5.4.5-1 List of works volumes for Sanmen comparison section and environmental protection comparison

No	Item	Unit	Scheme I （recommended scheme ）	Scheme II
1	Route length	km	6.923	6.896
2	Min radius of horizontal curve	m	1750	1750
3	Max longitudinal gradient	%	2.5	2
4	Subgrade earth/stoneworks	1000 m^3	188.537	131.615
5	Large and median bridge	m/place	1659/4	912/3
6	Culvert	place	5	9
7	Passageway	place	8	6
8	Grade separation	place	1	3
9	Tunnel	m/place	2153/1	2426/1
10	Land occupied	mu	668.13	611.49
	Farmland occupied	mu	282.6	232.08
11	Advantages	—	The highway overcrosses the railway with good visual sight Smaller works volume	The highway undercrosses the railway with fewer viaducts and lower cost
	Disadvantages	—	One more viaduct and thus higher cost Larger removal and resettlement works volume and larger size of land acquisition	Lower route location Occupation of a reservoir Relatively close to Sanmen middle school
12	Comparison of alternative schemes	—	Slightly larger quantity of land and farmland occupation	Relatively small quantity of land occupation and farmland occupation
			Relatively large volume of earth and stone works for subgrade	Relatively small volume of earth and stone works for subgrade

No	Item	Unit	Scheme I（recommended scheme ）	Scheme II
			To overpass Gan-Long Railway	To underpass Gan-Long Railway and passing by Fengchan reservoir, thus impacting water environment
			5 acoustic environment sensitive locations	3 acoustic environment sensitive locations, the route is 40m from Sanmen Middle School, thus producing relatively large impact on the school.
Comprehensive selection	The biggest disadvantage of scheme II is its occupation of reservoir and its large impact on Sanmen middle school; the two schemes do nto vary very much in land occupation and earth/stone works volume, so scheme I is recommended.			

7.5.4.6 Jingkeng comparison section

In section K83+455.138～K93+226.5, the Jingkeng comparison section is set up which includes two schemes: scheme I and scheme II.

（1）Route alignment and controlling points of scheme I (K85+455.138～K93+226.500)

The origin (K85+455.138) is located in the southeast of Maqimian reservoir in Licun Township of Yudu County, and overcrosses Yu-Pan Road near southwest of Jingkou village (K86+480); after passing the south of Bankeng, the route sets up Yudu interchange near Juntiannao (K90+255), after passing the south of Ma'anshan, it ends at the back of Miaobei village of Xinbei Township in Yudu County with destination stake number of K93+226.500 and mileage of 7.771 km.

（2）Route alignment and controlling points of scheme II（K85+455.138～K94+136.205）

The origin （K85+455.138）is the same as scheme I, located in the southeast of Maqimian reservoir in Licun Township of Yudu County, and then the route overcrosses Yu-Pan Road near southwest of Jingkou village（K86+480）; after passing the north of Bankeng, the route runs in the north of Guanzhaixia village and sets up Yudu interchange near Baotang（K90+705）, after passing Liuwu, Changkeng and Yanxia, it ends at the back of Miaobei village of Xinbei Township in Yudu County with destination stake number of K94+136.205 and mileage of 8.246 km.

(3) Works volume and environmental comparison of each scheme

The works volume and environmental comparison of Jingkeng comparison section are shown in Table 7.5.4.6-1.

Table 7.5.4.6-1 List of works volume and environmental comparison of Jingkeng comparison section

No	Item	Unit	Scheme Ⅰ（recommended ）	Scheme Ⅱ
1	Route length	km	7.771	8.246
2	Min radius of horizontal curve	m	1900	1500
3	Max. longitudinal gradient	%	3.5	3.5
4	Subgrade earth and stone works	1,000 m	2273.536	2058.337
5	Large and median bridge	m/place	841/5	1098/6
6	Culvert	place	6	11
7	Passageway	place	13	13
8	Grade separation	place	3	2
9	Occupied land	mu	1206.46	1164.62
	Of which farmland	mu	233.1	202.36
Comprehensive comparison	The major difference between the two schemes is works volume, the advantage of scheme I is that it has shorter route length, shorter linking road length and fewer bridges; the two schemes do not differ very much in environmental protection.			

7.5.5 Comparison conclusion of alternative schemes during the preliminary design stage

It can be seen from the comparison results of each alternative scheme that the route design has fully considered many factors so as to reduce land occupation (especially farmland), to protect ecological environment, to avoid sensitive locations, and to solicit local government and people’s opinion, the recommended route scheme is relatively reasonable. Further comparison and analysis of them in terms of environmental protection indicate that the recommended route scheme is basically the most optimal scheme, so it is recommended.

Chapter 8 Environmental Protection Measures and Suggestions

8.1 Mitigation measures for ecological environmental impact

8.1.1 Design stage

(1) To further optimize and adjust the alignment, to reduce occupation of cultivated lands, to balance cut/fill volumes and to reduce waste volume and the number of earth borrow and waste banks.

(2) Site selection for construction campsite shall avoid farmland or shall occupy as little farmland as possible. To rationally arrange construction plan, to reduce the time for temporary land occupation.

(3) When the highway passes through high mountains and natural forestlands, it shall mainly in the form of tunnel and bridge so to reduce the mileage of cut/fill works volume, and thus reducing destruction on vegetation and plant as much as possible. The present design alignment basically adopts tunnels and bridges to pass the natural forestlands.

(4) To design subgrade water drainage and protection works, such as intercepting trench, side ditch, facing wall, slope protection, retaining wall, crib protection etc., which can not only stabilize the subgrade but also can prevent and control soil erosion?

(5) The original appearance of rivers and valleys should be maintained as much as possible so to reduce river course realignment, to reduce the clearance of grass and trees in the rivers and valleys.

(6) The guardrail in bridges should choose material with high strength.

(7) Selection of earth borrow and waste banks: earth borrow and waste banks are forbidden to locate in basic farmland protection zone, rather they should be preferably located in secondary vegetation land with grass and wastelands, thus not directly influencing the primitive vegetation. In addition, in rainy season the intensity of rainstorm is relatively large and duration is relatively long, so construction should choose dry season during construction stage, thus helpful to construction. Before rainy season comes, good preparations must be taken to prevent soil erosion, concretely by piling waste earth neatly, excavating drainage ditches and building retaining walls, so as

to reduce soil erosion's destruction to natural vegetation and to maintain local rivers in their normal conditions too. Waste earth and slag banks shall not be located in river course and along rivers so to avoid water pollution and to avoid mud-rock flow destroying downstream river.

(8) For earth borrow pits and waste (dreg) banks, environmental protection design shall be carried out, and the following principles shall be followed to formulate tunnel waste dreg utilization plan.

① Used as filling materials for subgrade outside tunnel and for bridge embankment, while the transport distance is not too far;

② Used to fill hillside wasteland to turn into construction site so that they are unlikely to be destroyed by flood when mountain torrent comes and endanger downstream farmlands;

③ When the tunnel portal area is all good farmland and there is wasteland in distance, they shall be delivered to the waste land in long-distance;

④ When near the tunnel site there is all cultivated land and waste slags must take up farmland, the topsoil should be first shoveled away, after the project is finished, the original topsoil shall be covered on waste banks so as to restore cultivation.

(9) To rationally arrange construction season and time: to rationally arrange construction in dry season so as to reduce destruction on river and water quality; blasting and construction are forbidden at night in order to reduce impact on local wild animals.

(10) Propagation (wildlife and environmental protection propagation, and manufacturing propagation boards) and setting-up of supervisory organization before construction.

(11) The afforestation design of the highway shall be in pace with the engineering design of the main project, priority shall be given to adopting local arbor, shrub, and grass in the design in order to restore and compensate for the vegetation.

8.1.2 Construction stage

(1) Education for environmental protection shall be strengthened to construction workers so that they will observe national and regional laws and relevant regulations so as to protect natural resources, not to injure wild animals, not to cut down trees arbitrarily, and to consciously protect various kinds of animals, plant and natural

landscape in natural forestlands along the route.

(2) The tunnel (entrance and exit) will be the place needing special monitoring during construction. Because in road construction the tunnel is always a controlled project with long construction time, large volume of waste earthwork disposal, thus during tunnel construction, it is required to strictly control the piling of materials and the collecting/disposing of waste earthwork.

(3) Construction of pier in bridge construction will inevitably exert an influence on the vegetation, so it is required to strictly control the size of vegetation occupation and impact on peripheral vegetation. Relevant national laws and regulations shall be strictly followed to go through the formalities in acquiring forestland and vegetation, casual tree cutting and surface vegetation removing are forbidden.

(4) Construction time in the natural forestlands shall be shortened as much as possible, and construction at night is forbidden.

(5) Life garbage and sewage produced from construction campsites shall be disposed of collectively or be made into fertilizers.

(6) For temporary land occupation such as detour roads and working sheds, their destruction on vegetation shall be reduced to a minimum. If detour roads pass through wooded section with big trees, the detour roads shall pass around it, the trees around working sheds should be kept to a maximum extent. The establishment of detour road shall not destroy natural landscape, shall not move excessive earthwork, and shall not cause collapse.

(7) Attention shall be paid to protection of river course during construction, construction shall be mainly in dry season, before rainy season comes it is required to dredge the river course and to excavate drainage canals in construction site, and to guarantee unobstructed river flow and clean water quality in the river. As far as drinking water is concerned, it is required to solve the water problem for residents before the project construction begins, and to consider the influence on construction stage and in the future.

(8) Various kinds of construction behaviors such as earth borrowing and waste disposal shall be carried out strictly according to the designing requirement, ecological restoration shall be timely undertaken in earth borrow pits and waste banks. When excavating the acquired cultivated land, the topsoil(30cm)should be kept in order for

use in reclaiming and compensating cultivated land.

(9) Construction vehicles shall run on temporary roads, shall not run into farmlands and forestlands.

(10) To reduce the quantity and size of construction site: Construction shall be carried out in designed construction site, earth borrow pits and waste banks shall not be enlarged at will so to reduce excavation surface. If construction can't be conducted at once, don't enter the construction site too early.

(11) Each protection measure shall be implemented along with the main project in order to prevent pavement runoff in rainy season from directly eroding slope and leading to soil erosion.

(12) Management of solid waste during construction stage

① Solid wastes shall not be thrown or spilled over along the route during transportation.

② Greasy dirt of construction machinery shall be treated collectively, solid wastes with greasy dirt can't be thrown casually on ground, rather they shall be treated collectively.

③ Construction campsite shall set up septic tank and dustbin, the contractor shall removed the garbage and clear up the septic tank on time.

④ The boring mud from bridge construction shall be transported outside river district and piled in favorable terrain place. The waste mud piling shall be protected mainly by blocking and arresting; after the place is chosen, mud arresting dam shall be first built in downstream place of waste mud, drainage ditches shall be built in surrounding place according to water catchment, which connect with the original drainage system, then waste mud can be piled up. After waste mud piling, vegetation shall be restored as much as possible.

⑤ The planning and the operational procedure of constructing shall be followed to strictly control and to reduce the remaining supplies. In case of remaining materials, they shall be preserved well in an orderly manner, and be kept properly as for use in repairing rural roads or buildings in surrounding area.

⑥ Facilities, equipment and places that collect, store, transport and handle the solid wastes should be strengthened in management and maintenance so as to guarantee their normal running and use.

8.1.3 Operation stage

(1) According to road afforestation design requirement, it is suggested to continue the tree planting and grassing in slopes, median separators, interchanges and service areas of the proposed highway in order to achieve the purposes of restoring vegetation, protecting subgrade and reducing soil erosion.

(2) For slopes, earth borrow pits and waste banks, detour roads, tunnel mouths where their vegetation is damaged, measures should be taken as soon as possible so to restore the vegetation.

(3) In restoring vegetation, only local indigenous plants can be used, any exotic plant species are forbidden.

(4) It is to further perfect each engineering measure, planting measure and land reclamation measure for water and soil conservation according to the designing requirements, to scientifically and rationally implement a three-dimensional plantation pattern combining grass, flower, bush and arbor. Especially for earth slopes, afforestation can be carried out in later construction stage in order to protect subgrade slope stability and reduce soil erosion.

(5) Overflow culverts should be cleared silt in time in order to ensure unobstructed irrigate river system.

(6) Carrying out maintenance for protection works and afforestation project.

(7) Solid waste management during operation stage

① Through formulating and propagating regulations, it is forbidden that passengers casually throw out garbage such as beverage bags, easy-open cans, etc. on the highway so as to ensure traffic safety and sanitation/hygiene along both sides of the highway.

② The sewage and garbage in serving areas and management stations should be cleared periodically, delivered to and disposed of collectively in garbage disposal grounds along the highway, casual throwing-away is forbidden.

8.2 Mitigation measures for water environmental impact

8.2.1 Design stage

(1) To optimize and perfect the small bridge and culvert design; for each canal and pond occupied or cut off by the subgrade, remedial measures shall be taken by

relocating them under the prerequisite of not compressing the water-discharge cross-section of original river and canal and not influencing the function of original canal and ditch. It should also guarantee that new opening precedes relocating.

(2) In the next design stage, full emphasis should be paid to protect surface water body. During bridge substructure design, related regulations should be followed to explicitly stipulate that the wastes such as boring slags shall not be discharged into surface water body directly; local water conservation and environmental protection departments and other concerned departments shall be consulted to reasonably locate the positions of borrow pits, boring slags shall be used as much as possible in paving subgrade so to prevent soil erosion from polluting farmland and river system.

(3) When the route aligns along Gongjiang River terrace or bank slope, the designing shall consider river sluicing and bank slope undercutting's damage on subgrade, necessary measures shall be taken to strengthen the protection works for the subgrade close to river and to guarantee subgrade stability. Generally the road shoulder or toe of slope shall set up submersible retaining wall to prevent the river water undercut the toe of slope; the subgrade filler uses sand and cobble, the side slope of submersible retaining wall adopts solid slope protection.

(4) During the engineering design stage, underground water distribution should be verified; corresponding measures shall be taken to prevent the tunnel seepage causing the underground water level change.

(5) The 12 service areas, parking lots, maintenance divisions and tollgate stations along the route shall be installed with small sewage disposal facilities according to their functions, number of employees and mobile population so as to discharge the sewage up to standard and ensure that the water quality of treated sewage can meet class 1 criteria of GB8978-1996《*Sewage Comprehensive Discharge Standard*》. The sewage treatment procedure is shown in Fig. 4.2.2.3-1.

(6) In order to prevent vehicles, especially hazardous articles vehicle from out of control and falling into rivers and reservoirs along the route causing water pollution, the 12 bridges（see Table 8.2.1-1）crossing water bodies are required to have their guardrails strengthened and reinforced.

Table 8.2.1-1 Bridges overcrossing water bodies of this project

No	Bridge name	Overcrossed water body	Stake No	Length (m)
1	Jiubao River bridge	Jiubao River	K32+470	327
2	Xijiang River bridge	Xijiang River	K39+150	187
3	Shangba Gongjiang River viaduct	Gongjiang River	K63+025	1407
4	Miaobei viaduct	Shangxi River	K94+315	487
5	Gaotan Gongjiang River bridge	Gongjiang River	K100+424	497
6	Jiaolin Gongjiang River super-large bridge	Gongjiang River	K114+940	1087
7	Chenwu Gongjiang River super-large bridge	Gongjiang River	K119+220	1367
8	Ganjiang River super-large bridge	Ganjiang River	K135+491	1337
9	Dongfeng reservoir bridge	Dongfeng reservoir	K51+710	807
10	Jiuling reservoir bridge	Jiuling reservoir	K66+735	307
11	Maqimian viaduct	Maqimian reservoir	K85+593	367
12	Niugutang reservoir viaduct	Niugutang reservoir	K115+680	127

(7) In order to prevent water pollution on rivers and reservoirs in case of occurring hazardous articles vehicle accident, the 12 bridges（see Table 8.2.1-1）crossing water bodies are required to set up facilities for collecting bridge floor runoff (setting up sedimenting tanks at the two ends of bridge) so to prevent the runoff entering directly into water bodies. The capacity of drainage pipe and sedimenting tank shall be designed according to the runoff volume produced from one rainfall's slicing（15 minutes）with the raining strength being the largest rainfall in 5 years in that region plus 50%.

8.2.2 Construction stage

(1) Prevention and control measures for construction waste water pollution

① The project contract should clearly specify provisions for preventing sprinkle and leakage during transportation of roadbuilding materials (for example asphalt, fuel oil, chemical, pulverized coalash, cement, sand, and stone), their piling locations shall not be near water body or breeding pond in order to avoid being washed by rain water into water body, causing pollution.

② Deleterious construction materials such as asphalt, fuel oils, and chemical substances shall be covered when piled in yard so to reduce pollution caused by rain wash. Within 100m from river bank, it is prohibited to set up stock grounds (materials yard), waste bank, and construction campsite.

③ Construction waste water cannot be discharged into rivers and reservoirs directly. The construction waste water shall be circulated and recycled as much as possible so as to effectively control the construction waste water's pollution on local water quality due to its discharge with exceeded standard.

(2) Control measures for oil-containing wastewater

Oil-containing wastewater shall be controlled by adopting controlled construction process and clean production plan.

① Advanced equipment and machinery shall be selected as much as possible so to effectively reduce the quantity of oil leakage, bleeding, drop and spillage, and machinery repair times, thus reducing the production quantity of oil-containing wastewater.

② During construction process involving inevitable oil leakage, bleeding, drop and spillage, solid oil-absorption materials shall be used as many as possible (for example cotton yarn, saw dust and so on) to collect the oil and transform them into solid substance thus avoiding producing excessive oil-containing waste water. For oil dirts that are seeped into the ground, they should be scraped promptly for collection and sealing, and shall be hauled to garbage ground for processing.

③ Repair and maintenance of machinery, equipment and transportation vehicles shall be conducted in the repair zone of various road section as much as possible to facilitate collection of oil-containing waste; in case that concentrated repair cannot be made, because the production quantity of oil-containing wastewater is generally smaller than $0.5m^3/d$, then all can be absorbed by solid oil-absorption materials for collection, sealing and delivery to outside.

④ In construction site and machinery repair ground, horizontal flow precipitation pool shall be set up, the oil-containing waste water is collected by the precipitation pool, after simple treatments such as acid and alkali neutralization, precipitation, oil separating and dreg removing, the concentrations of oil and other pollutants will reduce. After construction, the precipitation pool will be buried by earth.

⑤ Collected oil-soaking waste shall be packaged, sealed and hauled to outside along with other solid wastes produced from construction site, the destination of hauling shall select towns with garbage burying or treatment ability.

(3) Control measures for life sewage

① Dining and laundry of construction workers will be managed in a unified way such as concentrated dining and laundry in fixed place and time so to reduce life sewage production volume as much as possible. During laundry, the detergent amount shall be controlled, hot water or other means can be substituted for so to reduce the detergent content in sewage.

② Septic tanks will be set up in construction campsites so to collect excrement and dining/laundry sewage, the excrement can be used for fertilizing the soil, the dining/laundry sewage can be used in agricultural irrigation after being precipitated. After construction, septic tanks will be buried by earth. The capacity and model design for septic tanks shall follow the specifications of the national construction standard design 02S701《*Brick Septic Tank*》 and 03S702《*Steel Reinforced Concrete Septic Tank*》.

③ Life garbage will be loaded into garbage can, which will be cleaned and hauled out periodically, or a garbage pit can be set up to ferment them so to be used in fertilizing the soil. After construction, the garbage pit will be buried by earth, if surface vegetation is damaged, vegetation shall be restored.

