SFG1750 V1 REV

World Bank Loaned Lushan Earthquake Reconstruction and Risk Reduction Project Rural Road Subproject

Environmental Management Plan

Sichuan Communication Surveying & Design Institute

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Contents

1. Project Overview

1.1. Introduction

On April 20, 2013, a Magnitude 7.0 earthquake struck Lushan County, Ya'an City, its impact spreading to Tianquan County, Ya'an City and the areas under the jurisdiction of Qionglai City among others. The State Council issued *Overall Planning for Post-Lushan Earthquake Recovery and Reconstruction* on July 15, 2013. The *Overall Planning* pointed out, according to comprehensive assessment of resource and environmental bearing capacity and planning for main function zones, reconstruction zones should be divided reasonably, urban-rural distribution optimized and land resources saved and intensively utilized. However, under the effect of 4.20 Earthquake, Daozuo-Huojing Road in Qionglai (referred to as Dao-Huo Road), Hongshigou - Daqiaotou Section of Ying-Lu Road in Yingjing County, Ya'an City and Shi-Xin Road in Tianquan County, Ya'an City have suffered from collapse of upper slope and pavement damages. As a result, the road traffic conditions were poor, adversely affecting people's travel along the line and obstructing post-earthquake reconstruction, recovery and development. In order to improve the traffic and transport conditions in the project area, provide good traffic and transport support for post-earthquake recovery and reconstruction and promote post-earthquake recovery and reconstruction and development of the towns and townships along the line, Qionglai City Road Maintenance Section, Yingjing County Road Maintenance Section and Tianquan County Traffic Development Corporation plan to upgrade the above three roads through World Bank financing and self-raised funds of the Owner. Reconstruction of the three roads can improve the traffic conditions and promote post-earthquake economic recovery and development in the earthquake stricken area.

Therefore, the three subprojects are included in the World Bank Loaned Post-Lushan Earthquake Recovery and Reconstruction of Rural Roads.

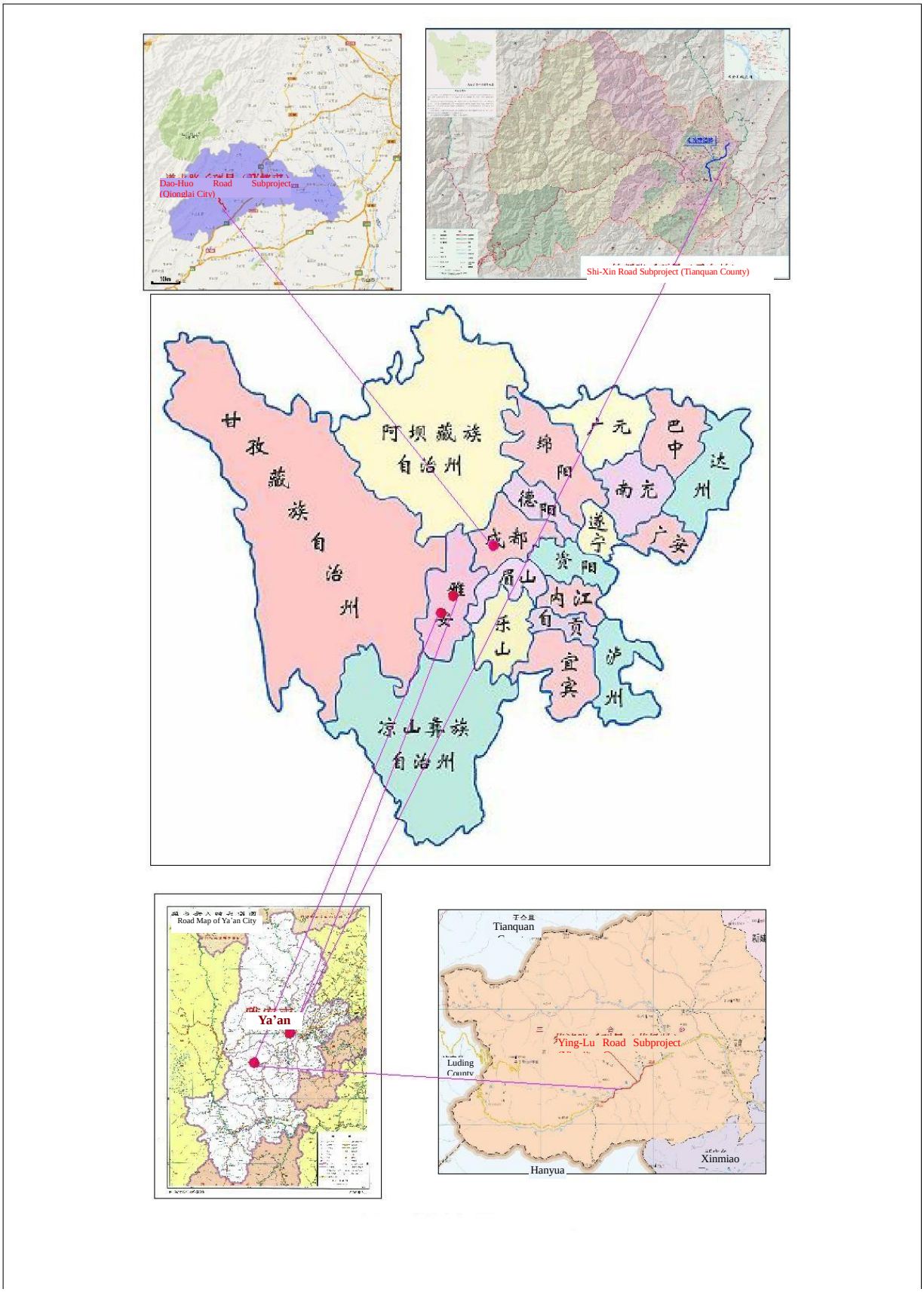


Fig. 1-1 Geological location of the Project

Daozuo-Huojing Road Subproject: the Daozuo-Huojing Road Subproject in Qionglai City includes the main line and two branch lines. In the recommended proposal for the main line, i.e. proposal K, the road is totally 12.172km long and is built based on Class III technical standard; its subgrade is 8.5m wide; it is a bidirectional road, with 2 lanes in each direction;

the designed speed is 30km/h. This project contains 1 major bridge of 146m length and 4 medium/minor bridges in total length of 148m and the bridges account for 2.41% of the total length of the road. The road contains 65 culverts, i.e. 5.34 culverts per km. The two branch lines are rural roads which are rebuilt upon the original rural roads. One branch line is 775m long and the other 459m. The main line is a Class III road which is completely built with asphalt concrete pavement.

Ying-Lu Road Subproject: the Yingjing-Luding Road in Yingjing County (Hongshigou to Daqiaotou) is an expansion project based on the existing road, with no new road. This road runs from Hongshigou to Daqiaotou in Sanhe Township and it is totally 6km long. (This project includes certain associated projects, among which the preceding section is from the Sanhe Township Government to Hongshigou and the following section is from Daqiaotou to Luding boundary. This subproject, upon completion, will be an import link between Yingjing County and Luding County of Ganzi Prefecture).

Shi-Xin Road Subproject: the rebuilt section has 6.5m wide subgrade and is 15.465km long; the newly built section is 1.09km long (Xinmin Group 1 and Xinhua Township) and comprises the main works and auxiliary works.

The main works include subgrade, bridges, culverts and road crossings; the auxiliary works include spoil ground, stock ground, construction site and access road.

Table 1.1-1 Construction scale and works of Dao-Huo Road

Works		Construction contents and scale
Main works	Subgrade works	8.5m wide subgrade of main line, directional road with two lanes in each direction, subgrade cross section of 1.0m (shoulder)+ 2×3.25m (lane)+ 1.0m (shoulder); 5.5m wide subgrade of branch line, subgrade cross section of 0.5m (shoulder)+ 3.5m (lane)+ 0.5m (shoulder)
	Pavement works	**1. Main line:** Upper topping: 5cm fine-grain dense-graded modified asphalt concrete AC-13; middle topping: 7cm medium-grain asphalt concrete AC-20; base: 20cm cement stabilized macadam; sub-base: 25cm cement stabilized macadam; cushion: 20cm thick graded sand gravel cushion. **2. Branch line:** Upper topping: 4cmAC-13C modified asphalt concrete; middle topping: 5cmAC-20C plain asphalt concrete
	Bridge works	The whole line contains 5 bridges including 1 major bridge, 2 medium bridges and 2 minor bridges which are all newly built.
	Culvert works	62 newly built bridges
	Level crossing	11 level crossings
	Traffic safety facilities	The traffic safety facilities include traffic signs, traffic markings, outlines, guardrail and speed bump, etc.
Temporary works	Production and living areas	3 construction sites will be furnished, occupying 0.63hm^2 of land area (0.34hm^2 farm land, 0.29hm^2 forest land); each construction site will contain fabrication yard and mixing station (cold mixing plan and batching plant)
		The construction camp will occupy rented private houses
	Spoil yard	2 spoil yards will be furnished which will temporarily occupy a land area of 3.14hm^2 (1.46hm^2 dry land, 1.68hm^2 forest land)
	Temporary surface soil storage yard	3 temporary surface soil storage yards will be furnished, occupying a land area of 0.70hm^2 (0.65hm^2 farm land, 0.05hm^2 forest land)
	Access road	A 0.55km long and 6m wide access roads will be built. The road will temporarily occupy land area of 0.33hm^2 (0.24hm^2 dry land, 0.09hm^2 forest land)
Demolition	Demolition	Demolition involves 6888.75m^2 of building area, including 2724.75m^2 of

and resettlement	of buildings	brick-concrete buildings, 2381m^2 of brick buildings and 1783 m^2 of threshing ground; 4 tombs will be demolished
	Residents resettlement	The demolished building area in the Project is 6410m^2, affecting 140 people in 35 households. Demolition and resettlement will be handled by the Qionglai City Government.

Table 1.1-2 Works in Ying-Lu Road Subproject

Works		Construction contents and scale
Main works	Subgrade works	The designed road length is 6km.
		Total excavation volume is 103,800 m^3, including 42,900 m^3 of soil and 60,900 m^3 of rock. Totally backfilling volume is 92,300 m^3 (rock) and borrowed material 31,400 m^3 (sand gravel); the surplus soil is planting soil which can be placed in the ambient farm land or transported to other works sites for land greening
		Before subgrade filling, the embankment base must be cleaned and compacted; the filled soil must be compacted in layers
		0.25m hard shoulder+ 3.0m lane+ 3.0m lane+ 0.25m hard shoulder, crown slope 1.5%, side ditch built of 40cm*40cm mortar blocks and pebbles; Based on the actual conditions of the original subgrade of the ordinary road, slope cutting plus facing wall or inclined cutting wall can be used at the left side, or widened subgrade plus bottom protection wall+ natural sloping or shoulder retaining wall can be used at the right side; special subgrade must be treated
	Pavement works	Plain cement concrete surface course is used; it is preliminarily proposed that the pavement structure layer is built of 22cm thick C30 cement concrete+ 20cm thick cement stabilized macadam base+ 20cm thick sand gravel cushion; the designed service life is 10 years under moderate traffic load; the concrete surface plate is 5m long; the maximum temperature gradient of the surface course is 88℃/m.
	Bridge and culvert works	2 medium bridges in total length of 40m will be built and each bridge is built of single-span 20m pre-stressed hollow slab and gravity U-type abutment; at the medium bridge at K27+582.013, the designed flood level is 1522.5m and designed flood frequency 1/50; at the medium bridge at K27+808.171, the designed flood level is 1529.0m and designed flood frequency 1/50. The existing culverts in sound structural condition will be dredged and utilized, while the structurally damaged ones will be demolished and rebuilt; certain road sections will require additional culverts
	Crossing works	No major crossing will occur, but there will be 2 secondary crossings where the road will intersect tractor road or temporary road in residential area
	Traffic control	Traffic will be maintained by half-breadth construction method or intermittent passing; traffic control in the road construction sections must be put under overall planning, with intensified traffic organization to ensure traffic safety; prior to construction, the traffic control plan must be publicized; during construction, conspicuous signboards must be installed to inform the passing vehicles of the bypass routes
Temporary works	Construction site	1 construction site will be furnished at the K23+335 Section. This construction site will occupy an area of 0.45 ha. in waste grassland and will contain parking lot, material storage yard and mixing field
	Access road	A 246.2m long and 6.5m wide access road will be built, occupying an area of 0.16 ha. in waste grassland. This road will be used to transport the mixed material to the road construction area
Environmental protection works	Wastewater	1 latrine pit will be furnished; 1 construction site settling tank and 1 oil separation settling tank will be furnished; an interception and drainage system will be arranged along the construction road
	Waste gas	1 sprinkling truck and 1 car washing stand

Table 1.1-3 Works for Shi-Xin Road Subproject

Works		Construction contents and scale
Main works	Subgrade works	Rebuilt subgrade is 6.5m wide and 15.465km long; newly built road is 1.09km long (Xinmin Group 1 to Xinhua Township)
	Pavement works	Cement concrete 226,160m^2

	Bridge works	2 new bridges in 44m length
	Culvert works	33 new culverts
	Crossing works	14 level crossings
	Demolition and resettlement	Total demolished building area 2,194m^2
Auxiliary works	Construction site	4 construction sites, occupying 0.24hm^2 land area
	Traffic works	Road signs, markings, etc.
	Landscaping works	Grass planting on slope 2.86hm^2
	Protection works	Slope protection, side ditch, slope greening
	Spoil yard	2 spoil yards, occupying 2.62hm^2 land area

1.2. Objective of *Environmental Management Plan*

Environmental Management Plan intends to implement appropriate mitigation measures for identified environmental impacts and monitor their effectiveness during project implementation period. *Environmental Management Plan* based on *Environmental Impact Assessment* is prepared in accordance with China's environmental regulations and guidelines, World Bank safeguard policies and best practice of similar projects. The objective of the Plan is to ensure the consistency between *Environmental Management Plan* and *Environmental Impact Assessment* to meet the corresponding standards for environmental protection. The Plan meets supervision requirements effectively and guides the Project Owner in management of contractors and subcontractors.

