E4808 V1

Tongren Rural Road Project
Financed by the World Bank Loan

Environmental Management Plan

Guizhou Tongren Rural Road Project (Financed by the World Bank)
loan) Leading Group
Dejiang Transport Agency
Sinan Transport Agency
Guizhou Environmental Science Research and Design Institute

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1. Overview

1.1 Project Background

Tongren, which named as “Famous city in western China”, is one of six prefecture-level cities administered by Guizhou province. It locates on northeast of Guizhou and middle of Wuling Mountains. In order to effectively resolve the rural traffic problem in Tongren, comprehensively implement scientific development, improve the living and production standard for farmers and focus on sovling “Three Road”(export road, economic road and connect road) to form rural road network with perfect function, it is necessary to speed up rural road establishement, promote the fast development of rural economy and the progress of rural social civilization, perfect the security facility of rural road, gradually eliminate safety risks of rural road and create good traffic condition for comprehensive construction of well-off society by guidance of government, positive participation of villagers and the expansive support of society. After a careful study, the municipal committee and government decide to implement traffic project on rural road financed by the World Bank Loan, in order to better adapt to the requirement of rapid development of rural economy and make maximum convenience for farmers’ production life. This project is mainly used to improve the structure of rural road and improve the living standard of farmers, which is an important measure to establish new socialist countryside and one of government's people-centered programs

Actually, the establishment of such project involves in two backward counties in western part of Tongren city, such as, Dejiang and Sinan, which will lay good foundation for “Poverty reduction” of those two counties and “Make sure to realize synchronous well-off life with the whole nation in 2020” , and plays a model-driven role to strengthen the intensity of balancing rural and urban development, enhance the vitality of rural development, reduce the development gap between east and west and between rural and urban, and thus accerlerate the establishment of comprehensive well-off society. Overall, it has an important siginificance for better and rapid economic development in Tongren.

Tongren rural road project finaced by the World Bank loan mainly contains the rural road establishment in Dejiang and Sinan county, new construction of bridge and capacity building project, which can be mainly summarized as following:

（1）Rural road construction project in Dejiang, including 59 roads（Class Ⅳ and 415.705km in total) and 18 bridges(539.5m in total).

（2）Rural road construction project in Sinan, including 27 roads (Class Ⅳ, 230.717 km in total) and 12 bridges (298.5m in total).

（3）Capacity building projects, including technical support, training and investigation of rural road development and plans.

Based on “ The environmental impact assessment law of the People's Republic of

China" , " The regulations on environmental protection and management of construction projects " (the 253 regulation of State Coucil in 1998), relative regulations about environmental assessment system of construction project and other concerning laws, regulations, policies and technical guideline of the World Bank, this project is confirmed to be compiled according to EIA-B type report of environmental impact assessment of the World Bank due to the nature of this construction and small potential environmental influence according to the field investigation result made by representaive group of the World Bank and relative envrionmental assessment experts.

Variety of items will be regulated by "Environmental Management Plan"(EMP), such as, project activity, potential influence, mitigation measure, entity of process, entity of supervise, budget allocation, supervise index & environmental management & supervision system setting and capacity building plan.

This "Environmental Management Plan" will be used by contractor and supervising engineer as one part of contract documents. The mitigation measure made in such plan should be comprehensively implemented by contractor according to the contracted obligations.bycombining with primary and detailed design.

The environmental impact assessment this time is based on the feasible study report, which should not be changed after approval unless there is big change occurred in the scope of engineer. The basis of such assessment is "Feasible study report of Tongren rural road project financed by the World Bank loan".

1.2 Project overview

1.Project name：Tongren rural road project financed by the Workd Bank loan

2. Project undertakers：Dejiang and Sinan Transport Agency

3. Location：Dejiang and Sinan county of Tongren city

4. Scope of project：Flat, longitudinal and transverse road engineer, main bridges and drainage network

5. Nature of construction：Road reconstruction and new construction of bridge

6. Scale and content of construction: 86 rural roads, 30 bridges and capacity building projet, which can be mainly shown as following:

（1）Rural road constrction: 86 rural roads(Class Ⅳ and 646.422km in total), including 59 roads in Dejiang (415.705km) and 27 roads in Sinan(230.717km) ,

please see details from table1.2-1.

（2）Bridge construction: 30 bridges (838m in total), including 20 small beidges(423m) and 10 medium bridges(415m)，which located on Dejiang (18 bridges) and Sinan (12 bridges)， please find details from table 1.2-2.

（3）Capacity building projet, including technical support, training and investigation of rural road development and plans.

Construction period: 5 years (2015 ~ 2019). It is planned to be fully operated in 2020.

Table 1.2-1 List of proposed new road

No.	Subordinate county	Road name	Type of construction	Total mileage（km）	Width of subgrade（m）	Pavement material
1	Dejiang	Mingxi - Dongquan	Reconstruction	10.578	6.5	Asphalt
2	Dejiang	Jiancha - Shaxi	Reconstruction	22.133	6.5	Asphalt
3	Dejiang	Hepeng - Longxi	Reconstruction	15.760	6.5	Asphalt
4	Dejiang	Qinjiawan - Chaodi	Reconstruction	10.205	6.5	Asphalt
5	Dejiang	Changba - Wangpai	Reconstruction	8.965	6.5	Asphalt
6	Dejiang	Pingyuan - Nangan	Reconstruction	21.324	6.5	Asphalt
7	Dejiang	Datu - Huangba	Reconstruction	9.156	6.5	Asphalt
8	Dejiang	Jiancha - Dahe	Reconstruction	4.654	6.5	Asphalt
9	Dejiang	Changfeng - Duoping	Reconstruction	15.598	6.5	Asphalt
10	Dejiang	Fengjiazhai - Zhayu	Reconstruction	9.812	5.5	Cement
11	Dejiang	Qiaotou - Yanjin	Reconstruction	8.353	5.5	Cement
12	Dejiang	Banzhuyan - Hepeng	Reconstruction	8.975	6.5	Asphalt
13	Dejiang	Baiguotuo - Longqiao	Reconstruction	17.143	5.5	Cement
14	Dejiang	Wenping - Yinsi	Reconstruction	10.080	5.5	Cement
15	Dejiang	Zhangxinjie - Yanmen	Reconstruction	3.746	5.5	Cement
16	Dejiang	Weigangzui - Gonghe	Reconstruction	3.960	5.5	Cement
17	Dejiang	Xinchang - Changxian	Reconstruction	7.791	4.5	Cement
18	Dejiang	Meizi - Huayuanzi	Reconstruction	6.108	5.5	Cement
19	Dejiang	Hetou - Dayuan	Reconstruction	19.005	5.5	Cement
20	Dejiang	Xiaba - Yalaoshan	Reconstruction	6.073	5.5	Cement
21	Dejiang	Laozhai - Dabatou	Reconstruction	2.537	5.5	Cement
22	Dejiang	Sancengyan - Anshan	Reconstruction	4.680	4.5	Cement
23	Dejiang	Changba - Xintan	Reconstruction	5.943	6.5	Asphalt
24	Dejiang	Shenxiyakou - Huangtu	Reconstruction	3.018	4.5	Cement
25	Dejiang	Chazishan - Fenghuang	Reconstruction	5.288	4.5	Cement
26	Dejiang	Dejiang - Luqing	Reconstruction	26.450	6.5	Asphalt
27	Dejiang	Gongheqiaotou - Hualiangai	Reconstruction	2.890	4.5	Cement
28	Dejiang	Yu Zhongchang - Daping	Reconstruction	3.335	4.5	Cement
29	Dejiang	Dingjiashan-Chawotuo	Reconstruction	3.990	4.5	Cement
30	Dejiang	Fengxi -Tongwan	Reconstruction	7.567	4.5	Cement
31	Dejiang	Laoshuixi - Guanzhuang	Reconstruction	2.781	4.5	Cement
32	Dejiang	Nanzhugou - Dengjia	Reconstruction	2.623	4.5	Cement
33	Dejiang	Xinzhai - Zaonixi	Reconstruction	1.516	4.5	Cement
34	Dejiang	Dashuwan - Jiantai	Reconstruction	8.271	4.5	Cement
35	Dejiang	Huo Yantu - Zao Jiaodou	Reconstruction	4.806	4.5	Cement

36	Dejiang	Huangjia - Huangba group 3	Reconstruction	3.180	4.5	Cement
37	Dejiang	Kedian - Tianxingqiao	Reconstruction	5.480	4.5	Cement
38	Dejiang	Shaxiyakou -Datuwan	Reconstruction	5.923	4.5	Cement
39	Dejiang	Longzhai - Ran Jiawan	Reconstruction	10.728	4.5	Cement
40	Dejiang	Town Government - Pengjiazhai	Reconstruction	3.550	4.5	Cement
41	Dejiang	Shanshuba - Taowan	Reconstruction	2.207	4.5	Cement
42	Dejiang	Heduimen - Xintang	Reconstruction	2.208	4.5	Cement
43	Dejiang	Chaodi -Chenyuan	Reconstruction	7.190	4.5	Cement
44	Dejiang	Wujiagou - Xujiashan	Reconstruction	3.618	4.5	Cement
45	Dejiang	Changtan - Yuanchang	Reconstruction	3.743	4.5	Cement
46	Dejiang	Xiaping - Xintan	Reconstruction	7.523	4.5	Cement
47	Dejiang	Xiajie - Shangchangtou	Reconstruction	3.439	4.5	Cement
48	Dejiang	Matixi - Meijia	Reconstruction	4.706	4.5	Cement
49	Dejiang	Lizitan - Huangjia	Reconstruction	3.943	4.5	Cement
50	Dejiang	Lizishui - Chenjia	Reconstruction	2.000	4.5	Cement
51	Dejiang	Matixi - Guanlin	Reconstruction	3.616	4.5	Cement
52	Dejiang	Zhoujia - Huangbayan	Reconstruction	4.034	4.5	Cement
53	Dejiang	Tujia - Zhuangyan	Reconstruction	6.235	4.5	Cement
54	Dejiang	Real estate council - Xiaogou	Reconstruction	1.314	4.5	Cement
55	Dejiang	Huangba Primary school - Qinba	Reconstruction	3.413	4.5	Cement
56	Dejiang	Ganxiqiaotou - Aojia	Reconstruction	6.458	4.5	Cement
57	Dejiang	Dahe - Longxi	Reconstruction	4.303	4.5	Cement
58	Dejiang	Fenglin - Qingqiushu	Reconstruction	3.341	4.5	Cement
59	Dejiang	Yanshang - Kuangshan	Reconstruction	8.44	4.5	Cement
60	Sinan	Wengwen -Tunshan	Reconstruction	7.646	4.5	Cement
61	Sinan	Paotongshu - Dawan	Reconstruction	13.330	4.5	Cement
62	Sinan	Wengxi - Sanxing	Reconstruction	12.988	6.5	Cement
63	Sinan	Wengsan Road - Lianmeng	Reconstruction	12.352	4.5	Cement
64	Sinan	Zaoziping - Huangnitian	Reconstruction	5.736	4.5	Cement
65	Sinan	Wengxi Government - Changzheng	Reconstruction	13.297	4.5	Cement
66	Sinan	Sanxing - Shangba	Reconstruction	8.276	4.5	Cement
67	Sinan	Wengsan Road - Tangjiaba	Reconstruction	4.851	4.5	Cement
68	Sinan	Yanmenkou - Sanxing	Reconstruction	8.942	4.5	Cement
69	Sinan	Tangben Road - Antang	Reconstruction	7.574	4.5	Cement
70	Sinan	Aijiashan - Xinming	Reconstruction	9.625	4.5	Cement
71	Sinan	Yongxing - Machi	Reconstruction	7.297	4.5	Cement

72	Sinan	Tangben Road - Shuanghe	Reconstruction	14.470	4.5	Cement
73	Sinan	Donghua Township - Dongguaxi	Reconstruction	6.605	4.5	Cement
74	Sinan	Zhangting Road - Liangtian	Reconstruction	8.078	4.5	Cement
75	Sinan	Zhangting Road - Baowei	Reconstruction	4.555	4.5	Cement
76	Sinan	Baiyangping - Nanshan	Reconstruction	3.175	4.5	Cement
77	Sinan	Lancaocha - Meizibao	Reconstruction	3.974	4.5	Cement
78	Sinan	Longshui - Chaxi	Reconstruction	14.320	4.5	Cement
79	Sinan	Shangguanqing - Langan	Reconstruction	8.411	4.5	Cement
80	Sinan	Zhangting Road - Jingang	Reconstruction	6.816	4.5	Cement
81	Sinan	Liangshuijin - Guankou	Reconstruction	11.997	6.5	Cement
82	Sinan	Nixi - Caer	Reconstruction	9.728	5.5	Cement
83	Sinan	Pujiagou -Dashan	Reconstruction	2.226	4.5	Cement
84	Sinan	Dongqingao - Dongjiawan	Reconstruction	11.563	4.5	Cement
85	Sinan	Qinglongzui - Zhuguaxi	Reconstruction	6.845	4.5	Cement
86	Sinan	Liangtian- Shanxing	Reconstruction	6.040	4.5	Cement
Total				**646.422**		

Table 1.2-2 Bridge list

No.	County/ Area	Bridge name	Type of construction	Scale of construction		Bridge arrangement	Route	River
				L(m)	W(m)			
1	Dejiang	Lengshuijie bridge	New	73	7.0	4-16m hollow slab	From Changfeng to Duoping	Yangshan river
2	Dejiang	Jiangjiagou bridge	New	42.5	5.5	2-16m hollow slab	From Xinchang to Changxian	Jiangjiagou ditch, branch of Liuchi river
3	Dejiang	Fengjiazhai bridge	New	15	7.5	1-10m solid slab	From Fengjiazhai to Zhayu	Fengjiazhai river, branch of Mati river
4	Dejiang	Chuanqian bridge	New	36	5.5	2-13m hollow slab	From Bajiaoxi to Shiban	Shengji river, branch of Yangshan river.
5	Dejiang	Huangnidui bridge	New	24	5.5	1-16m hollow slab	From Qishugou to Hengshiliang	Hengshiliang stream, branch of Wujiang river
6	Dejiang	Pianyan bridge	New	22	6.5	1-16m hollow slab	From Pianyanjieshang to Shibanxi	Pianyan river, branch of Liuchi river
7	Dejiang	Xianlong bridge	New	36	5.5	2-13m hollow slab		Nangan river, branch of Fengle river
8	Dejiang	Guanyinyan bridge	New	41	5.5	2-16m hollow slab	From Guanyinyan	Pianyan river, branch

No.	County/ Area	Bridge name	Type of construction	Scale of construction		Bridge arrangement	Route	River
				L(m)	W(m)			
							to Xinlongpo	of Liuchi river
9	Dejiang	Tianba bridge	New	23	5.5	1-16m hollow slab		Branch of Mati river
10	Dejiang	Shenxi bridge	New	28	5.5	1-16m hollow slab	From Xiaba to Shenxi	Nangan river, branch of Fengle river
11	Dejiang	Yanjin bridge	New	18	7.5	1-10m solid slab	From Qiaotou to Yanjin	Hengshiliang stream, branch of Wujiang river
12	Dejiang	Xiaoxigou bridge	New	15	5.5	1-6m solid slab	From Zhoujia to Huangbayan	Xiaoxi ditch, branch of Liuchi river
13	Dejiang	Tanjiashan bridge	New	20	5.5	1-10m solid slab		Tanjia river, branh of Mati river
14	Dejiang	Xinlong bridge	New	33	5.5	2-13m hollow slab		Pianyan river, branch of Liuchi river
15	Dejiang	Dongmenqian bridge	New	34	5.5	2-13m hollow slab	From Baiyan to Dongmenqian	Dongmenqian river, branch of Yangshan river
16	Dejiang	Hengshiliang bridge	New	24	5.5	1-16m hollow slab	From Qishugou to Hengshiliang	Hengshiliang stream, branch of Wujiang river
17	Dejiang	Zhongxi bridge	New	34	5.5	2-13m hollow slab	From Gaoshan to Zhonghe	Zhongxi ditch, branch of Yangshn river
18	Dejiang	Dashuituo bridge	New	21	5.5	1-13m hollow slab	From Gaoshan to Zhonghe	Zhongxi ditch, branch of Yangshn river
19	Sinan	Tangjiaba bridge	New	18.0	5.5	1-13m hollow slab	From Wengsan Road to Tangjiaba	Heitan river, branch of Wujiang river
20	Sinan	Kongjiahe bridge	New	29.0	5.5	1-13m hollow slab	From Wengxi Government to Changzheng	Kongjia river, branch of Heitan river
21	Sinan	Juanziwan bridge	New	26.0	5.5	1-16m hollow slab	From Lancaocha to Meizibao	Gangou
22	Sinan	Meizibao bridge	New	30.0	5.5	2-13m hollow slab	From Baiyangping to Nanshan	Meizibao river, branch of Qingdu river
23	Sinan	Yandixia bridge	New	18.0	5.5	1-13m hollow slab	From Baiyangping to Nanshan	Meizibao river, branch of Qingdu river
24	Sinan	Mayangdong bridge	New	14.0	5.5	1-8m hollow slab	From Pujiagou to	Stride over Zhangjiapo

No.	County/ Area	Bridge name	Type of construction	Scale of construction		Bridge arrangement	Route	River
				L(m)	W(m)			
							Dashan	stream and flow into Heie stream
25	Sinan	Qinglongzui bridge	New	40	7.0	1-30m reinforced concrete box girder	From Sishi road to Shuidong	Xiaoxi river, branh of Longdi river
26	Sinan	Guihua bridge	New	23	7.0	1-13m hollow slab	From Guihuashu to Guihua	Dabachang river, branch of Longdi river
27	Sinan	Danianfang bridge	New	23	7.0	1-13m hollow slab	From Guihuashu to Guihua	Dabachang river, branch of Longdi river
28	Sinan	Yuanjiahao bridge	New	26	7.0	1-16m hollow slab	From Shuijinwan to Sitangzhen	Yuanjiahao river, branch of Wujiang river
29	Sinan	Sanchatang bridge	New	35	7.0	2-13m hollow slab	From Shangguanqing to Langan	Yangjiaao river, branch of Liuchi river
30	Sinan	Sanxing bridge	New	16	7.0	1-8m hollow slab	From Wengxi to Sanxing	Kongjia river, branch of Heitan river

7. Main technical standard：

（1）Technical standard used for rural road construction

The construction should be implemented as per “Technical standard of road engineering” （JTHGB01-2003）, “Guidance of rural road construction standard” and “Guizhou rural road technical standard” issued by Ministry of transport. “Technical standard of road engineering” （JTHGB01-2003）will be mainly used in this project, for other difficult sections, “Guizhou rural road technical standard” and “Guizhou “Four in farmer•Beautiful countryside” Infrastructure—Well-off construction” will be used for reference.

Class of road：Class ⅳ

Designed speed：20km/h

Width of subgrade：6.5m(Double lane),4.5m（Single lane）,5.5m（Single lane）

Load standard：Road-Class Ⅱ

Design period：6 years of Class ⅳ asphalt concrete pavement and 10 years of Class ⅳ cement concrete pavement.

Roadway width：2×3.0m（6.5m subgrade）,1×3.5m（4.5m subgrade）,1×4.5m（5.5m subgrade）.

Design slope of camber: Considering the plentiful precipitation in the location of this project, 2.0% standard is recommended to use for cross-sectional slope in the road.

6.5m（Double lane）：Double slope is adopted (cross slope of roadway: 2.0%, cross slope of road shoulder: 2.0%)

5.5m、4.5m（Single lane）：Single slope is adopted (Cross slope of roadway: 2.0%).

8. Earthquake resistant design standard: Based on "Guizhou Earthquake intensity division map", the basic earthquake intensity in the location of this project is 6th protection class, the peak acceleration value is 0.05g and the engineering importance correction coefficient is 1.3.

（2）Technical standard for bridge and culvert

Designing load: Road (Class Ⅱ)

Designing flood frequeny:

Big and medium bridge: 1/100

Small bridge, culvert and small drainage facilities: 1/25

For detailed technical index, please refer to table1.2-3.

Table 1.2-3 Main technical standard table

No.	Index name	Unit	Technical index（Specified value）	Technical index（Adopted value）	Remark
1	Class of road		Class Ⅳ	Class Ⅳ	
2	Designing speed	km/h	20	20	
3	Width of subgrade	m	6.5/4.5	6.5/5.5/4.5	
4	Width of lane	m	6.0/3.5	5.5/4.5/3.5	
5	General minimum radill of horizontal curve	m	30	30	
6	Ultimate minimum radill of horizontal curve	m	15	12	"Beautiful countryside" standard will be used for some sections due to the difficult conditions.
7	Max. longitudinal slope	%	9	12	
8	Min. length of slope	m	60	60	
9	Min. radill of convex vertical curve	m	200	200	
10	Min. radill of concave vertical curve	m	200	200	
11	Auto load level		Road-Class Ⅱ	Road-Class Ⅱ	
12	Pavement structure type			Asphalt concrete /Cement concrete	
13	Width of bridge	m		7.0/7.5	

No.	Index name	Unit	Technical index （Specified value ）	Technical index （Adopted value ）	Remark
14	Designing flood frequency of medium bridge		1/100	1/100	
	Designing flood frequency of small bridge		1/25	1/25	
15	Designing flood frequency of subgrade		1/25	1/25	

8. Main quantities：

The main engineer of proposed road including rural road(646.422km), 30 bridges(838m)， culver(12714.8/1976m/streak, 302 plaes of grade crossing，engineering excavation (5.8778 million m^3), Protection and drainage engineering (646.422km)，special subgrade treatment(46.32km). For detailed quantities, please refer to the table 1.2-4 as below.