(4) Protection measures for bridge construction

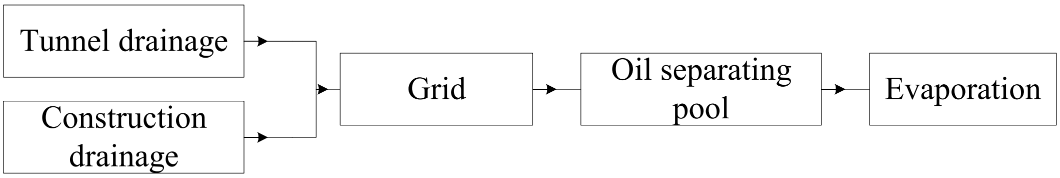
① For bridge foundation and pile locating in river course and reservoir, its boring dregs from foundation excavation shall not be discharged into water body directly, the boring dregs must be transported to nearby planned waste bank. During construction, the bridge construction site shall set up simple sedimentation pool in which the boring dregs and mud are precipitated and dried, then hauled to the waste bank.

② For other bridges crossing canals, the bridge pile foundation construction shall be conducted in dry season as much as possible, and shall avoid construction in flood season and high water period, the earth and stone works excavated from foundation and pile construction shall be used as much as possible, those that cannot be used will be hauled to nearby waste bank.

③ During bridge construction, maintenance and repair of construction machinery shall be well conducted so to prevent the fuel oil from leaking and polluting the water body.

(5) Protection measures for tunnel construction

Tunnel construction will produce large volume of waste water, the main pollutants are suspended substance, remained blasting explosive, petroleum and so on. It is suggested to adopt the following techniques for this project so to effectively control water pollution question during tunnel construction period.



(6) Protection measures for road section construction along Gongjiang River

In road section along Gongjiang River, the subgrade edge will be pitched by woven bags packed with earth for temporary arresting and retaining so to prevent the earth and stone from falling into water body. The woven bag's cross-sectional form is 1m×1m (high *width), the filling earth can use surface topsoil, and after construction the topsoil can be used in afforestation.

8.2.3 Operation stage

(1) Sewage disposal equipment in service area, parking lot and tollgate station shall be repaired and maintained periodically to ensure that the treated sewage can reach class Ⅰ standard of GB8978-1996 "*Sewage Comprehensive Discharge Standard*".

(2) Water quality monitoring plan shall be carried out(seeTable9.1.3-1), supplementary environmental protection measures shall be taken according to the water quality monitored results.

(3) Vehicles that leak or overload bulk goods are forbidden to run on the highway in order to prevent the bulky goods from spillover and causing water pollution along the route.

(4) The pollution risk prevention measures for hazardous articles vehicle accident occurring in river-crossing bridge section during operation stage are referred to section 8.6.

8.3 Mitigation measures for acoustic environmental impact

8.3.1 Design stage

(1) Stone quarries, earth borrow pits, waste banks and mixing stations shall be located far away from residential areas and shall be in 300m away from leeward wind direction. It is required to design the material transportation route rationally to keep

distant from residential areas so to avoid impact of wind-borne flying dust and noise on residents.

(2) It is suggested to further optimize and adjust design plan of some local route through dodging and relocating etc. so to make the route keeping away from acoustically sensitive locations.

(3) If constrained by local conditions, the route alignment cannot dodge or feasibly impossible to dodge in terms of technical and economic justification, noise-reduction measures shall be considered for the influenced sensitive locations in acoustic environment from road design, at the same time the funds for implementing these measures shall be budgeted.

(4) Environmental protection measures that need engineering design proposed in the environmental impact report should be designed for environmental protection simultaneously during the preliminary stage.

(5) According to prediction, different sensitive locations shall adopt different noise-reduction measures such as removal and installing noise-reduction windows, etc. which will be included in the design and bidding documents.

8.3.2 Construction stage

(1) To strengthen construction management. When the construction site lies near schools, the construction unit is required to understand the schooling schedule, strong-noise construction machinery is forbidden to operate at schooling time during the day; in construction site 150m within which there is dense residential area, strong-noise construction machinery is forbidden to operate at night (22:00 - 06:00). If required by production techniques, successive construction must proceed at night, the construction unit must obtain approval from local people's government above county-level or responsible authority, and should also do good propaganda work in advance and shall utilize portable or temporary sound barrier as noise-reduction measure.

(2) Construction unit must select construction machines and transportation vehicle complying with relevant national standards, shall select preferably low-noise construction machinery and techniques, for example substituting hydraulic tool for atmospheric pressure tool, substituting low-noise drived cast-in-place piling for impact or vibration type piling. Fixed mechanical equipment with large vibration should be installed with vibration-reducing base; at the same time attention should be given to

their maintenance and correct operation so as to maintain the noise of roadbuilding machinery at the lowest level. Construction machinery with strong noise shall adopt provisional noise-isolating measures. Material stock grounds and mixing stations should be located 300m away from acoustically sensitive locations.

(3) Noise of roadbuilding machinery is characterized by abruptness, irregularity, discontinuity and high strength, etc. According to investigation, noise at the construction site sometimes goes beyond class 4 noise standard, which can be generally alleviated by changing construction method. For example strong-noise operation can be carried out during daytime (06:00 - 22:00), or adjust the operation time of construction machinery to minimize the influence of construction noise. Noises produced from material transport, shocking and people's shouting during construction period can be alleviated through contractor's good-mannered construction activity and effective management.

(4) Detour roads shall be far away from schools, hospitals, and residences, and shall not cross acoustic sensitive locations. When there are large residences 50m within both sides of detour road, transportation of building materials is forbidden in this detour road at night.

(5) In order to supervise and protect residents' production and life, and school environment, acoustic environmental monitoring will be carried out in construction stage. The supervising engineer is required to sampling-monitor construction site within 100m of which there are larger residential areas or schools during construction stage. Based on monitored results, corresponding noise prevention measures shall be adopted, for instance: limit working time, change transportation route, adopt temporary sound barrier, etc.

(6) The work health standard shall be followed to control construction workers' working hours, personnel protective measures shall be provided to mechanical operators and concerned personnel, such as wearing ear plug and helmet, and so on.

(7) Transporting roadbuilding materials in the National Road 323 and other roads may deteriorate the acoustic environmental quality in sensitive locations along the route; in order to accurately and timely grasp the acoustic environmental quality in sensitive locations along the construction road (including detours), during

construction stage, the supervising engineer is required to monitor the noise in sensitive locations along two sides of G323: Shanshupai,Yuyang. According to the monitored results, if necessary the material hauling route can be considered to change, if unable to avert, temporary sound barriers can be built or some economic compensation can be made with agreement from local residents.

8.3.3 Operation stage

(1) It is suggested that planning department not to approve building schools and hospitals that have high acoustic quality demand within 310m from both sides of the highway, and building houses within 207m, otherwise the acoustic environment protective measures should be solved by the construction units themselves.

(2) Acoustic environmental protection measures for sensitive locations with predicted noise excess

In order to ensure a quiet working, studying and living environment for residents and schools along the proposed highway, corresponding noise prevention measures are taken according to the predicted noise excess, positions, scale, local conditions and project characteristics of sensitive locations.

Generally speaking, the protective measures available for acoustic environment include: adjust the highway alignment, build sound barrier, remove resident's houses, install sound-proofing windows and build wall enclosures, etc.

See Table 8.3.3-1 for the comparison of each measure and their noise reduction effects.

Table 8.3.3-1 List of commonly-used noise-reduction measures

No	Measure		Noise-reduction index	Cost	Applicable conditions
1	Sound barrier	Sound boarding	6～8dB	2500 yuan/ linear meter	① Sensitive building < 50m from road center line ② Relatively centralized residence ③ subgrade height parallel to or higher than house floor height
		Sound boarding + noise barrier	8～10dB	3200 yuan / linear meter	
2	Remove resident's houses for environmental protection		Distinct from noise source	30000～50000 yuan each house	New housing land available to sparse families
3	Build noise-proofing walls for residents' houses		4～6dB	500 yuan / linear meter	① Sensitive building > 50m from road center line ② House floor height parallel to or higher than subgrade height
4	Install ventilation sound-proofing windows		15～20dB	3000 yuan each	Wide application, especially suitable to high-rise building

The available measures that can be used are mainly to remove the households. The removal and resettlement cost for each household is 50000 yuan; the cost for sound barrier along the highway is 2500~3200 yuan/linear meter; the cost for installing ventilation sound-proofing window is 3000 yuan each.

Comparing the above-mentioned measures, sound barrier is better in noise reduction effects, which needs no lands for new residence houses, takes up little land, but which also involves large investment, uneconomical to sensitive locations with scattered households. The advantage of household removal is that it can solve the noise pollution problem in one single step with moderate investment, but needs lands for new residence houses. Installing ventilation sound-proofing windows has remarkable effect, but needs forced ventilation.

See Table 8.3.3-2 for the acoustic environmental protection measures of sensitive locations. Before the measures are implemented, opinions shall be solicited from concerned households, if disagreed with the recommended measures, other alternative measures should be considered. For sensitive locations with small predicted noise excess during the mid and long-term operation stages, periodic monitoring will be taken during the short and mid-term operation stages, and the monitored results will be followed to decide what measures to take such as removal, or sound-proofing.

Table 8.3.3-2 Acoustic environmental protection measures of sensitive locations in the recommended scheme of the proposed highway

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
1	Taoziyuan (I) K31+100～K31+380	Noise excess at night during long-term operation stage 2.9dB Sensitive location is relatively far from the highway (120m) Periodic monitoring will be taken during the mid-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows.	Soundproofing windows		Noise reduction by more than 15dB	300,000 yuan (estimated at 20 households)	Long-term operation stage
2	Taoziyuan (II) K31+370～K31+480 Yangwu (I) K31+570～K31+820	Taoziyuan (II)：Noise excess at night during long-term operation stage 0.2～2dB Yangwu (I)：Noise excess at night during long-term operation stage 2dB Periodic monitoring will be taken during the mid-term operation stage, impact scope will be determined according to the monitored results Sound barrier：to build a sound barrier 350m long in the south side of the highway	Sound barrier	Location of sound barrier K31+300～K31+650	Require acoustic design, noise reduction by more than 6dB	875,000 yuan	Long-term operation stage
3	Yangwu (II) K31+860～K32+320	Noise excess at night during long-term operation stage 3.3dB Households are distributed scarcely along the highway, about half of the households are 100m away from the highway and the village is relatively large in size ① Periodic monitoring will be taken during the short/mid-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows with a cost of about 450000 yuan ② Sound barrier：to build a sound barrier 300m long in the north side of the highway with a cost about 750000 yuan	Soundproofing windows		Noise reduction by more than 15dB	450,000 yuan (estimated at 30 households)	Long-term operation stage
4	Loubei K33+700～K34+300	Noise excess at night during long-term operation stage 2.7dB The village is relatively large in size, difficult to remove; most households are 100m away from the highway, so not good to build sound barrier Periodic monitoring will be taken during the mid-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	360,000 yuan (estimated at 24 households)	Long-term operation stage

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
5	Yanba primary school K34+500	Noise excess by1.6～3.7dB in day time, 0.3～6.6dB at night in short/mid/long-term operation stage This section is a viaduct section with height difference of 10m ①Sound barrier：to build a sound barrier 140m long in the north side of the highway ②EP removal：to remove the school with a cost of about 500000 yuan	Sound barrier	Location of sound barrier K34+420～K34+560	Require acoustic design, noise reduction by more than 6dB	350,000 yuan	Short-term operation stage
6	Zaozixia K34+560～K34+820	Noise excess by 1.6dB in day time, 0.7～5.7dB at night in mid/long-term operation stage Most households are 100m away from the highway, so not good to build sound barrier Periodic monitoring will be taken during the mid-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	150,000 yuan (estimated at 10 households)	Mid-term operation stage
7	Chazixia K34+560～K34+820	Noise excess by 0.1 dB in day time in long-term operation stage, 0.4～6.9dB at night in short/mid/long-term operation stage The village is small in size, distributed along a mountain foot in a strip form ① Sound barrier：to build a sound barrier 220m long in the north side of the highway with a cost about 550000 yuan ②EP removal：to remove 17 households near the highway, the original houses change their use function, with cost of 850,000 yuan.	Sound barrier	Location of sound barrier K34+620～K34+840	Require acoustic design, noise reduction by more than 6dB	550,000 yuan	Short-term operation stage
8	Lingxia K34+800～K35+350	Noise excess at night during long-term operation stage 2.2dB Households are distributed sparsely in a hill foot, the highway passes on the top of hill with height difference of 12m Periodic monitoring will be taken during the mid-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	300,000 yuan (estimated at 20 households)	Long-term operation stage
9	Citangxia K39+220～K39+640	Noise excess at night during long-term operation stage 2.1dB Scattered households, the village is relatively far away from the highway (140m) Periodic monitoring will be taken during the mid-term operation	To plant noise reduction green belt		To select broadleaf and evergreen trees for dense	200,000 yuan	Long-term operation stage

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
		stage, measures will be taken according to the monitored results ①to install soundproofing windows for influenced households with a cost of about 330000 yuan ②To plant noise reduction green belt in the side of village close to the highway, to plant 20m wide arbor-shrub-grass composite protection greenbelt with a cost of 200000 yuan			planting, which can reduce noise by 2dB		
10	Fengshuxia K39+380～K39+640	Noise excess at night during long-term operation stage 0.4～3.5dB Households are scattered Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results ① to install soundproofing windows with a cost of about 225000 yuan ②to remove influenced households with a cost of about 750000 yuan	Soundproofing windows		Noise reduction by more than 15dB	225,000 yuan (estimated at 15 households)	Long-term operation stage
11	Qiangong village K39+640～K39+960	Noise excess by 0.6～2.2dB in day time, 1.2～6.4dB at night in mid/long-term operation stage Periodic monitoring will be taken during the short-term operation stage, measures scope will be taken according to the monitored results ① Sound barrier：to build a sound barrier 250m long in the south side of the highway with a cost about 625000 yuan ② EP removal：to remove 20 households, the original houses change their use function, with cost of 1,000,000 yuan.	Sound barrier	Location of sound barrier K39+700～K39+950	Require acoustic design, noise reduction by more than 6dB	625,000 yuan	Mid-term operation stage
12	Xinxiaowu K39+740～K40+050	Noise excess at night during long-term operation stage 1.3～2.3dB Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 350m long in the north side of the highway	Sound barrier	Location of sound barrier K39+7020～K40+050	Require acoustic design, noise reduction by more than 6dB	875,000 yuan	Long-term operation stage
13	Jiuquping K40+140～K40+260	Noise excess at night during long-term operation stage 2.1dB Periodic monitoring will be taken during the mid-term operation stage, measures scope will be taken according to the monitored results Sound barrier：to build a sound barrier 170m long in the north side of the highway	Sound barrier	Location of sound barrier K40+100～K40+280	Require acoustic design, noise reduction by more than 6dB	425,000 yuan	Long-term operation stage

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
14	Changjiangqiao Laozhaixia K40+360～K41+100	Noise excess at night during long-term operation stage 0.1～1.9dB In the east side of the village there is the old road G323 Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 150m long in the south side of the highway and to build a sound barrier 170m long in the north side of the highway	Sound barrier	Location of sound barrier South side：K40+400～K40+550 North side：K40+350～K40+520	Require acoustic design, noise reduction by more than 6dB	800,000 yuan	Long-term operation stage
15	Wangjiangwan K41+650～K41+800	Noise excess by 0.5dB in day time, 4.6dB at night in long-term operation stage This is a viaduct section, the west of the village is a railway Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 200m long in the north side of the highway	Sound barrier	Location of sound barrier K41+620～K41+820	Require acoustic design, noise reduction by more than 6dB	500,000 yuan	Long-term operation stage
16	Jiaojiangtou K42+300～K42+540	Noise excess at night during long-term operation stage 1.9dB Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results ①Sound barrier：to build a sound barrier 200m long in the south side of the highway with a cost about 500000 yuan ②to remove influenced households with a cost of about 750000 yuan	Sound barrier	Location of sound barrier K42+300～K42+500	Require acoustic design, noise reduction by more than 6dB	500,000 yuan	Long-term operation stage
17	Tangtouxia K42+600～K42+800	Noise excess by 0.1～1.7dB in day time, 0.5～6dB at night in mid/long-term operation stage Periodic monitoring will be taken during the short-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	180,000 yuan (estimated at 12 households)	Mid-term operation stage
18	Datian primary school K42+550	Noise excess by 1.6～2.1dB in day time in short/mid/long-term operation stage, 0.5 dB at night in long-term operation stage, the ambient noise added value is 0.8dB in day and 5.1dB at night, the main reason of predicted noise excess is due to the excessive background value The school is 180m away from the highway, no boarding at night	To plant noise reduction green belt		To select broadleaf and evergreen trees for dense planting, which can reduce noise	100,000 yuan	Mid-term operation stage

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
		To plant noise reduction green belt in the side of school close to the highway, to plant 10m wide arbor-shrub-grass composite protection greenbelt with a cost of about 100000 yuan			by 1dB		
19	Hetang K42+600～K42+700	Noise excess by 0.1～1.7dB in day time, 0.5～6dB at night in mid/long-term operation stage Periodic monitoring will be taken during the short-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	150,000 yuan (estimated at 10 households)	Mid-term operation stage
20	Qiuqiu K42+900～K43+100	Noise excess at night during long-term operation stage 2.9～3.8dB Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 200m long in the south side of the highway	Sound barrier	Location of sound barrier K42+900～K43+100	Require acoustic design, noise reduction by more than 6dB	500,000 yuan	Long-term operation stage
21	Huoxing primary school K43+900	Noise excess by 2.9～3.5dB in day time in short/mid/long-term operation stage, 1.1 dB at night in long-term operation stage, the ambient noise added value is 0.8dB in day and 6.8dB at night, the main reason of predicted noise excess is due to the excessive background value The school is located in a hill foot, the highway passes by cutting the hill top, no boarding at night in the school To plant noise reduction green belt in the side of school close to the highway, to plant 10m wide arbor-shrub-grass composite protection greenbelt with a cost of about 100000 yuan	To plant noise reduction green belt		To select broadleaf and evergreen trees for dense planting, which can reduce noise by 1dB	100,000 yuan	Mid-term operation stage
22	Xijiang township sanatorium K48+500	Noise excess by 1.7～3.2dB in day time in short/mid/long-term operation stage, 4.2 dB at night in long-term operation stage The sanatorium is 174m away from the proposed highway with a hillock between, so not heavily influenced by the highway. The main reason for predicted noise excess is due to that the sanatorium is closely adjacent to national road 323 (about 20m), the background value is already excessive. No action is taken					
23	Shanshupai K48+900～	Noise excess by 0.2dB in day time in long-term operation stage,0.6～3.2dB in short/mid/long-term operation stage	Sound barrier	Location of sound barrier	Require acoustic design, noise	1.45 million	Short-term operation stage

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
	K49+460	Sound barrier：to build a sound barrier 580m long in the north side of the highway		K48+900～K49+480	reduction by more than 6dB	yuan	
24	Shanbei K49+580～K49+740	Noise excess at night during short/mid/long-term operation stages 0.3～2.2dB Sound barrier：to build a sound barrier 160m long each in the south and north sides of the highway	Sound barrier	Location of sound barrier K49+580～K49+740	Require acoustic design, noise reduction by more than 6dB	800,000 yuan	Short-term operation stage
25	Yuyang K54+700～K55+220	Noise excess at night during long-term operation stage 3.4dB Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 400m long in the north side of the highway	Sound barrier	Location of sound barrier K54+700～K54+960 K55+100～K55+240	Require acoustic design, noise reduction by more than 6dB	1 million yuan	Long-term operation stage
26	Heliaoxia K56+400～K57+060	Noise excess at night during long-term operation stage 4dB Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 320m long in the south side of the highway and to build a sound barrier 120m long in the north side of the highway	Sound barrier	Location of sound barrier South side：K56+400～K56+720 North side：K56+620～K56+740	Require acoustic design, noise reduction by more than 6dB	1.1 million yuan	Long-term operation stage
27	Shijing K71+950～K72+330	Noise excess at night during long-term operation stage 3.5dB Viaduct section, the village is relatively far away from the highway (110m) ① Soundproofing windows ②To plant noise reduction green belt 200m long, to plant 10m wide arbor-shrub-grass composite protection greenbelt in the side of village close to the highway	To plant noise reduction green belt		To select broadleaf and evergreen trees for dense planting, which can reduce noise by 1dB	100,000 yuan	Long-term operation stage
28	Shangduan K73+550～K73+800	Noise excess at night during long-term operation stage 3.5dB Periodic monitoring will be taken during the mid-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	150,000 yuan (estimated at 10 households)	Long-term operation stage
29	Huangtian K74～K74+280	Noise excess by 0.8dB in day time, 3.9～6.1dB at night in long-term operation stage	Soundproofing windows		Noise reduction by more than	150,000 yuan	Long-term operation stage