2. Environmental Laws, Policies and Regulations

2.1 Environmental protection laws, regulations and relevant documents

(1) *Environmental Protection Law of the People's Republic of China* (implemented on Jan. 1, 2015);

(2) *Law of the People's Republic of China on Promotion of Cleaner Production* (implemented on Sept. 1, 2003);

(3) *Law of the People's Republic of China on Prevention and Control of Pollution from Environmental Noise* (implemented on Mar. 1, 1997);

(4) *Law of the People's Republic of China on the Prevention and Control of Water Pollution* (implemented on Jun. 1, 2008);

(5) *Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution* (revised on Apr. 29, 2000 and implemented on Sep. 1, 2000);

(6) *Law of the People's Republic of China on Prevention and Control of Environmental Pollution by Solid Wastes* (implemented on Apr. 1, 1996);

(7) *Law of the People's Republic of China on Water and Soil Conservation* (implemented on Mar. 1, 2011);

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

(9) *Circular on Implementing Regulations on the Administration of Construction Project*

Environmental Protection (HF [1999] No. 107 of State Environmental Protection Administration, implemented on Apr. 29, 1999);

(10) *Circular on Relevant Issues of Implementing EIA System for Construction Project* (HF [1999] No. 107 of State Environmental Protection Administration, implemented on Apr. 29, 1999);

(11) *Circular on Stepping up Environmental Protection for Construction Project* (HF [2001] No. 19 of State Environmental Protection Administration, implemented on Feb. 21, 2001);

(12) *Classified Directory for Environmental Impact Assessment of Construction Project* (implemented on Oct. 1, 2008);

(13) *Measures for Environmental Protection Management of Traffic Construction Project* (Decree No. 17 [1990] of Ministry of Communications, implemented in 1990);

(14) *Circular on Printing and Issuing the Regulations on Soil and Water Conservation in Highway Construction Project* (SB [2001] No. 12 Document of Ministry of Communications and Ministry of Water Resources, implemented in 2001);

(15) *Circular on Stepping up Regulation of Environmental Impact Assessment* (HB [2002] No. 88 of the State Environmental Protection Administration, implemented in 2002);

(16) *Sichuan Province's Regulations on Environmental Protection* (implemented on Sep. 24, 2004);

(17) *Urban and Rural Planning Law of the People's Republic of China* (implemented on Jan. 1, 2008);

(18) *Law of the People's Republic of China on the Protection of Cultural Relics* (implemented on Oct. 28, 2002) and *Implementation Rules for the Laws of the People's Republic of China on the Protection of Cultural Relics*;

(19) *Guidelines for Developing Innovative Traffic Industry* (Ministry of Communications, Jul. 24, 2006);

(20) *Notice on Standardization of Acceptance of Construction Project Environmental Protection* (CHF [2003] No. 56);

2.2 Guidelines and technical specifications

(1) *Technical Guidelines for Environmental Impact Assessment - General Programme* (HJ 2.1-2011);

(2) *Technical Guidelines for Environmental Impact Assessment - Atmospheric Environment* (HJ 2.2-2008);

(3) *Technical Guidelines for Environmental Impact Assessment – Surface Water Environment* (HJ/T 2.3-93);

(4) *Technical Guidelines for Noise Impact Assessment* (HJ 2.4-2009);

(5) *Technical Guidelines for Environmental Impact Assessment – Groundwater Environment* (HJ 610-2011);

(6) *Technical Guideline for Environmental Impact Assessment – Ecological Environment* (HJ 19-2011);

(7) *Technical Guidelines for Environmental Risk Assessment on Projects* (HJ/T 169-2004);

(8) *Technical Criterion for Eco-Environmental Status Evaluation (Trial)* (HJ/T

192-2006);

(9) *Regulation of Techniques for Comprehensive Control of Soil Erosion* (GB/T 16543.1~16453.6-2008);

(10) *Technical Code on Soil and Water Conservation of Development and Construction Projects* (GB 50433-2008);

(11) World Bank Operations Manual - OP4.01 World Bank Procedures on Environmental Impact Assessment;

(12) World Bank Operations Manual - BP4.01 World Bank Procedures, Environmental Impact Assessment;

(13) World Bank Operations Manual - OP4.04 World Bank Policies on Natural Habitat;

(14) World Bank Operations Manual - OP4.11 World Bank Procedures on Cultural Property;

(15) World Bank Operations Manual - OP4.12 World Bank Procedures on Involuntary Resettlement

2.3 Project-related documents

(1) *Feasibility Study Report on "Daozuo-Huojing Road" Works for World Bank Loaned Post-Lushan Earthquake Recovery and Reconstruction of Roads* (Chengdu Communication Surveying & Design Institute, Nov. 2015);

(2) *Letter on Approving Prior Survey and Design Bidding for "Daozuo-Huojing Road" Works for World Bank Loaned Post-Lushan Earthquake Recovery and Reconstruction of Roads* (QFGH [2015] No. 36 of the Development and Reform Bureau of Qionglai City);

(3) *Statement on Soil and Water Conservation Scheme for "Daozuo-Huojing Road" Works for World Bank Loaned Post-Lushan Earthquake Recovery and Reconstruction of Roads* (Sichuan Kairing Engineering Investigation & Design Co., Ltd., Dec. 2015);

(4) *Overall Planning for Land Use in Qionglai City (2006~2020)*;

(5) *Overall Planning for Qionglai City* (2012-2020)

(6) *Overall Planning for Land Use in Yingjing County, Ya'an City* (2006-2020)

(7) *Survey Report on Forest Resources Category II in Yingjing County* (2015)

(8) *Overall Planning for Yingjing County, Sichuan Province (2012-2030)*

(9) *Feasibility Study Report on World Bank Loaned Reconstruction and Expansion of Ying-Lu Road (Hongshigou – Daqiaotou) in Yingjing County, Ya'an City*

(10) *Soil and Water Conservation Scheme Report on World Bank Loaned Reconstruction and Expansion of Ying-Lu Road (Hongshigou – Daqiaotou) in Yingjing County, Ya'an City*

(11) *Report on Social Impact Assessment of World Bank Loaned Post-4.20 Lushan Earthquake Recovery and Reconstruction of Rural Roads*

2.4 World Bank safeguard policy

2.4.1 10 World Bank safeguard policies and compliance analysis

World Bank has produced ten safeguard policies on social and environmental operation. On the basis of the project nature, layout, scope of assessment determined and site survey, the applicability of the ten policies to the Project is identified.

Table 2-1 Analysis of compliance of the Project with World Bank safeguard policies

S/N	Safeguard policy	Applicable or not	Compliance
1	OP/BP4.01 Environmental Impact Assessment	Yes	Category B project; Prepare *Environmental Impact Assessment* and *Environmental Management Plan*; Conduct two rounds of public consultation as part of the EIA procedure;
2	OP/BP4.04 Natural Habitat	Yes	This policy is triggered. None of the land areas and water areas in this project will involve any nature reserve, scenic spot or any other ecologically sensitive area, but this project will require bridge construction which may impact the aquatic ecosystem. The environmental assessment covers an ecological survey and the Environmental Management Plan covers habitat protection.
3	OP/BP4.36 Forest	No	This policy is not triggered. The Project will not fund major transformation or degradation activities involving important areas or relevant key natural habitats defined in this policy.
4	OP/BP4.09 Pest Management	No	This policy is not triggered. The Project will not purchase any insecticide or cause increased consumption of insecticides. No action will be required according to this policy.
5	OP/BP4.11 Physical Cultural Resources	No	The Project does not involve damage to physical resources.
6	OP/BP4.37 Dam Safety	No	This policy is not triggered. There is no dam in the project area.
7	OP/BP4.10 Indigenous People	No	This policy is not triggered. No indigenous people live in the project area nor are they affected.
8	OP/BP4.12 Involuntary Resettlement	Yes	It is applicable to resettlement and *Resettlement Action Plan* shall be prepared;
9	OP/BP7.50 International Waterway Project	No	This policy is not triggered. The project does not involve any international waterway.
10	OP/BP7.60 Disputed Area Project	No	This policy is not triggered. The Project does not involve any disputed site.

2.4.2 Analysis of compliance with World Bank *EHS Guidelines* and relevant policies

World Bank *EHS Guideline* (general guideline) and *EHS Guideline for Toll Roads* apply to the Project. Mitigation measures included in the *Environmental Management Plan* of the Project are in full compliance with the above guidelines, especially the provisions related to construction management. It should be noted that provisions in the Guidelines are basically consistent with China's laws, regulations, guidelines and construction management codes.

Table 2-2 List of project compliance with *World Bank EHS Guidelines*

World Bank EHS Guidelines	Compliance with Environmental Impact Assessment/ Environmental Management Plan
If facilities or projects are close to identified ecologically sensitive regions (such as national park), reduce increase of pollution level as much as possible. In addition, appropriate mitigation measures include application of clean fuels and technologies and implementation of comprehensive pollution control measures.	There are no ecologically sensitive regions around the project area.
Dust or particulate matters (PM) are the most common pollutants of unorganized emissions. Particles may be generated by certain operations (transportation and open storage of solid materials) and exposed soil surfaces (including unpaved roads).	During the construction period, apply dust control methods (including covering, water spraying or increasing water content of material stack in the open air) and use water spraying method to control delivered materials on paved or unpaved roads.

Table 2-3 List of project compliance with *World Bank EHS Guideline for Toll Roads*

EHS Guideline for Toll Roads	**Compliance with Environmental Impact Assessment/ Environmental Management Plan**
Under appropriate conditions, avoid important land and hydrophytic habitats (including old-growth forests, wetlands and fish spawning habitat) by selecting appropriate locations of roads and supporting facilities and applying existing traffic corridors.	The project area does not belong to important land and hydrophytic habitats.
During the construction period, reduce removal of local plants as much as possible and replant local plants in disturbed areas.	Prepare a water and soil conservation scheme specially and plant proper local herbaceous plants as per the water and soil conservation scheme.
Pave the road in dry days to prevent loss of asphalt and cement materials.	During the construction period, do not pave under strong wind, and confirm the construction site appropriately.
No matter whether much grease will be increased, oil-water separators shall be applied during treatment.	Machine oil-sewage collectors are arranged at the construction site for collecting oil and sewage. Collected oily water is delivered to the organization with treatment capacity for treatment. Do not directly discharge the oily water.
Prevent pollution caused by asphalt cleaning by the following measures: use vegetable oil instead of diesel as releasing agent and cleaning agent, prevent leakage of cleaning product and polluted asphalt, scrap before cleaning, and clean at the place far away from surface water or drainage facilities.	Requirements on "storage of fuels, oils and dangerous and toxic substances" are specifically specified in the Contractor's specification. All fuels at the construction site shall be fenced and the capacity of storage area shall be 110% of that of fuel storage container. The fuel storage area shall not be close to any water source (namely, within 100m from the water source).
Take soundproof measures for surrounding buildings (replace windows generally). Use pavement with low pavement/tyre friction noise such as stone mastic asphalt pavement.	During the road operation period, limit functions of areas along the trunk road, plan buildings at road sides, optimize acoustic design and strengthen speed control management.

In general, implementation of the Project is basically in conformity with relevant requirements for implementation of the World Bank Loaned Rural Road Component.

2.5 Environmental quality standard

2.5.1 Ambient air quality

The assessment of current ambient air quality complies with Class II standard in *Ambient Air Quality Standards* (GB3095-2012).

Table 2-4Ambient air quality standards

Pollutant	Concentration limit of each pollutant (mg/m^3)			Basis
	Hourly average	Daily average	Annual average	
SO_2	0.50	0.15	0.06	Class II standards in GB3095-2012
NO_2	0.12	0.08	0.04	
PM_{10}		0.15	0.10	

2.5.2 Water environment quality

Surface water complies with Class III standards in *Environmental Quality Standard for Surface Water* (GB3838-2002).

Table 2-5Environmental quality standards for surface water

Indicator	Standard value (mg/L)	Basis
pH	6-9	Standards for Class III water specified in GB3838-2002
Ammonia nitrogen	≤1.0	
Volatile Phenol	≤0.005	
Petroleum	≤0.05	

Chemical oxygen demand	≤20	
Five-day biological oxygen demand	≤4.0	
Fecal coliforms	≤10000	

The groundwater complies with Class III standard specified in the *Quality Standard for Ground Water* (GB/T14848-93).

Table 2-6Environmental quality standards for groundwater

Indicator	Standard value (mg/L)	Basis
pH	6.5-8.5	Class III standards in GB/T14848-93
Permanganate index	≤3.0	
Ammonia nitrogen	≤0.2	
Volatile Phenol	≤0.002	
Chloride	≤250	
Total coliforms	≤3.0	

2.5.3 Acoustic environment quality

Apply Class 4a and 2 standards in *Environmental Quality Standard for Noise* (GB3096-2008). Refer to the following table for standard values:

Table 2-7Acoustic environmental quality standards

Application area	Standard value (Leq: dB(A))		Basis
	Day	Night	
Mixed living, commercial and industrial area	60	50	Class II standards in GB3096-2008
Both sides of main traffic trunk roads	70	55	Class 4a standards in GB3096-2008

2.5.4 Soil environment quality

Comply with Class II standard in *Environmental Quality Standard for Soils* (GB15618-1995).

Table 2-8Environmental quality standard for soils (unit: mg/Kg)

Indicator	pH (non-dimensional)	Copper	Zinc	Nickel	Lead	Cadmium	Remarks
Standard value	<6.5	400	500	200	500	1.0	*Environmental Quality Standard for Soils* (GB15618-1995)

2.6 Emission standard of pollutants

2.6.1 Wastewater

For wastewater, apply class III standards in *Integrated Wastewater Discharge Standard* (GB8978-1996).

Table 2-9Emission standards for wastewater

Pollutant	Standard value (mg/L)	Basis
pH	6~9	Class III standards in GB8978-1996
COD_{cr}	500	
SS	400	
Animal and vegetable oils	100	
BOD_5	300	

2.6.2 Waste gas

Comply with Class II standard of *Integrated Emission Standard of Air Pollutants*

(GB16297-1996)

Table 2-10 Integrated emission standards of air pollutants

Pollutant	Maximum allowable emission concentration (mg/m^3)	Maximum allowable emission speed (kg/h)	Basis
SO_2	50	4.3	Class II standard limits in GB16297-1996 (exhaust funnel of 20m high)
Particle	120	5.9	
NO_2	240	1.3	

2.6.3 Noise

Apply Class II standard in *Emission Standard for Industrial Enterprises Noise at Boundary* (GB12348-2008).