Table 1.2-4 Main quantities index of proposed project

No.	Project name	Unit	Quantities		
			Dejiang	Sinan	Total
1	Rural road	Strip	59	27	86
		km	415.705	230.717	646.422
2	Bridge	m/set	539.5/18	298.5/120	838/30
（1）	Small bridge	m/set	210 / 10	213 / 10	423 / 20
（2）	Medium bridge	m/set	330 / 8	85 / 2	415 / 10
3	Subgrade	km	415.705	230.717	646.422
(1)	Amount of excavation	Ten thousand m^3	341.58	246.19	587.78
(2)	Amount of fill	Ten thousand m^3	114.08	62.70	176.78
(3)	Using amount of earthwork	Ten thousand m^3	79.02	59.92	138.94
（4）	Borrowed amount of earthwork	Ten thousand m^3	3.81	0	3.81
（5）	Abandoned amount of earthwork	Ten thousand m^3	218.31	183.12	401.43
（6）	Special subgrade treatment	km	29.40	16.92	46.32
（7）	Drainage engineering	km	415.706	230.717	646.422
（8）	Protection and reinforcement project	km	415.706	230.717	646.422

（1）	General subgrade protection and reinforcement	m^3	397621	163758.9	561379.9
4	Pavement	km	415.706	230.717	646.422
（1）	Cement concrete level	m^2	1256520	1028314	2284834
（2）	Asphalt concrete level	m^2	450651	-	450651
5	Culvert project	m/streak	8375.8 / 1211	4339 / 765	12714.8/1976
(1)	Pipe culvert	m/streak	104.5/ 17	-	104.5/ 17
(2)	Slab culvert	m/ streak	7188.8/1069	4339 / 765	11527.8/1834
(3)	Pipe culvert	m/ streak	1082.5/ 125	-	1082.5/ 125
6	Cross project ——Grade crossing	Place	216	86	302
7	Road facility and embedded pipeline engineering	km	415.706	230.717	646.422
(1)	Security facility	Km	415.706	230.717	646.422
(2)	Other engineering	Km	415.706	230.717	646.422
8	Green and environmental protection	km	415.706	230.717	646.422
9	Permanent covers	hm^2	77.98	26.46	104.44
10	Demolition of building	m^2	13555	8585	22140

9. Investment estimation and financing

The total investment of proposed project is 1.445586 billion yuan, which including: application of the World Bank loan(930 million yuan,about 64.33%） and domestic funds (515.586 million yuan, about 35.67%）.

1.3 Evaluation standard

1.3.1 Environmental quality standard

1. Ambient air： The class Ⅰ criterion of “Ambient air quality standard” (GB3095-1996) will be implemented for Sinan Siyetun nature protection area and Longdi river scenic region. For other sections, the class Ⅱ criterion of“Ambient air quality standard” (GB3095-1996) and State Environmental Protection Administration file environment and development [2000] No.1 “About releasing the modification notice of ‘Ambient air quality standard’（GB3095-1996）” will be adopted. Please see the standard value from table1.3-1.

Table 1.3-1 Ambient air quality standard Unit：mg/Nm^3

Pollutant	NO_2	Total suspended particulate

			(TSP)
GB3095-1996 standard class Ⅰ	Daily average	0.08	0.12
	Average per one hour	0.12	/
GB3095-1996 class Ⅱ	Daily average	0.12	0.30
	Average per one hour	0.24	/

2. Acounstic environment：Class 4a standard of "Acounstic environmental quality standard" （GB3096-2008）should be conducted for the area within 35m to the edge of road. Class Ⅱ standard should be implemented to all schools, hospital wards and other sensitive objectives. For the area beyond 35m to the edge of road, class Ⅱ standard is also adaptive. Please see table 1.3-5 for each kind of standard value.

3. Surface water：Class Ⅱ and Ⅲ criterion of " Surface water environmental quality standard" should be implemented for all the surface water in the area of assessment, please refer to the standard value from table1.3-2.

Table 1.3-3 Surface water environmental quality standard（Abstract）

Unit :mg/L（Except pH）

Project	pH	COD	BOD_5	DO	Petroleum	NH_3-N	Permanganate Index
Class Ⅱ stanard	6-9	≤15	≤3	≥6	≤0.05	≤0.5	≤4
Class Ⅲ standard	6-9	≤20	≤4	≥5	≤0.05	≤1.0	≤6

4. Underground water：Class Ⅲ criterion of "Underground water quality standard" （GB/T14848-93） should be adopted to use, please refer to table 1.3-3 as below.

Table 1.3-3 Underground water quality standard(Abstract) Unit:mg/L（Except pH）

Project	pH	Total hardness	Nitrate（Calculate by N）	Sulphate	Cyanide	Total coliform (pcs/L)	NH_3-N	Permanganate Index
Class Ⅲ	6.5-8.5	≤450	≤20	≤250	≤0.05	≤3.0	≤0.2	≤3.0

1.3.2 Pollutant discharge standard

1． Noise: Noise in construction period should meet the requirement of "Noise limits for construction site" (GB12523-90), please find detailed value from table1.3-4. While noise in operation period should meet the requirement of environmental and

development (2003) No. 94 "Notice about environmental noise issues in the environmental influence assessment of road and railway (including light rail)", please see the details from table1.3-5.

Table 1.3-4 Noise limits for construction site Unit：dB（A）

Construction period	Main noise resource	Noise limit	
		Day	Night
Earthwork	Bulldozer, excavator, loader	75	55
Structure	Concrete stirrer, vibrator, chainsaw	70	55
Decoration	Crane, lifter	65	55

Table 1.3-5 Acounstic environment assessment standard value in operation period
Unit： dB（A）

Type or sensitive objective	Day	Night
4a type of GB 3096-2008	70	55
Outside classroom	60	50
Outside hospital ward	60	50

2. Waste water： Production waste water needs to be recycled after treatment, and the domestic sewage can be used for agricultural fertilizer or irrigation after treated by septic tank and disinfection, which should not be discharged out. The agricultural irrigation waste water should meet the requirement of "Irrigation water quality criteria" （GB5084-2005）, which can be shown in table 1.3-5.

Table 1.3-5 Irrigation water quality criteria Unit：mg/L（Except pH）

Crop strains	pH	COD	BOD_5	SS
Water farming	5.5-8.5	150	60	80
Dry farming		200	100	100

3. Exhaust gas： The asphalt fume should meet the criteria of "The Integrated Emission Standard of Air Pollutants" （GB16297－1996）, which can be found in table 1.3-6.

Table 1.3-6 Emmision standard of asphalt fume(new pollution source) Unit：mg/m^3

Pollutant	Production technology	Max. allowable emission conentration（mg/m^3）	Supervising concentration limit for fugitive emission
asphalt fume	Asphalt layer	40～75	Visible fugitive emission is prohibited.

4. Water and soil loss assessment standard

The water and soil loss assessment standard is made by taking the reference of

average water and soil loss in the area passed by route for many years and classified according to " Industrial standard of PRC—Soil erosion classification standard" （SL190-2007）as shown in table 1.3-7.

Table 1.3-7 Soil erosion classification standard

CLASS	AVERAGE EROSION MODULE [t/(km^2·a)]
Micro erosion	<200，500，1000
Light erosion	200，500，1000～2500
Medium erosion	2,500～5000
Strong erosion	5,000～8000
Extremely strong erosion	8,000～15000
Severe erosion	>15000

1.4 Main environmental sensitive area

During the preparation period of environmental influence assessment, several main sensitive areas are required, which may be encountered the direct affect of construction and operation. Please see the summary from table 1.4-1.

Table 1.4-1 Main environmental sensitive area list of roposed project

Environmental factor	Protective objective	Proteciton level	Location	Relative loation	Project type
Ecological environment	Project land, earth fetching areas, spoil grand, occupated vegetation and farmland	-	Dejiang, Sinan	Around the route and both sides of base.	Subgrade, bridge, base
	Basis farmland	-		Occupation	Subgrade, bridge
	Water conservation facilities	-		Occupation	Subgrade, bridge
	Siyetun natural protection area	County level	Sinan	From Shangguanqing to Langan road and run across Sanchatang bridge	Subgrade, bridge
	Sinan Wujiang river Bailuzhou scenic spot---Longdijiang scenic spot	Provincial level	Sinan	Crossed by Qinglongzui bridge	Bridge
Acounstic environment	403 points in total, including: 359 villiages, 43 schools and one hospital	Class Ⅱ	Dejiang, Sinan	Village, school and hospital in the scope of 100m to the both sides of road and near the base.	Construction machinery and vehicle running
Ambient air	403 points in total, including: 359	Class Ⅱ	Dejiang, Sinan	Village, school and hospital in	Dust, exhaust of

	villiages, 43 schools and one hospital			the scope of 200m to the both sides of road and near the base.	vehicle, asphalt fume and exhanst of polluted air in construction period
Water environment	Surface water along the road&bridgeand near the base	Class Ⅱ and Ⅲ	Sinan, Dejiang	Along the road&bridgeand near the base	Construction waste water,road rain in operation period, drainage in base and polluted water in accident.
Physical cultural resources	Stone horse in Quankou township	Natural monument	Dejiang	From Hetou of Quankou township to 20m left of Dayuan（K3+900）	Subgrade construction
	123 graves	Ordinary and private grave	Dejiang, Sinan	On both sides of road	Subgrade construction

2 Environmental Code of Practices

The following Environmental Code of Practices refer to the common measures for general environmental protection, which are appropriate for construction activities related to all rural road projects under this project. In the implementation process of the specific project, the Environmental Code of Practices will be taken as the content composition for the sections of the environmental protection of "technical specifications" and civilized construction of the civil engineering procurement tender documents. The contractors shall strictly fulfill the approved mitigation measures of Environmental Assessment report, and consider it as an evidence for requiring payment of owners. The general Environmental Code of Practices include contents as follows:

Building site and job site

- Field cleanup
- Construction shortcut
- Quarry, borrow pit
- Spoil, slag field
- Slop stability, excavation and backfill
- Drainage system
- Bridge construction
- Pipe culvert construction
- Soil erosion
- Social disruption
- Sewage treatment
- Heritage protection
- Safety and health
- Management of hazardous wastes and chemicals

2.1 Environmental Code of Practices for building site and job site

2.1.1 Environmental Code of Practices for building site

The building site includes mainly the construction campsite, concrete mixing plant, asphalt mixing plant. According to different functions, the construction campsite can

be divided into three categories of the constriction living campsite, the construction production campsite, together with the construction living and production campsite. The construction living campsite refers to a place for living and accommodation of the construction workers; the construction production campsite is mainly used for keeping the building materials, concrete mixing, and the production of bridge precast etc.; the construction living and production campsite is a place by setting living and production as one, there's the room for dieting and accommodation of construction workers, keeping building materials and the production of bridge precast and others in such kind of the campsite. Asphalt mixing plant is mainly used for mixing asphalt required for paving the road.

(1) Site location requirements: see Table 2.1-1 for location requirements of construction site.

Table 2.1-1 Location requirements of construction site

Not Optional	Optional
•Sensitive land for dwelling houses, schools and within upwind of 200m range •Fundamental farmland • Homestead land • Woodland • Land area of rivers within 200m range • Land of watering points for drinking water source within the ranges of upstream 1000m and downstream 500m, and to avoid the scope of protection area of the drinking water source; and other environmentally sensitive areas such as nature reserves, scenic spots, forest parks etc. • Marsh land or paddy field • Land with good vegetation cover • Hazardous zones of collapse and hill-creep • Areas prone to debris flow • Land for special-purpose	• Hire local houses • Land within the range of permanent road site • Wasteland • Abandoned farmland •Land with higher terrain • Other low-quality land

(2) Impact analysis of the building site on the environment

The impact of the building site on the environment includes mainly the construction machinery noise, drainage of wastewater and domestic sewage, construction dust and living lampblack, construction waste and garbage etc. See Table 2.1-2 in detail.

Table 2.1-2 Impact of the building site on the environment

Classification of Building Site	**Environment Element**	**Impact on Environment**
Production Campsite	Water Environment	Impact of drainage of wastewater produced during construction on water environment.
	Ambient Air	Impact of construction dust on ambient air.
	Acoustic environment	Impact of construction machinery noise on acoustic environment.
	Solid Waste	Impact of accumulated construction waste on the environment.
Living Campsite	Water Environment	Impact of sewage on the environment produced by living and accommodation of construction workers.
	Ambient Air	Impact of the construction workers' living energy, heating as well as lampblack and others on ambient environment.
	Acoustic environment	Impact of the construction workers' yells on acoustic environment.
	Solid Waste	Impact of living garbage on the environment.
	Social Environment	Impact of stationed construction workers on local social environment.
Asphalt Mixing Plant	Ambient Air	Impact of asphalt smoke on ambient air.
	Acoustic environment	Impact of the noise of mixing machines on acoustic environment.

(3) Mitigation measures of the building site environment

According to the site location requirements and with the combination of the specific project, the project should comply with the following requirements when selecting its location of building site:

① Hire the houses along the project as much as possible, and set the garbage collection points or garbage collection barrels; offer living energy, heating electric energy or other clean energy.

② The construction should comply with local pacts, conduct civil construction, and handle the relationship with local residents smoothly.

③ The production campsite should set the shit toilet and settling pond for production wastewater, and the production wastewater will be used for production again rather than be discharged after precipitating, the sewage (from the toilet for construction workers) will be used for crop irrigation through hiring local farmers to deliver to the farmland after processed in the shit toilet, of which, the shit will be buried with soil after the construction is completed; recycle and use the construction waste inside the campsite as much as possible, and deliver the waste that can't reused to a designated place for storage at a regular period, the littering behavior is forbidden.

④ Barren slop land, shrub land and poor land should have the priority to serve as the production campsite, the arable land is forbidden; when it's inevitable to use the arable land as the production campsite, the fundamental farmland is prohibited; prior to the construction, the topsoil of the arable land should be stripped and temporarily stacked in relatively flat area of the site, which is temporarily retained through the use of the piled up bagged soil, and it should be surrounded with the temporary drainage ditches and sand settling measures, and the dust screen is used for coverage, and the topsoil will be used for covering the construction production campsite for the rehabilitation or greening soil after the completion of the construction.

⑤ The project won't set the special concrete mixing plant and asphalt mixing plant, all required concrete and asphalt are obtained through outsourcing.

2.1.2 Environmental Code of Practices for job site

（1）Requirement of construction time

① The construction is allowed from 6:00 am to 10:00pm, and the construction should be stopped in the time period of 10:00pm~6:00am, 12:00~2:00pm at noon. It should be noted that the access time of the construction vehicle must comply with local requirements.

② The nighttime construction is forbidden, and surrounding residents should be announced in case that the construction activities must be done at nighttime, at the same time, the relevant procedures are required, and appropriate measures should be taken to reduce its impact on the surrounding residents.

(2) Management of building materials for construction

The building materials for this project include sand, stone, cement and so on, if these building materials are not properly handled during transportation, storage and use, which will have different effects on the environment, and therefore, the appropriate environmental protection measures should be taken to minimize the impact.

The management measures taken for building materials of the project during transport, storage and use are as follows:

① The construction vehicles with low-noise are allowed, which should be used by strictly according to daytime shift transportation, strengthen management of vehicles and reduce night transport times under abnormal construction condition.

② The speed control measures should be taken for transport vehicles, and those vehicles should slow down when passing through the environmental protection objects (i.e. hospitals, residential areas, schools, etc.).

③ Signs should be provided for vehicle access, and the drivers should drive in a civilized way to ensure safe transportation.

④ Powdery materials like cement, lime and others should be canned or bagged for transportation, and the bulk transport is strictly prohibited; the vehicles for transporting sand and gravel materials, building materials should be equipped with anti-scatter devices, and the loading should not be too full to

prevent from blowing by wind, the scattered dust is prohibited during the transport, loaded items must be covered with felt cloth; and transportation routes and time should be planned to minimize the impact on points (areas) sensitive to the environment.

⑤ The locations for storage powdery building materials should be downwind 300m away from the points sensitive to the environment, reduce the stock volume and use these materials timely, besides, measures against wind and rain should be taken when piling up these materials. There should be fences around the material stock if necessary, and the timing watering is required to preventing dust, plus the coverage of the felt cloth on days with inclement weather.

⑥ The construction vehicles must be checked regularly, and the damaged cars shall be repaired promptly, reducing the possibility for vehicles to scatter the building materials and waste when driving along the way.

⑦ Take the measure of hardening the surface of construction shortcut (if any), or adopt watering and other approaches to treat the shortcut, thus to control the impact of vehicle wheels rolling and reduce the dust pollution.

⑧ Strengthening the management of delivery and use of powdery particles during construction, watering and cleaning the work surface that is easy to produce the dust for a second time.

(3) Management of construction equipment

Project construction equipment are mainly loader, roller, excavator, mixer, vibrator and tamper, and the noise, exhaust gas, the potential leaking and others generated by these construction equipment during the construction period may have impact on the environment of the project location, the following management measures are intended to take to minimize these adverse effects:

① The construction equipment should be stored in the area designated by the construction, rather than be arbitrarily placed beyond the construction site,

which will increase the area of temporary land and destroy the vegetation and soil.

② The low-noise equipment should be used as the construction equipment as much as possible.

③ Install the muffler at noise source of the equipment to eliminate the noise accordingly, namely, set the mufflers in place at entrance and exit of the duct of various types of exhaust vent system and so on; meanwhile, the base isolation of vibration or the setting of damp support can also be used.

④ Fuel construction machinery and vehicles must be used under a normal state, so as to ensure the standard exhaust emissions.

⑤ Rational use of the equipment, strengthen maintenance and repair of the equipment, prevent the equipment from phenomena of deviation, steaming, dripping and leaking, which will have impact on surface water environment, soil environment and others in the area of the project location.

2.2 Environmental Code of Practices for site cleanup

2.2.1 Content of the site cleanup

Site cleanup includes vegetation cleaning, topsoil dredging, the clearance of the old road subgrade, ditches, concrete pavement and concrete structures, as well as rubbish, waste and all other barriers specified by the supervisor. The corresponding scope includes the entire surface area of permanent and temporary works, stockyard, as well as storage spoil yards and others of the construction site need cleaning.

2.2.2 Environmental Code of Practices for site cleanup

(1) The vegetation cleanup on the surface of the main construction site must be extended to at least for a distance of 5m from the maximum excavation edges or outer fundamental edges of buildings shown on the construction drawings.

(2) The roots excavation scope of vegetation cleanup of the main project must be extended to the distance of 3m from the maximum excavation edges, filling lines or outer fundamental edges shown on the construction drawings.

(3) Attention should be paid to the protection of natural vegetation next to the cleanup area, and the destruction of forest resources close to the cleanup area due to improper construction, which have also adverse effects on environmental protection, and the contractor shall be responsible for appropriate compensation.

(4) Within the scope of site cleanup, the felled timber or materials with the commercial values that are obtained by the contractor during the cleanup working should be owned by the letting party, and the contractor should deliver them to the designated place for storage according to the supervisor's instruction.

(5) Where the worthless combustible materials, they should be burned as soon as possible. The necessary fire-control measure should be taken during burning, and the contractor should be responsible for the combustion consequences.

(6) Where the wastes can't burn out or have a serious impact on the environment, they must be buried in areas designated by the supervisor, and the buried objects shall not impede the natural drainage or pollute the rivers.

(7) Any heritage discovered on the site during the cleanup should be properly handled according to the provisions of 2.14 in this chapter.

(8) The topsoil dredging should be conducted according to topsoil excavation depth instructed by the supervisor, the excavated organic soil should be transported to designated area for storage. Measures should be taken to prevent the soil from losing due to erosion. And the stockpiles of organic soil should be used in the engineering environmental protection. The organic soil should be used in a rational way according to the contract requirements or overall environment planning of the letting party.

(9) The garbage and organic residues within the range of subgrade land, and pits of muck, grass, tree roots, crop roots on the original ground surface (100 ~ 300mm) of the pits should be removed, and stockpiled in locations designated by the supervisor intensively or placed in the place with spoil soil; after finishing the site cleanup, all pits within the range of subgrade land should be filled comprehensively and compact enough to make the soil density meet provided requirements.