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
		Periodic monitoring will be taken during the mid-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows			15dB	(estimated at 10 households)	
30	Shihuiling K75+050～K75+570	Noise excess at night during long-term operation stage 3～3.2dB Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 280m long in the south side of the highway and to build a sound barrier 240m long in the north side of the highway	Sound barrier	Location of sound barrier South side：K75+120～K75+400 North side：K75+320～K75+560	Require acoustic design, noise reduction by more than 6dB	1. 30 million yuan	Long-term operation stage
31	Tudi K76+175～K76+400	Noise excess by 0.4dB in day time, 5.6dBat night in long-term operation stage Periodic monitoring will be taken during the mid-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	120,000 yuan (estimated at 8 households)	Long-term operation stage
32	Youliaobei K76+435～K76+825	Noise excess at night during mid/long-term operation stages 1.5～5.8dB Periodic monitoring will be taken during the short-term operation stage, measures will be taken according to the monitored results ① Sound barrier：to build a sound barrier 210m long in the south side of the highway and to build a sound barrier 120m long in the north side of the highway with cost of 825000 yuan ② EP removal：to remove 26 scattered households near the highway, the original houses change their use function, with cost of 1,300,000 yuan.	Sound barrier	Location of sound barrier South side：K76+540～K76+750 North side：K76+560～K76+680	Require acoustic design, noise reduction by more than 6dB	825,000 yuan	Mid-term operation stage
33	Tangmianshang K76+445～K77+160	Noise excess at night during long-term operation stage 3.4～4.4dB Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results ① Sound barrier：to build a sound barrier 80m long in the south side of the highway and to build a sound barrier 210m long in the north side of the highway with cost of 725000 yuan	Sound barrier	Location of sound barrier South side：K76+900～K76+980 North side：	Require acoustic design, noise reduction by more than 6dB	725,000 yuan	Long-term operation stage

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
		② EP removal：to remove 25 scattered households near the highway, the original houses change their use function, with cost of 1,250,000 yuan.		K76+760～K76+970			
34	Daping K77+680～K77+900	Noise excess at night during long-term operation stage 3.6dB Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results ① to install soundproofing windows for influenced households ② To plant noise reduction green belt, to plant 20m wide arbor-shrub-grass composite protection greenbelt in the south side of the highway	To plant noise reduction green belt		To select broadleaf and evergreen trees for dense planting, which can reduce noise by 2dB	200,000 yuan	Long-term operation stage
35	Hantang K78+350～K78+480	Noise excess at night during long-term operation stage 0.9～4.6dB Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 120m long in the north side of the highway	Sound barrier	Location of sound barrier K78+340～K78+460	Require acoustic design, noise reduction by more than 6dB	300,000 yuan	Long-term operation stage
36	Chixu K79+850～K80+130	Noise excess at night during long-term operation stage 4dB Periodic monitoring will be taken during the mid-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	270,000 yuan (estimated at 18 households)	Long-term operation stage
37	Hongtang K99+170～K99+560	Noise excess by 0.1～1.1 dB in day time in mid/long-term operation stage, 0.3～5.3dB at night in long-term operation stage Periodic monitoring will be taken during the short-term operation stage, measures will be taken according to the monitored results ① to install soundproofing windows for influenced households with a cost of about 375000 yuan ② EP removal：to remove 25 households with cost of 1.25 million yuan. ③to build a sound barrier 190m long in the north side of the highway with a cost of 475000 yuan	Soundproofing windows		Noise reduction by more than 15dB	375,000 yuan (estimated at 25 households)	Mid-term operation stage
38	Xinwu K99+610～K99+910	Noise excess by 0.1～2.5dB in day time, 1～7.2dB at night in short/mid/long-term operation stage Periodic monitoring will be taken during the short-term operation stage, impact scope will be determined according to the monitored	Soundproofing windows		Noise reduction by more than 15dB	225,000 yuan (estimated at 15	Midt-term operation stage

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
		results, and the impacted households will be installed with soundproofing windows				households)	
39	Pengwu K101+980～K102+520	Noise excess during mid/long-term operation stages 0.3～5.6dB Scattered households, few are close to the highway Periodic monitoring will be taken during the short-term operation stage, measures will be taken according to the monitored results ①Soundproofing windows: to install soundproofing windows for households with excessive noise impact, with a cost of about 225000 yuan ②EP removal：to remove 15 households, the original houses change their use function, with cost of 750,000 yuan.	Soundproofing windows		Noise reduction by more than 15dB	225,000 yuan (estimated at 15 households)	Mid-term operation stage
40	Tianzigang K102+700～K102+910	Noise excess at night during long-term operation stage 3.5dB Periodic monitoring will be taken during the mid-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	225,000 yuan (estimated at 15 households)	Long-term operation stage
41	Shuiduan K102+880～K103+080	Noise excess by 0.2～1.2dB in day time, 1.4～5.3dB at night in mid/long-term operation stage Periodic monitoring will be taken during the short-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 240m long in the north side of the highway	Sound barrier	Location of sound barrier K102+860～K103+100	Require acoustic design, noise reduction by more than 6dB	600,000 yuan	Mid-term operation stage
42	Xiamaoping K103+490～K103+840	Noise excess by 0.8dB in day time in long-term operation stage, 0.8～4.7dB at night in mid/long-term operation stage Close to national road G323, seriously influenced by the old road, the proposed highway overcrosses the old road by a viaduct, scattered households Periodic monitoring will be taken during the short-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 340m long in the north side of the highway	Sound barrier	Location of sound barrier K103+600～K103+940	Require acoustic design, noise reduction by more than 6dB	850,000 yuan	Mid-term operation stage
43	Maoping K103+790～K104+300	Noise excess at night during long-term operation stage 3.4dB Viaduct section Periodic monitoring will be taken during the mid-term operation	Sound barrier	Location of sound barrier K103+940～	Require acoustic design, noise reduction by	750,000 yuan	Long-term operation stage

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
		stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 300m long in the north side of the highway		K104+240	more than 6dB		
44	Zhaijiaoxia K104+940～K105+050	Noise excess at night during long-term operation stage 0.8dB Viaduct section, near Xiashan tunnel mouth To plant noise reduction green belt 100m long, to plant 10m wide arbor-shrub-grass composite protection greenbelt in the side of village close to the highway	To plant noise reduction green belt		To select broadleaf and evergreen trees for dense planting, which can reduce noise by 1dB	100,000 yuan	Mid-term operation stage
45	Xiaba K114+530～K114+850	Noise excess at night during mid/long-term operation stages 0.9～5dB Viaduct section Periodic monitoring will be taken during the short-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	225,000 yuan (estimated at 15 households)	Mid-term operation stage
46	Pingzigao K119+600～K119+860	Noise excess by 0.2dB in day time, 1.9～5.9dB at night in mid/long-term operation stage A viaduct section with scattered households Periodic monitoring will be taken during the short-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	300,000 yuan (estimated at 20 households)	Mid-term operation stage
47	Xiaomenkou K119+580～K120	Noise excess at night during mid/long-term operation stages 1.5～5.5dB A viaduct section with scattered households Periodic monitoring will be taken during the mid-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	300,000 yuan (estimated at 20 households)	Midt-term operation stage
48	Laohupai K124+650～K124+880	Noise excess at night during mid/long-term operation stages 1.7～4.7dB Periodic monitoring will be taken during the short-term operation	Sound barrier	Location of sound barrier K124+700～	Require acoustic design, noise reduction by	250,000 yuan	Mid-term operation stage

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
		stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 100m long in the south side of the highway		K124+800	more than 6dB		
49	Wansong primary school K126+710～K126+740	Noise excess by 0.8dB in day time in long-term operation stage, 1.9～6.1dB at night in short/mid/long-term operation stage Background value in day time already excessive The school is located in a hill foot, and is 110m away from the highway, the highway passes by cutting the hill top Periodic monitoring will be taken during the short-term operation stage, measures will be taken according to the monitored results ① Soundproofing windows：cost of 120,000 yuan ② EP removal： cost of 300,000 yuan.	Soundproofing windows		Noise reduction by more than 15dB	120,000 yuan (estimated at 40 windows)	Mid-term operation stage
50	Zouwu K132+260～K132+400	Noise excess at night during mid/long-term operation stages 1.3～4.6dB the village is not large in size, distributed in a hill foot Periodic monitoring will be taken during the short-term operation stage, measures will be taken according to the monitored results ① Sound barrier：to build a sound barrier 170m long in the north side of the highway with a cost about 425000 yuan ② EP removal：to remove influenced households with cost of 750,000 yuan.	Sound barrier	Location of sound barrier K132+280～K132+450	Require acoustic design, noise reduction by more than 6dB	425,000 yuan	Mid-term operation stage
51	Shizishuxia K132+340～K132+670	Noise excess at night during mid/long-term operation stages 1.5～5.7dB Households are distributed along a hill foot, the highway passes by cutting the hill top, most households are sheltered by hill slope Periodic monitoring will be taken during the short-term operation stage, measures will be taken according to the monitored results ① Sound barrier：to build a sound barrier 360m long in the south side of the highway with a cost about 225000 yuan ② EP removal：to remove influenced households with cost of 500,000 yuan.	Sound barrier	Location of sound barrier K132+100～K132+460	Require acoustic design, noise reduction by more than 6dB	900,000 yuan	Mid-term operation stage
52	Tianxin primary school K132+500～	Noise excess by 2.4～3.2dB in day time time in short/mid/long-term operation stage, 1.7～4.5dB at night in mid/long-term operation stage Background value in day time already excessive	Sound barrier	Location of sound barrier K132+460～	Require acoustic design, noise reduction by	300,000 yuan	Short-term operation stage

No	Name of sensitive locations	Noise excess and environmental protection measure comparison	Recommended measure		Noise-reduction effect	Investment estimate	Implementation time
	K132+570	① Sound barrier：to build a sound barrier 120m long in the south side of the highway with a cost about 300000 yuan ② EP removal：to remove Tianxin primary school with cost of 300,000 yuan.		K132+580	more than 6dB		
53	Hechangbei K132+680～K132+850	Noise excess at night during long-term operation stages3dB Periodic monitoring will be taken during the mid-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 170m long in the north side of the highway	Sound barrier	Location of sound barrier K132+700～K132+870	Require acoustic design, noise reduction by more than 6dB	425,000 yuan	Long-term operation stage
54	Paishang K141+200～K141+400	Noise excess at night during mid/long-term operation stages 2.1～5.1dB Periodic monitoring will be taken during the short-term operation stage, measures will be taken according to the monitored results Sound barrier：to build a sound barrier 80m long in the south side of the highway and to build a sound barrier 100m long in the north side of the highway	Sound barrier	Location of sound barrier South side：K141+240～K141+300 North side：K141+260～K141+360	Require acoustic design, noise reduction by more than 6dB	450,000 yuan	Mid-term operation stage
55	Shanbiantoushang K141+570～K141+800	Noise excess by 0.9dB in day time in long-term operation stage, 3.4～6.7dB at night in mid/long-term operation stage Centered households, relatively far away from the highway (90m) Periodic monitoring will be taken during the short-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows	Soundproofing windows		Noise reduction by more than 15dB	225,000 yuan (estimated at 15 households)	Mid-term operation stage
56	Gangbianpai K142+290～K142+430 Gangbian primary school K142+340～K142+400	Gangbianpai：Noise excess at night during short/mid/long-term operation stages 1.1～7.3dB Gangbian primary school：Noise excess by 2.6～3.2dB in day time time in short/mid/long-term operation stage, 0.7～3.8dB at night in mid/long-term operation stage, background value in day time already excessive The school is within the village, no boarding at night,there are households between the school and the highway Sound barrier：to build a sound barrier 170m long in the south side of the highway	Sound barrier	Location of sound barrier K142+280～K142+450	Require acoustic design, noise reduction by more than 6dB	425,000 yuan	Short-term operation stage

<table>
<tr><th>No</th><th>Name of sensitive locations</th><th>Noise excess and environmental protection measure comparison</th><th colspan="2">Recommended measure</th><th>Noise-reduction effect</th><th>Investment estimate</th><th>Implementation time</th></tr>
<tr><td>57</td><td>Tengshuwo
K142+310～K142+450</td><td>Noise excess by 1.3～2.9dB in day time in mid/long-term operation stage, 0.9～8.7dB at night in short/mid/long-term operation stage
Most households are 120m away from the highway
Periodic monitoring will be taken during the short-term operation stage, impact scope will be determined according to the monitored results, and the impacted households will be installed with soundproofing windows</td><td>Soundproofing windows</td><td></td><td>Noise reduction by more than 15dB</td><td>150,000 yuan (estimated at 10 households)</td><td>Mid-term operation stage</td></tr>
<tr><td>58</td><td>Yongquangangshang
K144+340～K144+640</td><td>Noise excess by 0.1dB in day time in long-term operation stage, 2.7～5.8dB at night in mid/long-term operation stage Periodic monitoring will be taken during the short-term operation stage, measures will be taken according to the monitored results
Sound barrier：to build a sound barrier 120m long in the north side of the highway</td><td>Sound barrier</td><td>Location of sound barrier K144+380～K144+500</td><td>Require acoustic design, noise reduction by more than 6dB</td><td>300,000 yuan</td><td>Mid-term operation stage</td></tr>
<tr><td rowspan="2">59</td><td>Cangxia
K147+230～K147+350</td><td rowspan="2">Cangxia：Noise excess by 0.3dB in day time in long-term operation stage, 3～6.1dB at night in mid/long-term operation stage
Yeshan primary school：Noise excess by 3.3～5dB in day time, 1.5～9dB at night in short/mid/long-term operation stage, background value in day time already excessive
The school is within the village, there are households between the school and the highway
Sound barrier：to build a sound barrier 210m long in the north side of the highway</td><td rowspan="2">Sound barrier</td><td rowspan="2">Location of sound barrier K147+150～K147+360</td><td rowspan="2">Require acoustic design, noise reduction by more than 6dB</td><td rowspan="2">525,000 yuan</td><td rowspan="2">Short-term operation stage</td></tr>
<tr><td>Yeshan primary school
K147+200～K147+250</td></tr>
<tr><td colspan="8">Sound barrier：30 places, 7900 linear meters, investment estimate of 19.35 million yuan
Soundproofing window：22 places, 338 households/1725 windows, investment estimate of 5.175 million yuan
Noise reduction greenbelt：6 places, investment estimate of 800000 yuan
Total investment estimate：25.725 million yuan
Measures implementated during short-term operation stage: 7 places, implementated during mid-term operation stage:24 places, implementated during long-term operation stage:27 places.</td></tr>
</table>

Note：① for sensitive locations that environmental protection measures implementated during mid-term and long-term operation stage, the environmental protection measures can be properly adjusted according to monitored results.；② before implementing the measures, the protected subjects' opinions shall be solicited, if the recommended measures are not agreed, then alternative measures can be considered.

(3) Implementing noise monitoring plan and according to the monitored results to determine whether to adopt supplementary acoustic environmental protection measures. The predicted results of most sensitive locations are excessive during the mid and long-term operation stages, so it is necessary to conduct periodic monitoring on these sensitive locations after the highway is put into operation, and corresponding noise reduction measures will be taken according to the monitored results. 15 representative sensitive locations are chosen for periodic monitoring during the operation stage, see Table 9.1.3-1 for details.

(4) Strengthening traffic administration can effectively control traffic noise pollution. Vehicle of bad performance are restrained from running on the highway. When passing around towns and schools or other sensitive locations, the vehicles are forbidden to horn. The highway pavement shall be maintained regularly to guarantee evenness.

8.4 Mitigation measures for ambient air impact

8.4.1 Design stage

(1) Stone quarries, earth borrow pits, waste banks and mixing stations shall be located far away from residential areas and shall be in 300m away from leeward wind direction.

(2) It is required to design the material transportation route rationally to distant from residential areas so to avoid influences of wind-borne flying dust and noise on residents.

8.4.2 Construction stage

(1) Stock grounds, mixing stations of highway Construction shall be located in such places within 300m leeward of which there are no residences, hospitals and schools. Mixing machines shall be well sealed and shall be installed with shock absorber and dust remover. Operators shall be provided with labor protection devices such as eyeshield and mask.

(2) Roadbuilding materials that are easy to spill should adopt wet method to transport, covered by tarpaulin to prevent flying dust pollution on atmosphere.

(3) Roads for transporting materials, construction site especially stabilizing soil mixing station, shall have necessary water sprinkling to prevent wind-borne flying dust.

Water shall be sprinkled in dry weather, twice every day in the morning and afternoon respectively.

(4) In filled subgrade, water shall be sprinkled correspondingly according to material compaction requirement. The contractor must also often sprinkle water after material compaction so to ensure that materials do not fly dust.

(5) Construction roads, construction sites and mixing stations shall be sprinkled by water to prevent dust flying.

(6) Management on materials which are apt to cause flying dust must be strengthened, which shall not be piled up in the open ground. The stock grounds shall be at least 300m away from sensitive locations such as school and village.

8.4.3 Operation stage

(1) To strengthen road management and pavement maintenance, to keep the road in good operation state, to reduce traffic congestion and jam.

(2) To strengthen management of vehicles transporting bulky materials such as coal, cement, grit material and simple packaged chemical fertilizer and agricultural chemical, etc. and geotextile shall be covered when transporting the above-mentioned articles. These vehicles shall be inspected in the entrance of highway.

(3) To design afforestation and beautification project on highway boundary limits, to choose tree species that can purify the air, and to do good implementation of afforestation project and maintenance.

(4) To maintain tunnel air blowers and to guarantee good ventilation in the tunnel.

(5) To enforce ambient air monitoring plan, and to take supplementary environmental protection measures according to the monitored results.

8.5 Mitigation measures for social environmental impact

8.5.1 Design stage

(1) In route selection, interchange setting-up, environmental protection, removal and resettlement, consultations have been made with along-the-route governments, related departments, NGOs, villagers' committees, collective units and even individuals for soliciting their suggestions and for gaining public support on this project implementation.

(2) It is suggested that during the preliminary design stage and construction

drawing design stage, suggestions from local governments at all levels along the route are further solicited with attention paid to public participation. On the basis of full justification of reclaiming earth borrow and waste banks, their locations, quantity and borrowing and disposal methods shall be determined rationally.

(3) It is suggested to further optimize alignment design, to determine rational earth borrowing and waste volumes by earth/stone works balance calculation, and to optimize afforestation design so as to make it in close harmony with peripheral natural and human landscape and to highlight local characteristics.

(4) The contract signed between the owner and contractors should define contractor's responsibility and obligation to protecting the environment. The contractor shall open complaint telephone for environmental protection in construction site. For complaints the owner should contact local environmental protection department in time in order to deal with various kinds of environmental disputes in time.

(5) It is to entrust Jiangxi Provincial Cultural Relic Bureau and Jiangxi Provincial Cultural Relic Institute to carry out cultural relic reconnaissance along the route and to submit cultural relic investigation report. For details see the cultural relic investigation report of this project.

(6) The design for this project has always emphasized a principle of averting villages and small towns with least farmland occupation and removal. Immigrant resettlement offices are established in each level, the "*Resettlement Action Plan*" (RAP) was formulated, and independent supervising organization was hired. For concrete contents, see the "*Resettlement Action Plan*" (RAP).

8.5.2 Construction stage

(1) Effective means shall be used to further publicize the importance of this project and relevant policies and regulations concerning removal and resettlement issues so that local people support the construction of this project.