Table 2-11 Emission standard for industrial enterprises noise at boundary

Category	Day	Night	Basis
Noise limit [Leq: dB(A)]	60	50	GB12348-2008 (class 2)

Apply relevant standards in *Noise Limits for Construction Site* (GBl2523-2011) during the construction period.

3.0 Environmental Impacts and Mitigation Measures

3.1 Environmental impacts

This Project is a low-pollution type of municipal project that has obvious environmental and social benefits. But inevitably, there are some local environmental problems during construction and operation periods.

I. Analysis of main impacts during construction period

1. Analysis of impacts on ecological environment

(1) Impacts on plants during construction period

① Damage to vegetation and impacts on productivity of land

The permanent land occupation for project construction may bring load on and damage to vegetation in the project area, and the construction may make the vegetation habitat destroyed and make the individual organisms lose their growing environment, the degree of such impacts is irreversible. The results of investigation on current vegetation distribution situation show that the vegetation directly influenced by the Project which is a reconstruction one is mainly such woodland or meadow as is newly occupied.

In the process of road construction, the temporary sites mainly include spoil area, construction access road, stockyard, construction camps, and material storage yard. Such temporary land occupation for construction will directly disrupt the forest community and vegetation, thus making the community has less biological diversity. The vegetation and farmland loss resulting from the road construction may be compensated for to a great extent by taking measures for re-vegetation on the land temporarily occupied for construction.

In conclusion, the damage to vegetation is mainly caused by the permanent land occupation for the project construction and is long-term and unrecoverable.

② Impacts on ecosystem structure

Although the highway construction work will occupy certain forest land, it will not change the vegetation types or the forest community structure along the road

line. As for the forest land vegetation, the road will not disrupt the plant community, so the pollen flow can still fulfill gene exchange between plants and seed production and seed bank renewal remain unaffected. Therefore, the Project will not affect the species composition in the plant community. Thanks to the simple community structure, the ecosystem structure composed of different plant communities will not be changed either and the ecosystem functions and the ecological relations in the ecosystem will continue as usual.

③ Impact on nationally protected important plants, ancient trees and precious trees

None of the three project areas shows presence of nationally protected wild plants, ancient trees or precious trees. According to field survey indicates, the consultation with the forestry authorities of Qionglai and Ya'an and the local forestry annals, the road line in the assessment scope is accompanied by Class I national protected plants, metasequoia and gingko, and Class II national protected plants, i.e. nanmu and camptotheca acuminate. Consultation with the local forestry authority and the residents living along the project line, these protected plants are mostly artificially cultivated plants, in-courtyard plants, shade tree or economic trees and none of them is naturally grown wild plants, so none of them is covered by national protection. However, there are numerous metasequoia trees along the road line, some of them being very old; the small number of nanmu trees are in-courtyard trees in vicinity of the road, their grow has been long free from human interference so that they have developed certain ecological value and their proximity to the road makes them susceptible to impacts of road works, therefore it is recommended that the Project Employer should avoid, replant or enclose these trees and protect them from destruction.

(2) Impacts on landscapes during construction period

The impacts of project land requisition on the landscape are mainly represented by the effects of the Project on the regional vegetation and geomorphologic landscapes.

① Impacts of project permanent land occupation on landscapes

The damage brought by the project permanent land occupation (mainly the new land for road) to the original ground vegetation is unrecoverable. Thus the project has a strong impact on the vegetation and landscapes of the project area and the impact is mainly shown as ground surface excavation, vegetation deterioration, terrain fragmentation in the construction area, etc. which will bring people with strong visual contrast.

② Impacts of land occupation by temporary works on landscapes

Land requisition by temporary works mainly includes the land occupation by temporary soil storage yard, construction area and so on. Since temporary works mostly serve to implement the Project, they may require favorable topographical and traffic conditions. The land and vegetation are pretty good, but the construction will forcefully disturb the ground vegetation, landforms and so on in the operation area. Such disturbance mainly includes environmental pollution by production and sanitary waste, air pollution due to flying dust, and likely occurrence of scorching or mechanical damage of plants because of too much dust collection on their branches and leaves. Such will produce visual pollution. However, landscapes along the land occupied by temporary works will not be affected significantly, because the land used temporarily for the project has better fertile soil layer and can be easily used for reclamation and the land area occupied temporarily for construction will be used as an area for implementation of landscape works where landscape planting will be carried out upon

completion of project construction.

(3) Impacts on animals during construction period

There are few species of and a small number of terrestrial wildlife animals and no protected animals in the assessment area. Although the project construction during construction period will make the species and number of terrestrial wildlife animals reduced to some extent in the area of land occupied by the project and area of construction influence, the impact on the population quantity of such animals in the whole project area is limited. On the one hand such animals will migrate to other places; on the other hand the population quantity of such animals will recover soon after the habitat restoration along with the completion of project construction. Therefore, such adverse impact is very slight and acceptable.

This project is intended to rebuild and upgrade the existing roads. The area in 300m from the road line shows no presence of Class I national protected animals such as panda, takin and golden monkey or the Class II national protected animals such as macaque, lesser panda, golden cat, leopard, sambar and tragopan temminckii. Thus the project will not impact any protected wild animal.

As a result, such unfavorable impact is weak and acceptable.

(4) Analysis on impact on aquatic organism

There are few fish species in small number in the assessment area, and there is no rare aquatic organism under protection, and therefore the work has little impact on the fish species; the impact is worst for the plankton and benthos in the assessment area; as for the water and soil loss, workers' domestic sewage and mechanical oil leakage will cause the water body to be turbid. The operation period will essentially have no effect on the aquatic organisms.

The Project occupies just a small water area, the domestic sewage will not be discharged outside, the aquatic organisms can acclimate to any environment and the water body has self-cleaning capacity, thus only certain essential environmental protection measures are needed, e.g. construction of wading piers is avoided in the fish breeding season from March to July; construction materials are stockpiled at a location far away from water source and other water bodies and free from scouring of storm runoff; ecological restoration is conducted after project completion, to minimize the impact of vegetation damage and water and soil loss on the aquatic organisms; the construction processes and machineries are rationally arranged and the construction personnel are given necessary education on ecological protection.

2. Analysis of impacts on atmospheric environment

(1) Construction dust

① Analysis of pollution sources

The flying dust pollution produced by construction vehicles during construction is rather severe and covers a wide range of area. Flying dust pertains to dust fall with smaller particle size (10~20μm). The particle size distribution of dust on road surface (earth) not paved is: dust with particle size less than 5μm accounting for 8%, that with particle size between 5~30μm accounting for 24% and that with particle size greater than 30μm accounting for 68%. Hence dust is likely to be kicked up from the road under construction. But flying dust is less harmful than the fine dust produced from lime-soil mixing, and the impact period of the former is also shorter. Flying dust pollution can be reduced by watering.

Earth & stone excavation and filling during construction are the main works that

bring flying dust.

In the process of paving the road, much fine dust will be produced by lime-soil mixing which can be divided into two kinds of processes, i.e. road mixing and plant mixing according to the method of mixing. The former is the mixing on construction site and the latter refers to centralized mixing before the finished products are transported to the construction road section. By comparison, the impact of plant mixing is bigger in quantity and wider in area and the pollution scope can reach 150m in the downwind direction, while the pollution resulting from road mixing is less both in quantity and in area but the road line polluted is long. So an appropriate lime-soil mixing method shall be selected according to the actual situation during construction to reduce TSP pollution.

② Control measures for flying dust pollution

1) When the wind speed is above level IV and fugitive dust is likely to occur, the Construction Contractor is recommended to suspend the earth excavation and take such effective measures as covering the stacked materials and moistening so that flying dust pollution can be reduced;

2) Construction waste needs to be promptly removed and transported. For the construction waste that cannot be removed and transported for the moment, measures such as covering shall be taken. The vehicles for transporting sand, stones, cement, earth and other substances which are liable to produce dust must be well covered and no spilling or leakage is allowed.

3) The construction site shall be cleaned immediately after the completion of the Project. Construction site shall be afforested or recovered and used as arable land to plant crops, in addition to being cleaned in time.

4) A lime-soil mixing method shall be selected rationally based on the actual situations and fugitive dust pollution shall be reduced by watering.

5) In the process of excavation, drilling and demolition & relocation, water shall be sprinkled to maintain certain moisture in the operation; the loose and dry surface soil in construction site shall be watered to prevent and treat fine dust; at the time of earth backfilling, the surface soil shall be watered properly if it is dry, so as to prevent fine dust from flying.

6) The management of backfill storage yard shall be strengthened. Measures such as earth surface compaction, regular water spray and covering shall be developed; the needless earth, building materials and muck shall be carried away in time and should not be stacked for a long time.

7) Earth-moving trucks and building-material transport vehicles shall come complete with spilling-prevention equipment and should not be surcharged, so as to ensure no scattering during transport; the running routes and time of transport vehicles shall be well planned to avoid running in sensitive areas such as the downtown district, traffic concentration area and residential area whenever possible.

8) Transport vehicles shall be overcanopied and be rinsed before leaving the loading and unloading places, so that the amount of earth carried by wheels and chassis and scattering on the pavement can be reduced.

9) Earth falling on the pavement during transport shall be swept up without delay to reduce flying dust during running of vehicles.

10) In the process of construction, using abandoned building materials as fuels

to burn is strictly forbidden.

(2) Construction waste gas

Waste gas during construction of the project mainly comes from exhaust gas produced by construction machinery and transport vehicles. With small produced volume, such gas is discharged intermittently and dispersedly and its impacts are negligible.

(3) Asphalt fume

The pavement of proposed road of Daozuo-Huojing Subproject is asphalt concrete pavement. Asphalt fume mainly occurs in the process of asphalt fission & cooking, mixing and road paving, and the maximum discharge of asphalt fume comes from the process of asphalt cooking. Main toxic and harmful substances in asphalt fume are THC, phenols and 3.4-benzpyrene. The influence area of asphalt fume pollution is 100m in the downwind direction. Asphalt required for the project is commercial asphalt purchased in local and no asphalt mixing station is built. The EIA requires that special vehicles for canned asphalt be used for transport, so as to prevent asphalt from spilling along the road and polluting the environment. Thus the asphalt fume, with relatively low emission concentration, can meet the requirement of maximum allowable emission concentration of asphalt fume in *Integrated Emission Standard of Air Pollutants* (GB16297-1996) and has few impacts on the surrounding environment.

3. Analysis of impacts on surface water environment

(1) Impacts of construction wastewater

Wastewater during the construction period of the project mainly stems from construction wastewater and sanitary sewage. Construction wastewater includes water for cooling and washing of construction machinery, for cleaning construction site, for cleaning building materials, for concrete placement & curing and for rinsing and contains a certain amount of sand. Sanitary sewage of construction personnel mainly contains organic contaminants, ammoniacal nitrogen and SS. Besides, surface runoff of working site in rainy season contains a certain amount of sand and high concentrations of suspended substances.

1) Sanitary sewage and countermeasures

There are a total of 100 persons (construction personnel and site management personnel) during rush hours of construction. Water consumption is $5m^3/d$ through calculation according to 50L/person·d, and the amount of sanitary sewage generated during construction period of the project is $4m^3/d$ when the sanitary sewage discharge coefficient is 0.8.

Sanitary sewage from construction of the project can be disposed of by using the existing treatment facilities in the local house rented.

Therefore, the sanitary sewage during construction would not have distinct impacts on the local environment.

2) Construction wastewater and countermeasures

The construction wastewater and rainy-season surface runoff contain sand which is the primary contaminant, and high concentrations of suspended substances, and the pH values of them represent slightly alkaline. A sedimentation tank will be built to separate suspended substances. After being treated in the sedimentation tank, wastewater can be reused and cannot be discharged outside. The settled sludge shall be removed and elutriated regularly before being transported to the building material disposal site for burying.

(2) Impacts of construction methods

① Post-earthquake reconstruction project—Shi-Xin Road in Tianquan County

Main water bodies which the reconstructed highway passes include Shiyang Reservoir. There is no great bridge along the whole line of the project. A medium bridge (28m long) and a small bridge (16m long) are newly built. The bridges account for 0.27% of the total length of the line and 33 culverts are newly built. No underwater pier is provided for the newly-built small and medium bridges in the project. All of them do not stride across any water body; construction of culvert works is likely to result in water loss and soil erosion.

② Post-earthquake reconstruction project—Daozuo-Huojing Road

The foundations of wading bridges of this Project are all in the forms of cast-in-place pile foundations. The construction method of bored cast-in-place pile foundation is used generally and that of dug cast-in-situ pile is adopted where there is no groundwater or a small amount of groundwater.

Construction of wading bridges would have certain impacts on the water bodies where such bridges are under construction, especially, the disturbance to river bottom and spilling of boring mud will cause a sharp increase in the concentration of suspended substances in local water bodies. However, since the water body flows slowly, it would soon recover from such disturbance and such substances would settle within a short distance and would not change the water quality of water body beyond 200m downstream.

In addition, in formwork installation during construction of piers and abutments, mud will come out of the sealability guarantee joints between formwork connections. Before concreting for the pier and abutment bodies, the top surfaces of foundations need to be rinsed and the laitance on such surfaces, which may cause local water body pollution once falling into the water, shall be chipped away. Since such pollution load is small and the water body itself has the function of turbulent diffusion, the time and scope of impact on water quality is temporary and limited. It is recommended to intensify construction management by recycling washing waste water during piers construction instead of discharging such water into surface water bodies.

4. Analysis of impacts on groundwater environment

(1) Impacts of subgrade construction on groundwater

① Impacts on groundwater seepage during construction period

According to the subgrade distribution situation, the subgrade along the line shall be excavated and filled simultaneously, with excavation as the primary means and filling as the supplementary one, except most sections where the old road is broadened and its subgrade is strengthened. The investigation shows that portable water of residents in the subgrade construction area along the line is primarily the rivulet water on both sides of the line or the spring from the mountain. In combination with the characteristics of subgrade construction along the line, it can be concluded that the subgrade construction will have little influence on the groundwater seepage in the line area and on portable water of residents. However, attention shall be paid to the impacts of excavation on groundwater recharge and discharge, since the topographic slope in this area is large and the line is near the brooks or rivulets. Excavation of side slope will lower the groundwater level in shallow aquifer and have certain impacts on the ecological water use of lower vegetation. But such impacts are relatively small

and automatic recovery from such impacts can be achieved in a short time. Improper drainage of subgrade and pavement in the process of construction may cause difficult drainage of runoff of shallow groundwater system and have other impacts; hence consistent and smooth side ditch, drainage ditch and intercepting ditch shall be maintained during construction.