(10) When the blasting or other operations are required for the demolition of original structures or barriers, if they may damage the new structures, the demolition process must be completed before starting the new project, and avoid unnecessary losses of all materials that can be reused, which should be properly stored in the specified location.

All demolition pits should be backfilled and compacted to make the corresponding soil density meet provided requirements.

(11) The removal of old ditches, culverts, pavements and other obstacles should not be conducted till after proper arrangements of the normal traffic and drainage accordingly. For the underground part of the original structures, the excavation depth and scope should be handled in accordance with the requirements of the supervisor.

2.3 Environmental Code of Practices for construction shortcut

2.3.1 Location requirements of construction shortcut

If there's any necessary to build the construction shortcut, the location principles of Table 2.3-1 should be followed when doing site selection.

Table 2.3-1 Location requirements of construction shortcut

Not Optional	Optional
•Fundamental farmland or other farmlands, paddy fields and fields of cash crops • Land of natural protection area, protected areas of water resources, scenic spots, forest parks and other sensitive areas • Homestead land • Woodland • Land area of rivers within 200m range • Marsh land or paddy field • Land with good vegetation cover • Hazardous zones of collapse and hill-creep • Areas prone to debris flow • Land for special-purpose	• Roads in county, town and village • Wasteland • Abandoned farmland • Other low-quality land

2.3.2 Impact analysis of construction shortcut on environment

The constructing impact of construction shortcut on environment is mainly reflected in follows:

(1) Road dust pollution produced by driving vehicles and equipment under operation.

(2) Noise pollution from driving vehicles.

(3) Temporary land occupation destroys vegetation and cause soil erosion.

2.3.3 Environmental Code of Practices for construction shortcut

(1) Make full use of existing roads in county, town and village as the construction shortcut as much as possible, while taking the transformation of roads in the town and village.

(2) If there's any need to build the new construction shortcut, and then try to minimize the possibility for high filling and in-depth excavation, at the same time, to take effective measures for soil and water conservation, thus to reduce soil erosion and ecological damage; and the hardening treatment is required when building the new construction shortcut. The reusable load-bearing brick (construction member) can be used for hardening treatment of construction shortcut for heavy duty vehicles; and the reusable Dutch brick can be laid on construction shortcut for general vehicles.

(3) Before building the new construction shortcut, the topsoil should be stripped and temporarily stacked on relatively flat area of the site, and the topsoil should be temporarily retained through the use of the piled up bagged soil, and it should be surrounded with the temporary drainage ditches and sand settling measures, and the dust screen is used for coverage, the topsoil will be used for ecological restoration of the shortcut after completing the construction.

(4) The construction shortcut should be combined with the sidewalk of construction campsite as much as possible to minimize the number of shortcut.

(5) The construction shortcut should be maintained in a regular period, and it should be cleaned every day, the dust section should be watered for daily dust suppression.

(6) Minimize the noise impact on the environment by controlling the vehicle speed, silence, prohibiting transportation between the daytime 12:00~14:00 and nighttime 22:00~6:00 and other measures.

(7) Before the end of construction, the ecological restoration is required for new built construction, which should be restored to the state at least before the construction.

(8) The occupied or destroyed local roads should be changed or through the protective treatment after completing the construction, together with pavement recovery and greening. In addition, the contractor should provide the local government with some compensation expenses to safeguard the legitimate interests of local government and

the residents.

2.4 Environmental Code of Practices for quarry and borrow pit

2.4.1 Location requirements for quarry and borrow pit

Construction material fields typically includes sand quarry and borrow pit etc. The locations for the quarry and borrow pit should follow site selection principles of Table 2.4-1.

Table 2.4-1 Location requirements for quarry and borrow pit

Not Optional	Optional
•Fundamental farmland or other farmlands, paddy fields and fields of cash crops • Land of natural protection area, protected areas of water resources, scenic spots, forest parks and other sensitive areas • Homestead land • Woodland • Land area of rivers within 200m range • Marsh land or paddy field • Land with good vegetation cover • Hazardous zones of collapse and hill-creep • Areas prone to debris flow • Land for special-purpose	• Wasteland • Abandoned farmland • Other low-quality land

2.4.2 Impact analysis of setting the quarry and borrow pit on environment

(1) The destruction of vegetation and increases in soil erosion intensity

The vegetation diversity on slopes is more than that on the ground, there are shrubs, bushes and dry crops, after the excavation, the surface vegetation disappears, coupled with a certain slope (height difference), which will increase the soil erosion modulus within the local area. If there were no measures for prompt greening recovery after the

excavation of the quarry and borrow pit, it's easily to result in soil erosion.

(2) Landscape impact

The quarry and borrow pit will destroy the vegetation and change the original terrain, topography and natural landscape.

(3)The impact of mechanical noise produced by quarrying and earth fetching on acoustic environment.

(4) The dust impact of quarry and borrow pit on the ambient air.

(5) The excavated topsoil from quarry and borrow pit is prone to soil erosion if it was not stored properly.

2.4.3 Environmental Code of Practices for quarry and borrow pit

According to the location requirements of the quarry and borrow pit, as well as their impact on the environment, the quarry and borrow pit should follow the requirements as follows:

(1) The dressed stone should be mined nearby and it's essential to take advantage of spoil from the project itself, and make full use of existing legitimate quarries and borrow pits in the locality to minimize the impact of dressed stone mining and earth fetching on the ecological environment.

(2) There should be the construction of rainwater collecting ditches when mining the dressed stones, thus to avoid geological disasters such as soil erosion, hill-creep, debris flow and others when mining dressed stones during the rainy season.

(3) Avoid in-depth excavation during the construction, and try to keep balance between the excavation and the fill, if there's any need to borrow earth, then the spoil from other construction projects within the area should be used after the coordination, avoid setting another borrow pit, which can eliminate the impact of the borrow pit on the environment fundamentally.

(4) The project should mining the dressed stone and fetching the earth in a focus manner, in order to reduce the number of quarries and borrow pits.

(5) Be not to water for dust suppression during the operation of mining dressed stone and fetching the earth, so as to minimize the dust pollution caused by the earth excavation.

(6) For the prevention of soil erosion, there should be the intercepting ditch and drainage ditch set in the quarry and borrow pit to avoid the loss of sediment being

directly discharged into surface water along with runoff in the drainage ditch to affect the water quality.

(7)At the time of starting the excavation, the topsoil should be reserved for land reclamation, and the topsoil should be temporarily stacked in relatively flat area of the site, which is temporarily retained through the use of the piled up bagged soil, and it should be surrounded with the temporary drainage ditches and sand settling measures, and the dust screen is used for coverage, and the topsoil will be used for ecological restoration of the borrow pit.

(8) Follow the principle of simple and easy conservation, and adopt the greening form of a combination of grass, shrubs and trees, forming plant community landscape, thus to restore natural ecosystems of the quarry and borrow pit, reducing soil erosion.

(9) Strictly control the time of construction work, if there's sensitive objects such as the residential area and others within the noise impact range, and the operations of quarrying and earth fetching between daytime 12:00~14:00 and nighttime 22:00~6:00 is prohibited.

2.5 Environmental Code of Practices for spoil ground and slag field

2.5.1 Location requirements for spoil ground and slag field

The locations for spoil ground and slag field should follow site selection principles of Table 2.5-1.

Table 2.5-1 Location requirements for spoil ground and slag field

Not Optional	Optional
•Fundamental farmland or other farmlands, paddy fields and fields of cash crops • Homestead land • Woodland • Land area of rivers within 200m range • Land of natural protection area, scenic spots, protected areas of water resources, forest parks and other sensitive areas • Marsh land or paddy field • Land with good vegetation cover • Hazardous zones of collapse and	• Wasteland • Abandoned farmland • Other low-quality land • Col terrain or low-lying land

hill-creep • Areas prone to debris flow • Land for special-purpose	

2.5.2 Analysis of impact factors of spoil ground and slag field on environment

A certain amount of construction slag may be produced during highway construction, including mainly excess earthwork, deserted highway building materials, barren rock as well as the silt from site cleanup and others, which may have following impacts on environment if they were not disposed properly:

(1) The bare surface of spoil ground will cause serious dust pollution if nothing is done.

(2) There are no temporary measures for retaining or waterproof of the spoil ground and slag field, which will cause soil erosion accordingly.

(3) The damage to surface vegetation will have adverse impact on the ecological environment.

2.5.3 Environmental Code of Practices for spoil ground and slag field

(1) If there were the wastes, what should be considered first is to use them in situ or transported to the rest tenders of the project for use, or recycled for the vegetation recovery of the borrow pit, avoid setting another spoil ground, thus to eliminate the impact of the borrow pit on the environment fundamentally.

(2) When the wastes can’t be used any more, the first thing is to survey whether there is a specified local site for disposal of the construction wastes, if any, the muck removal procedures should be handled per required to deliver the construction wastes to the designated disposal location.

(3) The slag field should be layered and compacted to effectively suppress dust.

(4) Take the measure of watering for dust suppression to minimize dust pollution caused by the bare ground surface.

(5) In order to prevent soil erosion, there should be the intercepting ditch and drainage ditch set in the slag field to avoid the loss of sediment during period of construction and operation being directly discharged into surface water along with the runoff in the drainage ditch to affect the water quality.

(6) Before setting the slag field, the topsoil should be excavated for the land reclamation, and temporarily stacked in relatively flat area of the site, which is temporarily retained through the use of the piled up bagged soil, and it should be surrounded with the temporary drainage ditches and sand settling measures, and the dust screen is used for coverage, and the topsoil will be used for the ecological restoration of the slag field after completing the construction.

(7) Follow the principle of simple and easy conservation, and adopt the greening form of a combination of grass, shrubs and trees, forming plant community landscape, thus to restore natural ecosystems of spoil (slag) field, reducing soil erosion.

(8) The indiscriminate disposal of spoil heaps is strictly prohibited.

2.6 Environmental Code of Practices for slope stability, excavation and fill

2.6.1Analysis of problems commonly seen on slope and the causes

1. Type of problems commonly seen on the highway slope

The rural roads in the mountain areas are with low construction levels, lack of funds, rough design and low construction technology standards, which result in frequent problems appearing on rural highway slopes that have seriously affected the normal operation of the highway. The performance of problems of rural highway slopes is mainly of the following aspects:

(1) Exfoliation: The mountain rocks on highway slope are easily weathered and prone to peeling off during the normal passage of the highway.

(2) Falling rock: There are the rocks in loose block structure and fragmentation structure remained on the slope due to the insufficient construction of rocky mountain of the highway slope, with the passage of time and the role of external forces, those rocks are easily rolling down onto the pavement, thereby causing dangers.

(3) Collapse: Because of the rocky slope is too steep, there are often the cracks occur at the top of the slope, resulting in the slope collapse.

(4) Collapsed heap: As the slope is excavated too much to become over steep, there are tension cracks formed at the top or outer edge of the slope, which extend successively towards the mountain sides and result in collapsed heap.

(5) Surface slough: If there’s the distribution of soft soil or some crushing hard rock on the slope surface, which is likely to result in collapse of the cricked surface soil sliding along the partial weak surface under the effect of atmospheric weathering and water erosion, the collapsed stones and soil fall on the road, thereby seriously affecting the normal passage of the road.

(6) Weather peeling: The rocky slope prone to be weathered will occur severe weathering under the effect of external forces such as rain, sunshine and others after excavation, a loose layer with a certain thickness will be formed on the slope after the weathering slope, the loose layer will slide down along the slope under the effect of gravity and rain and result in damage due to weathering peeling.

(7) The shallow landslide of the slope: If there's the distribution of weaker rocks or crushing hard rocks on the shallow slope, these rocks are prone to integrally slide down based on horizontal displacement along certain weak surface or weak zone under the effect of natural attraction and the gravity, the shallow landslides will cause damage to a wide range of the pavement.

2. Factors affecting slope stability

(1) Rock structure factor: the structural presence of the slope rock mass is one of the important factors affecting rocky slope stability. The structural presence of rock mass has reduced the overall strength of the rock mass, increased the deformation properties of the rock mass, enhanced rheological properties and other time effects of rock mass. It has also deepened its natures of the inhomogeneity, anisotropism and non-continuity and others. The unstable rock mass often refers to the instability of the slope rock mass caused by shear slipping, rifting fracture, deformation and others along combined boundaries of a structural surface or the multi-structural surfaces.

(2) Impact of lithology weathering and erosion: the weathering can change rock properties, and the weathering may have adverse impact on the deformation properties of rocks and reduce strength of other properties. The erosion refers to mainly about the water erosion, and the water presence will increase fissures in the rock mass and enhance weathering of rocks, resulting in unstable rock mass.

(3) Impact of mechanical factor: There are many mechanical factors damaging highway rocky slope, such as vibration force, tectonic forces and self-gravity of the rock mass, stress produced inside the rock mass due to the role of physical chemistry and geochemistry and others of internal rock mass, and so on. The blasting (vibration) of the rock is the most common, serious and frequent basic factor affecting stability of the rocky slope during the highway construction, and this is particularly severe for the stepped slope.

(4) Impact of temperature factor: the temperature is one of the main causes for physically weathering of the rock mass. The cold and hot temperatures intensify the

weathering of slope rock mass, resulting in a natural slope cutting or natural peeling, which will ultimately change the shape and gradient of the slope.

(5) Impact of time factor and asymptotic destruction: the slope has experienced the asymptotic destruction over time through creeping and flow process, therefore, it's quite important that the final design of the slope should not only meet requirements of short-term stability, but also meet requirements of long-term stability.

2.6.2 Slope protection type

There are up-road slope and down-road slope, and generally the slope protection type has been currently divided into three types of plant protection, engineering protection and comprehensive protection (see Figure 2.6-1).

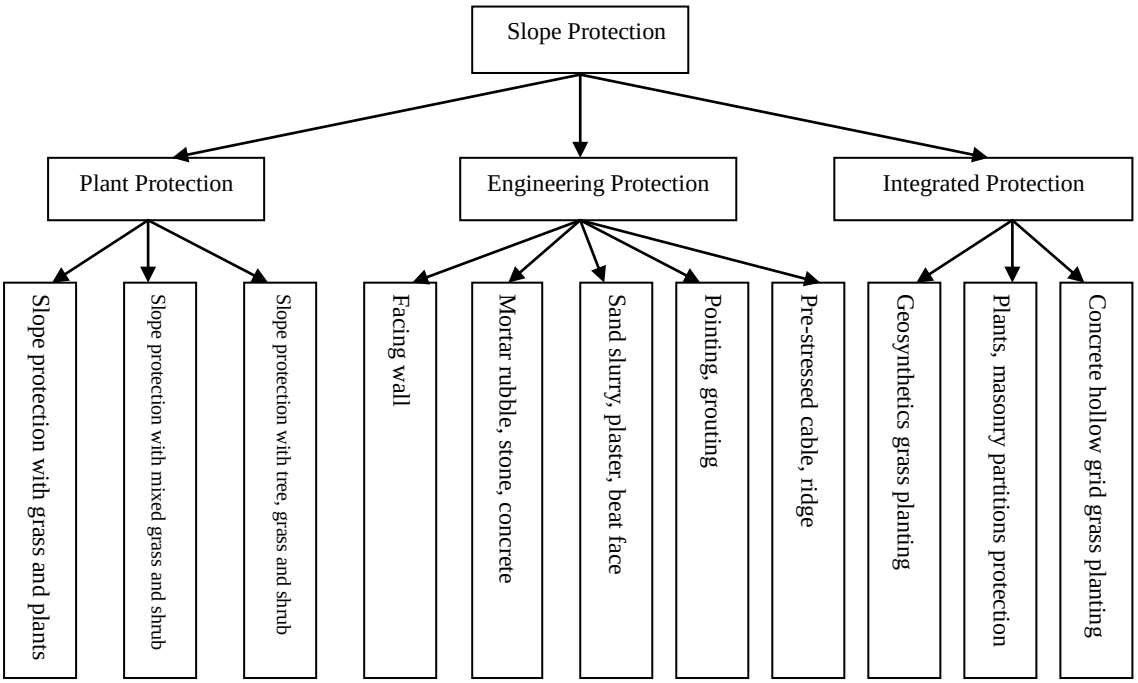

Figure2.6-1 Protection type of highway slope

(1) Plant protection: the plant protection refers to the use of vegetation covering on slope and reinforcement of plant roots on slope to protect the subgrade slope from erosion of atmospheric precipitation and surface runoff. Plant coverage has a great mitigation effect on surface runoff, soil and water erosion. Adopt the plant protection and increase the vegetation area to reduce the surface runoff, thereby minimizing the soil erosion on slope fundamentally, which is also good for air purification, ecological protection and landscaping, ensuring traffic safety, with good economic, social and ecological benefits. Therefore, plant protection measures should be taken first for all soil slope suitable for growing plants.

(2) Engineering protection: plant protection should be considered first as the slope protection approach, only the rock cutting slop and gravel-soil excavated slope and other slopes with soil quality that is not suitable for growing plants, or seriously weathered, faults development that should set the artificial structural protection when taking measures of engineering protection. Although the single engineering protection solves the problems of soil erosion and slope stability, it causes roadside slope to be uncoordinated with the landscape, since the road cutting action, the change of road construction towards the landscape structure not only reflects on its alteration of local habitat and destruction of the plant communities, but also reflects on its destruction of the integrity of the landscape, resulting in fragmented natural landscape.

(3)Integrated protection: vast majority of road slope protection adopts integrated protection combined with vegetation and masonry. There are many types of integrated protection, such as concrete hollow grid grass planting, a diamond slope, rectangular grid slope, hexagonal hollow brick slope, stacked arch slope etc., of which, due to the stacked arch slope is with relatively large cross-sectional dimension, stable structure and the good visual effects, and such kind of slope is conducive to water discharge, and is suitable for slopes with excavation or fill and high filling, in-depth excavated soil property; the concrete hollow grid grass planting slope is aimed at preventing soil property from forming grooves due to rain erosion and severe weathering, and it is adopted for soil property unsuitable for plant growth and places needs greening due to surroundings, and the drawback of such protection approach is that the slope can’t afford the soil pressure and the cost is higher than plant protection slope.

2.6.3 Environmental Code of Practices for slope protection

The most common approaches in slope protection are plaster, beat face, sand slurry, and shotcrete, pointing and grouting, facing wall, rubble as well as the mortar rubble, vegetation protection and so on.

(1) Plastering protection: during the highway construction, an additional layer of weathering-resistant surface is set on slope surface for the cutting slope that is with easily weathered soft rock, thereby isolating the effects of atmosphere and preventing weathering. The commonly used plastering materials are lime mixture mortar and grouting mortar etc., and the plaster thickness is generally 3~7cm, asphalt protective layer should be coated on the slope surface.

(2) Beat face protection: in the construction process, the beat face protection is adopted for soil property slope prone to the erosion or rocky slope that is vulnerable to weathering peeling. The protection approach is the same to that of plaster protection, while the difference is that the thickness of beat face is larger and its higher intensity compared with that of the plaster.

(3) Sand slurry and shotcrete protection: For rock slope prone to weathering, joint fissure development, the slope with the fragmentation structure, the sand slurry and shotcrete protection can be used accordingly. Its role is to close the rock crevices of the slope, joints, and prevent surface water from entering into the internal slope, preventing the continuous weathering of the rock, thereby increasing stability of the slope, protecting the slope from occurring rock-fall landslides.

(4) Pointing and grouting: For the more rigid and less likely to weathered rock cutting slope, and the hillside with more joint fissures, cement and other materials can be used for pointing and grouting.

(5) Dry masonry protection: For excavated or filled subgrade slopes with soil property and soft rock that are prone to weathering and seriously damaged, and the approach of dry masonry protection can be adopted with the use of local resources. The dry masonry structure is preferred in facing protection, which is not only in order to save investment, but also is suitable for slopes with large deformations, preventing not only the soil on slope surface from washing out by flow and reducing the impact of drifter, but also setting the cushion (inverted filter) composed of crushed stones or sand gravels under the dry masonry protection, and the cushion can also be replaced by geotextiles.

(6) Mortar rubble protection: It is generally applicable to soil slope prone to

water erosion, soft rock slope peeling severely, strongly weathered or more crushed rock slope, slope with loose and thicker eluvium needs mortar rubble protection.

(7) Highway slope protection with vegetation: To prevent the slope problems, the thicker vegetation can be planted on the slope in late construction to protect stability of the mountain. From the perspective of considering functional protection, the first requirement of plant protection should be capable to reinforce and stabilize the slope, and it should be with the effects of greening and improving the highway environment, therefore, the first thing need considering when choosing vegetation protection is that planted plants must have following characteristics: plants should be with prosperous root system, which have good effects on the soil fixation and slope protection; the plants should be with large coverage and high density; long green period, in perennial, trampling resistance, as well as suitable for extensive management, easy for migration, reproduction, derivation from natural reproduction is preferred for easy management; with a strong capacity of anti-pollution and air purification.