(2) Rely on local governments to do good job in land acquisition. Compensation fee shall be paid rationally so to safeguard the people's legitimate interests and to guarantee that the number of households whose lands are to be acquired and who are to be removed and resettled is a minimum, and to guarantee that their living standard is not lower than the level before this project construction.

(3) Septic tank and dustbin shall be sett up in construction campsite and

construction unit is responsible for removing and clearing the garbage and septic tank on time to prevent disease from breakout; epidemic prevention shall be well carried out by regularly killing harmful organisms such as the mouse, fly, mosquito, cockroach, etc.

(4) Contractors must provide workers with helmets and earplugs according to labor protection regulations, and must check workers' health condition; construction sites must be staffed with professional medical worker to provide medical service to the workers, and the medical worker must educate the construction workers on hygiene knowledge periodically. The drinking water in construction site should meet the national sanitary standard for drinking water. Personnel engaged in catering must obtain the hygiene license, and shall receive physical examination regularly;

(5) Construction sign boards shall be hung at construction site, indicating the project name, project responsible person name, builder's license and complaint telephone number, etc., so as to receive supervision from various circles of society and the local people; The construction unit should assign 1-2 full-time environmental protection personnel to be responsible for environmental management.

(6) In order to restore the natural landscape along the route and to highlight the view sight of modernized highway, when the proposed project is completed, all unnecessary and temporary works influencing the landscape should be removed in time, the material stock grounds and mixing stations shall be cleared up, the construction waste materials and sewage garbage shall be handled properly, the vegetation destroyed by the temporary works should be restored as much as possible. If the detour roads have value of utilization, local government can be consulted to clear and repair them before put into operation, at the same time the roadside shall be afforested and planted with trees to restore the landscape environment. If the National Road 323 and local roads are used as detour roads, during construction their pavements shall be maintained tidy and neat, damaged sections should be repaired in time. At the same time the traffic shall be controlled and mobilized to avoid traffic jam.

(7) Transportation management of National Road 323 shall be strengthened. Vehicles transporting construction materials shall be constrained by their time of passing, for example to avoid rush hour to transport roadbuilding materials; at the same time the contractor is required to carry out good transportation plan. Sand and stones shall be prepared in advance in a time with relatively small traffic.

(8) Local public security department and transportation management department shall be coordinated and cooperated with so to dredge traffic jam in time, to deal with traffic accident, and to ensure unblocked transportation.

(9) In order to guarantee noncongestion of the original roads, in intersection points of the highway with these roads, detour roads need to be set up. Such detours roads must be located in one side of the original road, and after the intersection bridge is open to traffic, the detour road will be built into highway subgrade.

(10) In conspicuous place of construction site, telephone number for environmental complaint will be posted for complaint; the owner and contractors must immediately contact with local environmental protection department and solve the dispute within 48 hours.

(11) During construction, if unexplored underground historical relics are found, then construction shall stop immediately, supervising engineer shall protect the site, local historical relic department shall be notified to deal with.

8.6 Traffic accident management and prevention measures

8.6.1 Design

(1) In the entrances and exits of bridges crossing water bodies and tunnels, to set up warning signs "Cautious Drive "(yellow) and “Speed limit 60km for hazardous cargo vehicles (red)" respectively so to remind the drivers to be careful of safety and speed control.

(2) At 100m in front of each tollgate station, to set up Attention Sign (blue) to remind the drivers of hazardous cargo vehicles to drive aside, to declare and to wait for inspection voluntarily.

(3) The 12 bridges (see Table 8.2.1-1) crossing water bodies are required to have guardrails at both sides strengthened and reinforced to prevent the vehicles from falling into the water and causing water pollution.

(4) Runoff collection measures for bridges crossing water bodies

In order to prevent river- and reservoir-crossing bridge sections from occurring accident of hazardous articles vehicles resulting in water pollution, the bridges crossing water bodies are required to design closed and perfect bridge floor drainage system which can lead the runoff into the sedimenting tanks at the two ends of bridge so that the leaked hazardous articles on the bridge floor will not enter into rivers along with the runoff.

There are 12 bridges crossing rivers and reservoirs, for which special drainage design have been conducted to collect the bridge floor runoff into the sedimenting tanks at the two ends of bridge. The capacity of sedimenting tank is required to store one rainfall（15 minutes）with the raining strength of the largest rainfall in 5 years in that region plus 50%.

During highway operation stage, the sedimenting tanks shall be periodically maintained and managed so as to ensure their good use and operation.

(5) Tunnel safety design

① To set up management facilities for tunnel operation and to install relevant equipment

Tunnel operation management facilities is composed of 8 systems such as ventilating system, power supply and illumination system, fire-fighting system, traffic control system, urgent telephone system, closed-circuit TV system, fire warning system and central control system.

A. Ventilation system

The 3 tunnels longer than 1000m of this project (Zhonggongzhang tunnel, Yudu tunnel and Xiashan tunnel) and Jiuling tunnel which is 540m long are all designed to install mechanical ventilating equipment according to the design requirements of 《*Highway Tunnel Ventilation and Illumination Design Standard*》（JTJ026.1-1999）. The ventilation system is composed of boaster air blower, air blower driving cabin, carbon monoxide monitor and visibility monitor. Two boaster air blowers form one group installed under the crown in front of tunnel construction boundary limit. The air blower power source is three-phase 380V adopting radiating power supply method, each air blower independently is supplied electric power from one low voltage outlet loop from the transformer substation, the air blower control point is located in the transformer substation. Nearby the air blower in the tunnel there is set up a distributing box installed with internal load switch which is used to cut off the power in case of blower repair so as to ensure safety. The air blower control and the local controller (PLC) within the tunnel hole are connected, the management and maintenance staff can operate manually or automatically the air blower in the air blower distributing box, or long-distance automatic control can be achieved through the PLC of the monitoring center.

B.Firefighting system

The firefighting system is composed of fire hydrant and chemical fire extinguisher; the fire alarm system has fire alarm button. In tunnels smaller than 1000m in length, fire extinguishers are installed in two sides of driving direction, and one extinguisher chamber is set up every 50m installed with three 6kg portable ammonium phosphate dry powder fire extinguishers. In the 3 tunnels longer than 1000m in length, fire extinguishers and hydrants are installed (in the left and right side of driving direction respectively).

The firefighting water supply system is composed of water collecting tank (catch basin), submerged pump, high level water storage tank and water supply pipe network, the tunnel left and right lines use one water supply system forming a reliable annular network of water supply by piping. The water used in firefighting is collected from the water seepage from the mountain by the water collecting tank, elevated by submerged pump installed in the collecting tank to the water storage tank, which then is lead to each water-use point in the tunnel by the pipe network(water is constantly available in the pipe network so that the water can be used in firefighting in case of fire). Zhonggongzhang tunnel is 4160m long with the tunnel longitudinal gradient being one-way slope, therefore there exists the problem of pipeline overpressure. In order to guarantee the stability and safety of firefighting system, it is to adopt use water supply in different zones by installing a set of water supply system each in the entrance and exit. The firefighting water consumption includes the water used in firefighting and other purposes. Considering that the impact scope of fire is generally between 20 ~ 50m and malignant accident will have serious impact, it is required to install 2 sets of fire hydrants and 4 water guns and to install 2 sets of aqueous film firefighting systems. The design firefighting duration time is 4 hours, the total water consumption is approximately 302m^3, therefore it is required to build two 300m^3 high-level water storage tanks, each on the mountain of tunnel portals respectively and to build one 500m^3 water collecting tank under the mountain to collect water seepage from the mountain. The water storage tank is equipped with water inlet pipe, outlet pipe, blow-down pipe, overflow pipe, water level display control meter and air vent.

C. Monitoring system

The tunnel safety monitoring adopts three-level control pattern, namely the monitoring subcenter, tunnel management station and field control.

With the aid of information gathered from wind speed wind and direction detector, carbon monoxide/visibility detector, fire detection and alarming device installed within the tunnel and rescues telephone installed outside, the monitoring system adopts closed-circuit TV camera and daily patrol vehicles to further confirm, issue control command for the outfield variable symbol and at the same time to inform concerned departments to send personnel for site dispatch or rescue through the processing and determination of central computer system.

② Tunnels all should set up an emergency parking strip in the middle with good surrounding rock condition, and correspondingly one transverse gallery for cars and two transverse galleries for pedestrians in interval.

③ To set up special-purpose signs to remind the drivers to pay attention to safe driving.

8.6.2 Hazardous substance transportation management measures during operation stage

In order to guarantee transportation security of hazardous cargo, the country and related departments have already formulated relevant regulations as follows, mainly:

(1) “*Safe Management Regulation for Chemical Hazardous Cargo*”. State Council;

(2) “*Automobile Transportation Regulations for Hazardous Cargo*”(JT617-2004)

(3) *“Operational Procedure for Hazardous Cargo Automobile Transportation and Loading/unloading*”(JT618-2004)

(4) “*People's Republic of China Law on Gun Management*”

(5) “*People's Republic of China Regulations on Civil Explosive Management*”

(6) “*People's Republic of China Regulations on Radio Isotope and Radioactive Device Management*”

(7) “*Regulation on Hazardous Cargo Transportation*” Ministry of Railways

(8) “*Jiangxi Province Highway Administration Management Method on Hazardous Cargo Transport*”

According to the above relevant regulations, the current Chinese hazardous cargo transportation management mode is as follows:

(1) The prefectural and municipal transportation bureaus set up dispatch and shipping agency network for chemical hazardous cargo transport in respective areas.

(2) Local transportation bureaus realize qualificational authentication to the shipping agencies and carrier units. Each shipping agency and carrier unit engaged in the production, sale, storage, and foreign trade of hazardous chemical goods should submit transport plan and relevant report forms to the local transportation bureaus.

(3) Chemical hazardous cargo transportation implements the system of "cargo license”, "driver license" and "guardian license". All vehicles engaged in hazardous chemical cargo transportation should use unified special-purpose sign and shall be inspected regularly in fixed places, relevant personnel shall be trained and certified.

(4) Public security, transportation management and fire fighting departments shall designate driving route to vehicles transporting hazardous cargo. The vehicles transporting chemical hazardous cargo must be parked in designated parking lot.

(5) Vehicles engaged in long-distance hazardous cargo transportation must use unified waybill with special mark. Each public security and traffic inspection station is responsible for supervising and inspecting.

As far as this project is concerned, the following management measures for hazardous substance transportation are enforced：

(1) Declare management system is enforced for vehicles transporting hazardous cargo. The driver (owner) needs to fill in a declaration form indicating the hazardous cargo license number, goods variety/grade/serial number, names of receiver and dispatcher, loading/unloading place, cargo characteristic, etc.

(2) In ultra-wide lane of highway entrance and exit, the three licenses shall be checked for completeness, after proved to be satisfactory, vehicles are allowed to go.

(3) Generally vehicles transporting hazardous cargo shall be arranged to pass through in a period with less traffic volume (such as 12:30 - 15:00). Under bad climate condition, they are forbidden to go on the highway.

(4) On highway entrance and exit, drivers are distributed the “*Safe Driving Guide in Ruijin-Ganzhou Highway*” which will be compiled by transportation security experts and contains accident emergency treatment method, contact telephone number and

mailing address of safety commission, etc.

(5) Declaration and checking of hazardous cargo transporting vehicles on highway entrance and exit will be carried out by fee-collectors in tollgates. Relevant staff members shall be trained on hazardous cargo vehicle management method, declaration, safety inspection, workflow and fire fighting, which will be included in the training plan of the project.

(6) When hazardous cargo vehicles loading detonator and explosive need to pass tunnels, the staff members of tollgate stations shall notify tunnel management staff in time that will send special personnel to escort the vehicles to pass the tunnel.

8.6.3 Possibility analysis of inspecting hazardous cargo vehicle in tollgate

The hazardous cargo automobile transportation in China strictly observes the "*Automobile Transportation Regulations for Hazardous Cargo*" (JT617-2004) and the "*Operational Procedure for Hazardous Cargo Automobile Transportation and Loading/unloading*" (JT618-2004) issued by Ministry of Communications of the People's Republic of China, which stipulate detailed regulations on hazardous cargo classification, packaging and sign, vehicle and equipment, consignment and documentation, shipping and receipt, transporting and loading/unloading, custody and fire fighting, supervising and management, etc. Vehicles transporting hazardous cargo need to register with transportation authority and to receive supervision and management from the transportation authorities of all levels. The vehicles need to stop and pay for toll while entering the expressway. In 100 m in front of tollgate there is an indication board (blue) reminding hazardous cargo vehicle' driver to step aside and to voluntarily declare and receive inspection. In the outmost side of tollgate there is ultra wide lane for ultra wide vehicle and hazardous cargo vehicle to use. In addition, the hazardous cargo vehicle shall hang a signal flag with black word "hazardous cargo" in yellow background in the left front, also the driver can remind the fee-collector to inspect the hazardous cargo vehicle.

8.6.4 Possibility analysis of accident within tunnel

According to forecast and analysis, within the tunnel traffic accident possibility is far smaller than accident rate in general road section, but such accident possibility still exists. Hazardous cargo traffic accident occurred within tunnel is mainly fire caused by hazardous cargo explosion and combustion, and noxious gas pollution, resulting in visibility reduction, personnel casualty, traffic jam, transportation interruption and equipment destruction. In addition it can also damage the tunnel structure itself to certain degree.

8.6.5 Tunnel pollution risk prevention

⑴ Tunnel management station is in charge of the daily maintenance, repair and emergency rescue so as to guarantee the normal work of ventilating, lighting, fire reporting, fire control, closed-circuit TV, emergency call, signal lamp, etc. and to control them.

⑵ Tunnel management staff shall be trained, which will be incorporated into the training plan, so to improve their ability and management level to handle accident.

⑶ Air quality in the tunnel shall be monitored, which will be included in the environmental monitoring plan and the monitoring data will be reported in time.

⑷ To strengthen management over hazardous cargo transportation

① To enforce declaration system;

② To enforce sample-check system;

③ Under unfavorable climatic conditions, hazardous cargo transportation vehicles are forbidden to enter tunnel.

The above-mentioned two activities ②and ③are implemented by tunnel management staff.

8.6.6 Hazardous substance traffic accident emergency plan

(1) In case accident happens, any person who discovers should immediately report to the central control room through roadside emergency call or other communication means.

(2) After receiving the accident report, the central control room should immediately notify nearby highway policemen to go to the accident site to control the site; meanwhile, local fire department shall be notified who shall send fire-fighting vehicles and firemen to rescue.

(3) If the hazardous cargo is solid, they can be cleaned and handled, and the accident shall be recorded in file.

(4) If the hazardous cargo is gaseous and highly toxic, firemen should wear gas mask to deal with; In case that the hazardous cargo will leak unavoidably, local environmental protection department and public security department shall be notified

immediately, and when necessary, people in the pollution range along the route shall be evacuated to avoid poisoning, injuries and deaths.

(5) If the hazardous cargo is of liquid state, and has already entered public water body, local environmental protection department should be notified immediately. The environmental protection department should immediately notify downstream units to stop fetching water, and at the same time shall send environmental experts and monitoring personnel to monitor the site and to salvage in time the hazardous cargo container which falls into the water body.

(6) Treatment measure for hazardous cargo accident within tunnel

Besides the above hazardous cargo accident treatment measures, for treatment measure for hazardous cargo accident within tunnel, special emphasis must be given to the prompt cleaning of the scene, to the inspection of ventilation and warning equipment in order to eliminates noxious gas pollution to the environment as soon as possible

8.6.7 Analysis of accident emergency ability

(1) The tunnel monitoring scheme covers three cases: normal, fire and traffic accident, according to which, programs on ventilation control, illumination control and traffic control are formulated.

(2) The operation of the expressway (including the tunnels) is under monitor all the time. In case of accident, it can be known at first time, and the first-aid rescue organization, fire control department, environmental protection department, and traffic police, etc. can be notified in time for rescue, fire fighting, traffic evacuation and environmental monitoring. Fire fighting and injury/death first-aid will be handled by nearby departments. The highway management department needs to establish connection with fire fighting and medical organizations along the route and shall provide telecommunication means.

(3) In order to strengthen the ability to deal with hazardous cargo traffic accident, it is suggested that the Jiangxi Provincial Communications Department Project Office convene meetings, share experience and carry out training so as to improve the ability to deal with similar accidents. Equipment damaged in accident shall be maintained, repaired, installed and calibrated in time so as to put into operation as soon as possible.

After the above measures are rigidly enforced, it can be thought that this project has relatively strong emergency ability handling traffic accidents.

8.7 Environmental protection measures for roadbuilding materials and transportation

(1) The quarry contractors must observe the security regulations on outdoor blasting to confirm ignite time which should avoid work peak hour; the contractors must conscientiously protect worker's personal security, must provide helmet, earplug, etc. to workers according to relevant labor protection regulations, and provide regular physical examination to them.

(2) For the soil erosion caused by stone quarries, management must be strengthened to formulate excavation plan so to control the vegetation damage and soil erosion in stone quarries to the minimum.

(3) Transport vehicle should observe local traffic regulations, overloading is forbidden to prevent bulk stones or other roadbuilding materials from falling and halting the traffic. Transportation department is responsible for such inspection.

(4) Detour roads should be sprinkled by water regularly. Vehicles transporting roadbuilding material easy to lose shall be covered by fluffy cloth.

(5) The contractors shall well prepare transportation plan so to avoid transporting materials in peak hours.

(6) It is required to rationally choose roads for transporting stones so to avoid dense residences and schools as much as possible. When there is residential area 50 meters within the transporting road, such stone transportation is forbidden at night (22: 00- 6. 00 next day). Meanwhile, blasting is forbidden at night.

(7) In daytime, if noise interference is produced in schools and residential areas near detour road, movable sound barriers can be set up to mitigate the noise impact.

(8) To strengthen transportation management of detour roads. The contractor is required to do a good job in vehicle maintenance so to make the noise level of the vehicles at a minimum level.

(9) The supervising engineer is required to strengthen noise monitoring. If materials transportation makes the acoustic environmental quality of residential areas along detour roads worsening, the driving route can be considered to change, or some economic compensation can be made with agreement from local residents.

8.8 Suggestions on landscape design

In order to build an ecological highway with sustainable development, a beautiful, harmonious and safe scenery, and in order to reduce destruction to natural environment, careful, systematic and scientific landscape design will be carried out by using rational and economic engineering and biological measures that are in harmony with the nature to improve the view aesthetics and ecology of the highway, to fully exploit and demonstrate the aesthetic effect of road transportation, and to better incorporate the highway into the nature, and to add a new landscape to this area.

8.8.1 Design principle

(1) Principle of respecting regional characteristic. Ganzhou Prefecture possesses its unique geographical location, landform and topography characteristics, meteorological characteristics, and social environment characteristics, all these form peculiar highway landscape for the highway, so they shall be fully manifested and reflected in the design.

(2) Principle of overall harmony. The highway alignment, subgrade, pavement, bridge and tunnel intersection, along-the-route facility, etc. shall be considered as an organic integrity with the landform, topography, and local cultural traditions.

(3) Principle of naturalness. With consciousness of "no destruction is the largest protection", it is required to reflect the protection, utilization and development of Ganzhou Prefecture's unique natural and humanity landscape resources, to integrate the highway as a resource into the natural and humanity environment.

(4) In a situation that alignment index and geological condition are satisfied, the landform should be adapted to prevent heavy fill and cut; it is required to strictly follow the principle of "fill is preferred to cut, tunnel is preferred to excavation, and bridge is preferred to filling" to reduce fill/cut volume and their destruction to vegetation.

(5) It is required to integrate naturally the highway into peripheral landscape, measures shall be taken to restore its natural appearance.

(6) Structures such as bridges, culverts, retaining walls, guardrails and sign boards shall be made conspicuous as much as possible and shall be properly treated in an artistic way.