② Impacts on groundwater quality during construction period

The impacts of subgrade construction in the way of embankment and road cutting on groundwater quality are mainly the "overflow, spillover, leakage and dropping" of greasy dirt of mechanical equipment and sanitary wastewater in the living quarters of the construction area.

The road cutting construction area is mainly located at the slope area where the groundwater mainly consists of the pore water in loose rocks and bedrock fissure water, with poor water yield property and large groundwater depth; there are few residential areas distributed near the construction area and no distribution of sensitive spots such as drinking water sources, additionally, oil leakage from the mechanical equipment is manually controllable during construction and operation and the leakage amount is small under normal circumstances. Therefore, the impact on groundwater environment is small.

There are few embankment construction sections, with a small amount of fill. Such construction area is mainly situated in ravine and low-lying regions near the brooks and rivulets. The leaked greasy dirt in the process of construction may cause pollution of surface water body. There is a recharge-discharge relation between rivulet water and groundwater, which may cause pollution of groundwater to some extent. Necessary measures shall be taken in construction to prevent possible risks.

As a whole, subgrade construction has few impacts on groundwater environment.

(2) Impacts of bridge construction on groundwater

The superstructures of newly-built bridges in the project are constructed with post-tensioned prestressed-concrete simply-supported small box girders, the bridge piers are pile-column type piers and no pier is provided for a small bridge; the abutment of a great bridge is constructed by installing bent cap on the pile foundation, and all piers are provided with bored cast-in-place pile foundations; the abutments of medium and small bridges are U-shaped gravity abutment. In general, there are few numbers of newly-built bridges whose length is short, the bridge construction is centered on subgrade construction, the number of bridge piers is small, the engineering geologic conditions are favorable, and there is no drinking groundwater source around the project area, therefore, the groundwater is hardly affected. But attention shall be paid to pollution prevention of rivulet water in the process of construction.

5. Analysis of impacts on acoustic environment

① Noise source

Noise during the construction period refers to noise generated in the process of operation of various construction machinery, equipment and engineering transportation vehicles. The project construction shall be carried out with the help of all kinds of machinery. The investigation shows that the frequently-used machinery at present mainly includes excavators, loaders and mixers. Noise values generated during the operation of major construction equipment are provided in Table 3-1 below.

Table 3-1Noise source intensity of construction equipment

S/N	Machinery type	Sound source characteristics	Noise value 5m away from equipment
1	Loader	Unstable source	90
2	Grader	Mobile unstable source	90
3	Vibratory roller	Mobile unstable source	86
4	Tandem roller	Mobile unstable source	81
5	Three-wheel roller	Mobile unstable source	81
6	Pneumatic tyre roller	Mobile unstable source	76
7	Bulldozer	Mobile unstable source	86
8	Hydraulic wheel excavator	Unstable source	84
9	Spreader	Mobile unstable source	87
10	Truck	Mobile unstable source	92
11	Concrete mixer	Stationary stable source, construction site	91
12	Concrete pump	Stationary stable source, construction site	85

② Prediction of noise impact during construction

Noise source during construction can be regarded as point sound source. Noise value at places with various distances from the sound source during the construction period can be estimated according to the attenuation mode of the point sound source. The prediction mode is as follows:

Lp=Lpo-20lg(r/r0)-ΔL

Where: Lp—sound pressure level at place r (m) away from the sound source (dB(A));

Lpo—sound pressure level at place r0 (m) away from the sound source (dB(A));

r—distance from the sound source (m);

r0—1m away from the sound source;

ΔL—amount of various attenuations (except for divergence attenuation (dB(A))). ΔL is assigned to be zero for outdoor sound noise source.

According to the predictor formula, noise attenuation values with respect to distance for all kinds of construction machinery operating at full load are calculated. See Table 3-2 below.

Table 3-2Predicted noise values of various construction machines at different distances

S/N	Machinery type	Noise values at different distances (dB) (A)								
		5	40	50	60	100	150	200	300	500
1	Wheel loader	90	71.94	70	68.42	63.98	60.46	57.96	54.44	50
2	Grader	90	71.94	70	68.42	63.98	60.46	57.96	54.44	50
3	Vibratory roller	86	67.94	66	64.42	59.98	56.46	53.96	50.44	46
4	Tandem roller	81	62.94	61	59.42	54.98	51.46	48.96	45.44	41
5	Three-wheel roller	81	62.94	61	59.42	54.98	51.46	48.96	45.44	41
6	Pneumatic tyre roller	76	57.94	56	54.42	49.98	46.46	43.96	40.44	36
7	Bulldozer	86	67.94	66	64.42	59.98	56.46	53.96	50.44	46
8	Hydraulic wheel excavator	84	65.94	64	62.42	57.98	54.46	51.96	48.44	44
9	Spreader	87	68.94	67	65.42	60.98	57.46	54.96	51.44	47
10	Concrete mixer	91	72.94	71	69.42	64.98	61.46	58.96	55.44	51
11	Concrete pump	85	66.94	65	63.42	58.98	55.46	52.96	49.44	45

(1) For a single construction machine, the noise more than 30m away from the

noise source in the daytime can reach the standard limit value and that more than 300m away from the noise source in the nighttime can reach the standard limit value.

(2) For simultaneous operation of various construction machines, the noise more than 60m away from the noise source in the daytime can reach the standard limit value and that more than 350m away from the noise source in the nighttime can reach the standard limit value.

(3) There are 5 sensitive spots distributed within 200m from Daozuo-Huojing Subproject to the road centerline. Considering that the road construction is mainly carried out in the daytime, the noise during road construction mainly has great influence on the sensitive spots within 53m from both sides of the road centerline according to the maximum influence range. Construction in the nighttime will have adverse impacts on all residential areas along the road line, therefore a notice shall be issued to the local residents if the Construction Contractor should conduct nighttime construction due to the limitations of the construction techniques and other factors, and the suggested noise-reduction measures should be taken to reduce the construction site noise, for example, through the erection of the temporary enclosure.

Noise caused by road construction is a kind of short-term pollution in the process of social development and usually can be understood and accepted by the residents. However, in order to protect residents along the line and make them have normal life and rest, the Construction Contractor shall take necessary noise control measures to reduce the impacts of construction noise on the environment. Prior to construction, the local residents must be notified of the potential environmental impacts of the construction activities.

6. Analysis of impact of solid waste

Solid waste during construction period of the project mainly comes from the muck such as abandoned earth and stone generated from subgrade excavation and filling, domestic garbage on construction camps, abandoned road building materials, and building waste after demolition within the land occupied.

Inappropriate stacking and disposal of solid waste will bring direct damage to the crops and vegetation, thus hinder the agricultural production; the solid waste will be covered with dust after being stacked for too long and flying dust caused in windy conditions will affect the nearby residents; stacking garbage along the road will lead to mass propagation of bacteria and flies which may cause increased incidence and transmissibility of infectious diseases in the local, the foul smell brought by garbage will affect the life of residents and the landscape environment. Since this Project involves construction close to the river, the assessment requirements are that solid waste during construction period of the project should not be stacked around the water body relating to this Project, particularly, it can not be discarded into the river. Hence such impacts shall be reduced and avoided by strengthening construction management during construction period of the project and by cleaning, transporting and disposing of solid waste immediately after completion of construction.

Moreover, improper transport ways of solid waste during construction also will have adverse effects on the surrounding environment. The EIA requirements: vehicles transporting construction and building waste must be capped with dust screens and be washed when they leave the muck loading yard, so as to prevent spilling and flying dust along the road; the vehicles must be emptied after they arrived at the muck unloading yard; the Construction Contractor shall carefully study the transport route

of spoil and muck with the traffic authority, environmental authority and so on, to avoid such route passing through environmental sensitive spots such as centralized residential areas; the transport shall be carried out in the nighttime whenever possible.

After the above-mentioned measures are taken, the impact of solid waste on the surrounding environment during construction period will be small.

II. Analysis of main impacts during operation period

1. Analysis of impacts on atmospheric environment

After this Project is implemented, flying dust pollution on the roads and bridges will be reduced, and for the road line, the daily average NO_2 concentration and peak-hour NO_2 concentration more than 20m away from the centerline of the proposed road in all time intervals of the operation period may meet the Grade II standards; since the distance between the sensitive spots along the project line and the road centerline is generally more than 20m, residential areas on both sides of the road can meet the corresponding ambient air quality standard.

At present, the most effective method for the road project is to strengthen the afforestation on the road. Some plants with good air purification function can be planted on both sides to form green belts for absorbing exhaust gas, so as to keep high regional ambient air quality. In addition, the pollutant emission amount of a single motor vehicle in the future will be significantly reduced as a result of the great importance attached to environmental protection, the technological progress and extensive use of clean energy. The current ambient air quality along the project line is very good, with large atmospheric environmental capacity and good vegetation cover, thus the vehicle exhaust will have negligible impacts.

2. Analysis of impacts on surface water environment

Sewage in the operation period of the proposed road of the project is mainly from rainfall and road runoff generated from pavement flushing. After the road and bridge are put into operation, the impact of pavement rainfall runoff (the main pollutant) on the water environment is mainly manifested in the water body pollution resulting from such emissions of vehicle exhaust, tyre friction particles, road flying dust and dripping oil as flow into the adjacent river system and cross over the river system with the pavement rainfall. The concentration of pollutant of road runoff depends on such factors as rainfall capacity and rainfall duration, traffic volume and degree of atmospheric pollution, time interval between two rainfalls and road width, with great randomness and contingency. Therefore, it’s hard to get a general rule and unified calculation method for application from the concentration of the pollutant of rainwater runoff. According to the statistics of domestic research data and assessment data, the pollution of the water body by road runoff mostly occurs at the initial stage of a rainfall, and as the duration of rainfall prolongs, the pollutant content in the runoff will decrease and the pollution of the water body will also decrease. Thus, it will not cause significant influence on the water body.

Xiaoxi River and its branch brooks are distributed within the project area. The main road intersects such brooks repeatedly within the route channel, and bridge deck (pavement) runoff sewage will be produced during operation period. So this assessment requires that such bridge deck (pavement) be provided with a drainage collection system and directly discharging the bridge deck runoff into Xiaoxi River and other water bodies is strictly forbidden during operation period. Besides, anti-collision walls must be arranged on both sides of bridges and on the side of the subgrade close to the river course, in order to prevent the passing vehicles from falling into the river where the fuel oil leakage will cause water pollution in the process of road operation. After the above-mentioned protection measures are taken, this Project during operation period will basically not pollute the

surface water environment.

3. Analysis of impacts on groundwater environment

During operation period, pouring of loaded goods, oil leakage and fugitive dust will occur inevitably when various vehicles are running on the road. Moreover, hazardous substances and atmospheric particulates in the vehicle exhaust gas, corrosion of pavement, abrasive objects on the tyre and pavement, external vehicle waste and residues of human activities will occur. The possible pollution pathway is to sink into groundwater by mixing with atmospheric precipitation. Through strengthening traffic management and periodically cleaning the garbage along the line, occurrence of hazardous waste during operation period of the project can be reduced effectively. And the places of water source within the scope of road are mostly covered with concrete, thus the pollutants can be prevented effectively from entering the aquifer. At the pile foundations of bridges, pollutants can infiltrate into the aquifer through the gaps between the pile bodies and walls of holes if such gaps are not sealed in the process of pile forming. Therefore, such pollution can be avoided if the gaps between pile bodies and walls of holes are sealed.

The major factor that is likely to pose a hazard to groundwater during road operation period is a traffic accident of a vehicle transporting hazardous goods. After this accident happens, the leaked (exploded) toxic and hazardous substances will enter the groundwater, causing pollution of groundwater. And risk and hidden danger of pollution in transporting hazardous goods often relates to the probability of a traffic accident. Thus this Project must focus on prevention of risk accidents during its operation period.

The surfaces of areas crossed by the road are mostly covered with concrete which plays a role in separating water. It separates surface water from groundwater, and effectively prevents the surface contaminants from polluting groundwater. Since the surface area occupied by the road regions is small, the permeability of regional atmospheric precipitation will rarely be obstructed and the normal replenishment of regional groundwater will not be affected. So the construction of this Project will not have a big influence on the groundwater environment.

4. Analysis of impacts on acoustic environment

(1) Reasonable planning, architectural layout and control of land on both sides of road

The land on both sides of the road shall be planned rationally and the use function of land along the line shall be strictly controlled according to the provision of "Article 11 of Chapter II" of the *Law of the People's Republic of China on Prevention and Control of Pollution from Environmental Noise*: When urban planning departments determine the architectural layout, they shall reasonably stipulate anti-noise distance between buildings and traffic arteries on the basis of the national acoustical environment quality standard and design specifications for civil buildings and shall propose corresponding planning and design requirements.

In principle, sensitive buildings such as schools, hospitals and concentrated residential areas should not be built or expanded in the area within the noise protection distance. Besides the recommendation of rationally planning the function of land on both sides of the road, the architectural layout and sound insulation design shall be strengthened to ensure that the indoor environment of the sensitive buildings can meet the requirements of use function, so as to reduce the impact of traffic noise on residents whenever possible. Meanwhile, the layout of environmentally sensitive buildings shall be optimized and the functional area sensitive to noise shall be arranged on the side far away from the road as much as possible.

Therefore, based on the noise prediction results, this EIA suggests that sensitive

buildings such as schools, hospitals, old people's homes and residential areas should not be built within 20m away from both sides of road centerline. If acoustical environment sensitive spots are arranged within the above scope, noise reduction measures must be taken during the construction process. Such spots may not be put into use until they are proved to meet corresponding function standards through acceptance inspection by competent environmental authorities.

(2) Noise pollution abatement measures and schemes

The predicted noise values, both in the daytime and in the nighttime, of the 10 sensitive spots of Shi-Xin Road Subproject in Tianquan County and of the 5 sensitive spots of Daozuo-Huojing Road Subproject during short term (2017), medium term (2023) and long term (2030) of operation meet the Class 2 limit requirement in *Environmental Quality Standard for Noise* and do not exceed the standard. Therefore, the relevant management requirements made by the EIA are as below: after the road is completed and put into operation, traffic control shall be strengthened to avoid excessive noise due to congestion, monitoring on vehicle noise shall be enhanced to keep vehicles with excessive noise off the road, and speeding is strictly forbidden.