2.7 Environmental Code of Practices for drainage system

2.7.1 Importance of drainage system for rural highways

Since rural highways have relatively low technical standards, if there's no sound drainage system, and it will prone to be water way, which may result in destroying subgrade, threatening pavement of rural roads, thus block traffic, ranging from uplift and subsidence of subgrade, pits, loose pavement as well as crater, affecting vehicle accessibility accordingly. If rural highways were with sound drainage systems, then the subgrade could be stable, solid, and dense, together with the smooth pavement, moderate crown, driving safety and comfort, thus to extend the service life of rural highways, improve social efficiency accordingly.

2.7.2 Types of drainage system for rural highways

Based on the relevant standard provisions of *Specifications for Drainage Design of Highway* (JTJ018-97), *Technical Standards of Highway Engineering* (JTGB01-2003), the rural highway drainage is divided into road surface drainage and the underground drainage, road line transverse drainage, drainage sections across market towns.

2.7.3 Environmental Code of Practices for drainage system

1. Drainage scheme of road surface water

(1) Pavement drainage

① Cross slope: If the highway design functions were fully played, there should be the reasonable crown set on highway surface to drainage water on the pavement, which will help reduce water accumulation. Therefore, there should be slopes slightly higher than the minimum crown in the possible road sectors. Specific

methods are as follows: a. For highways in mountain areas, crowns are required in the case of setting ditches on both sides of the highway is not feasible, so that the pavement will be tilted to one side for discharging the lane surface water to the ditches; b. When the highway is located on the slope that is constrained by the specified minimum crown, the more appropriate method is to set the crown with no less than 50% of the longitudinal slope, which is very important to ensure highway surface water flows rapidly towards the shoulder.

② Longitudinal gradient: the longitudinal gradient plays a role in natural drainage of rain accumulated on highway surface, it can also be used for internal drainage of the surface layer, and 0.3% longitudinal gradient is enough to achieve the purpose of drainage.

(2) Slope drainage

① Intercepting ditch on natural slope: When the surface runoff of natural slope above cutting slope or subgrade slope flowing into the road sector is larger, there should be the intercepting ditches set to intercept surface water. For county, township highways on mountain areas, there should be an approximately parallel intercepting ditch set discretionarily on the slope with the large bus length. The intercepting ditch should be set to coincide with the surrounding terrain and in parallel with the contour lines. The intercepting ditch should be located at a distance of about 5m from cutting slope or toe of slope of about 2m beyond embankment slope, if there's the quality soil and low cutting slope, the required distance above may not be less than 2m.

② Slope side ditch and intercepting ditch

The slope side ditch should be set at the toe of slope to receive the water runoff from road surface and slope. The ladder-shaped, U-shaped, triangular shaped and rectangle is commonly used as the fracture surface of the side ditch.

Drainage ditch is also known as outlet drain, which is mainly to discharge the water from beyond the side ditch, intercepting ditch, borrow pit or subgrade to marsh land or natural rivers beyond the bridge and culvert, as well as the subgrade. The cross section of the drainage ditch is often in the form of ladder-shaped with groove width and depth of no less than 0.5m, and generally the longitudinal gradient of the drainage

ditch is between 0.3% ~0.8%, and neither over 3%, nor below 0.12%; the drainage ditch should be short as much as possible rather than long, with the length of usually within 500m.

③ Vertical drains (hanging ditch): It's necessary to set the vertical drains (hanging ditch) on the slope with high embankment and deep cutting when the water is discharged collectively down in vertical from the top of slope and slope platform. Hanging ditch refers to rectangular or trapezoidal cross-section groove that is often paved by mortar rubble or composed of concrete structures, there should be energy dissipation measures (i.e. drop well, stilling bank, etc.) set at outlets for such drainage facilities to prevent from erosion of subgrade side ditches because of the too fast water flow.

④ Water fall and chute: For low-level highways in mountain areas, the slope runoff can easily result in erosion of slope vegetation in sections with relatively heavy rain and relatively steep slope gradient, even there are slope protection measures, which will sometimes have inevitable erosion of the slope to result in the slope collapse, leading to soil erosion together with greater impact on the surrounded ecological environment. Chute is a relatively steep artificial flume usually set at inlet and outlet sections of relatively steep slopes and culverts where the erosion is not allowed due to special geological conditions, this is aimed at collectively dissipating energy of water flow, reducing the flow rate of the water flow after it passes through the steep slope. The measures such as increase roughness at the bottom of the chute and others should be considered when designing the chute, thereby dissipating the water flow energy and slowing water flow velocity, or the approaches of a single-stage and multi-stage water fall are taken to dissipate the energy.

2. Underground drainage scheme of road sector

The main sources of ground water: upper layer water retention infiltrated from the ground but has not yet reached lower layer; the regular phreatic water; fissure water flowing along the rock fissures; interlayer fissure water that is stationary in cracks and crushed sedimentary rocks.

The underground drainage facility of the subgrade is to collect water flows mainly through seepage, and discharge them nearby beyond the subgrade scope. For county and township highways, the most commonly used underground drainage facilities are blind ditch, sewer and so on. With the emergence of new materials, the geotextile can be used to discharge the ground water for economic sake.

① Blind ditch: When there's individual springs (with spring jetting forth) on the subgrade, and there's no bypass route, in order to divert the spring to location beyond the toe of slope of fill or side ditch of excavation for discharging, a groove can be excavated between the spring and drainage outlet, a blind ditch or closed pipe should be built. The blind ditch is in height of about 20cm and width of 20~30cm, the depth should ensure that the landfills height of the cover top is ≥50cm, and the longitudinal gradient in bottom of the ditch is suggested to be ≥1%.

② Sewer: The ground water is collected in the ditch in the way of seepage, and water is discharged to the designated location through the passage in bottom of the ditch. Sewer can play the role in dewatering surface soil and increasing slope stability, and it can be used for intercepting and drainage of the ground water, reducing the ground water level to prevent the fine soil particles from washing away. The rock-fill sewer (blind ditch) is commonly used, with its longitudinal of 5%, and the width depends on the depth of the sewer. If the sewer depth was 2m, the appropriate width would be between 0.6~0.8m; if the sewer depth was between 3~4 m, the width would be ≥1 m, and the sand gravel packing in the sewer for drainage and seepage should be screened and cleaned.

③ Horizontal drainage pipe (drain hole): To release the hydrostatic pressure inside the slope and increase the slope stability, the drainage approach of using the horizontal drainage pipe to insert into the water stratum. Generally, a perforated plastic pipes with a diameter of 50mm will be drilled into slope with a slope gradient usually from10% to 15%, and 10mm of the aperture of the perforated drainage pipe, with a vertical spacing of 75mm. The holes are designed in three

rows along the pipe evenly, which are within the range of about 1~10m length near the drainage outlet, and there should be the plastic pipe without holes set within the range of at least 60cm length close to the drainage outlet, voids between drill holes and drainage holes will be clogged with clay.

④ Blind ditch: In order to avoid flow intercepting of ground water due to the construction of subgrade, resulting in differences in ground water level of slopes on both sides of the route, thus there should be horizontal and vertical blind ditches set inside the subgrade to keep seepage field inside the roadbed unchanged. A convert filter can be set on one of positive side when laying the vertical blind ditch, the impermeable layer is set at the other side; both sides of transverse blind ditch should have impermeable layer, thus the ground water can pass through the route without affecting roadbed stability.

3. Transverse drainage route

To segment the river closure of slope water flowing to roadbed and subgrade surface water by using drainage facilities such as side ditch, intercepting ditch and others, that is, to divert the surface water on upside of the road sector (or roadbed) to the natural valley, wasteland, borrow pit or low-lying marsh land of downside of the road sector through across roadbed, if the drainage process was not smooth, it would result in erosion of roadbed toe of the slope and damaged pavement, thus it's essential to set the transverse drainage structure of culvert. The selection and design of the culvert should consider factors such as landfill height of the roof, designed flow, foundation conditions, vehicle load, existing water route of upstream and downstream, road grade, terrain etc.

4. Drainage pass through township road

Reasonable setting of drainage measures for township road can not only minimize rain damage to roadbed and pavement to extending the service life, but also greatly improve traffic capacity of the road. According to the statistics, the existing subgrade drainage facilities for rural highways are mainly soil ditch, masonry rectangular and ladder-shaped ditches, pavement drainage mainly relies on the dispersed discharging approach of crown slope. There are many drainage ways of through township roads, the commonly used approaches are cover plate ditch and low wall ditch etc.

①Approach of cover plate ditch: This approach is to add the cover plate to side ditches on both sides of highways through township to prevent from clogged ditches and pedestrian-friendly. If necessary, the concentrated drainage of drain opening can be adopted for the discharge of pavement water, and there maybe the slots designed on the cover plate for the drainage. Generally, the top of the cover plate with slot should be level with pavement, the rainwater flows to cover plate along the crown and then flows into side ditches through slot on the cover plate; the cover plate without slot is usually combined with curb settings, there's drain openings at every 20m on curb side, the pavement water flows into the side ditch along drain opening. The side ditch is usually made of mortar rubble or brick masonry structure. Generally, such approach is suitable for roads through town with small traffic volume or relatively little transverse interference.

②Approach of low wall ditch: this approach adopts the combined form of low wall with side ditches, the side ditch is for drainage, and the low walls play a role in isolation, and there are the openings with a certain spacing in the low wall according to needs, the cover plate is added to the side ditch for pedestrians, which is one of the effective measures to governance the main highways through township with relatively large traffic volume. Low wall, side ditch and other masonry are commonly made by using mortar rubble or masonry, and plaster with mortar, there's red and white "<<" symbol painted on one side of the low wall to indicate the vehicle direction. Furthermore, in addition to the use of the low wall, the separating forms of hedges or metal fence and others can be served as the isolations. Because there's no cover plate added to the side ditches, it's essential to strengthen conservation, clean the debris and garbage of the ditched to ensure smooth drainage.

5. Inspection of drain cleaning and maintenance

Whether the drainage system of the subgrade is running properly will directly affect the roadbed stability. Therefore, the strengthening of routine maintenance and repair of various drainage facilities is the key to ensure the roadbed stability.

Before the spring thaw, especially prior to the flood season, during the rainy season, it's essential to fully dredge the side ditches, intercepting ditches and blind ditches and other drainage facilities to maintain smooth water flow and prevent rainwater from washing out the embankment collectively. The focus examination should be required for all above aspects after the rainstorm, the timely repair and reinforcement must be required if there's any erosion or damage, make sure to dredge immediately in case of any blockage.

For the soil side ditches, the designed section should always be retained to in order to meet drainage requirements, it's essential to focus on the outfall settings for smooth drainage. There should be longitudinal gradient of no less than 0.5% maintained at the bottom of ditch, while the longitudinal gradient should be no less than 0.3% for roads with drainage difficulty in the plains. No crops are allowed to grow in the side ditch, and the side ditch can't even be used as the drainage and irrigation channels.

2.8 Environmental Code of Practices for bridge construction

2.8.1 Characteristics and disease causes of rural highways

2.8.1.1 Bridge characteristics of rural highways

(1) The rural highway bridges should be with mainly small and medium span: almost half of all rural highway bridges are mainly the bridges with the span between 5~10m, and about 10% of highway bridges have span over 20 m.

(2) The rural highway bridges are made of concrete-based materials, there will be a large number of stone bridges located in those areas with abundant stones, there are a small number of brick arch bridges and wooden bridges in some regions.

(3) The bridge type is mainly focused on slab and beam bridges, as well as arch bridge, of which, the beam bridge has taken up the most number.

(4) There is mainly the mixed traffic on those bridges, and the corresponding load distribution is more chaos.

(5) Most of bridges are located near the residential areas, which are obviously subject to human impact.

2.8.1.2 Diseases survey and cause analysis of rural highway bridges

(1) Design factor

① The designed load of the bridge is a bit lower. There are various and complex transports in rural areas, however, there has been so far no design specifications or guidelines specifically for rural bridges, which have been designed mainly by taking reference of highway or urban bridge designs, a considerable part of rural bridges have even built by local residents alone with their own experiences, in this case, it's really difficult for the built bridges to meet requirements of actual load.

②The bridge structure is irrational. The option of bridge design scheme is determined by many factors such as the local hydrogeological conditions, construction techniques and methods, economic indicators, and application requirements etc. If the structural selection or layout of the bridge design is irrational, such as the form of the bridge structure, component construction approaches, the form of bridge cross-section, as well as the partition of the bridge span and processing of bridge pier height, etc., all these will make bridges occur various defects during the operation.

③Calculation error of the bridge. The calculation of bridge design may bring to the bridge inherent problems due to calculation errors and other reasons

④ The imperfect construction plans. Generally, only the design of integral structures has been concerned for bridges with small and medium span, which is without the consideration of detailed design of some local structures, such as insufficient thickness of web plate; fewer structural steels, reducing the structural capacity for resistance to a variety of non-load factors; local pressure-bearing capacity is not enough, no full consideration of the impact on secondary stress such as drying shrinkage, temperature stress and others; smaller thickness of structural protective layer, all aspects above will result in poor structural durability and showing signs of diseases earlier.

⑤The imperfect design theory. At present, rural highway bridges do not have suitable designs and construction standards of their own, resulting in no

evidence that can be taken as reference directly when designing the bridge scheme, the design is often conducted by drawing on bridges with the same span among the highway bridges or urban bridges, which will fail reflecting some specific issues directly.

(2) Factor of construction quality

Construction is the implementation process of the design, and the construction will confirm whether the design is correct and perfect. Meanwhile, the construction quality will also affect the overall performance of the bridge. In bridge construction, although the design is correct, the improper construction methods, not strict in quality control of construction, some non-predictable disasters occur during the construction, such as floods, earthquakes and others, which will often result in reduced load capacity of the bridge, thus make the design fail achieving the desired purpose. Due to construction reasons, the load capacity of the bridge will be insufficient in future. The material quality of concrete, steel, gravel and others used for the construction does not meet the required specifications is the internal reason for structures to cause various quality defects. As there are many jobs and processes in bridge construction, combined with site operation, each construction worker should be responsible for a wide range of construction tasks, there will be mistaken made due to even a bit neglect, which may result in structural defects accordingly.

(3) Conservation issue

①The shortage of maintenance machinery and maintenance technicians, which are difficult to be stable. Since rural roads are conserved by local traffic department, there's no fund to buy the maintenance machinery due to local financial difficulties, resulting in low conservation and mechanization level, and the maintenance personnel are drawn from the villages annually, few of them are professional staff, which can't meet the demands of rural road maintenance. The conservation team is rather unstable as the corresponding payment is too low, which makes it difficult to employ enough maintenance workers, resulting in the widespread problems of damaged pavement, subgrade settlement and others in rural roads, affecting the service level of rural roads.

②There's shortage of appropriate management for overloaded vehicles. The bridge management not only refers to the management of bridge structure itself, but also refers to the management of various vehicles passing through the bridge. The design standards of rural highway bridge have been lower than the normal ones, and however, those bridges will inevitable encounter the overloaded vehicles passing through in the actual operation. On the one hand, the overloaded bridge may cause fatigue issues, on the other hand, the internal bridge damage can't restore due to overloading, making service state of the bridge under normal loading conditions to be changed, which could thus endanger the safety and durability of the bridge.

③There's no relevant or incomplete technical information on rural bridges, which can't offer support for the conservation and management of rural bridges, each bridge should have a relatively complete archives to make decisions and schemes during the maintenance.

④ There's no technical standard suitable for rural highway bridge maintenance, the conservation work is done in chaos, and the conservation technology is weak.

2.8.2 Analysis of impact of bridge construction on environment

(1) The damage to ground surface causes soil erosion. It's inevitable to excavate the ground during bridge construction, thereby damaging the ground surface and the vegetation, resulting in bare earth and rocks, which is most likely to cause the soil erosion, if no appropriate measures were taken to control such situation, the soil is easily to be washed away into the river.

(2) Air pollution. The places for storing lime or sand and gravel, as well as the concrete mixing plant will produce a lot of dust, building materials are also prone to produce dust during transport and so on, if there were no corresponding protecting measures, the dust would have a certain impact on the ambient air.

(3) Water pollution. Currently, the mechanical operation approach of bored piles is commonly used in the construction of the pier structure of down part of the bridge. At the early stage of construction, due to the cofferdam or artificial island, the river bottom around the operation site will partially affected, resulting in the increase

of the sediment and other suspended solids in local water area; in addition, the drilling construction of the pier will produce a certain amount of drilling slag, which would result in blockage and deterioration of the downstream water quality if discharged indiscriminately, thereby polluting a certain range of waters at certain time; during the construction of the upper part structure of the bridge, it's inevitable for some construction debris and dust to fall into the water, thereby affecting the water quality accordingly; the run, dank, drip and leak of the oily wastewater produced during the repair, maintenance as well as operation of construction machinery, and wastewater from the bridge construction campsite, domestic sewage, wash water of the concrete mixing equipment and others enter into the rivers to affect water quality.

(4) Noise pollution. Noise from construction machinery, especially when there's bridge piling, will have a large impact on the acoustic environment.

(5) Solid waste. The impact of drilling slag, clay, sand, stone and other wastes, cluttered garbage on the environment.

2.8.3 Environmental Code of Practices for bridge construction

2.8.3.1 Environmental Code of Practices for the design phase

(1) According to actual situation of rural roads and bridges, the design methods of preventing issues can be proposed through investigation and analysis of bridge corrosion, bearings, expansion joints, bridge deck pavement as well as other problems, combined with experimental research on related engineering to completely solve the issues of concrete bridges.

(2) The design should adhere to the concept of security and smooth, including construction security, material security, geological safety, site selection safety, design safety, quality safety, functional safety and safe of use etc.

(3) The design of loading and bridge width should take full account of local rural development situation and improve the traffic capacity and use requirements of the bridge with the moderate advanced principle.

(4) The selection of bridge location should take full account of mountain forms, topographic feature, the flow patterns and features of river bed and canals, together with the consideration of the transfer law of causeway of highway roadbed and bridge mechanical behavior characteristics, security risks of poor geology and so on.

(5) Determine bridge type scientifically, and take priority to adopt the bridge structure form with mature technology, widely used and is easy for conservation.

2.8.3.2 Environmental Code of Practices for construction phase

(1) Management measures

①Establish environmental supervisory organization. The construction unit should take initiative to cooperate with environmental protection administrative department for the establishment of the environmental protection management office, which is responsible for the inspection and supervision of environmental protection measures and the corresponding implementation of construction unit at the construction phase.

②Conduct environmental monitoring during construction. In construction, it's the responsibility of the environmental protection administrative department to conduct the real-time monitoring of deforestation, soil erosion, noise pollution, air pollution, water pollution, landscape destruction as well as other problems during construction, and notify the construction unit to take promptly rectification in case of any excessive situation or not environmentally friendly behaviors.

③Take the role of supervision as a supervising engineer. The supervising engineer should check whether the design of the environmental protection engineering is implemented, whether the quality meets the requirements and so on; check whether the funds of environmental protection engineering are properly used, and cooperate with environmental protection administrative department to do environmental testing and monitoring during construction.

(2) Measures of reducing soil erosion

① Design the slope gradient in a reasonable way according to the actual soil excavation and filling, and a reasonable design of temporary drainage system for the earthwork excavating and filling construction site, drainage the rainwater flow timely

to reduce the rainwater erosion towards excavation and fill slopes. Besides, the fill slope should be compacted timely, together with the conduction of slope greening, the location of borrow earth and spoil should be determined reasonably, rational mining of sand and gravel quarry, make sure the dressed stone, spoil and sediment should be processed separately.

②When choosing the location for storing the earthwork, the excess earthwork should be used for finishing slope in place as much as possible, when there's too much earthwork left that should be delivered away, and then it should be transported to the specified place without any nature conservation value, the spoil should not destroy or bury the ground plants.

(3) Measures of air pollution control

①The garbage on construction site should be removed timely, random garbage throwing is forbidden, watering the construction site appropriately to reduce dust. The pavement of temporary construction road can be covered with cinder, broken masonry or concrete to reduce road dust, meanwhile, the pavement damaged by construction should be repaired at any time to prevent potential dust.

②Regular watering of the construction site is required to shorten the time and range of dust pollution, minimizing the amount of dusting.

③It's the construction workers that are most seriously affected by the pollution of ambient air in construction process, and the construction units should focus on protection measures and labor protection of the construction workers, such as shorten working hours and give out the dust masks etc.

(4) Measures of water pollution control

① Where the stirring operation of concrete, mortar and others is required, there must be sedimentation basin. The discharged wastewater can be recycled for watering to reduce the dust after it has been settled twice in the sediment basin, while the unprocessed slime water is strictly prohibited from discharging into rivers and sewers.

②When removing the topsoil of silt on the roadbed, the topsoil should be recycled on to the road for processing or piling up by delivering to the designated location; the spoil and discarded stones should be delivered to appropriate places, which should not be stacked randomly or even become blockage of the river; for bridge cofferdam construction, the cofferdam soil should be thoroughly cleared and delivered to other places rather than block the rivers.