(7) Existing vegetation within the range of road land use should be protected as much as possible, plants shall be properly laid-out in both sides of the highway, which is

helpful to integrate roadside with surrounding environment.

(8) In a condition that the slope stability is guaranteed, the slope top and toe shall be arc-chamfered so to make them and the surrounding area forming a natural transition.

8.8.2 Major contents of design

8.8.2.1 Landscape for slope

⑴ Slope design

The slope gradient should be flexible and natural, adapting to local conditions so as to reduce artificial elements. In designing, different slope gradient and subgrade heights should be adopted to overcome unified slope gradient and subgrade height design method, for example, according to different landforms, excavation heights and geological conditions, different forms can be built such as natural shape, curved shape (concave, convex), steep in bottom and slow in top, steep in top and slow in bottom, and even mansard shape, etc. Slope top and toe shall adopt circular transition. Excavating slope forbids truncating mountain skin; but low embankment and shallow-cutting highway sections should be slowed down in slopeness so to integrate with original topography, forming a buffer zone.

⑵ Slope protection design

It is required to minimize concrete pitching such as facing walls and mortar pitching slope protection, rather to use local plant protection. In case of necessity to build concrete pitching, the cross-sectional profiles and sizes should be flexible, shall be dynamic and natural, for example in the form of subgrade type, transition type, arch type, dry pitching, mortar pitching etc. The appearance shall avoid artificial elements so to make them appropriate and invisible. Landscape retaining walls can be set up in the form of natural type, small cobble embedded type, subgrade grassing type, etc.

8.8.2.2 Landscape for intersection project

⑴ Intersection laying-out can be made asymmetric, and can be linked by flexible ramps and auxiliary roads.

⑵ Local culture symbols can be used, landscaping can utilize arbor, bush and grass combined method. Indigenous tree species shall be used as much as possible as the background tree with some introduced ornamental varieties of leaf and flower so to build an ornamental ecological community, to rationally divide visual space, to incorporate into nature, to increase landscaping effect, and to make a comfortable and safe driving.

⑶ The shape of visual over-crossing bridge shall be designed in accordance with local humanity and cultural landscape and minority architecture characteristics, and shall be decorated properly in case of necessity in such a manner that the tone is harmonious with peripheral scenery, and shall be lucid and lively.

8.8.2.3 Landscape for earth borrowpits and waste banks

Design shall still follow the principle of simplicity and easy maintenance, planted by arbor, bush and grass combined form, forming a plant community landscape so as to restore the natural ecology of earth borrow (and waste) pits and to reduce soil erosion.

8.8.2.4 Landscape for super—large and large bridges

The landscape design for super-large and large bridges shall highlight the following aspects:

(1) To highlight the shaping characteristic and magnificence of large bridges;

(2) To beautify the large bridges, to build them into excellent project;

(3) To develop tourism function, to turn the bridges into new humanity and cultural scenery;

(4) To be economically feasible and practicable;

(5) To utilize the maximum potential of landscape and ecology, to protect and rebuild landscape environment.

8.8.2.5 Landscape for tunnel

⑴ Shaping design for tunnel portal

To choose tunnel portal shape that suits surrounding environment, design shall be succinct and elegant.

⑵ Decoration design for tunnel portal

To decorate tunnel portal artistically and to demonstrate local culture.

⑶ Greening design for tunnel portal

Considering tunnel portal shape and surrounding environment, to set up planting landscape and miniature sculpture in heading slope of tunnel mouth and front.

⑷ Decoration design within tunnel

According to change ofdriving visual perception, to carry out color design and internal decoration design within tunnel so to improve the environment of driving a vehicle in the tunnel.

8.8.2.6 Landscape for dry bridge

(1) Shaping design for dry bridges

To select dry bridge shape suitable to the bridge location environment, the bridge shape shall be simple, slim and graceful; the position, size, number and shape of the piers shall be controlled strictly to try to avoid building column in road median separator.

(2) Visual appearance design for dry bridges

To select coating color suitable to bridge shape such as the color for the pier, beam and pavement guardrail, etc., to investigate and analyze the coloring from regional color, cultural habits, and custom characteristic, then to simulate different coloring schemes and to determine the final appearance and color of the bridge so to highlight the characteristic of bridge.

8.8.2.7 Landscape for service area

It mainly refers to the environmental planning, architecture and gardening afforestation design of serving area, the landscape design shall consider serving area as the highway station, whose landscape style shall be compatible with local landscape and shall integrate local cultural characteristic so to build a unique humanity and cultural sight and resting environment.

8.9 Environmental protection scheme for basic farmlands

8.9.1 Laws and regulations

According to article 24 of "*Regulations of Basic Farmlands Protection*" released in Order No. 257 of the State Council on December 27, 1998, which stipulates that "in the environmental impact report of construction project, there should be environmental protection scheme for basic farmland", and according to the order [2004] 1 "*Urgent Notice on Forbidding Occupying Basic Farmland for Planting*" issued by State Council on March 20 2004, and according to the "*Notice on Most Rigid Implementing Cultivated Land Protection in Road Construction*" issued by the Ministry of Communications in its ordinance [2004] No. 164 on April 6 2004, strict protection system for cultivated lands and basic farmlands shall be enforced.

8.9.2 Environmental protection scheme for basic farmlands

The highway construction unit should enforce the "*People's Republic of China*

Law on Land Management" and "*Regulations of Basic Farmlands Protection*", change of the use of basic farmlands is firmly forbidden. Basic farmland protection shall be well done at each stage of road construction.

The following works shall be well done during highway design stage:

(1) The design plan should be optimized to reduce occupation of cultivated land. Route alignments should be compared, justified and selected by considering land use and farmland occupation to determine the rational route alignment. In situation of not increasing project works volume, preference shall be given to such alignment that can maximally economize the lands and protect the cultivated lands; it is required to utilize deserted mountains and hillsides, discarded lands and low-yield lands.

(2) If permitted by environmental and technological conditions, it is advisable to adopt low-embankment and shallow-cutting alignment so to reduce high-fill and deep-cut. In high-fill and deep-cut sections passing through basic farmlands and cash crops lands, protection measures shall be considered as much as possible such as retaining walls, slope protections and toe protection on the basis of technological and economic comparison so as to shorten slope length and to economize the land use.

(3) To reconnoiter conscientiously, to calculate carefully and to allocate the earth/stone works rationally so as to fully utilize the cut as fill within an economical distance and so as to strictly control the project earth/stone works volume. It is required to rationally set up earth borrow pits and waste banks and not to occupy farmlands as much as possible by combing earth borrow, waste disposal, field improvement and reclaiming. If conditions permit, industrial waste materials, building waste residues which accord with the technical standard should be adopted to fill subgrade so as to reduce earth borrow.

(4) The proposed highway should choose proper place to set up service area according to traffic volume, highway length, topographical condition, and social service requirement, and shall rationally determine the function and scale of the service area. It is suggested to utilize as much as possible discarded wastelands, deserted hillsides, or to build along with waste banks. Farmland can't be taken up in principle.

(5) The pipelines for highway engineering telecommunication, monitoring and controlling, power supply, etc. shall laid-out in same tube if permitted by technological, economical and security requirements, and shall be laid-out within road right-of-way as

much as possible.

(6) For construction land use for the highway, formalities for approval should be gone through strictly according to relevant regulations, if cultivated land occupation is involved, compensation must be available to account for the balance. Cultivated lands approved to be occupied shall be conscientiously compensated for according to the principle of "how much is occupied, how much shall be reclaimed".

The following works shall be well done during project implementation stage：

(1) In the tendering for the project construction, relevant clauses of cultivated land protection should be listed in the tendering documents and shall be carried out strictly. The contracting section should be divided in such a manner as to rationally allocate earth/stone works and to reduce earth borrow and waste volumes and quantity of temporary land use; the project implementation shall rationally utilize the arable layer in the cultivated lands, which shall be used in reclaiming; it is required to rationally set up earth borrow pits and waste banks, whose construction protection shall fulfill requirements so to prevent soil erosion.

(2) The construction unit should strengthen cultivated land protection consciousness, shall coordinate the project’s temporary land use, and shall strengthen scientific guidance; the supervising unit should strengthen supervision over land occupation during the construction stage, shall urge the construction unit to implement land protection measures. In handing over the project for acceptance, it is required to comprehensively inspect the land utilization and restoration.

(3) The construction unit should strictly control the quantity of temporary land use; the detour roads, various kinds of stock grounds and prefabricating grounds shall be coordinated according to the project progress, which shall be located within the range of highway right-of-way or shall be located in barren hillsides and discarded wastelands, farmland can't be taken up. In the construction stage, effective measures should be taken to prevent farmland pollution; the temporary land use should be restored conscientiously according to the contract term requirements after the project is completed.

(4) Afforestation on the highway shall be carried out in accordance with the relevant requirements of the [2004] 1 ordinance “*Urgent Notice on Forbidding Occupying Basic Farmland for Planting*” issued by State Council. If there are cultivated

lands along the highway, the width of greenbelt shall be controlled strictly. While in well afforesting the highway right-of-way, it is required to carry out the construction of landscaped highway under the leadership of local people's government and with cooperation from concerned departments. If the width of greenbelt does not meet the regulations, policy support shall not be granted such as seedling subsidy.

(5) Old roads that are discarded during the highway construction shall be reclaimed as much as possible; if can't be reclaimed, then afforestation shall be made so to avoid resource idling and unused.

It is an important responsibility of transportation administrations at all levels to implement the strictest protection system for cultivated land in road construction, which is rewarding at present and in the long-term. The construction unit must raise the awareness, strengthen organizational leadership, and enhance supervision and inspection so as to regulate land use in a rational, economical and scientific manner for the purpose of promoting an overall, coordinative, and sustainable development of highway transportation.

Chapter 9 Environmental Protection Management Plan and Environmental Monitoring Plan

9.1 Environmental protection management plan

9.1.1 Implementing organization

The environmental management of the proposed project is in the charge of Jiangxi Provincial Communication Department for organization and implementation, the Jiangxi Provincial Communication Department World Bank Loan Project Office is responsible for the environmental management for this project. The environmental management organizations for this project during construction and operation stages are shown in Fig. 9.1.1-1 and Fig. 9.1.1-2.

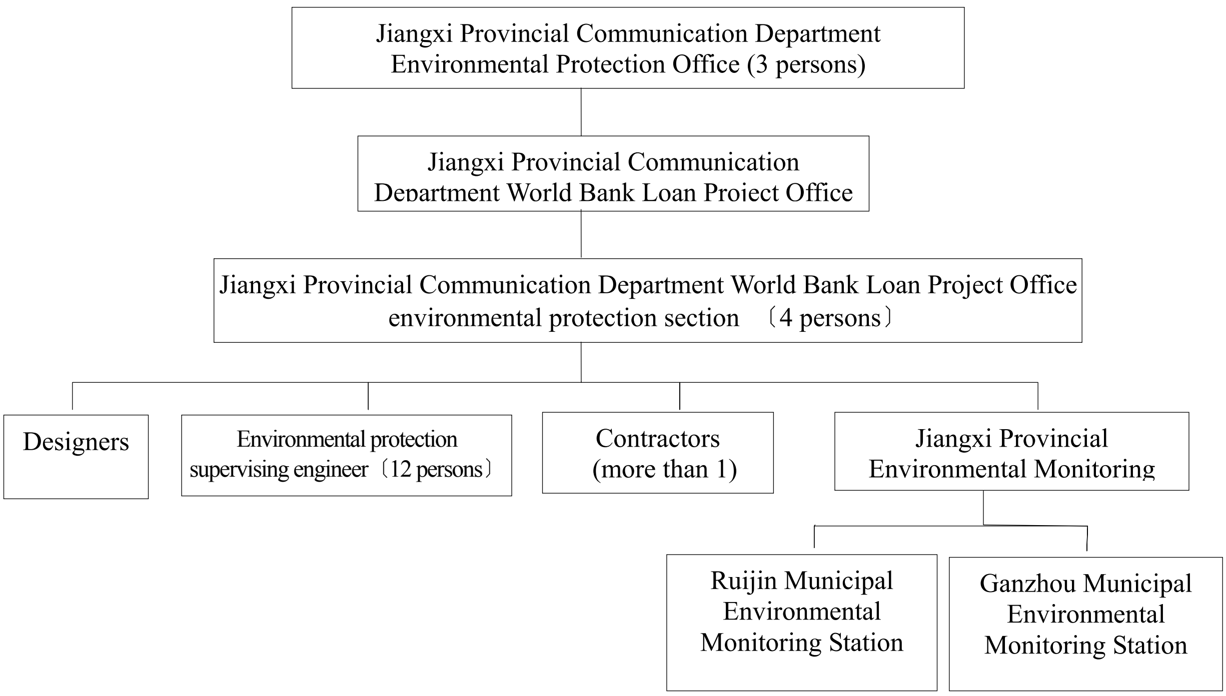


Fig. 9.1.1-1 Environmental management organization during construction stage

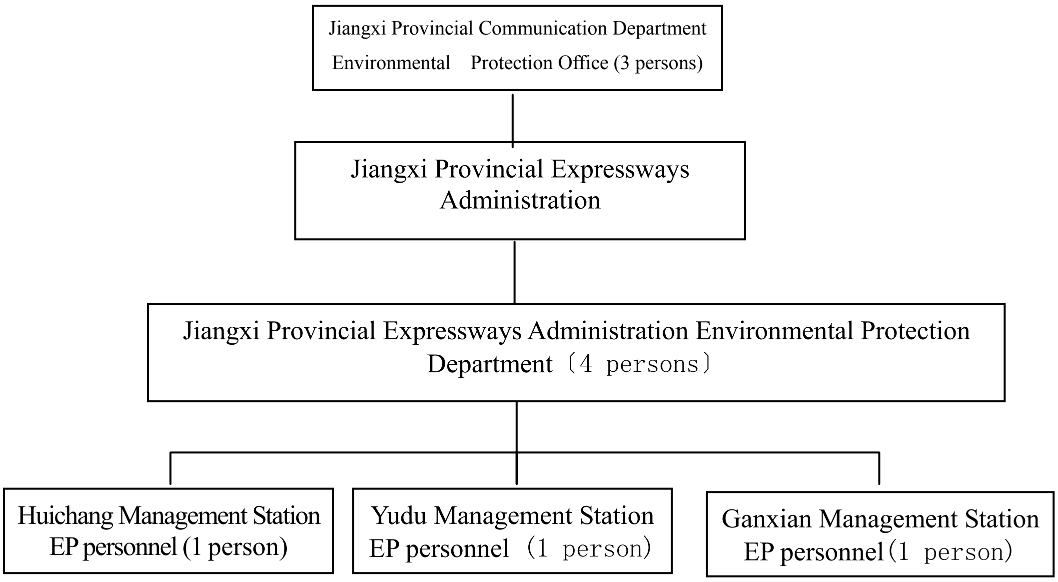


Fig. 9.1.1-2 Environmental management organization during operation stage

The environmental protection office of Ministry of Communications is responsible for coordinating the environmental protection work of the transportation sector in unison.

The Jiangxi Provincial Communication Department Planning Office is also responsible for environmental management function for transportation circle in the entire province, by formulating environmental protection management method and regulation, compiling environmental protection plan and supervising its implementation in this province.

The Jiangxi Provincial Communication Department World Bank Loan Project Office is the implementation organization for this project, in May 5 2000 (World Lank loan Jiangxi 2nd road project), it established a coordination leading group for project, environmental protection, and resettlement, which is composed of an environmental protection group and an immigration resettlement group with a staff of 3 ~ 6 people, of whom, 1 person is an environment expert. Its primary duties are:

⑴ To prepare this project's environmental impact assessment report and environment management plan.

⑵ To be responsible for this project's environment management and immigration resettlement work.

⑶ To finalize the environmental protection provisions in the contract, to cooperate the environmental supervising engineer, to provide environmental protection execution situation in the construction stage.

(4) To sign environmental monitoring contract with local environmental monitoring station, to inspect implementation of environmental monitoring plan, and to submit the implementation situation and the monitoring report.

(5) To coordinate the relationship among the environmental supervising engineer, the contractors and the design personnel.

(6) To be responsible for accept environmental protection complaint and local environmental protection department's surveillance.

(7) To purchase handhold automatic noise monitoring meter, to be responsible for noise monitoring during operation stage.

In this project's construction stage, each bid section is staffed with one environmental protection supervising engineer, whose responsibilities are:

(1) To supervise the implementation of environmental protection measures stipulated in EMP and the tender document;

(2) To be responsible for noise monitoring during construction stage.

Contractor of each bid section will assign more than 1 full-time environmental protection staff member(s) in construction stage, whose duties are:

(1) Responsible for strictly carrying out and implementing the environmental protection measures and works definitely specified in the contract and bidding documents when the contracted project in under construction;

(2) To cooperate with the environment supervising engineer to check and correct behaviors harmful to environmental protection during construction stage.

After completion of the project, the whole line will set up 3 highway management stations, each staffed with one full-time environmental protection staff member in charge of all environmental protection works in its managed section during operation stage.

9.1.2 Environmental management plan

In order to ensure the environmental concerns of this project be implemented in time, the following environmental management plan is formulated (Table 9.1.2-1).

9.1.3 Key EMP factors of the proposed highway

Table 9.1.3-1 presents the Key EMP factors of the proposed highway.