5. Analysis of impact of solid waste

Auxiliary facilities for road such as service area and toll gate are not provided in this Project. Therefore, solid waste during the road operation period mainly comes from domestic garbage from management personnel and maintenance staff and presents a point-like pattern along the project road and has less impact on the environment compared with the construction period; as solid waste during the operation period is produced in areas closer to the road and is closely linked with people's life, it will influence the scenery, contaminate air, transmit disease and jeopardize people's health if not properly handled. During the project operation period, collection, stacking and clearing of domestic garbage shall be well done to prevent voluntary stacking or throwing that affects the environmental hygiene. Solid waste generated during the operation period of the road and bridge works of the Project will be cleared in a unified way by the sanitation sector and transported to the local garbage disposal plant for disposal.

3.2 Mitigation measures

Abstract of environmental impacts and mitigation measures

Stage	S/N	Environmental issues	Mitigation measures	Executed by	Administered by
I. Design stage	1	Route selection	● A proper routing scheme shall be selected to minimize land acquisition and the number of wading structures.	Designer	Construction Headquarters
	2	Noise and air pollution	● The impacts of noise, dust, etc. on environmentally sensitive points shall be considered in site selection. ● For sensitive sites with out-of-limit noise levels, noise-reduction measures shall be designed depending on actual noise levels, including sound-proof wall, acoustic barrier, etc. to minimize the impacts of traffic noise during the operation period.	Designer	
	3	Landscape protection	● Landscaping design shall be carefully conducted to reduce the adverse impacts on natural landscapes along the road.	Designer	
	4	Water pollutio	● In scheme design for bridge pier foundation construction, proper comparisons shall be made between	Designer	

Stage	S/N	Environmental issues	Mitigation measures	Executed by	Administered by
		n	earth-rock cofferdam and steel cofferdam taking account of the construction period, water level, water depth, environmental impact, etc.		
II. Construction period	1	Air pollution	● Proper measures including sprinkling water shall be taken at the sites near residential areas to reduce dust nuisance and atmospheric pollution during the construction period. The frequency of sprinkling water shall be based on local soil and climate conditions. ● Piled-up materials and stockyards shall be at least 300m away from residential areas and covered up or wetted by sprinkling water to prevent dust pollution. Trucks transporting building materials shall be covered up with canvas, etc. to reduce leakage and spillage. ● In dry seasons, periodical water sprinkling shall be conducted at the construction site and on access roads to reduce flying dust.	Contractor	Construction Headquarters
	2	Soil erosion	● Trees and grass shall be planted in three months after subgrade is completed. ● Slope protection shall be carried out for subgrade slopes to prevent water and soil loss due to rainwater scouring. Drilling residues and spoil shall be well used to minimize water and soil loss.	Contractor	
	3	Water pollution	● Oil-separation sedimentation tanks shall be built to recycle properly treated water. It is not allowed to discharge production wastewater into the rivers. ● A proper construction scheme shall be prepared for bridge pier construction, which takes environmental protection as a priority. Management shall be enforced in construction. A sedimentation tank shall be built before construction of cast-in-site bored pile foundation is carried out. ● Measures shall be taken to prevent construction materials, oil or garbage from falling into rivers and cause water pollution. ● Leaked mechanical oil or dumping waste oil into water bodies will result in water pollution. Thus, environmental management and environmental protection education shall be enhanced. ● Construction materials should not be piled up near surface water. Temporary covering canvas shall be provided to prevent materials from being blown into water bodies by rainstorm and strong wind.	Contractor	
	4	Noise	● Noise standards shall be strictly abided to protect construction personnel from any injury caused by noise. Workers working close to intensive sound sources shall wear earplugs and helmet with limited working hours. ● Machines and vehicles shall be properly repaired and maintained to ensure low-noise level. ● If such equipment as a pile driver, excavator, concrete pump, etc. that may produce noise pollution is to be employed, the Construction Contractor shall submit a report to local environmental protection administration 5 days in advance of commencement, indicating the project mane, construction location, the noise-producing equipment to be used, possible noise level and the	Contractor	

Stage	S/N	Environmental issues	Mitigation measures	Executed by	Administered by
			preventive and controlling measures for noise pollution, etc. ● High-noise machines shall not be operated at noon (12:00-2:30) and night (22:00-6:00). Where it is necessary to carryout out construction activities at noon or night due to technological conditions or under other special circumstances, the Construction Contractor shall obtain opinions from the authorities and announce the situation to adjacent residents. ● Construction shall not be carried out during official and legal holidays whenever possible.		
	5	Landscape protection	● Landscaping in coordination with the surroundings shall be conducted based on proper landscape designs for road medians, roadsides and slopes.	Contractor	
	6	Protection for ecological resources	● Construction shall be carried out within the road boundary and land outside the range of acquisition shall not be disturbed. ● Drilling residues in bridge construction shall be delivered to an appointed site for comprehensive use instead of being randomly dumped. ● Topsoil shall be stripped and properly utilized.	Contractor, Employer and administrations of reserved areas	
	7	Transportation management	● Consultation shall be made with the traffic control and public security authorities for the guidance on traffic arrangement. Measures shall be taken to prevent traffic jam and poor transportation efficiency during construction. ● Proper plans for transportation of building materials shall be made to avoid rush hours of existing roads.	Contractor	
	8	Construction supervision	● Environmental supervision during the construction period shall be conducted according to the approved EIA report and the construction drawing.	Supervisor	
	9	Cultural relics	The Construction Contractor shall adequately protect the site and contact the cultural relics administration to discuss the protection measures, so as to ensure success of the Project and safety of the cultural relics.	Contractor	
III. Operation period	1	Noise	● Traffic control shall be enhanced. Excessively loud old vehicles shall not get on the road.	Road administration	Road administration, environmental protection administration and administrations of reserved areas
	2	Air pollution	● The inspection system for car emission shall be implemented strictly. Car emission shall be spot checked. Vehicles having excessive emission of tail gas are not allowed to get on the road.	Traffic control and environmental protection administrations	
	3	Hazardous material manage	● An emergency leading group shall be formed to handle accidents related to spillage of hazardous materials. In case of accidental spillage of hazardous materials, it is required to follow the emergency plan,	Road administration, public	

Stage	S/N	Environmental issues	Mitigation measures	Executed by	Administered by
		ment	notify the authorities and take emergency measures. ● The three certificates issued by the public security department shall be obtained for transportation of hazardous goods, which are the permit for transportation, driver's license and security certificate. Marks for hazardous goods shall be provided on vehicles transporting such goods, and special travelling route and parking site shall be designed for these vehicles. ● In case of accidental spillage of hazardous materials, it is required to follow the emergency plan, notify the authorities and take emergency measures. Meanwhile, a monitoring group will be formed to deal with such accident. ● Patrol examination on deck runoff collection system and emergency handling tank.	security department and administrations of reserved areas	
	4	Road landscaping	● Road greenbelt shall be properly maintained.	Road administration	

4.0 Implementation Organizations of Environmental Management Plan

4.1 Environmental management and monitoring organization

4.1.1 Management requirements for the Contractor

In the process of project construction, the Contractor and the Construction Contractor will play a key role in environmental management, pollution control, implementation of preventive measures and other aspects. Therefore, the Contractor is required to do the following:

(1) The Contractor must have related capabilities and financial resources to ensure effective execution of environmental management plan;

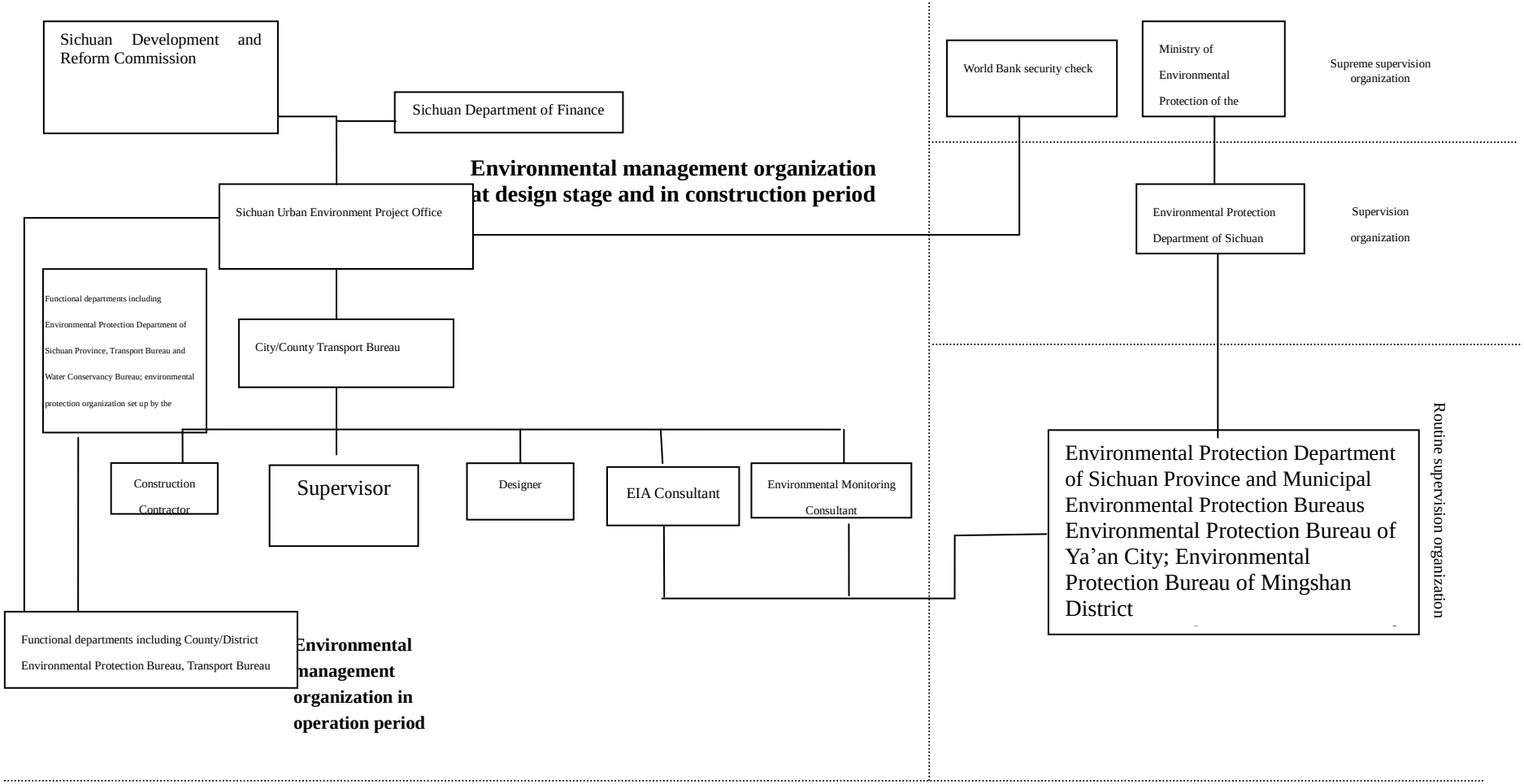
(2) All environmental impact mitigation measures during construction period shall be included in the bidding documents of the Contractor and eventually embraced by the Construction Contract as the contract requirements for the Contractor of the Project.

(3) The Contractor needs to provide a full-time environmental worker who will monitor and record the environmental activities in construction, offer environmental records to the Client or the environmental protection supervision organization once a week or as required for supervision and check.

(4) The Contractor and the environmental workers appointed by him, the Construction Supervisor and so on must receive the training in respect of environmental protection and management prior to commencement, thus they are qualified for their jobs.

(5) In the process of construction, the Contractor must keep communications and negotiations with the general public in the project area, and erect billboards at each construction unit to inform the public of the concrete construction activities and time. Moreover, he must provide the name and telephone of contact person, so as to receive the complaints and suggestions about the construction activities from the public.

4.1.2 Frame diagram of environmental management system



Environmental management organization

Environmental supervision organization

4.1.2 Environmental management organization

The environmental management organization of the Project consists of organizations at two levels, i.e. the Project Employer and Sichuan Road Bureau Project Office (referred to as Sichuan Project Office). The Sichuan Road Bureau Project Office will be involved in the project management, for this part of the Project is under the jurisdiction of Department of Transportation of Sichuan Province.

(1) The Project Client—Tianquan County Traffic Development Corporation, Qionglai City Road Maintenance Section and Yingjing County Road Maintenance Section shall respectively appoint 1 full-time person to take charge of the environmental protection and management of the Project. In addition, a supervision and complaint hotline shall be provided for the whole project and be in the charge of full-time or part-time personnel assigned by the Client.

(2) Sichuan Project Office is a coordinating body in the preparation and implementation of the Project. During the implementation of the whole project, the special personnel assigned by it will coordinate all environmental management work, supervise the implementation of environmental management plan, and provide World Bank and relevant national departments with necessary monitoring reports.

4.1.3 Environmental management responsibilities

1. Construction period

Environmental management personnel shall make detailed environmental management plan based on the construction plan of the Project and shall check it and make necessary amendments on a monthly basis.

Also, they shall patrol the construction site to check the Construction Contractor's fulfillment of various environmental protection measures during construction period according to the plan; they shall be responsible for commissioning or arranging the monitoring work which must be done at fixed time and fixed location as planned; in each month, they shall report the check and monitoring results and on-site handling comments to the project leaders, report the environmental management inspection results at regular intervals, and propose targeted solutions to potential environmental problems found in such inspection.

The hotline workers shall be responsible for recording and sorting out the complaint calls, reporting the complaints to the environmental management personnel and explain the problem handling results to the public.

2. Operation period

(1) Give publicity to and organize the implementation of relevant main national environmental protection guidelines, policies, statutes and regulations;

(2) Fulfill various environmental management systems established by the superior competent authorities;

(3) Arrange the implementation of environmental protection measures during operation period put forward in EIA report and environmental management plan;

(4) Lead and organize environmental monitoring work during project operation period and create monitoring files;

(5) Registering the wastewater volume and water quality of all pollutant discharging units getting into the sewage pipe network system of the Project and supervising the operation conditions of sewage pretreatment facilities of such units shall be commissioned or turned over to corresponding environmental protection bureaus,

according to the coordination between various functional departments of local governments.