③When the sewage from the temporary canteen of the construction site is discharged, a simple and effective separation tank is required, and the sewage discharged through the sewer should pass the separation tank, which should usually be with strengthening management, regular oil cutting to prevent contamination.

④The construction of fundamental bridge pile engineering should be done in the dry season as much as possible, and try to avoid the construction of the bridge pile and culvert pile foundation during flood season.

(5) Measure of prevention and control of noise pollution

①The construction unit must use construction equipment and transport vehicles comply with the relevant national standards, construction machinery and operating process with low-noise are preferred, and damping frame should be installed in fixed mechanical equipment with relatively large vibration, the noise cover (i.e. generator car etc.) should be considered installing in the place with fixed strong noise source, meanwhile, it's essential to strengthen maintenance of various construction equipment, and maintain their good functioning, reducing the strong noise source fundamentally.

②The construction machinery with large noise should top working at night period (22:00 ~06:00). For the construction site that needs continuous construction work, the construction unit should contact with the local environmental protection department depends on specific condition, so as to apply for night construction permits according to relevant provisions, while releasing the announcement for obtaining the maximum public support. When there are acres of residents living 50m within the perimeter, the transport of construction materials on the sidewalk should be prohibited at night time.

③The finished, semi-finished products with strong noise and producing operations should be completed in plant and workshop to reduce the noise from the construction site due to the operations.

④Strengthen the management of the construction site, in particular, the noise caused by human beat, shouting and others is forbidden to minimize noise disturbance to the residents.

⑤ To protect the health of the construction workers, the construction units should make reasonable arrangements staff operate construction machinery with high radiation and strong noise in turns, reducing the time of exposure to environment with strong noise. For construction workers close to places with high radiation and strong noise, their working hours should be shortened appropriately in addition to the labor protection measures such as put on the earplugs and helmets etc.

⑥ The project developer should instruct the construction unit to mark posted notice and complaint calls at the construction site, and the project developer should contact with the local environmental protection department promptly after receiving any case report, thus to handle various environmental disputes timely.

2.8.3.3 Environmental Code of Practices for bridge maintenance

(1) Clear the main responsibilities and strengthen corresponding responsibilities of the regulatory body.

The maintenance management of highway bridges should implement management system of "unified leadership and decentralized management", according to the principle of "consistent powers and clear responsibilities", powers and responsibilities are divided based on regulatory units and maintenance units to clear administrative leadership in charge and specific technical staff, specifically determine their duties as follows:

① City/County Transportation Authority is the regulatory body of all bridges within the jurisdiction and the maintenance authority of bridges at county roads and important rural lanes. It should be responsible for raising funds of

bridge maintenance, supervise the highway conservation management station of countryside (township) to maintain and manage bridges in towns and villages, offering technical guidance; responsible for reviewing and assessing the bridges with four or five technological conditions as required, developing engineering technical solutions and countermeasures for extensive repair, medium repair and reconstruction of seriously damaged bridges.

② The countryside (township) highway conservation management station is responsible for regulation and maintenance of bridges at countryside and rural areas of the respective jurisdiction. It should be responsible for daily minor repairs, maintenance and disaster rescues of bridges at countryside and rural areas of the respective jurisdiction, carrying out regular and periodic inspections of bridges, promptly reporting damage extent of bridges within jurisdictions due to natural disasters and other factors, submitting application report for bridges need special inspections, and double post responsibility system of "administrative responsible person, technical responsible person" should be established timely for bridges that have already been determined to be seriously damaged, and make a notice board at the site of the bridge for those persons who should be responsible for the damaged bridge.

③ It is the corresponding regulation and maintenance unit that should bear the primary responsibility for highway bridge accidents due to their neglect of maintenance and management, the unit has not known precise information of the technical condition of the bridge according to the relevant provisions, or failed taking appropriate measures in a timely manner.

(2) Strengthen bridge inspection, timely conduct regulation and maintenance to ensure bridge security

① Frequent inspection refers to daily walk-around inspection of the technical condition of bridge floor facility, the superstructure and substructure, and subsidiary structures. The inspection is conducted in visual combined with simple tools, and the corresponding inspection cycle should not be less than once each month, and the inspection frequency should be increased in flood periods.

②Regular inspection refers to conduct the regular checking and comprehensive inspection of the technical condition of the main structure of the bridge and its subsidiary structure, and evaluate technical condition rating of bridge in accordance with the provided cycle. The inspection is conducted mainly in visual combined with instrument, and the corresponding inspection cycle should usually not be less than once every three years, the inspection frequency should be once each year for bridges with special structure.

③Special inspection refers to evaluate the technical condition of the bridge in certain circumstances, in order to identify causes of problems, the extent of damage, loading capacity or anti-disaster ability of the bridge etc. The inspection is conducted mainly by using the instrument to give a scientific and clear judgment of damaged condition, causes of problems, loading capacity or anti-disaster ability of the bridge through the methods of detection or test, combined with the theoretical analysis. And put forward the recommendations and measures for specific maintenance based on test results.

According to test results, strengthen the minor repairs and maintenance for bridges with first and second class of technical conditions to prevent significant bridge issues. For bridges with third class of technical conditions, timely medium repair is required to prevent the accelerated development of bridge issues from affecting bridge safety. For bridges with fourth and fifth class of technical conditions, the relevant provisions of safety management should be developed based on specific test results and technical feasibility analysis of the bridge, determine the form, quantity of warning sign, and management measures shall be taken, to arrange extensive repair or reconstruction.

(3) Strengthen supervision to remove hidden dangers timely

① As the regulatory body of the highway bridges within the jurisdiction, the City/County Transportation Authority should conduct the supervision and inspection of conservation management of highway bridges within the jurisdiction based on the provisions of relevant laws and regulations. Countryside (township) road conservation management station should consciously accept supervision and inspection conducted

by County Transportation Authority according to law, rather than excuse or refuse with any excuses.

②During supervision and inspection of highway bridge conservation management condition conducted by City/County Transportation Authority, the Authority should go to the work site of highway bridge conservation management and confirm the practical implementation of conservation plans and conservation project management situation, take necessary means of technical detection to evaluate the bridge condition and remove hidden dangers timely. For problems identified, the Authority should instruct relevant units to make correction immediately. After completing supervision and inspection, there should be a written comments feedback to the relevant units.

2.9 Environmental Code of Practices for pipe culvert

2.9.1 Classification and applicable conditions of pipe culvert

(1) Based on building materials, the culvert can be divided into stone culvert, concrete culvert, steel concrete culvert, corrugated steel pipe culvert and so on.

(2) Based on structural form, the culvert can be divided into pipe culvert, slab culvert, arch culvert and box culvert etc.

(3) Based on landfill height, the culvert can be divided into open culvert, buried culvert. The open culvert refers to the culvert with roof landfill height of less than 0.5m, and the buried culvert refers to the culvert with roof landfill height of over or equal to 0.5m.

(4) Based on hydraulic properties, the culvert can be divided into three kinds of inlet un-submerged culvert, inlet submerged culvert and outlet submerged culvert.

The steel concrete pipe culvert has a better adaptability and mechanical performance towards the foundation, it is with simple structure. Generally, it’s better to use the steel concrete pipe culvert with single hole, while the multi-hole steel concrete pipe culvert should be with no more than three holes. Such kind of culvert applies to buried culvert with small span, which is located in the areas lack of building stones but with adequate landfill height; the steel concrete slab culvert applies to the open culvert or buried culvert at the areas with no building stones and large discharge area; arch culvert applies to areas across trench or with high embankment; the steel concrete box

culvert applies to roadbed with soft soil; stone slab culvert applies to the small culvert with abundant building stones but relatively small discharge water; inverted siphon pipe culvert applies to the irrigation canal when the cutting excavation height can't meet clearance requirement of set aqueduct, but it is not applicable for flood drainage ditches; the corrugated steel pipe culvert applies to the subgrade with relatively low bearing capacity of foundation, or the subgrade with a relatively large settlement and deformation.

2.9.2 Impact analysis of pipe culvert on environment

(1) The culvert with irrational design can't meet requirements of discharge water capacity and others, thereby resulting in water overflowing the highway, pavement damage, roadbed destruction, etc.

(2) The impact of construction machinery noise, dust, sewage and wastewater, earthwork, ground excavation and others on the environment.

(3) Ineffective or neglected culvert conservation, resulting in clogged culvert, losing its function of discharging water, causing roadbed erosion, water overflowing the highway, damaged pavement due to long term of immersion and others.

2.9.3 Environmental Code of Practices for pipe and culvert

2.9.3.1 Environmental Code of Practices for pipe and culvert during design stage

(1) Culvert laid principle

① The culvert should be laid in a reasonable and economic manner according to the topography, geology, hydrology and other conditions along the line, combined with the drainage system of the line, which should applicable for agricultural irrigation.

② The culvert should be set in areas across the groove, through agricultural discharge and irrigation canals, plain route through a relative long low-lying marsh land or morass land, hillside line or the line along the creek that is easy for collective runoff when encountering storm, and the need for side ditch to discharge water. The ditches can be merged to set culvert through technical,

economic comparisons when there's suitable topography.

③ The layout of culvert location and orientation should be consistent with the direction of flow, avoid the rise of upstream water level due to improperly laid culverts, which will result in the flooded farmland, villages and roadbed, causing too large current velocity in downstream, accelerating the erosion of ditch bank and roadbed.

④ The setting of culvert should take integral consideration of the construction, conservation and repair requirements, reducing construction and conservation costs

⑤ The layout density of the culvert along the line should be determined by depending on the natural conditions such as topography, topographic feature, hydrology, agricultural irrigation and others, while considering convenient compacted construction of the roadbed, the culvert spacing should not be less than 50m.

⑥ Generally, there should be one culvert per ditch in mountain areas. In areas with heavy rainfall volume or focused storm, and hillside with very sparse vegetation, the ditches are not suitable for being merged to set culverts. The ditches can be merged to set culverts through the technical and economic comparisons only in the condition that there's small catchment area, close spacing between two ditches, which are feasible for thorough cut, however, it should be noted to establish the necessary protective works.

⑦ The culvert should be set to be in line with the flow direction, and the forced orthogonal is not allowed to cut short the culvert length. When the current velocity or flow volume of the culvert is relatively large, or the transverse slope on both sides of narrow and deep ditches are relatively large, the flow direction of the ditch is not perpendicular to the line, it's better to lay the culvert in oblique crossing with the inclination of no more than 45° .

⑧ The culvert should be laid at the outlet of drainage ditches, in order to avoid the erosion of pavement due to the excess distance for water flowing along the side ditch.

⑨ The culvert should be laid at the place next to the curve, where the route angle is greater than 90° , with relatively small curve radius, the longitudinal slope prior to the curve is greater than 4%, and the slope length is within 200m, there's no other culvert.

⑩ The culvert should be laid next to grade change point, where the transition of route is from steep slope (≥5%) to the mild slope (≤3%), and there's no other culvert within this 200m range.

⑪ The layout of the culvert along the river line should consider the direction of flow of upstream opening, and downstream opening should not endanger the farmland and villages.

(2) Technical specifications of culvert design

①The flood frequency, vehicle load grade of highway culvert design with different levels, and the design safety class, all should comply with the relevant requirements, see Table 2.9-1 for details.

Table 2.9-1 Flood frequency, vehicle load of culvert design and design safety class

Road Rating	**Expressway**	**Class I Highway**	**Class II Highway**	**Class III Highway**	**Class IV Highway**
Flood frequency	1/100	1/100	1/50	1/25	Not Specified
Vehicle Load Class	Highway-Class I	Highway-Class I	Highway-Class II	Highway-Class II	Highway-Class II
Design Safety Level	Level 3				

②The inlet un-submerged culvert should be adopted for new culvert, and the outlet submerged culvert or inlet submerged culvert can be adopted when there's ponding allowed prior to the culvert.

③The culvert aperture should be determined through checking calculation based on design flood flow, river section form, geology, and the reinforcement form of inlet and outlet ditch bed as well as other conditions.

④The new culvert should take standard span of 0.75m, 1.0m, 1.25m, 2.0m, 2.5m, 3.0m, 4.0m, 5.0m, of which, 0.75m aperture only applies to irrigation canal in areas without any silting. The span of flood drainage culvert should be no less than 1.0m.

⑤The inner diameter or vertical clearance of the culvert should be no less than 0.75m; when the culvert length is greater than 15m but less than 30m, its inner diameter or vertical clearance should be no less than 1.0m; when the culvert length is greater than 30m but less than 60m, its inner diameter or vertical clearance should be no less than 1.25m; when culvert length is greater than 60m, its inner diameter or vertical clearance should be no less than 1.5m.

⑥The pipe culvert with small aperture and inverted siphon pipe culvert can't be used in frozen areas. When the pipe culvert with small aperture must be used for agricultural irrigation in frozen areas, the water inside the pipe should be discharged before the freezing period, and seal the inlet and outlet on both ends.

⑦The vertical clearance from top to the highest water surface inside the inlet un-submerged culvert shall comply with the provisions of Table 2.9-2. The water depth prior to the culvert should be less than or equal to 1.15 times of the vertical clearance of the culvert, the impact of ponding prior to the culvert on design flow can be neglected.

Table 2.9-2 Vertical clearance of inlet un-submerged culvert

Culvert Type / Vertical Clearance	Pipe Culvert	Arch Culvert	Rectangular Culvert

of Culvert Inlet			
≤3	≥h_d/4	≥h_d/4	≥h_d/6
＞3	≥0.75	≥0.75	≥0.5

⑧The checking calculation of inlet un-submerged culvert can be conducted through checking calculation of current velocity, water depth inside the culvert and the rise of water level prior to the culvert after proposing initial aperture according to the form of ditch section.

⑨The culvert should be laid at the location along the line based on linear layout requirement, when it is not limited by linear layout, it's better to lay the culvert on river (ditch) section where there's favorable terrain, good geological condition, relative high foundation bearing capacity, stable river bed.

10. There should be end wall set at inlet and outlet of the culvert. The end wall should be separated from the culvert body with a void, and the void should be filled with impermeable materials.

11. The culvert body and ditch bed within certain range of inlet and outlet of the culvert, subgrade slope and cone filling, all should be paved for reinforcement, the plane form paved at inlet and outlet should be determined based on ditch type, for ditch without any significant grooves, it's better to use isosceles trapezoid as outlet plane, the corresponding paved corner should be taken as 20, and the paving material should be determined by the maximum current velocity on pavements, the paving end must be with cut-off wall.

When the ditch bed is covered by rock or large stone that is not to be washed out by floods and boulders, there's no need to pave the ditch bed.

For ditches with steep longitudinal slopes and large current velocity, the chute, drop and other appropriate energy dissipation measures need to be taken when necessary, and there should be the should cut-off wall set at the bottom of the outer end wall. It's better to set cut-off wall at the end of paved ditch bed.

12 For the base culvert with the foundation, the culvert should be designed as integral style or non-integral style according to culvert structure, geological condition and processing of foundation.

13 For pipe culvert and other culverts with closed section, when the foundation is in accordance with provisions of Table 2.9-3, and the soil quality is evenly with little subsidence, then the non-base culvert is applicable. However, there should be foundation set at the inlet and outlet of the culvert with the consideration of the corresponding impermeable effect, in order to prevent the occurrence of uneven settlement between pipe sections and joint leak.

Table 2.9-3 Processing form for the pipe section bottom of non-base culvert

Name of base bottom soil	**Form**	**Bed course thickness or thickness of compacted layer (m)**
Rock	Bed course paved by concrete	----
	Bed course with sand	No less than 0.4m
Gravelly soil, land pebble	The void is filled with sand while being compacted	No less than 0.4m
Gravelly sand, coarse sand, medium sand and fine sand	Surface compaction	No less than 0.4m

14 There should be the end wall and wing wall set at the inlet and outlet of the culvert, the corresponding style and size should make the culvert have appropriate water discharge capacity and ensure the stability of the embankment at the culvert.

15 The culvert foundation should include calculation of construction settlement, which should not exceed 100mm. When the construction settlement of the culvert does not meet above requirement, the corresponding foundation should be processed.

2.9.3.2 Environmental Code of Practices for construction period

(1) General provisions

①The assessment is conducted by considering each culvert as a sub-project. The construction quality of various parts and working procedures during the construction should be strictly controlled.

②The landfill requirement on the culvert is the same to that of the roadbed.

③For channels with span or full-length meet culvert standards, quality assessment should be conducted by taking reference to the standards of this chapter.。

④For culvert with chute, assess the culvert and chute respectively, and then take the average value.

⑤The quality assessment of prefabricated concrete members (such as pipe section, slab, etc.), culvert pile foundation and steel bar of the box culvert should be conducted in accordance with the relevant standards.

⑥Strictly control the construction time, when there are residents living near the construction site, the construction work is strictly prohibited between daytime 12:00 ~14:00 and nighttime 22:00~6:00

⑦Watering operation is required at construction site to prevent dust pollution.

⑧The sedimentation basin should be set at construction site, so that the produced wastewater can be reused after sedimentation rather than be discharged.

⑨The produced earthwork should be excavated and shifted for filling as much as possible, and the excess earthwork should be transported to a designated place for storage, the indiscriminate disposal is strictly prohibited.

⑩ The topsoil excavated from ground should be stockpiled, measures should be taken to retain the topsoil, and the topsoil should be backfilled after completing the construction for vegetation restoration.

(2) Implementing regulations for pipe culvert

①The quality of finished product of outsourced steel concrete pipe must meet the design requirements provided in construction specifications, it can't be installed until after the inspection of the construction site. The prefabricated pipe section can't be installed until it is assessed to be qualified according to the relevant standards.

②The void width of the pipe section and filling materials should be handled in strict accordance with the design and specification requirements.

④ The foundation bearing capacity must meet the design requirements.

(3) Slab culvert and box culvert

①The prefabricated slab must be assessed to be qualified according to relevant standards before installation. The concrete quality of box culvert must meet the design requirements provided in the specifications.

②The construction of settlement joint, waterproof layer and back-wall refill must be conducted according to construction specifications and design requirements.

③The culvert foundation bearing capacity must meet design requirements.

④When building the channel, the corresponding vertical clearance must meet the design requirements.

(3) Arch culvert

①Arch ring masonry or cast should comply with specification requirements.

② When the arch ring reach the strength of the design requirements, the arch ring can be dismantled and refilled the soil. When the arch ring cracks, the causes must be identified and handled accordingly.

③ The construction of settlement joint, waterproof layer and back-wall refill must be conducted according to construction specifications and design requirements.

④ The culvert foundation bearing capacity must meet the design requirements.

(4) Inverted siphon pipe

① The pipe section joints, inlet and outlet seams must be waterproofed to ensure watertight. Water filling test should be done before landfilling, and the landfill can't be done until the test meet the requirements.

②The pipe section quality must comply with construction specifications and design requirements. The prefabricated pipe section can't be installed until assessed to be qualified according to section 6.13.

③The foundation bearing capacity must meet the design requirements.

(5) Bridge and culvert constructed through jack-in method

① The base should be compact with sufficient bearing capacity.

② The operation with water is strictly prohibited.

③ The abutment wall of work pit must be perpendicular to the axis of bridge and culvert, and it has sufficient strength to withstand the jacking force.

④Joints between sections should be waterproofed according to the design requirements.

2.9.3.3 Environmental Code of Practices for conservation and management of pipe culvert

(1) Timely repair is required if there's any damage, deformation or subsidence for paving layers of culvert bottom and opening, upstream and downstream trenches should be repaired to ensure relatively smooth and proper flow gradient.

(2) If there were any cracks on drop water at culvert opening and culvert outlet, and junction of rapids slope, those cracks can be in-filled by using dry oakum with soaked pitch, thus the cracks can be tightly combined with the culvert opening into an integral.

(3) The inverted siphon pipe easily broken and leaking should be examined carefully in particular. If there's any damp patch, the siphon pipe should stop serving promptly, and it should be excavated for repair, for example, replacement of softening roadbed landfill and burst pipe section, anyway, the joints should be tightly filled.

(4) When joints of pipe culvert and seams of hinge points of four hinged culvert breaking off, mortar plastering approach can't be used for corresponding repairs, the dry oakum with soaked pitch can be used to infill.

(5) If there's any leak on roof of masonry arch culvert, it's needed excavating for landfills, the high-strength grade of cement mortar is the proper backfill soil, and then covered with 10~15cm waterproof layer of sealant or linoleum, the entire construction process should be careful to prevent another leaking.

2.10 Environmental Code of Practices for erosion control

The soil erosion in highway construction projects should implement the principle of "The water conservation engineering should be combined with the highway main project, main projects and auxiliary project, temporary works are treated in the same way by focusing on prevention, comprehensive control, seeking both temporary and permanent solutions, combining prevention with control". Meanwhile, the soil and water conservation facilities should be reasonably laid according to local conditions, results-oriented, highlighting water conservation during construction period, attaching importance to greening and reclamation of borrow pit and spoil ground of the road engineering, and the spoil ground should be retained prior to be abandoned.