Table 9.1.2-1 Environmental management plan for this project

Potential environmental impact	Mitigation measures	Implementing organization	Responsible organization
I. Planning and designing stage 1. Migration and forced resettlement of residents in road right-of-way 2. Loss of land resource 3. Loss of environmental beauty 4. Blocked way from house to farmland, increased walking time 5. Soil erosion caused by open or blind drainage ditches on the soil lower than subgrade 6. Bridge floor runoff pollution 7. in case of accident in river-crossing section, hazardous cargo vehicles fall into river and cause water pollution 8. The route runs through floodplain, influencing flood discharge and enlarging the influenced area 9. Schools, sanatorium and villages with excess noise due to traffic noise of the highway 10. Risk of fire accident within tunnels	1. To formulate and carry out fair and proper resettlement plan and to compensate for 2. To occupy as few lands (good farmland) as possible 3. To meticulously design so to make it in harmony with landform (landscape) 4. To provide suitable number of passageways in suitable locations 5. To increase number of water outlet, to set up good outlet in order to avoid cascade effects 6. To make the bridge floor runoff of the 12 bridge sections overcrossing rivers along the route not enter into water bodies directly, to set up sedimenting tanks at both sides of bridges 7. To strengthen the protection guardrails of the 12 bridge sections overcrossing rivers along the route 8. To adjust route alignment or to increase bridge length 9. To design noise reduction measures such as sound barrier and soundproofing window in 62 sensitive locations with noise excess 10. To conduct special design for ventilation and safety for tunnels and to formulate effective management and rescue measures	Local government Design unit	Jiangxi Provincial Communication Department Jiangxi Provincial Expressways Administration World Bank Loan Project Office Local government
II. Construction stage 1.Increased river sediment due to erosion in construction site, road cutting and waste disposal 2. Oil/engine oil/fuel and paint's pollution to soil and water produced in equipment ground and bituminous mixing station 3. Ambient air pollution in bituminous mixing station/stabilizing soil mixing station 4. Dust, noise and air pollution in construction site 5. Unexplored underground historical relics found during construction 6. Landform disruption produced from embankment/fill and stone production	1.To use coverings or fiber to protect sensitive surface, to plant reliable plants as soon as possible. 2. To collect recycled lubricant, to prevent accidental spillover by good operation. 3. To install and open air pollution control devices, to choose suitable place 4. To regularly sprinkle water on temporary road, to install silencer on equipment and to maintain in time. 5. To stop construction and to notify historical relics administrative department for protection 6. To make it integrated into landform (landscape) through	Contractors (construction unit)	Jiangxi Provincial Communication Department Jiangxi Provincial Expressways Administration World Bank Loan Project Office

Potential environmental impact	Mitigation measures	Implementing organization	Responsible organization
7. Interference to facilities along the highway (electricity/ telecommunication, etc.) 8. Existing road driving conditions impacted during construction. 9. Formidable sewage facilities and solid waste in construction site 10. Possible infectious disease dissemination among workers and local people. 11.Temporary germ (mosquito) breeding habitat produced such as stagnant pool on sunny side. 12. Influence to land yield produced by large earth borrowing	design, to repair the broken earth surface 7. To sign agreement with related departments, to relocate after being first open so to reduce impacts 8. To strengthen traffic administration in possible traffic conflict points. 9. To provide suitable lavatory and dustbin, to strengthen environmental management. 10. To regularly examine workers' health, to handle when needed 11. To adopt necessary measures to avoid producing reproducible place 12. To keep the topsoil and to pile collectively, to level land as soon as possible after construction, and to recover the topsoil so to shorten temporary land use time		
III. Operation stage 1. Ambient air pollution and noise pollution produced by vehicle driving. 2. Persistent soil erosion 3. Highway runoff pollution in bridge floor and road pavement 4. Sewage discharge and pollution in service areas, parking areas and management stations 5. Disorderly roadside 6. Toxicant spillover/injury or death caused by accident of vehicle traffic and transportation	1. To install sound barriers or other noise-reduction measures in acoustic sensitive locations along the route according to predicted noise excess, and to control follow-up monitoring during operation stage and to adopt noise reduction measures on time; to control the technological condition of vehicles running in the highway so to reduce air pollution and to strengthen public transportation and traffic managerial ability 2. To meticulously maintain/afforest/add protection works 3. To make the bridge floor and road pavement runoff not enter into water bodies directly, runoff shall be collected and treated; to set up sedimenting tanks at both ends of the 13 bridges overcrossing rivers along the route and to maintain and manage them well 4. To install sewage treatment facilities in the 12 service areas along the route. 5. To provide treatment equipment, to formulate regulation forbidding throwing out waste 6. To formulate and enforce emergency accident handling plan, especially in tunnel and bridge sections, to set up necessary organizations and management procedures to inhibit dangers caused by accidents	Jiangxi Provincial Expressways Administration	Jiangxi Provincial Communication Department Jiangxi Provincial Expressways Administration Ganzhou Prefecture and Ruijin City environmental monitoring stations

Table 9.1.3-1 Key EMP factors of the proposed highway

Environmental problem	Actions taken or to be taken	Implementing organization	Responsible organization	Contract clause
A Design stage				
1.Rout selection	The recommended alignment scheme was determined from different route schemes during the feasibility study stage and preliminary design stage, for partial route sections, different comparison alternative schemes are set up and in next stage the partial route schemes will be further optimized and compared so as to minimize adverse impacts on environment and society, and similarly also to avoid unfavorable geological conditions and cultural relic sites.	Design unit	Jiangxi Provincial Communication Department	
2.Disturb people	Designed 203 passageways to satisfy traffic demand of inhabitant and vehicles.	Design unit	Jiangxi Provincial Communication Department	
3.Soil erosion	• In side slopes and appropriate roadside places, it is to plant bush, grass as well as to set up retaining walls, catch drains, mortar pitching to prevent soil erosion. • Designed temporary and permanent water drainage system, the affected irrigation ponds will be dug again to keep soil erosion and influence on water conservation dam to a minimum. • Designed protection works for 12 earth borrow pits and 24 waste banks.	Design unit	Jiangxi Provincial Communication Department	
4.Dust/air pollution	Except for the actions in item "1", earth borrow pits, material yards, waste banks, stabilizing earth mixing station and asphalt mixing station have been identified the necessity to consider dust pollution on residences, educational and cultural units.	Design unit	Jiangxi Provincial Communication Department	
5.Water pollution	The 12 service areas, parking lots and other facilities have designed sewage treatment facility to make the waste water discharged into public water body after satisfying designated standard.	Design unit	Jiangxi Provincial Communication Department	
6.Noise	Except for the actions in item "1", sufficient measures such as removal and sound barrier have been confirmed and incorporated into the design and tender documents.	Design unit	Jiangxi Provincial Communication Department	
7.Cultural relics	Carried out cultural relic investigation, submitted the cultural relic investigation report.	Jiangxi Provincial Archaeological Institute	Jiangxi Provincial Communication Department	
8.Flood	Bridge and culvert have undertaken sufficient design so to satisfy flood discharge requirement (1/300 years for large bridge, 1/100 years for others).	Design unit	Jiangxi Provincial	

Environmental problem	Actions taken or to be taken	Implementing organization	Responsible organization	Contract clause
			Communication Department	
9.Hazardouas cargo transport	Conducted strengthening design for the protection guardrails of the 12 bridges overcrossing rivers along the route, sedimenting tanks at both sides of bridges will be set up to collect bridge floor runoff; accident contingency plan have been formulated so to prevent impact on water body because of hazardous cargo transportation accident.	Design unit	Jiangxi Provincial Communication Department	
B.Construction stage				
1.Dust/air pollution	• During construction period water will be sprayed, especially on stabilizing earth mixing station and asphalt concrete mixing station and detour road. When filling subgrade, water will be sprayed to compact the material, after material compaction, water will be sprayed regularly to prevent dusting. • Warehouses and stock grounds will be covered, unless the material is used immediately. • Vehicles transporting roadbuilding materials must also be covered to reduce spillage and fall. • Stabilizing earth mixing station and asphalt concrete mixing station must be at least 300m leeward from residences. • Mixing equipment must have good sealing and the vibrators must be installed with dust removal device, the workers shall pay attention to labor protection.	Contractors (construction unit)	Jiangxi Provincial Expressways Administration World Bank Loan Project Office	Contract general clause 19.1 Project specific clause 19.1(5)
2.Soil erosion/water pollution	• In suitable places such as side slope and roadside, trees and grass will be planted, especially on high-fill and deep=cut section, stone walls will be covered and grass will be planted. • If existing irrigation, drainage system or pond is damaged, they will be rebuilt or reconstructed. • When lime and other easily flying materials are piled together, they will be fenced by brick or earth walls and be kept from water body. • In constructing permanent drainage system, temporary canals and culverts will be constructed for irrigation and drainage. • All necessary measures will be taken to prevent the earth ad stone from blocking river and canal course or current irrigation and drainage system. • All reasonable measures will be taken to prevent the waste water produced in construction from entering into river courses and irrigation canals directly.	Contractors (construction unit)	Jiangxi Provincial Expressways Administration World Bank Loan Project Office	Project specific clause 19.1(6), (7)
3.Constructon campsite	• Garbage can and sanitary disposal facility will be provided in construction campsites, and will be cleaned up regularly. • The drinking water will satisfy Chinese national drinking water standard. • Hygienic propaganda and education will be regularly educated to the construction workers.	Contractors (construction unit)	Jiangxi Provincial Expressways Administration World Bank Loan	Contract general clause 32.1 Contract specific clause 35.4, 35.5, 35.6

Environmental problem	Actions taken or to be taken	Implementing organization	Responsible organization	Contract clause
			Project Office	
4.Noise	• It is to strictly enforce industrial enterprise noise standard so to prevent workers from noise damage, the workers close to strong acoustic source will wear ear plug and helmet, and their working duration will be limited. •When there are large residences 150m within construction site, noisy construction shall not undertake at night (22:00 ~ 6:00). • Machinery and vehicle maintenance will be strengthened to keep their noise to a minimum. • If construction machinery noise produces disturbance on schools, mobile sound barrier should be established. • When there are large-sized residences50mwithin detour roads, transportation of construction materials should be forbidden at night on the detour roads. • In G323 on which construction materials are transported and on residences near detour roads, monitoring points will be set up, and corresponding measures will be taken according to monitored results.	Contractors (construction unit)	Jiangxi Provincial Expressways Administration World Bank Loan Project Office	Contract specific clause 34.5 Project specific clause 19.1(4)
5.Protection of ecological resource	• In order to protect forestland from damaged, earth shall not be borrowed from forestland, and materials shall not be piled and temporary campsite shall not be built in forestland. • Farmland shall not be used as earth borrowing pits as much as possible, if inevitable, the topsoil (30cm) will be retained, and promptly backfilled. • Education on construction workers will be strengthened to protect natural resources and wildlife animals and plants, hunting is strictly forbidden. • Construction vehicles will run on temporary detour roads so as not to damage farmland and vegetation.	Contractors (construction unit)	Jiangxi Provincial Expressways Administration World Bank Loan Project Office	Project specific clause 19.1(6), (7), 42.4
6.Accident risk	• In order to guarantee construction security, on temporary roads, effective lighting devices and safety signals will be installed, and at the same time full traffic regulations will be adopted and enforced. • During construction stage, the blasting time, signal and security guard will be regulated; vehicles in dangerous areas will be immediately dispersed. • Before blasting, careful and thorough inspection must be taken. • Safety watchout post will be set up so to prevent people and vehicles from passing before blasting; during rush peak hours, blasting will not be conducted so to avoid traffic jam and personnel casualty. • Blasting material management and use will strictly follow public security department's safety requirements.	Contractors (construction unit)	Jiangxi Provincial Expressways Administration World Bank Loan Project Office	Project specific clause 79.1
7.Cultural relics	• If there discovered any fossil, ancient coin, architecture or other remains of archaeological and geological value, construction should stop immediately, and such discovery shall be reported to local cultural relic department immediately until authorized protection department completes the cultural	Contractors (construction unit)	Jiangxi Provincial cultural Relics	Project specific clause 27.2

Environmental problem	Actions taken or to be taken	Implementing organization	Responsible organization	Contract clause
	relic confirmation.	Jiangxi Provincial Archaeological Institute	Administration Jiangxi Provincial Expressways Administration World Bank Loan Project Office	
8.Traffic and transportation	• Local construction materials shall be used as much as possible so to avoid long-distance transport of construction materials, especially the earth and stone works. •When there is traffic jam during construction stage, enough traffic mobilizing measures shall be taken with coordination from transportation and public security departments. • In the interchange places of the proposed highway with other roads, temporary access roads will be built. • Materials can be considered to prepare in advance in seasons with fewer traffic jams (Jan/Feb and Sept/Oct). • A construction material transportation plan will be formulated to avoid transportation in rush hour, especially on existing roads.	Contractors (construction unit)	Jiangxi Provincial Expressways Administration World Bank Loan Project Office	Project specific clause 30.1
C.Operation stage				
1.Hazardous cargo leakage risk	• Prefectural or municipal transportation departments will set up respective coordinating organizations for chemical hazardous cargo transportation. • Chemical hazardous cargo transportation implements the system of "cargo license" , "driver license" and "guardian license" issued by transportation department. All vehicles engaged in hazardous chemical freight transportation should use unified special-purpose sign. •Public security, transportation management and fire fighting departments shall designate driving route to vehicles transporting hazardous cargo. The vehicles transporting chemical hazardous cargo must be parked in designated parking lot. • Regarding this project's hazardous cargo transportation management, the highway administration department will manage through registration system. •In case hazardous cargo leaks, such accident must be reported to concerned departments immediately, and must be handled according to formulated emergency plan.	Jiangxi Provincial Expressways Administration	Local transportation bureau, public security and fire bureau, environmental protection bureau, Jiangxi Provincial Expressways Administration	
2.Vehicle management	• It is to strengthen inspection on vehicles noise and exhaust tail gas. If the vehicles noise exceeds the allowed standard or does not comply with discharge standard, they are not allowed to run on the highway.	Jiangxi Provincial Expressways Administration	Jiangxi Provincial Expressways	

Environmental problem	Actions taken or to be taken	Implementing organization	Responsible organization	Contract clause
	• Announcement and education will be strengthened to the people on relevant laws and regulation concerning vehicle air pollution and noise. • Massive cargo transportation of coal, cement, sand and simply packaged chemical fertilizer and others may possibly spill along the route and pollute the road. Entrance inspection will be strengthened, vehicles that do not have enough measures to prevent such spillage will not be allowed to run on this highway.		Administration	
3.Noise	According to predicted and monitored results, sound barriers, soundproofing windows and other noise-reduction measures will be adopted in sensitive locations with noise excess along the route.	Jiangxi Provincial Expressways Administration	Jiangxi Provincial Expressways Administration	
4.Maintenance of drainage system	Drainage system will be desilted periodically so to ensure a smooth operation.	Jiangxi Provincial Expressways Administration	Jiangxi Provincial Expressways Administration	
5. Others	It is forbidden to build civilian houses 207m within two sides of the road center line, and it is forbidden to build schools and hospitals 310m within two sides of the road center line.	Land management department	Land management department	
D.Environmental monitoring				
1. Ambient air	(1) Construction stage a. Monitoring item：TSP, bituminous smoke b. Monitoring frequency：once/week, random monitoring c. Monitoring time：1 day d. Monitoring point：stabilizing earth mixing station, large residence and school near unpaved construction road and bitumen concrete mixing station (2) Operation stage a. Monitoring item：NO_2 ,HC b. Monitoring frequency：2 time/year(winter and summer) c. Monitoring time：1～2 days, continuous monitoring in 24 hours d. Monitoring point：, Penggwu, Laohupai, Shiziishuxia	Local environmental monitoring station	Supervising company, Jiangxi Provincial Expressways Administration	
2.Noise	(1) Monitoring frequency a. Construction stage：once/month, random monitoring if needed b. Operation stage：4 times/year c. Monitoring time：2 times/day(daytime and nighttime)	EP supervising engineer or Local environmental monitoring station	Supervising company, World Bank Loan Project Office,	

Environmental problem	Actions taken or to be taken	Implementing organization	Responsible organization	Contract clause
	(2) Monitoring point a. Construction stage Main line of the proposed highway: construction sites 100m within which there are residences or sensitive units residences near detour roads: Shanshupai, Yuyang b. Operation stage schools：Datian primary school, Huoxing primary school, Wansong primary school residence：Yangwu, Citangxia, Xinxiaowu, Wanjiangwan, Heliaoxia, Shihuiling, Pengwu, Maoping, Chenwu, Shizishuxia, Shanbiantoushang, Yongquangangshang		Jiangxi Provincial Expressways Administration	
3.Water quality	(1) Construction stage a. Monitoring item：pH, COD_{Cr}, SS, petroleum b. Monitoring frequency：depends on actual needs of construction c. Monitoring time：1 day d. Monitoring point：100m upstream and 200m downstream the bridge sites of Shangba Gongshui river super-large bridge (K63+025), Jiaolin Gongjiang River bridge (K114+940), Chenwu Gongjiang River bridge (K118+920), Ganjiang River super-large bridge (K135+491)	Local environmental monitoring station	Supervising company, World Bank Loan Project Office, Jiangxi Provincial Expressways Administration	
	(2) Operation stage a. Monitoring item：pH, COD_{Cr}, SS, petroleum, grease, TP, TN, BOD_5 b. Monitoring frequency：2 times/year c. Monitoring time：2 days d. Monitoring point：sewage outlets of Xijiang service area and Yudu service area, downstream50m of Ganjiang River super-large bridge site (K135+491)			

9.1.4 Supervising organization

The Jiangxi Provincial Environmental Protection Agency is the environmental protection administrative organization of Jiangxi provincial government responsible for unified supervision and management of environmental protection works in this province. The municipal (Prefecture) Environmental Protection Agency is the environmental protection administrative organization of local government responsible for unified supervision and management of environmental protection works in this prefecture. The City (County) environmental protection agencies are responsible for environmental quality of their jurisdictions. The Jiangxi Provincial Environmental Protection Agency sets up an Environmental Monitoring Central Station, and the municipal (Prefecture) Environmental Protection Agency sets up an Environmental Monitoring Station, responsible for the environmental monitoring of the prefecture. The environmental protection works of this project are subject to supervision from local environmental protection departments along the route. This project's environmental management and supervision plans are shown in Table 9.1.4-1.

Table 9.1.4-1 Environmental management and supervision plan of this project

Stage	Organization	Supervision contents	Supervision purposes
Feasibility study	China National Environmental Protection Agency Jiangxi Provincial Environmental Protection Agency	1.To review TOR of environmental assessment 2.to review EIA report 3. To review EMP (Environmental Management Plan)draft.	1. To guarantee that the EIA contents are complete, topic identification is appropriate, the key points are highlighted. 2. To guarantee that the great potential problems produced by this project have been already reflected. 3. To guarantee that the mitigation measures are specific and feasible.
Design and construction stage	World Bank China National Environmental Protection Agency Jiangxi Provincial Environmental Protection Agency	1.To review preliminary design for environmental protection and EMP	1.To strictly enforce "Three simultaneousness" and the environmental protection measures promised in EMP.
	World Bank China National Environmental Protection Agency	2.To make sure whether the environmental protection investment is finalized	2.To guarantee the environmental protection investment is available in full sum
	Jiangxi Provincial Environmental Protection Agency Prefectural, municipal and county	3. To inspect whether the locations of stock grounds, concrete mixing station, stabilizing soil mixing station and bituminous mixing station are reasonable	3.To guarantee these stations meet environmental protection requirements
		4. To inspect dust and noise pollution, to determine construction time	4. To reduce impacts on surrounding environment caused by engineering construction, to enforce relevant laws,

Stage	Organization	Supervision contents	Supervision purposes
	environmental protection bureaus		regulations and standards of environmental protection
		5. To inspect whether the management methods and measures for loading/unloading and piling poisonous, harmful substances are applicable or not, to inspect whether the air pollutant discharge satisfies the corresponding discharge standard	5. To reduce impacts on surrounding environment caused by engineering construction, to enforce relevant laws, regulations and standards of environmental protection
		6. To inspect whether the discharge and treatment method of sewage and engine oil in the construction site are suitable or not	6. To guarantee surface water not contaminated
	Jiangxi Provincial Environmental Protection Agency	7.To restore and handle earth borrow pits and waste banks	7.To guarantee that the landscape and land resources are restored as soon as possible
		8.To inspect the "Three simultaneousness" of environmental protection facilities, to determine final completion time	8. To guarantee the "Three simultaneousness" of environmental protection facilities
	China National Environmental Protection Agency Jiangxi Provincial Environmental Protection Agency Jiangxi Provincial Relics Administration	9.To inspect whether the environmental protection facilities meet design standard	9.To accept environmental protection facilities
		10.To inspect whether there are underground relics	10.To guarantee that relics are not damaged
Operation stage	Jiangxi Provincial Environmental Protection Agency	1. To inspect the implementation of EMP (environmental management plan) during operation stage. 2. To inspect the implementation of environmental monitoring plan. 3 To inspect whether it is necessary to take further environmental protection measures (environmental problems not estimated originally may occur)	1. To finalize the environmental requirements proposed in EMP. 2. To finalize the implement contents of the environmental monitoring plan. 3. To protect the environment conscientiously so to minimize the impacts on environment caused by the project construction and operation.
	Jiangxi Provincial Environmental Protection Agency Prefectural, municipal and county environmental protection bureaus	4. To inspect whether the environmental quality of environmental sensitive locations meets their corresponding quality requirement. 5. To inspect whether the sewage disposal of service area is up to discharge standard 6. To inspect whether the road surface water is entered into drinking water source	4. To strengthen environmental management, to protect people's life quality conscientiously 5 To guarantee the sewage discharge meet standard requirement 6. To guarantee drinking water source not polluted
	Jiangxi Provincial Environmental Protection Agency Public security department and fire-fighting department	7. To strengthen supervision to prevent emergency accident, to eliminate accident-hidden danger. To formulate in advance urgent accident handling plan so to eliminate dangers in time in case of accident and to ensure hypertoxic material is not leaked in the accident.	7. To eliminate accident hidden danger to avoid fatal pollution accident.

9.2 Environmental monitoring plan

⑴ Formulation purpose and principle

The purpose to formulate environmental monitoring plan is to supervise the implementation of each measure in order to adjust the environmental action plan in good time according to the result of monitoring and to provide the basis for the implementation time and scheme of environmental protection measures. The principle is to follow the anticipated main environmental impacts of each period (construction or operation stage).