(6) Annually report the environmental monitoring results and environmental management inspection results to Sichuan Project Office as required and propose targeted solutions to potential environmental problems found in the inspection.

4.1.4 Supervision organization and its responsibility

The environmental supervision organization of the Project is mainly composed of World Bank Delegation, Sichuan Urban Environment Project Office (hereinafter referred to as Sichuan Project Office), Environmental Protection Department of Sichuan Province, Qionglai Environmental Protection Bureau, Tianquan County Environmental Protection Bureau, Yingjing County Environmental Protection Bureau and all employers.

4.1.5 Monitoring organization and its responsibility

Environmental protection supervision organizations and their responsibilities are shown in Table 4-1.

Table 4-1 Environmental protection supervision organizations and their responsibilities

Name	Responsibilities	Remarks
Environmental Protection Department of Sichuan Province	Be responsible for: review and approval of EIA documents for the proposed project; supervision of the implementation of various environmental protection and management measures for the proposed project; inspection and acceptance of environmental protection for the proposed project.	Sichuan Environmental Protection Administration
Municipal environmental protection bureaus	Carry out supervision and management of environmental protection work for the construction project; organize and coordinate relevant agencies to provide service for environmental protection work; supervise the implementation of EMP; take charge of completion acceptance of environmental protection facilities of the project; confirm environmental regulations and standards applicable to the project; instruct County/District Environmental Protection Bureau on environmental supervision and management in construction and operation periods; accept, investigate and coordinate the handling of public complaints about environment and supervise improvement of environmental protection facilities and measures.	Environmental Protection Bureaus of Chengdu City and Ya'an City
3 County/District Environmental Protection Bureaus	Accept work instructions from environmental protection department at a higher level, supervise the Employer's implementation of EMP and relevant environmental management regulations and standards; coordinate various departments to carry out environmental protection work; take charge of inspection, supervision and management of construction, completion and operation of environmental protection facilities under its jurisdiction; accept, investigate and coordinate the handling of public complaints about environment and supervise the improvement of environmental protection	Environmental Protection Bureaus of Qionglai City, Tianquan County and Yingjing County

Name	Responsibilities	Remarks
	facilities and measures.	
External Environmental Monitoring Consultant	Environmental supervision in project preparation period includes: review provisions on environmental protection in the *Project Construction Organization Plan* prepared by the Construction Contractor; check whether the environmental protection system established by the Construction Contractor is reasonable; participate in the approval of the submitted *Unit Project Commencement Report*; conduct engineering supervision of construction of pollutant treatment works. Environmental supervision in construction period includes: prepare *Key Points of Environmental Protection Work* based on construction organization design for each lot; publicize environmental protection to the Construction Contractor; point out sensitive spots vulnerable to environmental pollution for the Construction Contractor; propose detailed environmental protection measures based on major pollutants in the construction process; review the *Scheme for Environmental Protection during Project Construction* submitted by the Construction Contractor; inspect whether the Construction Contractor's environmental protection system operates normally; check the implementation of environmental protection measures; supervise the construction of water and soil conservation measures. Environmental supervision in operation period includes: review the *Final Report on Environmental Protection during Project Construction* prepared by the Construction Contractor; compile completion documents on environmental protection; carry out acceptance of environmental protection work for the project; prepare the *Final Report on Environmental Supervision*, etc.	At the next stage, determine External Monitoring Consultant through bidding.

4.2 Training and capacity building

The target group of environmental management training in the Project includes executive staff and technical staff of PMO, the Client, the Construction Contractor and the Supervisor.

After the Construction Contractors and the Supervisors of the Project are determined, the Client shall be responsible for organizing the Environmental Protection Training Class for World Bank Loaned Post-4.20 Lushan Earthquake Recovery and Reconstruction of Rural Roads, which will lasts 2-3 days before the commencement of the Project. The training may be conducted in any college, university, scientific research institute or other organization in Qionglai City, Ya'an City, Tianquan County or Chengdu City. It is required that the Client, all Construction Contractors and Supervisors respectively appoint at least one responsible engineering technical person and one environmental management person to participate in the training.

The training contents involve:

(1) National and Sichuan Provincial laws and regulations, documents and requirements in respect of environmental protection, water & soil conservation and so on in the management of construction project;

(2) Environmental protection measures proposed in the design of the Project and environmental protection requirements during construction and operation periods;

(3) Environmental protection guidelines during construction and operation periods of the Project and other contents.

Responsible environmental protection designers from Sichuan Environmental Protection Department, Municipal Environmental Protection Bureau and Sichuan Communication Surveying & Design Institute and associated experts of the EIA Consultant may be invited to give instruction to the training class.

5.0 Monitoring Plan

5.1 Monitoring plan

5.1.1 Monitoring during construction period

Monitoring plan during construction period (Dao-Huo Road Subproject)

Environmental elements	Monitoring point	Monitoring item	Monitoring frequency, cycle and time of sampling	Executed by	Administered by
Surface water	Yapeng Medium-sized Bridge K9+535 (the Xiaoxi River)	pH, COD, suspended solids, petrolic substances	Once every two months, 1 day/once; random check	Entrusted environmental supervision station	Qionglai Road Maintenance Section, Qionglai Environmental Protection Bureau
Atmosphere	Group 8, Yapeng Village	PM_{10}, TSP, NO_2	Twice every year (considerably intensified during construction rush hours), 12 consecutive hours each time		
Noise	Sanhe Village (K6+100~K7+100) (left side of the road), Yapeng Village (K7+550) (right side of the road), Chuanwang Village (K10+650) (left side of the road)	LAeq	Once every quarter, 2 day/once, sampling twice a day, one in day time and one at night; random check		

Monitoring plan during construction period (Ying-Lu Road Subproject)

Environmental elements	Monitoring point	Monitoring item	Monitoring frequency, cycle and time of sampling	Executed by:	Administered by:
Surface water	Daihuanggou water body in the north of the start, K23+260 (Daihuanggou)	pH, COD, suspended solids, petrolic	Once every two months, 1 day/once;	Entrusted environmental supervision	Ya'an Road Maintenance Section, Ya'an

		substances	random check	station	Environmental Protection Bureau
Atmosphere	About 200m downstream of the Sanhui Power Station	TSP, NO_2, PM_{10}	Twice every year (considerably intensified during construction rush hours), 12 consecutive hours each time		
Noise	Hongshigou (K23+260) (beside the road section at the start) with the height of 1.2m, 1m at the roadside structure of the Sanhui Power Station(K26+600) with the height of 1.2m, Daqiaotou (K29+260) (beside the road section at the terminal) with the height of 1.2m	LAeq	Once every quarter, 2 day/once, sampling twice a day, one in day time and one at night; random check		

Monitoring plan during construction period (Shi-Xin Road Subproject)

Environmental elements	Monitoring point	Monitoring item	Monitoring frequency, cycle and time of sampling	Executed by:	Administered by:
Surface water	The influx of Chenjiagou and Luocaogou, 100m upstream of K4+400, 500m downstream of the influx	pH, COD, suspended solids, petrolic substances	Once every two months, 1 day/once; random check	Entrusted environmental supervision station	Ya'an Road Maintenance Section, Tianquan Environmental Protection Bureau
Atmosphere	Dawo You'ai Hope Primary School	PM_{10}, NO_2, TSP	Twice every year (considerably intensified during construction rush hours), 12 consecutive hours each time		
Noise	Group 1 of Xinmin Village (K0+500), Dawo You'ai Hope Primary School (K3+100), Group 1 of Waping Village (K9+100), Team 3 of Wangjia Village (K13+900), G108(K0+000)	LAeq	Once every quarter, 2 day/once, sampling twice a day, one in day time and one at night; random check		

5.2 Management system

5.2.1 Record

For the sake of effective operation of environmental management system, the Client must organize and establish a sound record system and keep the records of the following:

(1) Requirements of laws and regulations;

(2) Project related reviews and replies;

(3) Environmental factors and associated environmental impacts;

(4) Training;

(5) Inspection, check and maintenance activities;

(6) Monitoring data;

(7) Problems in environmental management and protection;

(8) Effectiveness of mitigation measures;

(9) Information of relevant works.

In addition, the aforementioned various records must be subject to necessary control, including such links as identification, collection, cataloging, filing, storage, management, maintenance, inquiry, storage life and handling of records.

5.2.2 Report

In the project implementation process, Sichuan Urban Environment Project Office, the Client, the Contractor and the Monitoring Organization shall record the project progress, fulfillment of environmental management plan (EMP), environmental quality monitoring results and so on and report them to relevant departments promptly. The details include:

(1) The Monitoring Organization and the Contractor keep detailed records of the EMP fulfillment and report to the Client and Project Office in time.

(2) Sichuan Project Office has to finish the project progress reports (such as semiannual report and annual report) on time according to the requirements of World Bank and submit them to World Bank. The reports mainly contain the following:

1) Implementation of environmental protection measures, environmental management and training plan in EMP;

2) Project progress, such as the length of road that has been built and the length of pipe network that has been laid for drainage works;

3) Whether or not there are complaints from the public. If there are, the main contents of complaints, solutions and public satisfaction index shall be recorded;

4) Execution plan of EMP in the next year.

6.0 Consultation, Public Participation and Complaint

6.1 Public participation

Public participation is widely conducted during preparation of *Environmental Impact Assessment* (EIA), so people's concerns are expressed in EIA/*Environmental Management Plan*. To minimize the impact, communication with persons affected by the Project will continue at the whole stages of the Project. The purpose of communication is to provide a two-way information channel, through which, implementation of the Project and *Environmental Management Plan* can be promoted to affected people so that feedback from these people on the impacts of the project under construction can be timely sent to the

Contractor and the Client.

Public consultation and compliant mechanism is a two-way communication between the Employer and the general public, an important mechanism for the Project to eliminate its own risk and reduce its social impacts, as well as an important means of making project information open and transparent and of public participation. One set of highly transparent and simple & feasible public consultation and compliant mechanism shall be established to handle the problems of the general public objectively, justly and efficiently so as to ensure smooth implementation of the Project.

Public interview and opinion survey is one important means of communicating with surrounding people during the Project construction. The main respondents are mainly affected people around the Project. The people around the Project shall be interviewed and surveyed within 1-2 months before the Project completion to know whether environmental impact is caused during the Project construction.

6.2 Identification of stakeholders

Stakeholders refer to the individuals or communities that can affect or be affected by the achievement of the project goals. Stakeholders can be classified as primary stakeholders and secondary stakeholders.

Stakeholders of World Bank Loaned Post-4.20 Lushan Earthquake Recovery and Reconstruction of Rural Roads are identified according to the nature of the Project, the field survey results and interviews with associated organizations. Primary stakeholders are the urban and rural residents (residents of villages and small towns passed by the newly-built or reconstructed roads) within the area of direct influence by construction of newly-built and rebuilt roads, especially the vulnerable groups such as women, poverty-stricken families, families entitled to basic living allowances, the disabled and the households relocating due to land requisition.

Secondary stakeholders include: (1) the mixed passenger and freight corporations and the drivers, Project Office, the Client, the Designer and other related organizations; (2) functional departments of related government authorities.

6.3 Information publicity and public participation

It is essential that various measures are taken to disclose the project information and to encourage and guarantee full participation of the local general public during implementation and operation periods of the proposed project, so that implementation of this World Bank Loaned Project can bring the maximum social and economic benefits for the local residents as well as avoid the possible potential risks of the Project.

(1) Formulate related policies, laws, regulations, and implementation measures.

In the construction process of the proposed project, guarantee and basis shall be provided for well-regulated public participation. The counties and cities shall formulate corresponding *Implementation Measures for Maintenance of Rural Roads*, *Scheme of Public Participation in Traffic Safety* and other policies and laws & regulations that allow wide public participation, so that the general public in the project area can truly get involved in the implementation and operation processes of the Project, get jobs as well as make contributions to their own hometown.

(2) Implement the public participation mechanism.

① Project Office and related organizations shall get the information release well done and publish information concerning project progress and the links of project progress in which the public can participate in time and in place. Such as, inform the public of the project scope in which they can participate, associated ways of

participation and the permission to participate during the preparation and construction stages of the Project. Cooperate with all organizations in time to issue the recruitment information in the local during the project construction period and after the project is completed.

② Related organizations, township governments and village/residents' committees shall get the work of conveying project related information and organizing public participation well done. The TV stations, township governments and village/residents' committees shall pass on the information in relation to detailed rules and schemes of public participation in the Project to the general public. Township governments and village/residents' committees shall organize the general public to establish village-level project supervision and management teams through democratic principles and such teams shall be vested with certain supervision rights.

③ A village-level project supervision team shall be composed of representatives of women, the poor and ethnic minorities. The proportion of ethnic minority representatives shall not be less than the proportion of local minority population in the local total population. The project supervision and management teams shall supervise the quality of project implementation, report the detailed grievances of the general public in terms of land requisition compensation, demolition and relocation, and road construction, and report the problems in the construction process.

(3) Establish a grievance and complaint mechanism.

① It is suggested that a public hotline should be set in the Social Assessment Department of Project Execution Office to receive the suggestions, criticisms and complaints from the public during the implementation of the Project. The working personnel are required to put the suggestions, criticisms and complaints from the public on record, promptly give feedback about such suggestions, criticisms and complaints as can be replied immediately, and give feedback to the public giving calls within two weeks about those that cannot be replied immediately.

② The village-level project supervision and management team, as a mass organization for the pubic participating in the Project, shall report, in spoken or written form, the issues from the public to the Project Execution Office. The Project Execution Office shall put such issues on record and give feedback about them within two weeks. If the feedback is not satisfactory, further consultation may be held or the issues may be reported to the Project Leading Group and related governments level by level.

③ For the urgent or sensitive issues presented by the public, such as ethnic minority related sensitive issues and affairs concerning religious sites, the project supervision and management teams and village/residents' committees may request suspension of construction and consult with all stakeholders in respect of such issues. Construction cannot resume until such issues are settled, so as to avoid such contradictions and conflicts as may cause adverse social effects.

(4) Establish a traffic safety publicity and education mechanism.