2.11.1 Layout of soil and water conservation measures and construction schedule

(1) Layout of prevention and control measures: potential soil erosion produced from the project construction mainly occurs in the roadbed area and area of spoil ground, of which, the roadbed construction area takes the longest construction time, the focus of prevention should be slope control and layout of drainage works; the prevention focus of area of the spoil ground should be temporary retaining, drainage facilities and vegetation restoration measures.

(2) Construction schedule: the potential soil erosion produced from the project construction mainly occurs in the project construction period, the main erosion type is water erosion, the prevention is focused on dredging rainwater, while the main project design has a more comprehensive rainwater system, advanced implementation should be taken for some rainwater system, in order to be connected to natural drainage ditch and original drainage facilities to take an early play of its soil and water conservation

function.

2.11.2 Prevention district for main project

The potential soil erosion occurs mainly during the stage from subgrade filling to complete pavement construction. There's a large number of earthworks need to be removed during the filling operation of the subgrade, the loose earthwork is easily to slip; in the late stage of the construction, with the compacted rolling of the pavement, runoff yield increases, pavement runoff will cause erosion of the roadbed slope. Type of soil erosion is mainly the gulley erosion, which is accompanied by a large amount of surface erosion and raindrop splash erosion. Therefore, the control focus of soil erosion in this area is on drainage on both sides of the roadbed, slope protection and temporary protective measures during construction.

(1) Construction requirements:

① The subgrade side ditch should be filled prior to the roadbed, thus to reduce the impact of the subgrade filling on both sides;

② The slope protection work should be done in a timely manner after forming the roadbed;

③ Dredge drainage ditch and sedimentation basin regularly during the rainy season, the silt soil should be tiled to fill slope and compacted;

④ For the roadbed occupancy of irrigation ditch, the ditch should be diverted, and dredged timely to avoid affecting the normal agricultural production.

(2) Prevention measures:

① Topsoil stripping and protection

Topsoil stacking principle: The topsoil should not be stacked on the ground for runoff gathering; never stacked in sensitive roads and rivers near the project; never stacked in areas affecting construction or road smooth; try to stack in idle land with low-lying terrain, thus to reduce engineering amount of the protective measures. The temporary stacking of topsoil refers to the arable topsoil and others stripped prior to the subgrade filling, it is used for the backfill of the slope greening in later periods. The topsoil is temporary stacked within the range of land requisition on both sides of the roadbed. In

order to avoid earthwork slipping, and there should be temporary woven soil bags set around the stacked soil.

② Shoulder water retaining ridge and temporary chute

There should be soil ridge set after the formation of roadbed filling at the shoulder and there should be a chute set on the slope, the pavement runoff is leading-in the chute, thereby avoiding the erosion of the runoff to the side slope. The soil ridge may be superfluous soil of the shoulder during roadbed filling that is compacted as a shape with width of 0.2m and height of 0.1m; the chutes are set at locations with the spacing of 100m, and the chute is in disc shape, with its width of 0.3m and depth of 0.15m, the mortar is applied to the inlet in the range of 1m for facing protection, with its thickness of 0.05m, and 2% gradient. For facing protection mode of the chute, there's the mortar plastering (3cm thickness), and the color strip cloth or woven bag of soil can be used for facing protection. After investigation, the mortar plastering has the features of simple construction, durable and easy removal and so on; although the color strip cloth is cost reduction for investment, it's not easy to paste on the ditch, thus the protective effect is unstable, requiring maintenance; the construction of the woven bag soil is relatively difficult and the woven bag is easily weathered, losing impermeable effect. Therefore, the type of mortar plastering chute is recommended.

③ Silt precipitation measures: The sedimentation basin should be set at outlet of roadbed drainage.

2.11.3 Prevention district of concrete mixing plant

(1) Construction requirements

① The layout of the concrete mixing station must be based on the principle of "reducing layout point for focus building" to minimize temporary land area as much as possible;

②The site for the concrete mixing station should choose the land with relatively high-lying terrain to avoid runoff erosion from the periphery;

③ The floor of the concrete mixing plant should use the hardening of cement;

④ The necessary anti-dust and dust reducing measures of concrete mixing plant should be taken, such as increase the anti-dust equipment such as cement tank;

⑤Watering the concrete mixing station regularly on sunny (dry weather) day for reducing the dust;

⑥It's necessary to dredge the sedimentation basin timely, the silt soil should not be stacked around the sedimentation basin randomly.

(2) Prevention measures

The control of concrete mixing station is to focus on surface water inside the site. Due to the busy traffic and the stacking needs, it's recommended that the whole site should be covered with the hardened cement. There is large stockpiling of sand and gravel materials in the field, and the surface water is with large amount of the sediment, in addition, there's much cement in wastewater from cleaning the cement tankers and mixing equipment, which will pollute the water body if discharged directly. Therefore, it's intended to set a sedimentation basin in each concrete mixing station, the surface water in the field is not applicable for comprehensive utilization until through the sedimentation in sedimentation .

The land remediation will be conducted in late period of the project, and the main task is to dismantle construction facilities, and clear up the thrown stones, sand cleaning and other construction materials in the process of concrete mixing, meanwhile, conduct greening and reclamation of the corresponding land in order to restore the original condition as much as possible.

2.11.4 Prevention district of construction shortcut

The construction shortcut of the project is the transport channel for delivering the building materials and spoil (slag), if it is really necessary to build new construction shortcut, the preferred land use type should be wasteland or dry land, at the same time, the scope of construction shortcut should be minimized as much as possible, reducing the damage of temporary land occupation of the shortcut on the pavement vegetation and soil.

(1) Construction requirements:

①The existing road should be preferred construction shortcut, which can be

widened and hardened by the contractor with investment after conducting consultation with local department in charge of road, so as to achieve win-win situation;

② For newly opened shortcut, large excavation and land along the river should be avoided;

(2) Design of prevention measure: there should be drainage ditch set on both sides of the construction shortcut, type II of trapezoidal section should be chosen as the cross-section.

2.11.5 Prevention district for temporary spoil (slag)

(1) Focus on location selection of spoil (slag) field; when spoil (slag) field has destroyed original surface vegetation or changed the original surface gradient and formed a bare slope, the greening or reclamation should be conducted accordingly.

The temporary spoil (slag) field should be selected to locate marsh land with large reserves and low-lying topography, or deserted ditch, wasteland or real estate field that is less susceptible to be subject to water current erosion. The temporary spoil(slag) field should not be set in basic farmland, woodland, as well as in area that may cause geological disasters or roadbed disease; it is strictly prohibited to set the spoil (slag) field in the debris flow gulley, the upper edge of the landslide and other locations.

(2) After handling the spoil, it's better to conduct the greening, soil reclamation timely or consider other comprehensive utilization. The corresponding remediation requirements are as follows:

Prior to handle the spoil, the topsoil should be stacked collectively, and the topsoil will be used after handling the spoil; regarding to the spoil ground after remediation or reclamation, it's use orientation should be determined in a rational way based on the land quality, irrigation condition, climate features as well as production function and planning etc.

(3) Dregs and slope protection works should be determined according to the

location for stacking the spoil, spoil nature, excepted spoil height and other factors, when the spoil is stacked in the ditch, the dregs block dam should be built.

(4) The discharge system of spoil ground should be set based on comprehensive consideration of the topography, geological and hydrological conditions of the spoil ground, combined with ditches, irrigation and other facilities, avoid erosion of farmland and slope due to water erosion of soil or changing surface runoff conditions, conditions. For spoil ground located in the valley and slope, there must be improved drainage facilities accordingly; when there is condition suitable for flow concentration around the spoil ground, the water flow can be diverted for discharge through taking measures of water interception and discharge.

In addition, after ending the project, when the vegetation restoration is conducted in the main project prevention area, prevention area of the construction shortcut, the prevention area of concrete mixing plant as well as temporary spoil (slag) field, native species should be used and avoid the introduction of alien species

2.11 Management of social interference

During the project construction, the social interference includes mainly connectivity of water conservancy system, regional connectivity, engineering construction noise, dust, building waste and garbage and other impacts on living and production of residents along the line.

2.11.1 Connectivity of water conservancy system

This project is for rural highways, and there is a large number of agricultural irrigation canals distributed along the line, which are used for irrigation of farmland and other water conservancy facilities, so the project construction should take full account of the connectivity of farmland irrigation canals of the project along the line and other water conservancy facilities, and ensure those aspects are not affected project construction. Therefore, the following measures should be taken:

(1) For intersecting road sections between the project and agricultural irrigation ditches, the buried pipe or slab culvert should be used to ensure connectivity of agricultural irrigation ditches.

(2) For road sections that the agricultural irrigation ditches are parallel with the highway, the agricultural irrigation ditches should be hardened, on the one hand, this aspect can protect the roadbed; on the other hand, it can ensure there's no leakage of agricultural irrigation water due to project construction.

(3) At the end of the construction, damaged rural roads, ditches and others during the construction process should be repaired or offer the local government a certain amount of compensation fee to safeguard the legitimate interests of local government and the residents.

2.11.2 Regional connectivity

This project is for rural highways, the corresponding role is to facilitate the trip and transport of goods for the residents along the line. Therefore, the design should take full account of the connection between the main project lines and is connected with the feeder roads through the village, which is based on the premise of facilitating the trip and cargo transport of the people along the route to the greatest extent, ensure smooth connectivity and security between the branches and main line when meeting the technical standards.

2.11.3 Environmental Code of Practices for noise impact

At different stages during the construction phase, various noise sources will have different impacts on quality of acoustical environment at the place where the project is located, thus it's necessary to strengthen management and take appropriate preventive measures to minimize their impact on the environment.

(1) During equipment selection, the advanced and reliable low-noise equipment should be chosen;

(2) The allowed construction time is from daytime 6:00 am~22:00 pm, and at noon 12:00~, the construction is forbidden for noon break from 12:00~14:00. Meanwhile, the nighttime construction is also prohibited, if it's really necessary to take continuous construction work at night, it shall be certified by the construction administrative departments, and approved by environmental protection administrative department, and the residents nearby should be notified accordingly;

(3)Reasonable arrangements of the construction period and avoid more than one large machinery with high noise operating at the same construction site within the same time, the construction should be based on the schedule to save time and shorten time of noise impact as much as possible, thereby making the impact of construction noise on workers decrease to minimum;

(4) For machinery equipment producing relatively large noise, the basic vibration isolation or setting damping bearings, enswathing the damping materials;

(5) The vehicle transport noise may have some impact on the areas sensitive to acoustic environment along the line. Therefore, it's the responsibility of construction unit to strengthen the environmental awareness of the construction workers, and keep abreast of local folk-customs, habits and so on, to reasonably arrange the transport time, for areas sensitive to environment condition such as the neighborhood residents etc., taking measures of limiting speed of vehicles and other construction machinery, silence and other measures consciously to achieve effects of preventing and mitigating the noise;

(6) For machinery equipment with relatively large noise, the construction site should be set as far as possible away from the location of the residential side, and for construction site with the distance of no more than 5m from the residence, school and other buildings, there should be fence with noise reduction function set around the construction site;

(7) The construction unit is recommended to have reasonable arrangement of the construction workers, reducing the work time for operators to operate the machinery

equipment with high noise, the construction workers can be equipped with ear shields to minimize the noise impact on them accordingly;

(8) Conduct a regular and effective maintenance for all mechanical equipment, thus to keep the equipment in good conditions to achieve purposes of noise reduction and prolonged service life of the equipment;

(9) There should be strictly requirements in the management of the construction strength, machinery and vehicle operators, and operating procedures etc.;

2.11.4 Mitigation measures for dust management

(1) The construction road should be simple enough with the gravel pavement, watering the road regularly for dust reduction;

(2) The dispersed fine particle materials stacked in the construction site should be in confined storage or covered tightly, and watering the surface of the stockpile according to material properties for effective dust suppression;

(3) When the road construction passes through the points (areas) sensitive to the in environment, the fence should be set around the construction site as a barrier;

(4) The construction wastes should be conveyed in a closed container, and the volley throw is prohibited. The construction wastes shall be classified for storage in accordance with relevant provisions of urban garbage management, and the wastes should be removed away timely for disposal; watering the wastes with proper amount of water prior to the removal of them;

(5) Strengthen the management of transport vehicles, the tarpaulin is required to cover the vehicle that is easy to produce dust during the transport;

(6) The measure of water spraying for dust reduction should be taken in the construction of dismantling engineering. The slag should be completed delivering within three days from the date of completion of the demolition construction, and the disposal process shall comply with relevant provisions of the demolition engineering management;

(7) Fencing or watering for dust reduction and other measures should be taken at the area of the construction site with flying dust;

(8) The earthwork on the construction site should be collectively stacked and

covered; and the vehicle should not be overfilled to avoid spilling during shock in transport;

(9) Measures should be taken at the entrance of the construction site e to ensure the vehicle to be clean, the surface adhesion of dirt on the vehicle should be cleared before it drives out of the construction site;

(10) The field for storing the materials and large formwork in construction site must be flat and solid enough;

(11) The construction site must be watered and cleaned timely;

(12) Considering prevailing wind and the protection objectives in surrounding environment, the stacking field of dispersed fine particle materials and other main source of dust should be laid downwind with a distance of 300m from other protection objectives in surrounding environment;

(13) The burning of all kinds of wastes is strictly forbidden.

2.11.5 Mitigation measures for management of solid wastes

(1) The construction wastes should be in comprehensive utilization combined with the small scale civil engineering projects carried out simultaneously and road engineering, remaining wastes should be collectively stacked in designated location at construction sites, which will be removed to refuse landfill of each project timely for disposing according to the construction schedule;

(2) The construction wastes should be conveyed in a closed container, and the volley throw is prohibited. The construction wastes shall be classified for storage in accordance with relevant provisions of classified garbage management, and the wastes should be removed away timely for disposal;

(3) Watering the construction wastes with proper amount of water prior to the removal of them;

(4) The garbage should be removed in unify to refuse landfill of each project site for disposal after being collected in bags that are set on the construction site;

(5) The spoil includes some mellow soil, which should be used for reclamation and afforestation of wasteland in the area of the project site, the remaining earthwork can be used as the roadbed landfill of road works and pad soil on both sides of the ditch;

(6) The toxic and hazardous substances should not be burnt at construction site, and the disposal of toxic, hazardous substances should be conducted in accordance with the requirements of relevant provisions.

2.11.6 Traffic organization plan for the construction

The reasonable construction scheme should be developed during construction phase of the project, and the demi construction scheme should be adopted, and there should be warning signs at the construction roads, two traffic managers should be designated for diverting the traffic to reduce the negative impact of road construction on traffic capacity along the line. Meanwhile, the whole site of the road construction should be avoided affecting the traffic capacity; for roads must be implemented the whole site road construction, and the temporary access road should be built in advance before starting the construction.

2.12 Environmental Code of Practices for sewage treatment

2.12.1 Wastewater type from highway construction and operation

After completing the road construction and putting into operation, the produced sewage and wastewater are mainly wastewater (wastewater from foundation ditch, wastewater from washing machinery vehicles and building materials, concrete mixing washing wastewater, etc.), sewage, and wastewater of pavement runoff etc.

2.12.2 Environmental Code of Practices for sewage treatment

(1) The foundation construction of the bridge pile should be done as much as possible in the dry season, and try to avoid the construction of the pile foundation of bridge and culvert during flood season.

(2) The terms of preventing spill and leakage of the road building materials (i.e. asphalt, oil, chemicals, etc.) during transport process should be clearly specified in engineering contract, the material stacking site should not be located in roads next to the river to avoid road building materials into the water with the rainwater, resulting in pollution of surface water.

(3)There should be fencing measures around the stacking site of construction materials such as oil, chemicals and other hazardous materials, which should be covered with tarpaulin to reduce the pollution caused by rainfall.

(4) Do not discharge the slag from the pile foundation drilling and solid wastes from construction into surface water, there should be the necessary drainage ditch set at the construction site near the river to divert the construction wastewater, the soil slope of the drains should be compacted timely.

(5) There should be the sedimentation basin set on construction site to reuse the construction wastewater after proper precipitation.

(6) Use advanced equipment and machinery as much as possible to effectively reduce the amount of run, dank, drip and leak, and mechanical maintenance frequency, thereby reducing the amount of oily wastewater. Use the solid oil absorbing materials (such as cotton, bits of wood, oil-absorbing sheet etc.) as much as possible in case of the inevitable process of run, dank, drip and leak, collect the waste oil to transform it into solid material, avoiding producing excessive oily wastewater, the scraping means should be used for collecting and sealing the oil leaking into the soil, delivering the oil into a qualified disposal site for focused treatment.

(7) The maintenance of machinery, equipment and transport vehicles should be collected and conducted in maintenance location at various roads in order to facilitate the collection of oily water; in case that the maintenance can’t be conducted on focus, all oily water can be absorbed by solid oil absorbing material and sealed in a mix way to deliver away due to the amount of oily wastewater is generally no more than $0.5m^3/d$.

(8) There should be rectangular sedimentation basin set at the construction site and machinery maintenance points, the oily wastewater is collected by sedimentation basin, and the concentration of oil and other pollutants will be reduced after simple treatment of acid-base neutralization, precipitation, oil removal, slag removal, etc., the sedimentation basin should be buried after completing the construction.

(9) The disposal measure of delivering the collected oiliness wastes to other places together with other hazardous solid wastes on construction campsite after the enclosed packing, the destination for these wastes should be the disposal site qualified for disposing such kind of wastes.

(10) The construction campsite should be away from the area with focused rivers and other water bodies as far as possible, there should be the modified septic tank set in the vicinity of the construction campsite, which can collect the fecal sewage as well as washing sewage of catering respectively, the feces is used for farmland fertilizer, the washing sewage of catering will be disposed together with the feces in the septic tank after it is collected to oil removal tank for oil removal treatment, and the sewage can be used for agricultural irrigation after reaching the water quality standards for the agricultural irrigation. The villagers along the line will be commissioned to clear the silt in the septic tank regularly, after completing the construction the septic tanks will be buries with soil. The residential housing of along the line is strongly recommended to be used as the construction campsite, and do well in the work of sewage control to prevent sewage from entering into the water.

(11) The dining and washing details of construction workers is managed through centralized and unified form, such as the centralized dining, washing etc., in order to minimize the amount of domestic sewage. The amount of the detergent should be controlled during washing process controls, in order to reduce the content of detergent in domestic sewage.

(12) During the construction, there should be the retaining walls and drainage facilities set around wells along the line to prevent construction slag and wastewater entering into wells, meanwhile, prohibiting temporary slag field and stacking field for construction materials set at the distance of within 50m around the wells. Avoid the construction slag and materials having the adverse effects on water quality of wells.

During the operation period, there should drainage ditch and crash barrier set at roads near the wells, in order to avoid initial rainwater on the pavement and discharge water from road accidents entering into drinking water wells affecting water quality.

(13) Road (Bridge) surface water runoff

The main source of the road (bridge) surface runoff is runoff water formed by the pavement water and the bridge water of cross river bridge, according to the simulation data, the average rainwater pH value of pavement runoff is about 7.4, and the average value of SS concentration is about 100mg/L, the average value of BOD_5 concentration is about 5.0, the value of mean concentration of oil is 11.25mg/L, the road surface runoff drainage will have an adverse impact on the water quality of surface water, however, such impact is only confined to the influence of initial rainfall (usually about 20 minutes), with temporary increase in rainfall volume, the above concentration in the rain is decreased, with the reduction of the impact on surface water accordingly, in short, the pavement runoff has little impact on surface water.

2.12.3Management system of contingency handling and suggestions

To protect water environment along the line, sufficient attention should be paid to the problems of transport risks of dangerous goods at proposed roads across the river sections and roads sensitive to the wells. For this purpose, it is recommended that all levels of the government along the line to incorporate the contingency rescue issues of the transport risks of above road sections of proposed highways into the contingency plan of highway hazardous chemicals transport accidents. And the contingency plan includes organizational institution, job duties and systems, emergency procedures and disposal principles etc. The organizational institutions of various levels of the District Department of Transportation, Bureau of Public Security and Environmental Protection Agency in charge of leadership jointly set up a coordination group of highway hazardous chemicals transport accidents, which is responsible for organizing and coordinating rescue and handling of highway transport accidents of hazardous goods. The main job duties are to study the formulation of safety measures and policies of highway hazardous chemicals transport in various districts, to establish files for hazardous chemicals transport operators, vehicles and personnel within the jurisdiction, and regularly handle safety inspections on highway hazardous chemicals transport operators, and hold coordination leadership group member meeting on a regular period, in order to report conditions of highway chemicals transport accidents, organize the person in charge of highway chemicals transport, drivers, guards and

handling personnel to conduct the business training, meanwhile, to carry out the regular drills of contingency plans, actively carry out various forms of the propaganda activities to improve safety awareness in production of masses and employees, do well in statistics and reporting work of the highway hazardous chemicals transport accidents. The emergency procedures and disposal principles are as follows:

(1) In case of an accident, any person who discovered the accident should report to coordination group of local hazardous chemicals transport accidents at the first time through the contact telephone of the roadside signage maintenance personnel or other communication means.