⑵ Monitoring items

According to the anticipated environmental impact analysis and assessment results, the monitoring items during construction stage are identified as TSP, bituminous smoke, construction noise and water quality; the monitoring items during operation stage are identified as traffic noise, ambient air, water environment.

⑶ Environmental monitoring organization

It is more convenient for the noise monitoring during construction stage to be carried out by supervising engineer. Other monitoring can be entrusted to local environmental monitoring stations. The construction unit should sign monitoring contract during construction stage with the monitoring stations before constructing, and sign monitoring contract during operation stage with the monitoring stations before the project is made available to the users.

⑷ Environmental monitoring plan

The environmental monitoring plan for this project is shown in Table 9.1.3-1.

⑸ Monitoring cost

The monitor cost during construction stage for this project is estimated to be 600,000 yuan, which of during operation stage is 840,000 yuan (see Table 9. 2-1). The total monitoring cost for this project is 1,440,000 yuan.

⑹ Monitoring report system

The monitoring report system is illustrated in Fig. 9. 2-1. after each monitoring, the monitoring unit should submit a monitoring report to higher organizations in a hierarchical manner. Jiangxi Provincial Expressways Administration should submit environmental monitoring plan to Jiangxi Provincial Environmental Protection Agency once in every quarter during construction stage and once every half year during operation stage.

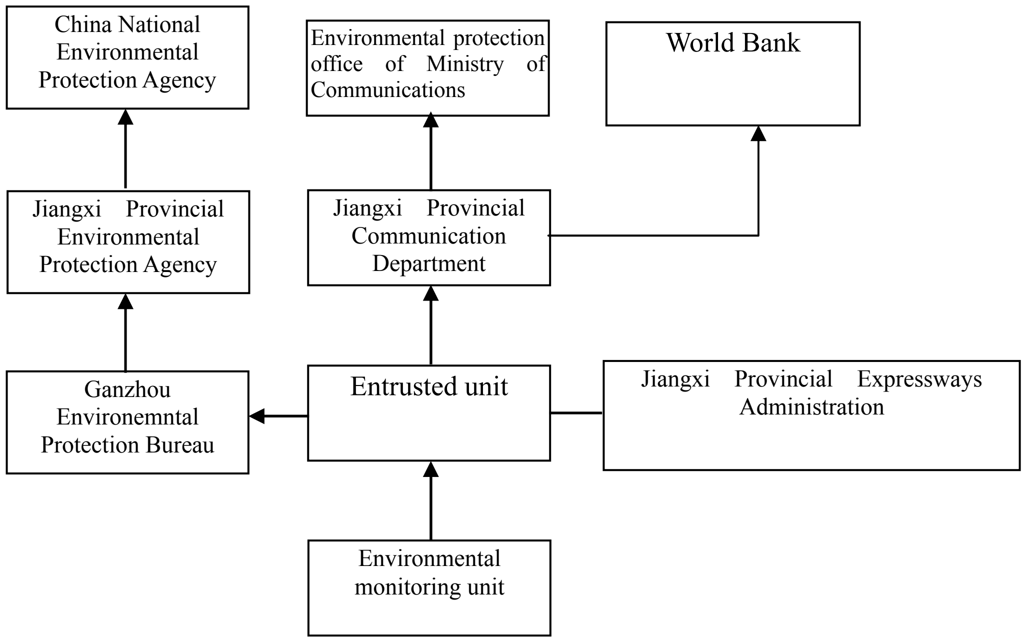


Fig. 9.2-1 Illustration of monitoring report system

Table 9.2-1 List of monitoring cost

Stage	Construction stage		Operation stage		Remark
Item	Unit price	Cost	Unit price	Cost	
Noise	50,000 yuan/year	150,000 yuan	100,000 yuan/year	600,000 yuan	Construction stage is set to be 4 years and mid-term operation stage calculates the first 3 years
Ambient air	100,000 yuan/year	300,000 yuan	40,000 yuan/year	120,000 yuan	
Water quality	50,000 yuan/year	150,000 yuan	40,000 yuan/year	120,000 yuan	
Total	600,000 yuan		840,000 yuan		

9.3 Environment supervision content and requirement

9.3.1 Environment supervision scope and method

According to the Ministry of Communications document [2004] No. 314 "*Notice on Environmental Supervision for Transportation Project*", environmental supervision work is required for this project during construction stage, which is considered as an important part of the project supervision and shall be integrated into the project supervision management system so as to exercise Total Quality Management over the project according to the dual requirements of project quality and environmental protection quality.

The project environmental supervision scope is the highway construction area and the project directly-influence region, including construction sites, construction detour roads, earth borrow and waste banks, sand and stone quarries, various mixing stations for the main road project and temporary project, as well as local existing roads (national road and provincial road) that undertake the massive transportation work.

The supervision content includes ecological protection, water conservation, geological disaster prevention and control, afforestation, pollutant prevention and control and so on.

The environmental supervision for Ruijin-Ganzhou Highway is an important part of project supervision, and integrated into the project supervision system. This project's environmental supervision is in the charge of chief supervision office (also the environmental supervision office) for organization and implementation, the chief supervision office's representative office (also the environmental supervision office's representative office) are responsible for undertaking the supervision. The field environmental supervising engineer is held by the project supervising engineer of the local representative office, who will be qualified to post by environmental supervising engineer training organized by the development company.

9.3.2 Work content of environmental supervision

The project environmental supervision includes standard-attaining supervision and environmental protection. Namely:

⑴ Environmental standard-attaining supervision is to supervise whether the construction of the main project conforms to environmental protection requirement, such as that the noise, the discharge of waste gas and sewage should meet the related standard; is to supervise whether the construction creates soil erosion and destroys the ecological environment, whether it conforms to related environmental protection laws, and regulations;

⑵ Environmental project supervision is to supervise various environmental protection facilities (including temporary facilities) built for protecting environment during construction and operation stages, such as sewage treatment facility, sound barrier, afforestation works, land reclamation (including waste compaction, retaining works, drainage works)in earth borrow pits and waste banks, etc.

9.3.2.1 Environmental standard-attaining supervision

According to this project's main environmental impacts and the environmental protection objectives identified in this environmental report, the key point of environmental standard-attaining supervision for Ruijin-Ganzhou Highway is the ecological environmental protection and water environmental protection. At the same time, the acoustic environment, social environment and ambient air quality protection are also the works of environmental standard-attaining supervision. The main work contents of environmental standard-attaining supervision are listed in Table 9.3.2.1-1.

Table 9.3.2.1-1 Supervision contents for EP standard-satisfying of Ruijin-Ganzhou Highway

Item	Sub-item	Supervising contents
Ecological environment	Earth borrow pit	Whether earth borrow pit selection is reasonable; whether topsoil in earth borrow pits is suitably preserved; whether earth borrow depth coordinates with its habitat: whether earth borrow pits are fully restored.
	Waste bank	Whether waste bank selection is reasonable; whether the waste is disposed of in designated pits; whether topsoil in waste banks is suitably preserved; whether the waste disposal height is appropriate; whether the waste banks are fully restored; whether the waste is fully disposed in waste banks.
	Construction detour	Whether construction detour selection is reasonable; whether they are built by construction drawing; whether they are restored after completion.
	Subgrade	Whether the topsoil clearing and earth/stone cut enter into waste banks according to requirement; whether slope protection is prompt; whether slope afforestation complies with design requirement; whether the highway subgrade cuts off the habitats in its sides; construction and establishment of temporary water conservation facility.
	Bridge and culvert	Whether the number and location of bridge and culvert guarantee the local habitat connectivity; whether the construction waste material enter into waste banks; whether bridge foundation construction and time conform to water conservation and flood prevention requirement.
	Transport road	Whether the transport roads pass some protected sections; whether there is dust prevention measures; how about the implementation of dust prevention measures.
	Afforestation	Whether the species selection conforms to corresponding habitat; whether the project progress strictly conform to the season; whether construction strictly follow design requirement; afforestation quantity and survival rate should conform to requirement.
	Stock ground, prefabrication ground	Whether adopt measures to arrest wind and prevent rainstorm corrosion; whether the project waste material enters into waste banks.
	Construction campsite	Whether the life and production garbage are properly treated; whether the white garbage is under control; whether the construction is good-mannered and civilized.
	Tunnel	Whether the waste is disposed of in designated waste banks; whether tunnel excavation working face is strictly controlled.
Acoustic environment	School and village	Whether the construction noise conforms to corresponding ambient noise standard; whether measures are taken when construction vehicles run in sensitive locations.
Water environment	Gongjiang River Ganjiang River	Whether unobstructed water flow is guaranteed; preventing water pollution during construction stage; whether sewage and life garbage from management area and service area are processed reasonably.
Ambient air	School and village	Conforming to corresponding ambient air quality standard during construction stage.

Item	Sub-item	Supervising contents
Social environment	Traffic safety	To guarantee unobstructed traffic flow in construction road sections; whether the village road sections have security hidden danger; whether impact of transportation vehicles on existing roads reduces to minimum; whether the passageways are gathering water, so inconvenient to people's movement.

9.3.2.2 Environmental protection supervision

Environmental protection supervision usually includes:

⑴ Ecological protection supervision: ecosystem protection of rivers along the route, takes, afforestation of earth borrow pits, waste banks, subgrade side slopes, medial separators, interchange and house construction area.

⑵ Noise protection supervision: to adopt sound barrier, soundproofing window and other protective measures in sensitive locations.

⑶ Water pollution prevention supervision: To adopt sewage treatment facility on service areas, parking lots, tollgate stations,and management stations.

⑷Water conservation supervision: Subgrade side slope protection works, drainage works; temporary water conservation facilities in civil engineering construction such as retaining and arresting works, and drainage works for earth borrow and waste banks.

⑸ Supervision over implementing environmental protection design: to supervise environmental protection engineering design.

9.4 Training plan of environmental protection

In order to strengthen the project organization's environmental managerial ability, it is planned to train relevant personnel with environmental protection, the following environmental protection training plan for the project is formulated (See Table 9.4-1)

Table 9.4-1 Environmental protection training plan

No	Trainee	Training content	Time	Place	Size	Cost (10,000 yuan)
1	Environmental protection supervising engineer	National environmental protection regulations and standards, this project's main environmental questions, environmental protection supervising engineer's duty, use of noise monitoring instrument, etc.	Within 2 months before project construction	Nanchang	45 persons, 15 days	30
2	Project environmental management personnel	Study the advanced environmental management experience of foreign countries, and apply the knowledge learnt to the environmental management of the project.	From half year to 12 months after project starts construction	Foreign country	5 persons, half month	15.56
3	Contractors' environmental protection personnel	National environmental protection regulations, standards and this project's main environmental questions, environmental protection precautions and environmental measures during construction, duty of environmental protection staff member.	Within 1 month before project construction	Nanchang	20 persons, 5 days	10
4	Inspection personnel for hazardous cargo transportation	Relevant national regulations and management rules on hazardous cargo transportation, rudimentary knowledge of hazardous cargo, vehicle declaration and inspection program, emergency plan, fire fighting knowledge.	Within 2 months before project operation	Nanchang	All tollgate station staff and tunnel management station staff, 5 days	7

Chapter 10 Profit and Loss Analysis of Environmental Economy

10.1 Engineering economy analysis

The engineering economic assessment of the project includes assessment of national economy, financial assessment and sensitivity analysis. The results of each indicators are shown in Table 10.1-1～10.1-3

it can be seen from Table 10.1-1～10.1-3 that this project possesses better economic benefit, financial return and strong anti-risk ability. Construction of this project is feasible.

Table 10.1-1 List of indicators for national economic assessment unit：10,000 yuan

Year	Construction cost	Maintenance cost	Repair cost	Overhead	Benefit from reduced cost	Benefit from reduced time	Benefit from reduced accidents	Net cash flow
2006	105016	0	0	0				-105016
2007	157524	0	0	0				-157524
2008	157524	0	0	0				-157524
2009	105016	775	0	812	15337	20732	1296	-69238
2010	0	1611	0	1658	33036	23013	2695	55475
2011	0	1675	0	1691	35580	25544	2803	60560
2012	0	1742	0	1725	38319	28354	2915	66121
2013	0	1812	0	1759	41270	31473	3032	72203
2014	0	1885	0	1795	44448	34935	3153	78856
2015	0	1960	0	1831	47870	38777	3279	86136
2016	0	2038	0	1867	50599	41686	3410	91789
2017	0	2120	0	1905	53483	44812	3546	97817
2018	0	2205	0	1943	56532	48173	3688	104246
2019	0	2293	22930	1981	59754	51786	3836	88171
2020	0	2385	0	2021	63160	55670	3989	118413
2021	0	2480	0	2062	66318	59289	4149	125214
2022	0	2579	0	2103	69634	63142	4315	132409
2023	0	2682	0	2145	73115	67247	4487	140022
2024	0	2790	0	2188	76771	71618	4667	148078
2025	0	2901	0	2231	80610	76273	4854	156603
2026	0	3017	0	2276	84560	80239	5048	164553
2027	0	3138	0	2322	88703	84411	5250	172904
2028	0	3264	0	2368	93049	88801	5460	181678
2029	-262540	3394	33940	2415	97609	93418	5678	419496
EIRR=14.01% ENPV=189177.3(10,000 yuan)								
EBCR=1.447 EN=16.61(year)(including construction stage)								

Table 10.1-2 Economic sensitivity analysis

EIRR(%)		Investment variation				
		0.8	0.9	1	1.1	1.2
Traffic volume variation	1.2	19.37	17.69	16.29	15.07	14.01
	1.1	18.12	16.52	15.17	14.01	12.99
	1	16.82	15.29	14.01	12.90	11.94
	0.9	15.45	14.01	12.78	11.74	10.82
	0.8	14.01	12.65	11.48	10.49	9.64

Table 10.1-3 Financial sensitivity analysis

FIRR(%)		Investment variation		
		0.9	1	1.1
Traffic volume variation	1.1	7.30	6.82	5.76
	1	6.21	5.76	5.30
	0.9	5.76	4.55	4.13

10.2 Benefits produced from the project

10.2.1 Direct economic benefits

The national economic benefits of this project are mainly as follows:

(1) Benefit produced from improved road grade and reduced transportation cost by the newly-built highway;

(2) Benefit produced from shortened transportation mileage and reduced transportation cost by the newly-built highway;

(3) Benefit produced from reduced traffic congestion in original old roads and reduced transportation cost by the newly-built highway;

(4) Benefit produced from improved original road network transportation condition and reduced traffic accidents cost by the newly-built highway;

(5) Benefit produced from raised driving speed and reduced transportation time of passengers and freight on road by the newly-built highway.

10.2.2 Indirect social benefits

The indirect social benefits produced from the project are various, including improvement of people's living standard, improvement of social economic environment and natural environment, increase of employment opportunity, and promotion of urbanization development, etc., which are difficult to measure and assess in quantitative and monetary terms.

10.3 Environmental protection investment budget and benefit analysis

10.3.1 Investment budget of environmental protection measures

The environmental protection investment budget estimates for the environmental protection measures proposed in this assessment are listed in Table 10.3.1-1. The environmental protection investment needed by the proposed highway is about 73.39696 million yuan(including the water conservation investment), accounting for 1.27% of the total investment for the project.

Table 10.3.1-1 Investment budget of environmental protection measures

No	Environmental protection measures	Measure description	Quantity	Unit cost	Amount (10,000 yuan)	Remarks
1	Planting and vegetation restoration	Planting in 12 earth borrow pits, 24 waste banks	36places	100,000 yuan	360	Planning cost for side slopes, separators and interchanges is included into the total project cost
2	Sound barrier	Acoustic environmental protection for sensitive location	6050 linear meters	2500 yuan/ linear meters	2055	
	Sound-proofing window	Acoustic environmental protection for sensitive location	338 households/1725 windows	3000 yuan/each window	517.5	
	Planting noise-reduction greenbelt	Acoustic environmental protection for sensitive location	6 places		80	
3	Environmental protection and management during construction stage	Construction campsite will set up septic tank, garbage pit to clear and deliver the garbage; labor protection for workers and water sprinkling	16 bid sections	300,000 yuan/ bid section	480	Preliminarily calculated at 16 bid sections
4	Sewage treatment facility	sewage treatment for service area, parking lot and tollgate station	12	400,000 yuan/place	480	
5	Cultural relics protection	Cultural relics reconnaissance, excavation and tracing			120	
6	Environmental monitoring	Complete the environmental monitoring planning			144	Monitoring cost includes G323 and construction detour roads
7	Environmental protection training	See environmental protection training planning			62.56	
8	Sign board	Careful Driving(yellow), Hazardous Cargo Speed Limit(red)and reminding board(blue)	104	2000 yuan/piece	20.8	
9	Contingency	10% in the above total sum			423.986	
10	Water conservation	As listed in "*Water Conservation Plan*"			2675.85	Not including those already incorporated into the main project investment
11	Total				7339.696	

10.3.2 Benefit analysis of environmental protection investment

(1) Direct benefit

Construction and operation of this project will produce various environmental problems in areas along the route. So, after taking operative, feasible and applicable environmental protection measures, the economic losses retrieved in every year, namely the direct benefits of environmental protection investment are obvious, but very difficult to estimate in concrete monetary terms at present. Only brief calculation or qualitative analysis can be made on the economic losses in people's health, life quality and agricultural production along the route caused by changes in ecological environment, water environment, acoustic environment and ambient air quality when no measures are taken, so as to feedback the direct economic benefits of environmental protection investment.

(2) Indirect benefit

After implementing effective environmental protection measures, the following indirect benefits will be produced: Guaranteeing life quality and normal life order of residents along the route, maintaining residents' environmental psychological health and reducing the agitated mood of residents, reducing the unstable risk factor in society, etc. at present all these indirect benefits are very difficult to measure in monetary terms, but one thing is certain they will be the main component of social benefit produced from environmental protection investment.

Considering that the direct benefits and indirect benefits of environmental protection investment are difficult to quantize, so brief qualitative analysis will be conducted on the environmental, social economic and comprehensive benefits produced from environmental protection investment of this project (see Table 10.3.2-1)

Table 10.3.2-1 Analysis of environmental & economic benefits of environmental protection investment

Environmental protection investment type	Environmental benefits	Social economic benefits	Comprehensive benefits
Environmental protection measures during construction stage	1. Prevent noise from disturbing people 2. Prevent water pollution 3. Prevent air pollution 4. Protect farmland 5. Protect animals and plants 6. Innovate wastelands 7. Protect public security and easy access 8. Repair and innovate local roads	1. Protect people's living and working environment 2. Protect land, agriculture, forestry and vegetation 3. Protect national property and people's personal safety	1. Minimize adverse impact on environment during construction stage 2. Gain social support for the highway construction

Environmental protection investment type	Environmental benefits	Social economic benefits	Comprehensive benefits
Road land use, greening and wasteland reclaiming	1. Road landscaping 2. Water conservation 3. Restore or compensate vegetation 4. Wasteland innovation and ecological improvement 5. Farmland compensation	1. Innovate overall environment 2. Prevent furthering soil erosion 3. Subgrade stability 4. Protect land resource and farmlands dynamic balance 5. Raise land utilization value	1. Improve regional ecological environment 2. Assure road transportation safety 3. Increase travel safety and comfort
Noise-prevention works	Prevent traffic noise's pollution on areas along the route	1. Protect residents' living environment of townships and villages 2. Land value-assurance	Protect people's living and working environment and health
Sewage treatment, water drainage and protection works	Protect water quality of rivers and canals along the route	1. Protect water quality of rivers and canals 2. Protect water resource 3. Water conservation	Protect water resource
Environmental monitoring Environmental management	1. Monitor environmental quality along the route 2. Protect environmental quality along the route	Protect survival environment of human and biology	Sustainable development of economy and environment

10.4 Profit/loss analysis of environmental impact

For the main environmental factors influenced by this project, the profit/loss of environmental impact for the proposed highway will be analyzed quantitatively or qualitatively by compensation method or expert scoring method, see Table 10.4-1 for the results.