① Traffic safety publicity teams shall be established to visit the villagers and give publicity to traffic safety knowledge in the form loved by villagers in slack season. In festivals, holidays and market days, such teams shall dispatch propaganda cars and set propaganda sites, so as to give publicity to traffic safety, provide related consultations, and carry out propaganda education by giving out

traffic safety manuals, leaflets and such wall calendars, desk calendars and greeting cards as contain traffic safety knowledge.

② Go to schools to carry out propaganda education of traffic safety knowledge for the primary school pupils and middle school students by means of safety education assembly, giving out publicity greeting cards and so on. The primary school pupils and middle school students shall know well about traffic safety. Besides, they shall be encouraged to "hold big hands in their little hands", which means that they are encouraged to bring traffic safety knowledge to other members in their families.

③ For the migrant workers, they shall be incidentally issued with Traffic Safety Booklet for Migrant Workers when Labor Certificates are issued to them, so as to make them get additional knowledge of traffic safety.

④ Electronic boards or public service advertising columns for traffic safety publicity shall be installed in important road sections with large pedestrian volume, such as bazaar intersections, squares and waiting halls in stations, to publicize traffic safety among the people.

(5) Accept and handle the suggestions of the public.

S/N	Project name	Public participation methods used	Organization	Main participant	Date	Place	Remarks
1	Dao-Huo Road Subproject	Questionnaire Notice posting Conversazione of public survey	The Client and the EIA Consultant	Affected persons in the project area	January 8, 2016	Zhaigou Village of Daozuo Township, Yapeng Village of Huojing Town, Chuanwang Village of Youzha Township	According to the survey, 100% respondents support construction of the Project, and no respondent shows objection to construction of the Project. Therefore, the construction of this Project wins absolute support from local people.
2	Ying-Lu Road Subproject	Public consultation and compliant Conversazione of public survey	The Client and the EIA Consultant	Affected persons in the project area	December 2015-project completion	Conference room of Sanhe Township Govern	During the project implementation stage, set up a public consultation and compliant office at Sanhe Township to establish a regular

						ment	public consultation and compliant mechanism.
3	Shi-Xin Road Subproje ct	Interview and survey Conversazione of public survey	The Client and the EIA Consultant	Affected persons in the project area	Dece mber 24, 2015	Shiyang Town, Daping Townshi p, Xinhua Townshi p	Dialogue with the residents in symposiums to collect their suggestions and requirements concerning environmental protection during construction period

This public participation survey involves a wide range, and the respondents are mainly from such residential areas, government organizations and so on as are mostly affected by the Project and they are fairly representative groups of people. The survey methods conform to the standards and the public participation questionnaires have a higher rate of recovery. For the suggestions made by the public, the Project EIA Team has duly reported them to and communicated with the Client, and consulted with the Client, the Designer, the Employer and local governments. Meanwhile, the Project EIA Team has classified and collected the suggestions and requirements of the interviewed people and organizations in time, analyzed the strongly suggested issues in depth, put forward the principles and preliminary schemes of environmental protection, and fed back such issues to the Employer. And the Employer has given handling suggestions with regard to such issues and recommendations of the EIA Consultant.

① Pay attention to the environmental impacts caused by project construction; perform all environmental protection work by taking all environmental protection measures proposed in the Environmental Impact Report.

② Cooperate closely with the local cultural relics departments in the design of the next stage to well protect the existing cultural relics and those likely to occur along the project road line.

③ The Construction Contractor shall sign a civilized construction contract. The temporary access roads shall be built in advance during construction of the road sections crossing the existing roads, so as to avoid traffic jam or segmentation. Meanwhile, supervision and management on the construction team shall be strengthened to avoid construction quality problems. When construction is carried out at the road sections close to the rivers, side ditches shall be excavated first and retaining walls shall be built (if necessary) to ensure that construction slurry and excavated earth and stones as well as wastewater will not enter the water bodies, so as to prevent water quality from being affected. Fences and warning signs shall be erected on construction site. The Project Construction Department shall listen to the comments given by the affected masses along the way carefully, and minimize the occupation of cultivated land to reduce the damage on agriculture.

Through the public participation survey of the Project, the comments of the residents

in the area are collected effectively, and lots of important information is fed back. This public survey is fair, open and just. It can reasonably and effectively reflect the opinions and comments of the affected masses in the area on the Project.

7.0 Investment in Environmental Protection

The implementation of *Environmental Management Plan* during construction & operation periods has been estimated, as shown in Tables 7-1, 7-2, and 7-3. The general budget of environmental investment includes environmental mitigation measures, environmental protection monitoring, engineering management and main works, as well as investment in slowing down or eliminating negative impact on environment. It should be noted that many mitigation measures are of managerial and practical nature, and their budgets are included in overall contract and will not be specified.

1. "Daozuo-Huojing Road" Works for World Bank Loaned Post-Lushan Earthquake Recovery and Reconstruction of Roads

Table 7-1 Investment estimate on project environmental protection measures (Dao-Huo Road Subproject)

Item of environmental protection works	Specific measures		Qty.	Amount (10,000 yuan)	Remarks
Protection and restoration of ecological environment	Construction period	Subgrade and surface drainage engineering and protection works	Entire road	Investment in water and soil conservation is not included in environmental investment of current stage.	According to the report on water and soil conservation, the additional investment in water and soil conservation is estimated to be 3,525,400 yuan.
		Bridge engineering and protection works	——		
		Protection for waste disposal area and vegetation restoration	2 waste disposal areas		
		Protection for construction camp and access roads and vegetation restoration	——		
		Temporary water and soil conservation in the construction period	——		
		Ecological monitoring and investigation in the construction period	——	5	Provisional
		Putting up signboards and fencing for plant conservation	——	8	Provisional
	Road planting and landscaping		Entire road	60	Provisionally 50,000 yuan/km
Noise control	Construction period	Noise control measures	-	8	Provisional
	Operation period	Operation tracking and monitoring	5 places	20	Provisional
Water pollution control	Construction period	Production wastewater sedimentation tank at construction site	3 places	6	20,000 yuan/place
	Operation period	Anti-collision piers and speed-limit warning signs	——	10	Provisional
		Preparation of the emergency plan for	——	10	Provisional

		hazard transportation accident			
		Emergency rescue equipment and apparatus	1 set	20	Provisional
Ambient air pollution control	Construction period	Road sprinkler (6,000 L)	3 Nr.	30	For 3 road sprinklers and 3 dry months a year, the cost for water sprinkling is around 400 yuan/Nr.-day (1 year).
		Costs for water sprinkling in dry seasons	March	3.6	
Environmental engineering design	Design period		——	50	Provisional
Environmental supervision	Environmental supervision in the construction period		1 year	40	Environmental supervision plan
Environmental monitoring	Environmental monitoring in the construction period		1 year	10	Environmental monitoring plan
	Environmental monitoring in the trial-operation period		1 year	5	
Environmental engineering acceptance	Expenditures for conferences, document preparation, monitoring, etc.		-	40	Provisional
Total	——		——	325.6	The investment in water and soil conservation is excluded.

The amount of the initial investment in environmental protection of the subproject is around 3,256,000 yuan, accounting for 1.77% of total investment of the Project.

2. World Bank Loaned Reconstruction and Expansion Works of Ying-Lu Road (Hongshigou–Daqiaotou) in Yingjing County, Ya'an City

Table 7-3Investment estimate on project environmental protection measures (Ying-Lu Road Subproject)

S/N	Investment items		Unit	Qty.	Investment (10,000 yuan)	Remarks
I.	Investment in environmental pollution control					
1	Control of surface water pollution					
1.1	Treatment of sanitary sewage	Septic tank, drainage pipe	Nr.	1	2	
1.2	Treatment of construction wastewater	Sedimentation tank	Nr.	6	24	
1.3	Bridge & culvert works wastewater collection system	Cofferdam, drainage ditch and so on.			10	
1.3	Vehicle washing	Vehicle washing platform, sedimentation tank	Nr.	1	2	
1.4	Road surface sprinkling and cleaning in the construction period				5	
2	Ambient air pollution control					
2.1	Dedusting measures in the construction period	Cost for water sprinkling	Month	12	10	
3	Acoustic pollution control					
3.1	Tracking and monitoring		Nr.	5	5	10,000 yuan/once, once per year, totally 5 years

S/N	Investment items	Unit	Qty.	Investment (10,000 yuan)	Remarks
4	Pollution control of solid waste				
4.1	Transfer of waste soil			20	
II.	Investment in ecological protection				
1	Measures for ecological protection			5	
2	Grass planting and textile covering for subgrade and slopes			20	
3	Landscaping and grass-seed sowing for temporarily acquired land, including construction site, etc.			5	
Subtotal				108	

The total investment in this project is 50,588,982 yuan, with the investment in environmental protection estimated to be 1,080,000 yuan, accounting for 2.1% of total investment.

3. Post-Earthquake Reconstruction Works for Shi-Xin Road (Xinmin-Yong'an Section) in Tianquan County

Table 7-1Investment estimate on project environmental protection measures (Shi-Xin Road Subproject)

Item of environmental protection works	Specific measures		Qty.	Amount (10,000 yuan)	Remarks
Protection and restoration of ecological environment	Construction period	Subgrade and surface drainage engineering and protection works	Entire road	160.72	According to the report on water and soil conservation, the additional investment in water and soil conservation is estimated to be 1,607,200 yuan.
		Bridge engineering and protection works	—		
		Protection for waste disposal area and vegetation restoration	2 waste disposal areas		
		Protection for construction site and access roads and vegetation restoration	—		
		Temporary water and soil conservation in the construction period	—		
	Road planting and landscaping		Entire road	2.96	According to the report on water and soil conservation, the cost for road planting is 29,600 yuan.
Noise control	Construction period	Noise control measures	—	5.0	Estimated
	Operation period	"No Horn" signboards	2 places	1.2	Estimated
Water pollution control	Construction period	Sedimentation tank	4 places	8.0	Estimated as per 20,000 yuan/place
		Septic tank or latrine pit	4 places	4.0	Estimated as per 10,000 yuan/place
		Oil trap and oil-water separator	4 places	16.0	Estimated as per 40,000 yuan/place
	Operation period	Anti-collision barrier	—	10.0	Estimated
		Preparation of the emergency plan for hazard transportation accident	—	5.0	Estimated
		"Slow down" warning signboards	8 pcs	0.8	Estimated
Ambient air pollution	Construction period	Watering by watering cart to reduce dust	2 Nr.	10.0	Mainly around concentrated residential

control				areas along the road
Solid waste	Centralized collection of solid waste in garbage bins provided at the construction camp	2 places	1.0	Estimated
Environmental supervision and personnel training	Personnel training	3 persons	3.0	10,000 yuan/person, estimated
	Environmental supervision	——	22.55	Estimated
Environmental engineering acceptance	——	——	25.0	Estimated
Total			275.23	

The subproject has a total engineering investment of 78,047,900 yuan, including an investment of 2,752,300 yuan in environmental engineering (containing the investment in water and soil conservation of 1,636,800 yuan) that accounts for 3.53% of total engineering investment of the subproject.

Attachment 1 Environmental impact mitigation measures in Daozuo-Huojing Subproject

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
I. Design stage	1	Route deciding	● A proper routing scheme shall be selected to minimize land acquisition and the number of wading structures.	Designer	Construction Headquarters
	2	Noise and air pollution	● The impacts of noise, dust, etc. on environmentally sensitive sites shall be considered in site selection. ● For sensitive sites with out-of-limit noise levels, noise-reduction measures shall be designed depending on actual noise levels, including sound-proof wall, acoustic barrier, etc. to minimize the impacts of traffic noise during the operation period.	Designer	
	3	Landscape protection	● Landscaping design shall be carefully conducted to reduce the adverse impacts on natural landscapes along the road.	Designer	
	4	Water pollution	● In scheme design for bridge pier foundation construction, proper comparisons shall be made between earth-rock cofferdam and steel cofferdam taking account of the construction period, water level, water depth, environmental impact, etc.	Designer	
II. Construction period	1	Air pollution	● Proper measures including sprinkling water shall be taken at the sites near residential areas to reduce dust nuisance and atmospheric pollution during the construction period. The frequency of sprinkling water shall be based on local soil and climate conditions. ● Piled-up materials and stockyards shall be at least 300m away from residential areas and covered up or wetted by sprinkling water to prevent dust pollution. Trucks transporting building materials shall be covered up with canvas, etc. to reduce spillage. ● In dry seasons, periodical water sprinkling shall be conducted at the construction site and on access roads to reduce flying dust.	Contractor	Construction Headquarters
	2	Soil erosion	● Trees and grass shall be planted in three months after subgrade is completed. ● Slope protection shall be carried out for subgrade slopes to prevent	Contractor	

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
			water and soil loss due to rainwater scouring. Drilling residues and spoil shall be well used to minimize water and soil loss.		
	3	Water pollution	● Oil-separation sedimentation tanks shall be built to recycle properly treated water. It is not allowed to discharge production wastewater into the rivers. ● A proper construction scheme shall be prepared for bridge pier construction, which takes environmental protection as a priority. Management shall be enforced in construction. A sedimentation tank shall be built before construction of cast-in-site bored pile foundation is carried out. ● Measures shall be taken to prevent construction materials, oil or garbage from falling into rivers and cause water pollution. ● Leaked mechanical oil or dumping waste oil into water bodies will result in water pollution. Thus, environmental management and environmental protection education shall be enhanced. ● Construction materials should not be piled up near the Tuojiang River. Temporary covering canvas shall be provided to prevent materials from being blown into water bodies by rainstorm and strong wind.	Contractor	
	4	Noise	● Noise standards shall be strictly abided to protect construction personnel from any injury caused by noise. Workers working close to intensive sound sources shall wear earplugs and helmet with limited working hours. ● Machines and vehicles shall be properly repaired and maintained to ensure low-noise level. ● If such equipment as a pile driver, excavator, concrete pump, etc. that may produce noise pollution is to be employed, the Construction Contractor shall submit a report to local environmental protection administration 5 days in advance of commencement, indicating the	Contractor	