(2) After the local coordination group receives the accident report, they shall immediately inform the closest local fire department to send fire fighting vehicles and personnel to the accident site for the rescue.

(3) If hazardous goods are solid, the accident site can be disposed through cleaning, and document the accident.

(4) If hazardous goods is highly toxic gas, firefighters should wear a gas mask before handling the accident; in case of inevitable leakage of dangerous goods, it's necessary to immediately notify the environmental protection department, police department, if necessary, the personnel within the scope of pollution along the line should be demobilized to avoid poisoning casualties.

(5) If the hazardous goods is liquid and it has already entered into the public water, it's necessary to notify the environmental protection department immediately. The environmental protection department should immediately send the corresponding experts and the monitoring personnel to the accident scene to conduct monitoring and analysis after receiving the report, and salvage the container of dangerous products falling into water timely through the cooperation with the relevant departments.

(6) Strengthen the design of the crash barriers on both sides of the bridge across the river, and install the crash barriers on both sides of the bridge across the river along the line of all highways, so as to prevent the impact of hazardous chemicals transport vehicle accident on water quality of the river.

2.13 Environmental Code of Practices for preservation of cultural relics

If there's any relics discovered or suspected during the construction, the construction unit should protect the scene immediately according to requirements of *Cultural Relics Protection Law of the People's Republic of China* (2007.12.29) and report to the local Cultural Relics Bureau for handling the details and the construction should be stopped until after the Cultural Relics Bureau come to the scene to process. The reporting procedure of cultural heritage is seen in Figure 2.14-1.

If there's any cultural heritage discovered or suspected during the construction, the construction unit should conduct the following details:

(1) The construction should be stopped immediately at the location where the cultural relics is discovered, and strengthen the protection of the site;

(2) The contractor shall promptly report to police department and the cultural authorities for conducting the identification work;

(3) Once the item was identified as cultural relics by experts, it could be defined as the scope of protection;

(4) It is necessary to rescue and excavate the cultural relics if there's indeed due to the urgent construction period or the risk of natural destruction;

(5)The rescue and excavation of the cultural relics must be conducted by the professionals through using the special equipment, rather than be excavated by the contractor unauthorized;

(6) Once the item is judged to be the significant discovery of cultural relics, there should be the discussion on whether the engineering to be built in another place.

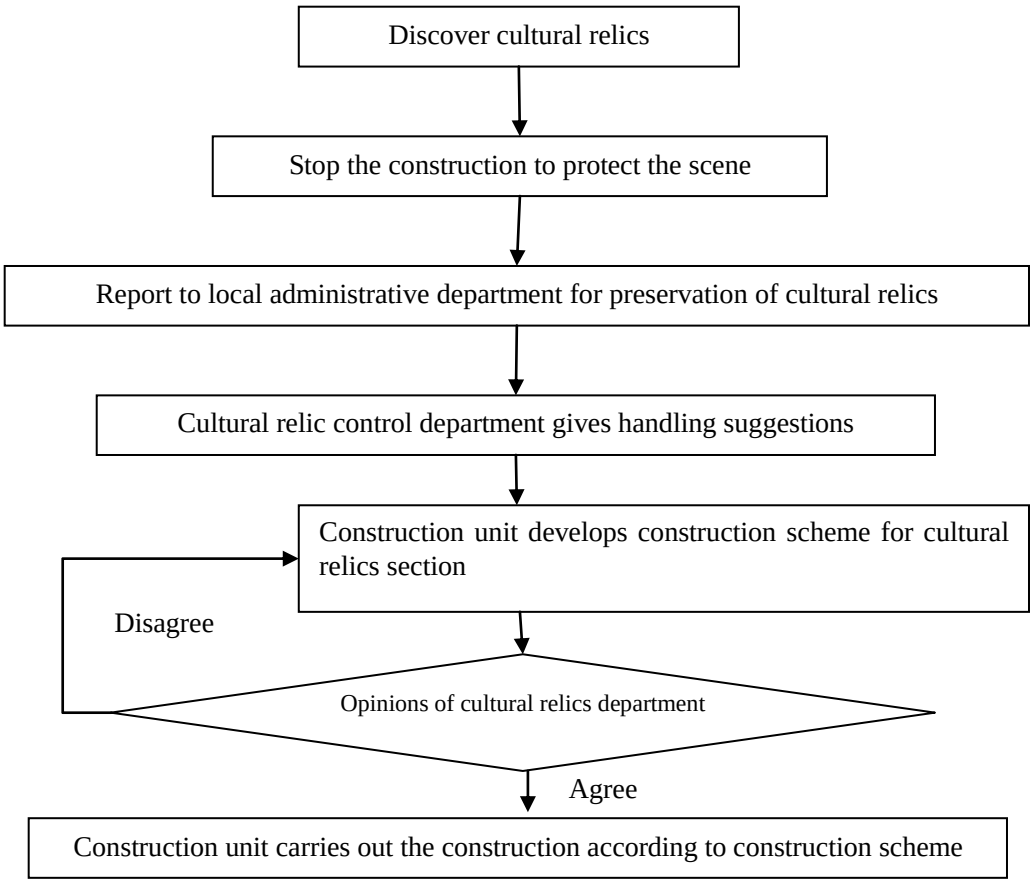

Figure 2.14-1 Handling procedure map of cultural relics discovered during the construction

2.14 Environmental Code of Practices for safety and health

2.15.1 Analysis of construction safety and healthy

Construction units and regulatory agencies are responsible for taking all reasonable measures to protect the safety of workers and security of buildings nearby from damage from construction accidents. Enterprises should hire the contractors that have the ability to manage occupational health and safety matters of their employees, and allow contractors also to perform the risk management rules of the company through formal purchase agreement. The construction safety and health of the project, includes the design and operation of general facilities, communication and training, human body dangerous and supervision.

2.14.2 Construction safety and health measures

The construction unit is responsible for complying with all state and local safety requirements and other safety measures to avoid accidents, so as to protect the safety and health of construction workers.

(1) Ensure integrity of all buildings within the construction site; temporary buildings should be safe, reliable in the structure, and able to withstand the bad weather of the area, and the buildings should be with appropriate sunshine, which can cut off part of the dust and noise;

(2) The construction unit should ensure to offer the first aid in compliance with the corresponding requirements. The construction site shall be equipped with appropriate first aid devices; there should be the emergency procedures in remote areas, which is convenient for taking care of the patient until they are transferred to an appropriate medical institution;

(3) All new construction personnel should participate into the occupational health and safety training, and the construction unit should introduce all the basic rules of work at construction site, and personal protection rules to the new workers, and how to prevent other employees from being injured;

(4) There should be correct warning signs hung in places of hazardous areas (power distribution room, compressor room etc.), equipment, materials, safety measures as well as emergency exits and so on;

(5) If a worker's hands and arms are subject to the vibration as a result of the use of hand tools, electrical tools, or the whole body of the workers standing or sitting on vibrating surfaces, then such condition can be controlled by selecting the equipment, installing the damping pad or vibration damper, limiting the exposure time;

(6) The risk of clamping should be eliminated when designing the machine, in order to ensure that the bumping part of the machine won’t cause harms to human body under normal operating conditions;

(7) There should be warning signs placed on all powered electrical devices and wires; check all wires, cables, hand electrical tools to see whether there's any damaged or exposed wires, and determine maximum allowable working voltage of hand tools in accordance with the manufacturer's recommendation; all the electrical equipment used in moisture (or potential moisture) environments should be through double insulated/ ground connection treatment;

(8) The construction unit should provide all operators participating in or facilitating the welding work with appropriate eye protection equipment (i.e. welding goggles and/or mask);

(9)There should be protective barrier installed in hazardous areas with fragile edges (the barrier should be with a bar in middle part with baffles), meanwhile, construction workers should use fall prevention devices (including the safety belt and lanyard for distance limitation);

(10) The construction unit should determine and provide construction workers with the appropriate personal protective equipment, which can fully protect workers, other workers, occasional visitors, and the equipment should not cause any unnecessary inconvenience to the users;

(11) The construction unit should establish reports and record occupational accidents and diseases, procedures and systems for the danger of the accident;

(12) The construction unit should conduct the healthy education for construction workers, such as the implementation of the information communication strategies, enhancement of face-to-face counseling to address the systemic issues affecting individual behaviors, encouraging individuals to take the protective measures, for example, avoid the spread of the disease to others through the use of condoms; in addition, encourage the use of the insect repellent, clothes, mosquito nets and other shield methods to avoid mosquito bites and the spread of disease.

2.14.3 Road traffic safety signs and facilities

2.14.3.1 Necessity for setting traffic safety signs and facilities

The traffic safety warning signs and facilities should be set, allowing the drivers to predict the conditions of road and villages, schools and other sensitive sites in front with ahead of time, allowing them to concentrate and reduce car speed, which can effectively prevent the occurrence of accidents or reduce the extent of losses of traffic accidents. Therefore, it's necessary to set the traffic safety signs and facilities.

2.14.3.2 Traffic safety signs and mitigation measures of facility environment

(1) For road sections with rivers, lakes, swamps and other waters on road side, and cliff, deep valley, deep ditch and other ravines, the road sections may cause large accidents, there should be roadside fences or railings set on those bridges. The night reflective logo should be designed on the bridge fences and railings.

(2) The warning pile is required for the bridge that has a roadside pond with a depth of over 3m or a scarp and shallow trench with the embankment relative altitude of greater than 4m, and the warning pile is laid on the roadside 10m beyond the bridge length.

(3) The convex reflective mirror is required at the roads where there's a sharp turn, and poor horizon due to bad mountain structure, and other structures.

(4) The deceleration hillock or shift down zone is required to be set at the roads entering the market town, village, in front of school, which will make drivers reduce speed to protect pedestrian safety in towns and villages. The appropriate speed limit signs, signs of give way to pedestrians and caution of children signs and other signs can be set in front of the deceleration hillock or shift down zone according to the speed limits roads through towns and villages.

(5) For level crossing on roadside of the school, the school sign, warning sign of speed limit, students channel marking, deceleration hillock or taw pavement and others should be set at the appropriate roads, if necessary, the traffic control lights can be set to control the traffic.

2.15 Environmental Code of Practices for hazardous wastes and chemical wastes

2.15.1 Management measures of hazardous wastes and chemical wastes

The project involves the storage, transport and others of some hazardous wastes and chemical wastes during the construction, if not properly handled, those wastes would have a relatively large impact on the environment. The management measures of the hazardous wastes and chemical wastes are as follows:

(1) The chemicals should be properly stored and labeled;

(2) The storage of hazardous goods shall conform to provisions of the storage certificate to types, data and other requirements of the storage;

(3) During the maintenance of machinery and equipment, oil and others should be collected with a special container;

(4) The tools and materials such as antifouling emergency box/sand/saw mill and others that should be equipped to absorb the leakage of chemicals.

2.15.2 Risk prevention measures and contingency plans

2.15.2.1 Risk prevention measures

(1) Establish an emergency network, and set up leadership group for emergency incidents, designating the emergency commander;

It is the project organizational unit, also the location of the project, which takes the lead to form the emergency network together with other related units such as the Environmental Protection Agency, the Public Security Bureau as well as Fire Brigade, environmental monitor station, and related department such as water conservancy departments etc., the hazardous goods transport accident handling group is established by the personnel of relevant units that are with the abilities of handling accidents, which is responsible for emergency treatment of hazardous goods transport accidents.

(2) After the investigation, the strictly management regulations for transporting oil, chemicals and others are developed to strengthen the management and prevention of sudden environmental pollution accidents in highways;

(3) Strengthen the transport management of hazardous chemicals, and develop contingency plans for accidents of hazardous goods, transport of all hazardous goods should be registered for record in the Traffic Police Department, job training is conducted for relevant managers and employees, thus they can work with certificates to avoid leakage accidents;

(4) During transport of hazardous goods, both drivers and passengers have to concentrate and observe road signs carefully, especially pay more attention to traffic safety when passing through residential areas and rivers, free stop in halfway and other abnormal behaviors are strictly forbidden;

(5) On both sides of the bridge, there should be the anti-collision sign, speed limit signs and warning signs for vehicles carrying hazardous goods, which indicate the alarm call to remind the drivers to drive cautiously.

2.15.2.2 Risk contingency plans

The construction unit shall prepare the detailed contingency plans for taking unified emergency action, specifying person with emergency responsibility and duties of related departments, in order to ensure that the accident can be under control within the shortest time, reducing damage to the environment. The contingency plan of the project is incorporated into regional contingency plans in order that the rescue work can be smoothly carried out at the first time in case of accident caused by hazardous chemicals, reducing the harm caused by accidents, together with the accident losses, establishing the emergency rescue headquarters for accidents caused by hazardous chemicals, which is responsible for unified organizing and directing the rescue work of the accidents caused by hazardous chemicals within the jurisdiction. The main contingency plan should include:

(1) Alarm call and contact mode;
(2) Classified response procedures;
(3) Emergency environmental monitoring, rescue and control measures;
(4) Emergency personnel evacuation, organization plan of evacuation;
(5) Recovery measures;

(6) Emergency training plan

The accident recovery measures mainly refer to the restoration of polluted soil and water contamination, for soil heavily contaminated, scraping the contaminated topsoil by delivering to hazardous wastes center for treatment, for the contaminated water, taking active purification measures like the skimming of surface contaminants etc., the skimmed pollutants should be delivered to sewage treatment plant for treatment or incinerated.

3. Special measures for feasibility of sensitive areas

In addition to the abovementioned general guidelines for environment, for the project, special protective measures shall be taken for the following special sections.

3.1 Special protective measures for nature conservation area

According to the site survey, the proposed project locates at Shangguanqing to Langan road and Sancha Tangqiao village, which are located in Siye Tun Nature Reserve.

1. Within the range of Siye Tun Nature Reserve in Sinan County, soil and spoil borrowing and the setup of camp and other construction sites are prohibited.

2. Prohibit from cutting of the old trees crossing through Shangguanqing in Siye Tun Nature Reserve and other roads. Reliable protection measures should be taken to ensure that the construction process does not destroy or damage those trees. Do not treat the trees as a support, or carve in the trunk, etc.; without the consent of forestry authorities, prohibit from unauthorized pruning or unauthorized cultivation; and do not damage signs and protection facilities.

3. According to the Law of the People's Republic of China on the Protection of Wild Plants, No construction units or individuals can illegally gather wild plants, or destruct their growth environment. Prohibit the acquisition, and cutting of the wild plant under State protection (category I and II) and ancient woods. If, during the construction, it is a must to cut wild plant under State protection (category I and II), it must be reported to the administrative departments of wild plants under local people's government and take credible protection or transplant measures.

4. According to the Law of the People's Republic of China on the Protection of Wild Animals, during the highway construction, environmental education should be strengthened for construction workers to increase the publicity for "protection of nature and love for wild animals; Prohibiting the use of weapons, poisons and explosives for hunting. For the wildlife found in the construction, the construction personnel shall not kill the same and should promptly release them to a place away from the road. When any unit or individual finds any injured, sick, hungry, trapped, or lost wild animals under the key protection of the state and local authorities, it should immediately report to local administrative department of wildlife, which will take rescue measures; or it can send the same to the nearest ambulance unit with ambulance conditions. Ambulance units shall immediately report to the local administrative department of wildlife.

5. strengthen the publicity and education of officers and construction workers. For nature reserves, and forest, fireworks are prohibited and no kindling and explosive items can be brought into the conservation area and forests to prevent forest fires. Construction unit should, in the project construction process, focus on strengthening links with the local forestry bureau. When Siye Tun Nature Reserve is involved, before the entry, the constructor should sign a liability form, sanitation liability form and liability form for forest and wildlife protection with Sinan Forestry Bureau, to make road construction and management of the conservation area be carried out on an orderly basis.

6. For the wood packaging transferred by the constructor and other materials that may bring exotic pest invasion, they should be brought to the forest and quarantine agencies of the transferring place and forest quarantine agency of the transferred place for review to strictly prevent invasion of alien species. The green seedlings and grass used for highway green should be native plants, but strictly prohibit from excavation of wildlife resources for local use.

3.2 Special protective measures for scenic area

According to the site survey, the Qinglongzui Bridge where the proposed project is located is located in a scenic area, Longdi River of Sinan Wujiang Bailu River.

1. Within the range of Longdi River of Sinan Wujiang Bailu River, soil and spoil borrowing and the setup of camp and other construction sites are prohibited.

2. Prohibit the opening of higher digging in the area, and the destruction of any attractions and scenic landscapes. Temporary construction camp and debris fields should not be set up in the places where the attractions are distributed and where it may affect the landscape and prohibit any act designed to undermine the landscape.

3. The road greening should be coordinated with the road along the natural landscape, especially in nature reserves and scenic zones, and landscaping measures must be chosen to fit for the landscape and the green trees and grass fit for local conditions should be selected.

4. Protection measures for attractions

Because the project will not have an impact on the attractions, the protection of attractions is to protect the scenic area, Wujiang Bailu river of Sinan Qinglong bridge - Longdi River.

For protective measures, it is a key to take scientific construction methods to

minimize the adverse effects due to the construction on the creek water. To strengthen the construction technology and greening recovery measures to ensure that the construction sediment will not enter into the river and to avoid the construction in wet period and rainy season. Well develop the drainage work of the construction site, and special attention should be paid to the treatment and disposal of wastewater from the construction of bridge. Prohibit the flow of sewage, wastewater, and muddy water into Xiaoxi River, thus affecting downstream attractions.

5. Measures to mitigate the influence on travel tours

Mainly to mitigate the impact on Xiaoxi river of Longdi River.

The key is to reduce the impact from the construction process on the tourist vision, hearing and other senses and on the touring circuit.

The main measures taken are safe and civilized construction, construction design optimization, organization of lines for tourists' travel tours, so as to minimize the impact on activity.

3.3 Protection measures for cultural relic

1. For the purpose of the construction, attention should be paid to the protection of the cultural relic site close to the road. The construction should not destroy the historical features of the cultural relic; Within the scope of the cultural relic conservation units, no soil borrowing and spoil are allowed; in the engineering construction, it should strengthen the cultural relic conservation effort that may be encountered. Once a cultural relic is found, the scene should be protected and, the local cultural relics management department should be immediately reported. No constructor or individual may conceal, privately divide, hide the relics and the construction can be proceed after effective measures are taken and the consent from the cultural relics management department is obtained.

2. For the stone horse found at about 20m away from the left road of "Hetou to Dayuan" in Dejiang Quankou, it is a cultural relic. According to the Jiajing Sinan House of Ming Dynasty, it is one of top 10 attractions in Sinan House and one of the top four attractions in Yongzhou. Since it is close to the highway, the construction process may affect or damage the cultural relic. Therefore, for the construction of the project, the management and education should be strengthened. Set up the obvious signs of cultural relics therein; prohibit the expansion of the road to the left, blasting during construction and prohibit all possible behaviors damaging cultural relic so as to

ensure the safety of cultural relics.

4. Environmental Management Plan

4.1 Environmental management structure setup and its main responsibilities

According to the relevant policies and regulations of the World Bank on loans and the needs in actual work, to implement this environment implementation guidelines, the project will set up a special organization, which will be responsible for the project environmental management and supervision work. The office of Tongren Rural Road Project funded by the World Bank, sub-offices of Dejiang County, and Sinan County, the designer, EIA unit, external monitoring and controlling agency of environmental management and the supervisors form internal environmental management institutional framework to effect the environmental management and environmental engineering supervision work. For details of the setup and the main responsibilities, see Figure 4.1-1 and Table 4.1-1.