Table 10.4-1 Profit/loss analysis of environmental impact for the proposed highway

No	Environmental factors	Impact, measure and investment	value
1	Ambient air and acoustic environment	Acoustic and air environmental quality along the route reduces (-2) Acoustic and air environmental quality in towns and along existing road improves (+2)	0
2	Water quality	Negative impact on water environment along the route during construction stage	-2
3	Human health	No significant adverse impact, transportation helpful to go to hospital	+1
4	Plant	No significant adverse impact	0
5	Tourism resource	No significant adverse impact, helpful to resource development	+2
6	Flood prevention	No impact	0
7	Agriculture	Land occupation influences agricultural production	-2
8	Fishery	Pond occupation influences fishery production	-1
9	Town planning	No significant adverse impact, helpful to town and social development	+2
10	Landscaping and beautification	To increase environmental protection investment and to improve environmental quality along the route	+2
11	Removal and resettlement	Monetary compensation for removal, No significant adverse impact	0

No	Environmental factors	Impact, measure and investment	value
12	Land value	Land for housing along the route depreciates, land for industry and commerce appreciates	+2
13	Highway's direct social benefit	To shorten mileage, save time, reduce transportation cost, reduce oil consumption, and improve safety.	+3
14	Highway's indirect social benefit	To improve investment climate, promote economic development and to strengthen environmental awareness	+3
15	Environmental protection measures	To increase project investment	-1
Total		Positive benefit：(+15);negative benefit：(-6);positive benefit/negative benefit ＝2.50	+9

note： 1. scoring 1, 2, 3 from small to large according to impact degree;
2."+"means positive benefit, "-" negative benefit.

The environmental profit/loss analysis indicates that the environmental positive benefit/negative benefit ratio of the proposed highway is 2.5, which shows that the positive benefit of environmental economy produced by the proposed highway occupy a leading position. This project is feasible from the point of view of environmental protection.

Chapter 11 Assessment Conclusions

11.1 Ecological environment

(1) The current ecological environment in the assessment scope of the proposed highway is good. The highway will take up a permanent land size of about 12535.42mu. The land occupation type includes forestland, paddy field, non-irrigated field, wasteland, etc. The construction of the highway will cause certain agricultural economic losses, but will not produce remarkable influence on the distribution pattern of the land and vegetation.

(2) Subgrade excavation and earth/stone filling of the proposed highway construction will change the landform and topography of some areas to a certain extent. But corresponding engineering protection measures taken during the design, construction and operation stages of the highway can minimize such adverse effects on vegetation, land utilization and farmland change.

(3) Within the assessment scope of the proposed highway there is no natural reserve, no rare and endangered animals and plants distributed there. The engineering construction's impact on vegetation is mainly the cutting, rooting, burying and trampling of trees, fruit trees, flowers and plants, bush and farmland crops in the acquired lands during construction stage. Some small animals living there will be threatened to some degree during the whole construction stage of the highway. The above impact can be compensated for to a certain degree through the greening and planting measures.

(4) Within the assessment scope for this highway, the animal species are mostly domestic animals, poultry and some common little wild animals that are few in population and are not very demanding for living environment and are adaptable to human activity. This road construction has not caused and changed their habitat environment greatly, will not interfere their normal life, which can still continue surviving in the areas along the route.

(5) This project construction will disrupt and damage the original landform, land and vegetation, the possibly created soil erosion will produce adverse impact on the project construction, production and life along the route, as well as nearby ecological

environment. But because the protection works will be designed, constructed and accepted simultaneously with the main works of the project, the actually occurred water and soil erosion will be far smaller than the forecasted value. The earth borrow pits, waste banks, embankments, cutting slopes, service areas and construction sites are the main places where soil erosion occurs.

11.2 Water environment

(1) Current water quality monitoring on route section crossing rivers and reservoirs indicates that: the three water quality indicators: pH value, hypermanganate index and petroleum all can meet corresponding water quality functional zoning requirement; the monitored results of suspended substance in Gongjiang River, Ganjiang River, Xijiang River and Dongfeng reservoir can satisfy class Ⅲ standard of SL63-94《Surface Water Resource Quality Standard》(see table 1.9.1-1), the monitored results of suspended solid in Shangxi River cannot satisfy class Ⅲ standard of SL63-94《Surface Water Resource Quality Standard》.

(2) During the construction stage, because earth borrowing and filling may cause silt of certain amount to enter into water bodies along the route, which will produce certain influence to the water quality of some rivers, reservoirs, and canals. In building subgrade at the two banks of river-crossing bridges, measures shall be taken to reduce and avoid the impact on water body, which can be resumed after construction is finished.

(3) The bridge substructure construction is separated from road section construction campsite, and the sanitary sewage emission of each campsite is only 3.2-6.4t, discharged in a dispersed and temporary manner. Through setting up septic tank and effective management, the influence of sanitary sewage during construction stage can be acceptable. So the bridge substructure construction for the proposed highway will only have a slight negative effect on water environment. In addition during construction stage the construction waste oil will be collected, deposited and transported to designated places for treatment, thus will not exert an unfavorable influence on the surrounding environment either. The boring dregs of bridge construction are required to be transported out of river district and be piled up, and corresponding environmental protection measures shall be taken to prevent water body pollution.

(4) The water pollution sources during operation stage are mainly sewage from service areas, parking lots, tollgates and management stations. The sewage must be treated to meet national class Ⅰ discharge standard before discharging. It is sugeested to install small sewage disposal equipment of relevant capacity according to respective sewage discharge volume and the sewage disposal equipment should be well maintained and managed so to ensure its normal operation, in this way the outlet water quality can meet class Ⅰ criteria of《*Sewage Comprehensive Discharge Standard*》（GB8978-1996）. After the sewage disposal equipment is finalized, impact on local water environment by the sewage produced from the above service facilities is not large.

(5) During Operation stage, the pollutants carried by pavement runoff in a raining period are mostly suspended substances and little amount of petroleum, mainly occurring in the initial raining time. The flow and velocity of the river which the proposed highway crosses are relatively stable, having greater dilution ability. Within the assessment scope of downstream bridge site, there is no centralized type drinking water intake. So, it can be concluded that bridge floor runoff's impact on water quality is very small. In order to prevent river-crossing bridge section from occurring leakage accident of hazardous articles resulting in water pollution, the 12 bridges crossing rivers and reservoirs of this project are required to have guardrails strengthened and reinforced, and the bridge floor runoff shall be collected and dealt with so that they will not enter into water bodies directly.

(6) This project will not cause great adverse effect on farmland irrigation along the route. Water conservancy projects such as river and channel that are intruded will be reconstructed according to their existing capability.

(7) In the next stage design it is suggested to optimize bridge and culvert design. Farmland irrigation system and water supply/drainage facilities that are intruded and separated by subgrade shall be restored.

11.3 Acoustic environment

(1) Within the assessment scope there is no large-scale industrial and mining enterprises, the traffic noise of existing railways, national roads, provincial roads, and county roads are the main sources of noise pollution, followed by the living and

production noise of residents in most Monitoring sites, the applicable noise criteria are not exceeded. The major noise source is traffic noise on existing roads; the acoustic quality along the route is basically good.

(2) Construction noise will have a certain impact on the acoustic environmental quality along the route; this kind of noise impact mainly appears in a range 130m from construction site in daytime and 480m from construction site in nighttime.

(3) In 100m beyond construction site and its construction/transportation roads (detour roads) the acoustic impact is relatively small, but will still exert a relatively great influence on people within 50m, especially construction noise at night will influence their rest and sleep.

(4) To carry out environmental monitoring on sensitive locations, to supervise and promote good-mannered construction, to regulate construction, and to guarantee residents' normal life and study.

(5) According to class 1 standard limit(55dB in daytime and 45dB at nighttime) in GB3096-93, the farthest standard-satisfying distances in daytime along the two sides of the highway in short-term, mid-term and long-term stages are 126m, 155m and 187m respectively from road center line; the farthest standard-satisfying distances in nighttime along the two sides of the highway in short-term, mid-term and long-term stages are 123m, 223m and 310m respectively from road center line. According to class 2 standard limit(60dB in daytime and 50dB at nighttime) in GB3096-93, the farthest standard-satisfying distances in daytime along the two sides of the highway in short-term, mid-term and long-term stages are 69m, 86m and 106m respectively from road center line; the farthest standard-satisfying distances in nighttime along the two sides of the highway in short-term, mid-term and long-term stages are 76m, 136m and 207m respectively from road center line. According to class 4 standard limit(70dB in daytime and 55dB at nighttime) in GB3096-93, the farthest standard-satisfying distances in daytime along the two sides of the highway in short-term, mid-term and long-term stages are 20m, 24m and 30m respectively from road center line; the farthest standard-satisfying distances in nighttime along the two sides of the highway in short-term, mid-term and long-term stages are 46m, 78m and 119m respectively from road center line. It is suggested that planning department not to approve building schools and hospitals that have high acoustic quality requirement within 310m from

both sides of the Highway, and building civilian houses within 207m.

(6) Prediction and calculation of 67 sensitive locations identified in the recommended scheme indicate that among them there are 5 sensitive locations satisfying the noise standard and the other 62 sensitive locations have noise excess of different degrees. The 5 sensitive locations satisfying the noise standard all locate in interchange linking-up road.The predicted results of 3 sensitive locations in scheme Ⅱ of Sanmen comparison section are exceeding standard. Among the sensitive locations with noise excess, 43% sensitive locations exceed standard at night during the long-term operation stage. Except xiabao sanatorium, the predicted results of 8 schools and 1 sanatorium along the route exceed standard during the short, mid and long-term operation stage, of which the ambient background noise values in Datian primary school, Huoxing primary school, Xijaing Township sanatorium, Sanmen middle school, Wansong primary school, Tianxin primary school, Gangbian primary school and Yeshan primary school have already exceeded class 1 criteria (55dB in daytime and 45dB at nighttime) of *Ambient Noise Standard in Urban Area* (GB3096-93).

(7) For the standard-exceeding sensitive locations of recommended scheme during operation stage, it is recommended to build sound barrier, to install soundproofing windows and to plant noise reduction greenbelt with an investment of 25.725 million yuan.

(8) Among the noise excessive sensitive locations of this project, 53 sensitive locations are excessive during the mid and long-term operation stage. For those sensitive locations, 15 representative locations (schools and residences) are chosen for noise monitoring during operation stage, and corresponding noise reduction measures will be taken according to the monitored results.

11.4 Ambient air

(1) The areas the highway runs by are mostly rural areas with the outdoor ambient air kept in natural condition. There is no large-scale pollution source in the assessment scope along the route, and the existing pollutants are automobile tail gas, pollutants produced by people’s life and production, etc. But the emission is relatively small.

(2) The NO_2 and TSP average daily concentrations along the highway all comply

with class Ⅱ air quality standard(NO_2:0.30mg/m^3,TSP:0.12mg/m^3) of GB3095-1996, the monitored results indicate that the environmental air quality is good along the route.

(3) The main environmental problem is TSP and bituminous smoke pollution during highway construction stage. Stabilizing soil mixing station shall be far away from sensitive locations; attention shall be given to workers' labor protection. Construction roads and material transportation roads shall be sprinkled with water and road surface shall be cleaned, roadbuilding material transporting vehicles shall be covered with geotextile. Stock grounds shall be far away from residential areas and shall be covered. In filling subgrade water shall be sprinkled in time; the bituminous concrete mixing station should be located 300m away from leeward wind direction of sensitive locations.

(4) The NO_2 daily average concentrations in 20m from road center line of the proposed highway can meet the class 2 limits(NO_2:0.30mg/m^3) for ambient air quality standard during the short-term and mid-term stages; The NO_2 peak hour concentrations in 20m from road center line of the proposed highway can meet the class 2 limits for ambient air quality standard during the long-term operation stages; The class Ⅱ standard-satisfying distance of NO_2 daily average concentration is 20～60m from road center line.

(5) It can be seen from the forecasting results that this project's impact on ambient air quality is slight. There are a total of 67 sensitive locations along the route, analyses and predicting indicate that when the sensitive locations are in leeward wind direction during the long-term operation stage, standard exceeding may probably occur in 3 sensitive locations.

11.5 Social environment

(1) Construction of the proposed highway will exert a positive influence in promoting social and economic development, in promoting rational adjustment of industrial sectors in areas along the route, in fostering the social and economic development and tourist resource development in areas along the route and in the whole Jiangxi Province, in improving the local investment environment, and in promoting structural adjustment of three major industries.

(2) This project will permanently take up lands with a total size of 12535.42mu, of which3934.73 mu for cultivated lands. Land allocation and use value transformation

could mitigate land occupation's impact on agricultural economy.

(3) It is required to do good removal and resettlement work, to conscientiously enforce local government's removal and resettlement policy. Because reasonable number of overpasses and passageways will be set up, impact on life convenience of residents along the route is not big.

(4) Operation of the proposed highway will alleviate the traffic pressure imposing on original existing roads, will improve traffic environment, and will reduce traffic accidents.

(5) The construction unit will strengthen publicity on historical relic protection, protective measures shall be made available to underground historical relic being found during construction, which shall be traced and monitored.

11.6 Pollution risk of transportation

(1) Though accident probability of hazardous cargo transportation is extremely small, but once the accident takes place, the consequence will be very serious. The construction department will formulate emergency plan, shall enhance training and management and shall strengthen emergency handling ability so to reduce pollution risk to a minimum.

(2) In order to prevent river- and reservoir-crossing bridge sections from occurring accident of hazardous articles vehicles resulting in water pollution, the 12 bridges crossing water bodies of this project are required to have guardrails strengthened and reinforced to prevent the vehicles from falling into the water, and to design closed and perfect bridge floor drainage system which can lead the runoff into the sedimenting tanks at the two ends of bridge so that the leaked hazardous articles on the bridge floor will not enter into rivers along with the runoff.

(3) The 7 tunnels of this project, especially the 3 long tunnels, all have been designed for safety purpose, and are installed with relatively perfect ventilating system, power supply and illumination system, fire-fighting system, traffic control system, urgent telephone system, closed-circuit TV system, fire warning system and central control system, whose normal operation and use can effectively prevent accidents from occurring or can ensure quick and effective rescue in case of accident.

11.7 Comparison and selection of route alternative alignments

After several route comparisons and justifications in the Feasibility Study stage and preliminary design stage, the recommended scheme basically is the best scheme in terms of environmental protection.In order to do good environmental protection work for this project conscientiously, it is advised that the designing unit pay attention to solving the following problems at next stage:

⑴ In high-fill and deep-cut sections, it is required to further study the design plan for slope protection.

⑵ At the design of next stage, attention should be paid to the environmental protection and water and soil conservation of the highway itself and the earth borrow and waste banks.

⑶ It is required to conscientiously implement simultaneous design between the environmental protection project and main project works.

11.8 Profit/loss analysis of environmental economy

⑴ National economic evaluation and financial evaluation of this project indicate that it has certain anti-risk ability.

⑵ The environmental protection investment needed by the proposed highway is about 73.39696 million yuan(including the water conservation investment), accounting for 1.27% of the total investment for the project.

11.9 Environmental protection, management and monitoring plans

(1) The environmental protection management during construction and operation stage for this project is executed by Jiangxi Provincial Communication Department planning office, Jiangxi Provincial Communication Department World Bank loan project office, and Jiangxi Provincial Expressway Administration.

(2) The monitoring cost for this project during construction stage is 600,000 yuan, and the monitoring cost during operation stage is 840,000 yuan.

(3) The construction unit has already established a removal and resettlement office and a coordinating group for design, resettlement and environmental protection, responsible for the environmental management and removal/resettlement of this project.

(4) Detailed environmental management plan (EMP) has already been formulated

so as to finalize the environmental mitigation measures and implementation of environmental monitoring plan.

11.10 Public participation

(1) Construction of the proposed highway is a rare good chance to the areas along the route, especially to the development of county towns where the route passes. Local government and residents along the route spare no effort to support this highway to pass in front of their "own door".

(2) In order to avoid and mitigate various kinds of negative impacts possibly produced by the highway construction, it is suggested that related departments and units: in designing route and construction, should make every effort to take as little cultivated land and good farmland as possible; to well protect the existing irrigation and water conservancy facilities; to take highway afforestation and engineering protection measures in highway section apt to soil erosion so to prevent soil erosion; to safeguard the legitimate interests of residents involved in land acquisition and removal; to make public the relevant compensation policy and standard, and to distribute compensation money to the grassroot organizations in order to be used in local production and resident life in due time.

(3) Because people along the project, especially those who may be subject to land occupation, removal and resettlement do not still know compensation policies about land occupation, removal and resettlement in road construction, it is suggested that during the land occupation, removal and resettlement for this project, such policies and compensation standard shall be publicized to concerned people along the route through local government so as to make this project familiar to and welcomed by the people.

(4) For possible environmental problems brought out by this project, the environmental assessment unit and design unit have already put forward corresponding environmental protection measures such as removal, sound barrier, installing sound insulating window, and environmental management in construction stage, etc.

(5) At next stage various kinds of media such as broadcast, TV, newspaper, etc. will be utilized to release information to the public, to offer unobstructed access to environmental file inquiry and environmental complaint telephone.

(6) Cooperating with environmental protection department to solve and deal with

public appeal and complaint in time.

(7) According to various environmental protection measures put forward in the assessment report, Jiangxi Provincial Expressway Administration will carry out follow-up investigations in all period during the design, construction and operation stage.

11.11 Comprehensive assessment conclusion

In sum, the development, construction and operation of this project will produce certain adverse impacts on the ecological environment, resident's life, school teaching along the route, but so long as the mitigation measures proposed by this report are conscientiously implemented, such adverse impacts produced can be effectively controlled and can be reduced to a minimum acceptable to the environment. The route alignment is basically rational; the social and economic benefits of the project are remarkable. This assessment concludes that in terms of environmental protection, construction of this proposed highway is feasible.

Attachment 1：Introduction to the assessment unit and staff

The Ministry of Communications Highway Research Institute is a scientific research institution directly subordinate to the Ministry of Communications. It is a comprehensive, multi-disciplinary and largest scientific organization in China engaging in road transportation research, experimentation and technical development, qualified with a class A environmental impact assessment certificate issued by China National Environmental Protection Agency.

The environmental engineering office of the Ministry of Communications Highway Research Institute is mainly engaged in environmental impact assessment, of water and soil conservation, environmental protection approval and acceptance, and related basic research on transportation environmental protection for road engineering, independent bridge and others, staffed by 32 personnel specializing in road engineering, automotive engineering, environmental engineering, chemical analysis, landscape afforestation, and bio-engineering, of whom there are 8 persons holding senior professional title, 5 persons holding intermediate professional title. This office has successively undertaken environmental impact assessment for nearly 300 high grade roads and independent bridges, has chaired the compilation for "*Environmental Impact Assessment code for Road Construction Project*" issued by the Ministry of Communications, this office possesses environmental impact assessment experience for projects loaned by the World Bank and the Asia Development Bank and possesses good theoretical foundation and practical experience.

The environmental impact assessment staff for this project is:

Dong Bochang, male, born in 1974, associate researcher, graduated with MA degree from Northeast Normal University majoring in environmental science; responsible for this project, responsible for the alternative alignment comparison and selection, and environmental management plan.

Zhao Qin,female,born in 1978, interim researcher,graduated with a MA degree frim Chang'an University majoring in environment engineering; responsible for the whole report.

Piao Zhongxuan, male, born in 1938, professor-level senior engineer, graduated from Jilin University majoring in automobile engineering; responsible for social environment, hazardous cargo risk analysis, and public participation.

Wang Fang, female, born in 1957, engineer; majoring in electronic engineering, responsible for acoustic environment and ambient air.

Zhu Yufeng, male, born in 1979, interim researcher, graduated with a MA degree from Beijing University of Science and Technology majoring in environment engineering, responsible for water environment, and ecological environment.

Attachment 2：References

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Attachment 3：Sample of public participation form

Attachment 4：List of tables and figures