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
			project mane, construction location, the noise-producing equipment to be used, possible noise level and the preventive and controlling measures for noise pollution, etc. ● High-noise machines shall not be operated at noon (12:00-2:30) and night (22:00-6:00). Where it is necessary to carryout out construction activities at noon or night due to technological conditions or under other special circumstances, the Construction Contractor shall obtain opinions from the authorities and announce the situation to adjacent residents. ● Construction shall not be carried out during official and legal holidays whenever possible.		
	5	Landscape protection	● Landscaping in coordination with the surroundings shall be conducted based on proper landscape designs for road medians, roadsides and slopes.	Contractor	
	6	Protection for ecological resources	● Construction shall be carried out within the road boundary and land outside the range of acquisition shall not be disturbed. ● Drilling residues in bridge construction shall be delivered to an appointed site for comprehensive use instead of being randomly dumped. ● Topsoil shall be stripped and properly utilized.	Contractor, Employer and administrations of reserved areas	
	7	Transportation management	● Consultation shall be made with the traffic control and public security authorities for the guidance on traffic arrangement. Measures shall be taken to prevent traffic jam and poor transportation efficiency during construction. ● Proper plans for transportation of building materials shall be made to avoid rush hours of existing roads.	Contractor	
	8	Construction supervision	● Environmental supervision during the construction period shall be conducted according to the approved EIA report and the construction drawing.	Supervisor	
	9	Cultural relics	The Construction Contractor shall adequately protect the site and contact the cultural relics administration to discuss the protection measures, so as to ensure	Contractor	

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
			success of the Project and safety of the cultural relics.		
III. Operation period	1	Noise	● Traffic control shall be enhanced. Excessively loud old vehicles shall not get on the road.	Road administration	Road administration, environmental protection administration and administrations of reserved areas
	2	Air pollution	● The inspection system for car emission shall be implemented strictly. Car emission shall be spot checked. Vehicles having excessive emission of exhaust are not allowed to get on the road.	Traffic control and environmental protection administrations	
	3	Hazardous material management	● An emergency leading group shall be formed to handle accidents related to spillage of hazardous materials. In case of accidental spillage of hazardous materials, it is required to follow the emergency plan, notify the authorities and take emergency measures. ● The three certificates issued by the public security department shall be obtained for transportation of hazardous goods, which are the permit for transportation, driver's license and security certificate. Marks for hazardous goods shall be provided on vehicles transporting such goods, and special travelling route and parking site shall be designed for these vehicles. ● In case of accidental spillage of hazardous materials, it is required to follow the emergency plan, notify the authorities and take emergency measures. Meanwhile, a monitoring group will be formed to deal with such accident. ● Patrol examination on deck runoff collection system and emergency handling tank of the Dunzi River.	Road administration, public security department and administrations of reserved areas	
	4	Road greenbelt	● Road greenbelt shall be properly maintained.	Road administration	

Attachment 2 Environmental impact mitigation measures in Yingjing-Luding Road Subproject

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
I. Design stage	1	Route deciding	● A proper routing scheme shall be selected to minimize land acquisition and the number of wading structures.	Designer	Construction Headquarters

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
	2	Noise and air pollution	● The impacts of noise, dust, etc. on environmentally sensitive sites shall be considered in site selection. ● For sensitive sites with out-of-limit noise levels, noise-reduction measures shall be designed depending on actual noise levels, including sound-proof wall, acoustic barrier, etc. to minimize the impacts of traffic noise during the operation period.	Designer	
	3	Landscape protection	● Landscaping design shall be carefully conducted to reduce the adverse impacts on natural landscapes along the road.	Designer	
	4	Water pollution	● In scheme design for bridge pier foundation construction, proper comparisons shall be made between earth-rock cofferdam and steel cofferdam taking account of the construction period, water level, water depth, environmental impact, etc.	Designer	
II. Construction period	1	Air pollution	● Proper measures including sprinkling water shall be taken at the sites near residential areas to reduce dust nuisance and atmospheric pollution during the construction period. The frequency of sprinkling water shall be based on local soil and climate conditions. ● Piled-up materials and stockyards shall be at least 300m away from residential areas and covered up or wetted by sprinkling water to prevent dust pollution. Trucks transporting building materials shall be covered up with canvas, etc. to reduce spillage. ● In dry seasons, periodical water sprinkling shall be conducted at the construction site and on access roads to reduce flying dust.	Contractor	Construction Headquarters
	2	Soil erosion	● Trees and grass shall be planted in three months after subgrade is completed. ● Slope protection shall be carried out for subgrade slopes to prevent water and soil loss due to rainwater scouring. Drilling residues and spoil shall be well used to minimize water and soil loss.	Contractor	

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
	3	Water pollution	● Oil-separation sedimentation tanks shall be built to recycle properly treated water. It is not allowed to discharge production wastewater into the rivers. ● A proper construction scheme shall be prepared for bridge pier construction, which takes environmental protection as a priority. Management shall be enforced in construction. A sedimentation tank shall be built before construction of cast-in-site bored pile foundation is carried out. ● Measures shall be taken to prevent construction materials, oil or garbage from falling into rivers and cause water pollution. ● Leaked mechanical oil or dumping waste oil into water bodies will result in water pollution. Thus, environmental management and environmental protection education shall be enhanced. ● Construction materials should not be piled up near the Tuojiang River. Temporary covering canvas shall be provided to prevent materials from being blown into water bodies by rainstorm and strong wind.	Contractor	
	4	Noise	● Noise standards shall be strictly abided to protect construction personnel from any injury caused by noise. Workers working close to intensive sound sources shall wear earplugs and helmet with limited working hours. ● Machines and vehicles shall be properly repaired and maintained to ensure low-noise level. ● If such equipment as a pile driver, excavator, concrete pump, etc. that may produce noise pollution is to be employed, the Construction Contractor shall submit a report to local environmental protection administration 5 days in advance of commencement, indicating the project mane, construction location, the noise-producing equipment to be used, possible noise level and the preventive and controlling measures for noise	Contractor	

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
			pollution, etc. ● High-noise machines shall not be operated at noon (12:00-2:30) and night (22:00-6:00). Where it is necessary to carryout out construction activities at noon or night due to technological conditions or under other special circumstances, the Construction Contractor shall obtain opinions from the authorities and announce the situation to adjacent residents. ● Construction shall not be carried out during official and legal holidays whenever possible.		
	5	Landscape protection	● Landscaping in coordination with the surroundings shall be conducted based on proper landscape designs for road medians, roadsides and slopes.	Contractor	
	6	Protection for ecological resources	● Construction shall be carried out within the road boundary and land outside the range of acquisition shall not be disturbed. ● Drilling residues in bridge construction shall be delivered to an appointed site for comprehensive use instead of being randomly dumped. ● Topsoil shall be stripped and properly utilized.	Contractor, Employer and administrations of reserved areas	
	7	Transportation management	● Consultation shall be made with the traffic control and public security authorities for the guidance on traffic arrangement. Measures shall be taken to prevent traffic jam and poor transportation efficiency during construction. ● Proper plans for transportation of building materials shall be made to avoid rush hours of existing roads.	Contractor	
	8	Construction supervision	● Environmental supervision during the construction period shall be conducted according to the approved EIA report and the construction drawing.	Supervisor	
	9	Cultural relics	The Construction Contractor shall adequately protect the site and contact the cultural relics administration to discuss the protection measures, so as to ensure success of the Project and safety of the cultural relics.	Contractor	
III.	1	Noise	● Traffic control shall be enhanced.	Road	Road

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
Operation period			Excessively loud old vehicles shall not get on the road.	administration	administration, environmental protection administration and administrations of reserved areas
	2	Air pollution	● The inspection system for car emission shall be implemented strictly. Car emission shall be spot checked. Vehicles having excessive emission of exhaust are not allowed to get on the road.	Traffic control and environmental protection administrations	
	3	Hazardous material management	● An emergency leading group shall be formed to handle accidents related to spillage of hazardous materials. In case of accidental spillage of hazardous materials, it is required to follow the emergency plan, notify the authorities and take emergency measures. ● The three certificates issued by the public security department shall be obtained for transportation of hazardous goods, which are the permit for transportation, driver's license and security certificate. Marks for hazardous goods shall be provided on vehicles transporting such goods, and special travelling route and parking site shall be designed for these vehicles. ● In case of accidental spillage of hazardous materials, it is required to follow the emergency plan, notify the authorities and take emergency measures. Meanwhile, a monitoring group will be formed to deal with such accident. ● Patrol examination on deck runoff collection system and emergency handling tank of the Dunzi River.	Road administration, public security department and administrations of reserved areas	
	4	Road greenbelt	● Road greenbelt shall be properly maintained.	Road administration	

Attachment 3 Environmental impact mitigation measures in Shiyang-Xinhua Road Subproject

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
I. Design stage	1	Route deciding	● A proper routing scheme shall be selected to minimize land acquisition and the number of wading structures.	Designer	Construction Headquarters
	2	Noise and air pollution	● The impacts of noise, dust, etc. on environmentally sensitive sites shall be considered in site selection. ● For sensitive sites with	Designer	

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
			out-of-limit noise levels, noise-reduction measures shall be designed depending on actual noise levels, including sound-proof wall, acoustic barrier, etc. to minimize the impacts of traffic noise during the operation period.		
	3	Landscape protection	● Landscaping design shall be carefully conducted to reduce the adverse impacts on natural landscapes along the road.	Designer	
	4	Water pollution	● In scheme design for bridge pier foundation construction, proper comparisons shall be made between earth-rock cofferdam and steel cofferdam taking account of the construction period, water level, water depth, environmental impact, etc.	Designer	
II. Construction period	1	Air pollution	● Proper measures including sprinkling water shall be taken at the sites near residential areas to reduce dust nuisance and atmospheric pollution during the construction period. The frequency of sprinkling water shall be based on local soil and climate conditions. ● Piled-up materials and stockyards shall be at least 300m away from residential areas and covered up or wetted by sprinkling water to prevent dust pollution. Trucks transporting building materials shall be covered up with canvas, etc. to reduce spillage. ● In dry seasons, periodical water sprinkling shall be conducted at the construction site and on access roads to reduce flying dust.	Contractor	Construction Headquarters
	2	Soil erosion	● Trees and grass shall be planted in three months after subgrade is completed. ● Slope protection shall be carried out for subgrade slopes to prevent water and soil loss due to rainwater scouring. Drilling residues and spoil shall be well used to minimize water and soil loss.	Contractor	
	3	Water pollution	● Oil-separation sedimentation tanks shall be built to recycle properly treated water. It is not allowed to discharge production wastewater into the rivers.	Contractor	

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
			● A proper construction scheme shall be prepared for bridge pier construction, which takes environmental protection as a priority. Management shall be enforced in construction. A sedimentation tank shall be built before construction of cast-in-site bored pile foundation is carried out. ● Measures shall be taken to prevent construction materials, oil or garbage from falling into rivers and cause water pollution. ● Leaked mechanical oil or dumping waste oil into water bodies will result in water pollution. Thus, environmental management and environmental protection education shall be enhanced. ● Construction materials should not be piled up near the Tuojiang River. Temporary covering canvas shall be provided to prevent materials from being blown into water bodies by rainstorm and strong wind.		
	4	Noise	● Noise standards shall be strictly abided to protect construction personnel from any injury caused by noise. Workers working close to intensive sound sources shall wear earplugs and helmet with limited working hours. ● Machines and vehicles shall be properly repaired and maintained to ensure low-noise level. ● If such equipment as a pile driver, excavator, concrete pump, etc. that may produce noise pollution is to be employed, the Construction Contractor shall submit a report to local environmental protection administration 5 days in advance of commencement, indicating the project mane, construction location, the noise-producing equipment to be used, possible noise level and the preventive and controlling measures for noise pollution, etc. ● High-noise machines shall not be operated at noon (12:00-2:30) and night (22:00-6:00). Where it is necessary to carryout out	Contractor	

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
			construction activities at noon or night due to technological conditions or under other special circumstances, the Construction Contractor shall obtain opinions from the authorities and announce the situation to adjacent residents. ● Construction shall not be carried out during official and legal holidays whenever possible.		
	5	Landscape protection	● Landscaping in coordination with the surroundings shall be conducted based on proper landscape designs for road medians, roadsides and slopes.	Contractor	
	6	Protection for ecological resources	● Construction shall be carried out within the road boundary and land outside the range of acquisition shall not be disturbed. ● Drilling residues in bridge construction shall be delivered to an appointed site for comprehensive use instead of being randomly dumped. ● Topsoil shall be stripped and properly utilized.	Contractor, Employer and administrations of reserved areas	
	7	Transportation management	● Consultation shall be made with the traffic control and public security authorities for the guidance on traffic arrangement. Measures shall be taken to prevent traffic jam and poor transportation efficiency during construction. ● Proper plans for transportation of building materials shall be made to avoid rush hours of existing roads.	Contractor	
	8	Construction supervision	● Environmental supervision during the construction period shall be conducted according to the approved EIA report and the construction drawing.	Supervisor	
	9	Cultural relics	The Construction Contractor shall adequately protect the site and contact the cultural relics administration to discuss the protection measures, so as to ensure success of the Project and safety of the cultural relics.	Contractor	
III. Operation period	1	Noise	● Traffic control shall be enhanced. Excessively loud old vehicles shall not get on the road.	Road administration	Road administration, environmental protection administration and
	2	Air pollution	● The inspection system for car emission shall be implemented strictly. Car emission shall be	Traffic control and environmental	

Stage	S/N	Environmental issues	Description of environmental management	Executed by:	Administered by:
			spot checked. Vehicles having excessive emission of exhaust are not allowed to get on the road.	protection administrations	administrations of reserved areas
	3	Hazardous material management	● An emergency leading group shall be formed to handle accidents related to spillage of hazardous materials. In case of accidental spillage of hazardous materials, it is required to follow the emergency plan, notify the authorities and take emergency measures. ● The three certificates issued by the public security department shall be obtained for transportation of hazardous goods, which are the permit for transportation, driver's license and security certificate. Marks for hazardous goods shall be provided on vehicles transporting such goods, and special travelling route and parking site shall be designed for these vehicles. ● In case of accidental spillage of hazardous materials, it is required to follow the emergency plan, notify the authorities and take emergency measures. Meanwhile, a monitoring group will be formed to deal with such accident. ● Patrol examination on deck runoff collection system and emergency handling tank of the Dunzi River.	Road administration, public security department and administrations of reserved areas	
	4	Road greenbelt	● Road greenbelt shall be properly maintained.	Road administration	