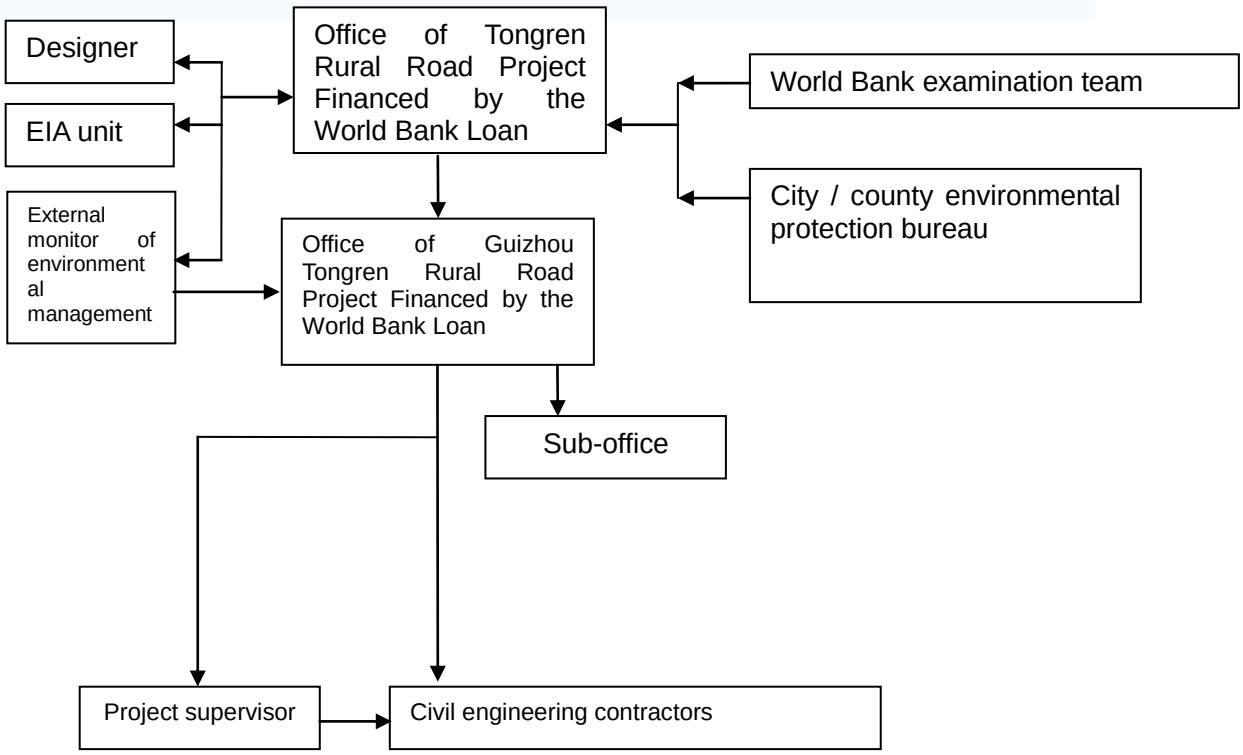

Figure 4.1-1 Environmental Management System Diagram

4.2 Environmental officers setup and their main responsibilities

In terms of the environmental management system, some are internal

organizations, or hired project advisory services, or external organizations. In order to better fulfill their primary responsibilities of environmental management agency, relevant environmental officers are recommended to be set by the environmental management agencies according to the requirements of Table 4.2-1.

Table 4.2-1 Environmental management system composition and its main responsibilities

Name	Task	Duties
Office of Tongren Rural Road Project Financed by the World Bank Loan	Responsible for the overall coordination and management of the project	① ensure that the project planning, design and environmental protection projects meet the domestic and World Bank requirements. ② coordination, supervision and overall tracking report to solve major environmental problems. ③ responsible for hiring EIA unit and external monitoring and controlling agency of environmental management.
Office of Tongren Rural Road Project Financed by the World Bank Loan	Implementation and management of sub-projects	① a series of environmental protection administration efforts for project design and preparation phases. ② effect environmental protection funds. ③ responsible for liaison with the office of Guiyang transport project funded by World Bank and coordination for the implementation of environmental management issues. ④ designate environmental officers to implement their own environmental implementation guidelines and track for reporting, timely coordinate the contractor and supervisor to take environmental management actions, and accept and deal with environmental complaints.
Sub-offices	Responsible for the overall coordination and management of the sub-project	Responsible for the land acquisition and relocation of the sub-project.
City / county environmental protection bureau	Government administrative supervision agency, which will exam and approve the EIA of projects	Government environmental protection supervision agency, which will exam and approve the EIA of projects.
Constructor (contractor)	Implementing agency, which will effect the relevant environmental protection measures stipulated in Environmental Implementation Guidelines.	Before the start of the construction, check the construction site and the Environmental Implementation Guidelines / Environmental Impact Assessment Report, implement the environmental protection regulations, and protect the environmental quality to ensure that the environmental quality will not decrease due to the project construction.
Project supervisor acting as the environmental supervisor at the same time	Implement on-site supervision and inspection for the pollution emissions and ecological damage incident according to the law, and participate in treatment thereof	① conduct site environmental inspections weekly, fill in environmental inspection checklist for the construction period and archive the same; ② for those that do not satisfy the requirements of environmental implementation guidelines, put forward reform program and oversee its implementation.
EA consulting unit	conduct independent environmental impact assessment for subprojects, to provide technical support for the engineering design of environmental protection and develop the Environmental Implementation Guidelines	Develop the Environmental Implementation Guidelines and prepare domestic EIA documents.
Design consulting unit	Undertake the project feasibility study, preliminary design, construction design and tender preparation	① ensure the minimal impact of the engineering technology program on the environment. ② include the environmental protection measures put forward during the feasibility study, preliminary design, and the environmental impact assessment into the design program and budget, and the technical specifications of the tender.
External	assist the office of Tongren	① before June 30 each year, submit to the World Bank and the

monitoring and controlling agency of environmental management	Rural Road Project funded by the World Bank in the preparation of the environmental assessment report and monitoring of the environmental protection during the project implementation period	environmental management agency the medium-term monitoring report. ② prior to December 31 of each year, submit an annual monitoring report to the World Bank and the owners. ③ after six months after the completion of environmental management, submit a comprehensive post-environmental management assessment report.

Table 4.2-2 List of Environmental Officers

Environmental protection authority	**Setup**	**Duties**	**Qualification Requirements**
Office of Tongren Rural Road Project Financed by the World Bank Loan	1 supervisor	① Check and coordinate the work of the environmental officer; ② responsible for arranging the inspection activities of the environmental experts of the World Bank, report to the World Bank and effect the requirement thereof for environmental management; ③ summarize environmental management report for submission to the World Bank's review, and coordinate with other relevant departments to solve major environmental problems; ④ conduct site environmental inspections once every year, fill in environmental inspection checklist for the construction period and archive the same.	Environmental officers should have environmental and management expertise.
	Independent external monitoring and controlling agency of environmental management	① provide technical assistance and training. ② assist in the implementation of the (recovery) plan of the destroyed ecological environment during the construction. ③ in accordance with the Environmental Implementation Guidelines, conduct environmental management and monitoring survey. ④ assess the living conditions of affected populations to determine whether it can be adequately recovered. ⑤ prepare and submit external monitoring and evaluation reports to the project management office and the World Bank.	
Office of Tongren Rural Road Project	1 supervisor	① conduct site environmental inspections once every month, fill in environmental inspection checklist for the construction period and archive the same; ② organize and implement environmental management training; ③ supervise to effect the environmental protection measures as required by the Environmental Implementation Guidelines.	
	1 complaints reception personnel	① record the complaint contents for the project construction and operation, report to the supervisor and resolve public complaints; ② coordinate the supervisor with the environmental protection.	
Sub-office	1 supervisor	Responsible for coordinating the implementation of sub-projects and well developing the environmental protection work with Guiyang rural road project construction office.	
Unit with A-level environmental impact assessment	3 persons	① site visits for each project and evaluate their environment; ② responsible for the preparation of Environmental Implementation Guidelines.	

certificate			
Constructor	1 person for environmental management	① cause the constructor to perform during the construction process, the environmental protection measures proposed by the Environmental Implementation Guidelines; ② for the sudden environmental issues occur during construction, timely report to the environmental officer of the place where the project is located. Develop the environmental protection measures for construction period; ③ accept the supervision and inspection from the supervisor, World Bank, and environmental protection departments at all levels in terms of environmental protection; ④ establish a feedback mechanism, and complete the rectification upon the receipt of a rectification notice within three working days (for those who need coordination of administrative agency, within 10 working days); ⑤ together complete the checklist with the supervisor before the construction and report the same to the organization where the project is located; ⑥ the constructor weekly reports the implementation of project to project supervisor.	
Environmental supervisor	1 environmental supervisor, which will be taken by the project supervisor	① conduct site environmental inspections weekly, fill in environmental inspection checklist for the construction period and archive the same; ② for those that do not satisfy the requirements of environmental implementation guidelines, put forward reform program and oversee its implementation.	

4.3 Environmental supervisor

After the award and before the construction, at the World Bank office, the results formed from the environmental impact assessment for each project, including the EIA report, the Environmental Implementation Guidelines and the environmental management plan to be prepared in the future), and local environmental EIA approval copies of documents, should be provided to the contractor. The contractor is required to carry out environmental research on the construction site, the purpose of which is to verify and identify the items described in the environmental impact assessment of the construction site and the surrounding environment and limiting factor of the project area. For the environmentally sensitive issues found in the pre-construction environmental study, appropriate environmental prevention and mitigation measures

are proposed. The construction can be made after the approval of the environment supervisor. For the environmental supervisor, please see Table 4.3-1.

Table 4.3-1 Summary of Environmental Supervisor

No.	Contents	Mitigation measures	Implemented by	Supervised by
Design phase				
1	Soil and water erosion	Rationally design the construction process and the scientific construction method. Reasonably choose materials and the location of stockyard and spoil ground to prevent soil erosion;	Designer Evaluation unit	Office for Guizhou Tongren Rural Road Project Financed by the World Bank Loan and project supervisor
2	Green	conduct greening design of the surrounding buildings;		
3	Farmland protection	Compensation for expropriation of land for the project will be made in accordance with relevant regulations and the funds should be given on an individual basis;		
4	Air pollution	When selecting yard and mixing station, the location should be outside the 200m distance from the sensitive point;		
5	Slope protection	According to the project characteristics and slope protection requirements, choose a reasonable approach for slope protection.		
Construction phase				
1	Land resources and vegetation protection	⑴ reasonably optimize the construction site layout, and minimize the scope of activities, so as to reduce the extent of the damage of project implementation on vegetation; ⑵ for the materials required to be purchased for the construction, such as stone, sand, cement, etc., they shall be transported in the case of use to minimize the destruction of vegetation; After the project is completed, clean the construction site and green the construction site to recover the vegetation that has been destroyed to the maximum extent; ⑶ According to the verification results of the construction site, set up temporary protective fence around the trees that have not been cut or transplanted within the construction site; ⑷ not add other signs on the trees in addition to the identification tags, and not stack or store materials and park machinery and equipment in the trees protection areas; ⑸ build temporary drainage ditches in the construction site and establish tunnel for that is damaged by the project, to lead to the outflow of flood in the rainy season, so as to avoid runoff erosion for the engineering; ⑹ subject to the assurance of the construction quality, the constructor should shorten the temporary land occupation as short as possible, and control the earthworks construction time as well as maintain the stability of the slope, to reduce the impact on the outsider of the construction range; ⑺ for construction camps, material quarry and borrow pits, they will be stripped of topsoil stockpiling for post-rehabilitation and greening.	Constructor	Office for Guizhou Tongren Rural Road Project Financed by the World Bank Loan, the environment supervisor and the external monitoring institution of environment management
2	Soil and water erosion	1. Embankment area ⑴ Topsoil stripping and protection; ⑵shoulder ridge and temporary chute; ⑶ sediment deposition measures. Set up basin for the roadbed gutter outlet. 2. Concrete mixing station ⑴ Hardened the site; ⑵In each concrete mixing station, set a settling basin, and the inside surface water will be sediment for the comprehensive utilization; ⑶ Land remediation will be conducted in the later stage of the construction, the main task of which is to dismantle the construction facilities, to clean up the stones, sand and other	Constructor	Ditto

No.	Contents	Mitigation measures	Implemented by	Supervised by
		construction materials thrown during the concrete mixing process and at the same time, conduct the greening or reclamation, so as to reinstate the same as far as possible. 3. The construction access Construction roads should be an existing road pavement. If new construction is necessary, wasteland should be chosen and prohibit the occupation of forestland and basic farmland. Build drainage ditches for the construction access roads to prevent soil erosion. 4. Temporary spoil (slag) field ⑴ pay attention to the position selection of spoil (slag) field; When the spoil (slag) field destructs the original vegetation or has changed the original surface to form the exposed slope, greening or reclamation measures should be taken; ⑵ After the spoiling, landscaping and overburden should be promptly conducted or other farmland utilization should be considered; ⑶For the dregs of dump and slope protection works, they should be decided based on the location, the nature, height and other factors of the spoil; when the spoil is stacked in the channel, dregs dam should be built. ⑷ the drainage system of the dump yard should be set up based on topography, geological and hydrological conditions and in combination of the ditches, irrigation and other facilities to avoid water erosion of soil conditions or the erosion of farmland and slope arising from the changes in surface runoff. when conditions permit, the cut and drainage measures can be taken to lead to the outflow of water; In addition, when, after the end of the project, the prevention area of the main project, construction detour prevention area, concrete mixing station prevention area, and temporary spoil (slag) field are subject to the vegetation restoration, native species should be used to avoid the introduction of alien species.		
3	Surface water pollution	⑴ the wastewater used to clean the vehicles of the construction site, building materials, maintain the concrete, sand and gravel should be collected and flow into the temporary sedimentation tanks for treatment after being diluted to the extent that the size of the temporary sedimentation tank size can store the wastewater for more than 12hs. All treated wastewater will be reused for the cleaning of the construction site, building materials, maintenance of concrete, and rinse of sand and gravel; ⑵ set up temporary toilets within construction site and regularly clear the excrement as agricultural fertilizer according to the actual living conditions in rural areas; ⑶ strengthen construction management and strictly control the drop and leakage of the construction machinery; Well develop the drainage system and water conservation measures for the temporary earth field to prevent soil erosion impact on the water environment; ⑷ all constructors should implement the treatment measures for the construction of wastewater to ensure the proper handling and disposal of wastewater; ⑸ strengthen environmental education for the construction workers, raise their environmental awareness and they should not throw or dump waste and sewage.	Constructor	Ditto
4	Construction noise	⑴ select advanced and reliable low-noise equipment in equipment selection; ⑵Construction time is from 6:00 am to 22:00 pm. Noon 12: 00 ~ 14:00 pm, no construction can be conducted. At the same time, limit nighttime construction; when continuous	Constructor	Ditto

No.	Contents	Mitigation measures	Implemented by	Supervised by
		construction at night is really necessary, it shall be certified by the administrative department of construction, and approved by the administrative department of environmental protection, and after that, notify the nearby residents; (3) reasonably arrange construction period to avoid that more than one large high-noise machinery simultaneously operate at the same construction site and at the same time; During the construction, the progress should be grabbed to save time and shorten noise time as possible to reduce the effect of construction noise on the workers to a minimum; (4) for greater noise machinery and equipment, the setup of foundation damping and damping materials shall be considered; (5) the vehicle transport noise may have some impact on sensitive points along the acoustic environment. Therefore, the constructor should strengthen the environmental awareness of construction workers, keep abreast of local folk customs and habits, etc. and reasonably arrange transportation time; in the sensitive environmental sections where neighborhoods and residents gather, consciously limit the speed of vehicles and other construction machinery and take other measures that can prevent and mitigate the effects of noise; (6) for machinery and equipment of greater noise, they should be set up in the location as far as possible away from the residential zone; for the construction site within 5m distance from the homes, schools and other buildings, the stalls with noise reduction should be set around; (7) recommend reasonable arrangement of construction workers by the constructor, reduce the operating time of operators operating high noise machinery and, the earmuffs can be equipped to minimize the impact of construction on the workers; (8) conduct regular and effective maintenance and repair for all mechanical equipment to keep the equipment in good condition to achieve the purpose of noise reduction and useful life prolonging of the equipment; (9) the requirements for the construction, machinery and vehicles operating personnel, and procedures, etc. should be strengthened.		
5	Air pollution	(1) the construction road should be simple and gravel road, and subject to regular watering to reduce dust; (2) the fine particulate dust materials stored in the construction site should be stored or cover measures should be taken and spray water on the surface according to material properties, which can effectively suppress dust production; (3) use road block-type fence when the highway construction crosses through sensitive environmental point (district) (4) apply a closed container for the construction waste removal and prohibit throwing The construction waste shall be stored by types in accordance with the relevant provisions of the city garbage management; and certain watering is preferred in the case of removal; (5) strengthen the management over transporting vehicles, and cover tarpaulin for the transportation vehicles prone to dust; (6) for the construction demolition, spraying and other dust suppression measures should be taken. The muck removal should be completed within three days of the demolition and shall comply with the relevant provisions on the demolition project management;	Constructor	Ditto

No.	Contents	Mitigation measures	Implemented by	Supervised by
		(7) enclosure or spraying and other dust measures should be taken for the area of the construction site; (8) the earthwork of the construction site should be stacked and covered; the vehicle should not be overfilled to avoid shock or spilling in transit; (9) for the entrances and exits of the construction site, measures should be taken to ensure the cleanness of the vehicle and the surface dirt in front of the vehicle should be cleaned before leaving the site; (10) the material storage and large formwork yards in the construction site must be flat and solid; (11) timely water and clean the construction site; (12) consider the prevailing wind and the surrounding environmental protection objectives and locate the yield of fine particulate dust materials beyond 300m from the environmental protection objectives (13) do not fire all types of wastes; (14) fuel construction machinery and vehicles must be used in a normal state to ensure standard exhaust emissions.		
6	Construction safety and health	The constructor has the responsibility to comply with all state and local requirements and other safety measures to protect the safety and health of construction workers. (1) ensure the integrity of all buildings within the construction site; for temporary buildings, they should be safe and reliable in the structure and can withstand the bad weather in the appropriate area and have proper lighting that can cut off part of the dust and noise; (2) the contractor shall ensure the provision of first aid in compliance with the requirements. In the construction site, appropriate first aid equipment shall be equipped; for the remote locations, there should have written emergency procedures so that the patient can be transferred to an appropriate medical facility; (3) occupational health and safety training should be carried out for all new construction workers to introduce the basic rules of construction site, personal protection rules and how to prevent injuries of other employees; (4) correct signs should be hanged for hazardous areas (power distribution room, compressor room, etc.), equipment, materials, safety measures, emergency exits and so on; (5)if the worker's hands and arms vibrate due to the use of hand tools and power tools, or workers' body vibrates due to standing or sitting on the vibrated surface, it should be controlled by the choice of equipment, installation of vibration damping pad or device and limit on exposure time; (6) when eliminating dangerous grip during the machine design, make sure that under normal operating conditions, the protruding mechanical part will not cause damages to the human body; (7) place warning signs on all powered electrical devices and wires; check all wires, cables, and hand power tools, to check whether there is wire breakage or exposure; and determine the maximum allowable operating voltage according to the manufacturer's recommendations; double insulation / ground handling should be conducted for all electrical equipment on wet (or possibly wet) environment; (8) provide adequate eye protection equipment (such as welding goggles and / or face shield) to the workers participating or assisting the welding operation;	Constructor	Ditto

No.	Contents	Mitigation measures	Implemented by	Supervised by
		(9) install protective railing in hazardous areas (should have a bar in the middle and around the baffle), while construction workers are equipped with fall prevention devices (including seat belts and distance limitations lanyard); (10) the constructor should identify and provide for construction workers appropriate personal protective equipment, to adequately protect workers, other workers, and occasional visitors, and should not cause unnecessary inconvenience to the user; (11) the constructor should establish the procedures and systems for reporting and recording the occupational accidents and diseases and the dangerous accident; (12) conduct health education for constructor, such as the implementation of information communication strategies to enhance face-to-face consultation; in addition, encourage the use of insect repellent, clothes, mosquito nets and other barrier methods to prevent mosquito bites and the spread of disease.		
7	Hazardous waste and chemical waste	(1) chemicals should be properly stored and labeled; (2) the storage of dangerous goods shall conform to the store type, data and other provisions of the certificate; (3) during the maintenance period of the machinery equipment , oil and other wastes are collected by a special container; (4) equip antifouling emergency kits / sand / saw mill and other tools and materials to absorb the leakage of chemicals.	Constructor	Ditto
8	Others	(1) for the land occupied by this project, compensation should be made in accordance with the relevant requirements without withholding or misappropriating to guarantee the vital interests of the affected masses; (2) conduct regular physical examinations for workers to prevent epidemics; (3) where cultural relic is found during construction, immediately stop the construction, and report the situation to the local cultural relics department, and do not construct before the cultural heritage authorities do not finish the cultural relic identification work and take necessary protective measures; (4) set up safety supervisor for the construction zone, provide with clear warning signs and night lights, and prohibit pedestrians, livestock from entering into the construction area.	Constructor	Ditto

During the construction, the task of the environmental supervisor is to check whether the construction and environmental protection measures meet the requirements proposed by the Environmental Implementation Guidelines. Environment supervisor shall, at least once a week, check the construction site, fill in and record the environmental inspection checklist (see Annex 1), issue rectification notice to the contractor for the environmental issues existing in the construction activity of the constructor (see Annex 2), supervise the contractors to take appropriate corrective measures, and report, every six months to Guiyang rural road office and the World Bank. After the end of the construction, a site environmental inspection will be

conducted once again before the environmental acceptance, fill in and record the checklist before the environmental protection acceptance (see Annex 3).

Workflow of Environmental Supervision during Construction is shown in Figure 4.3-1.

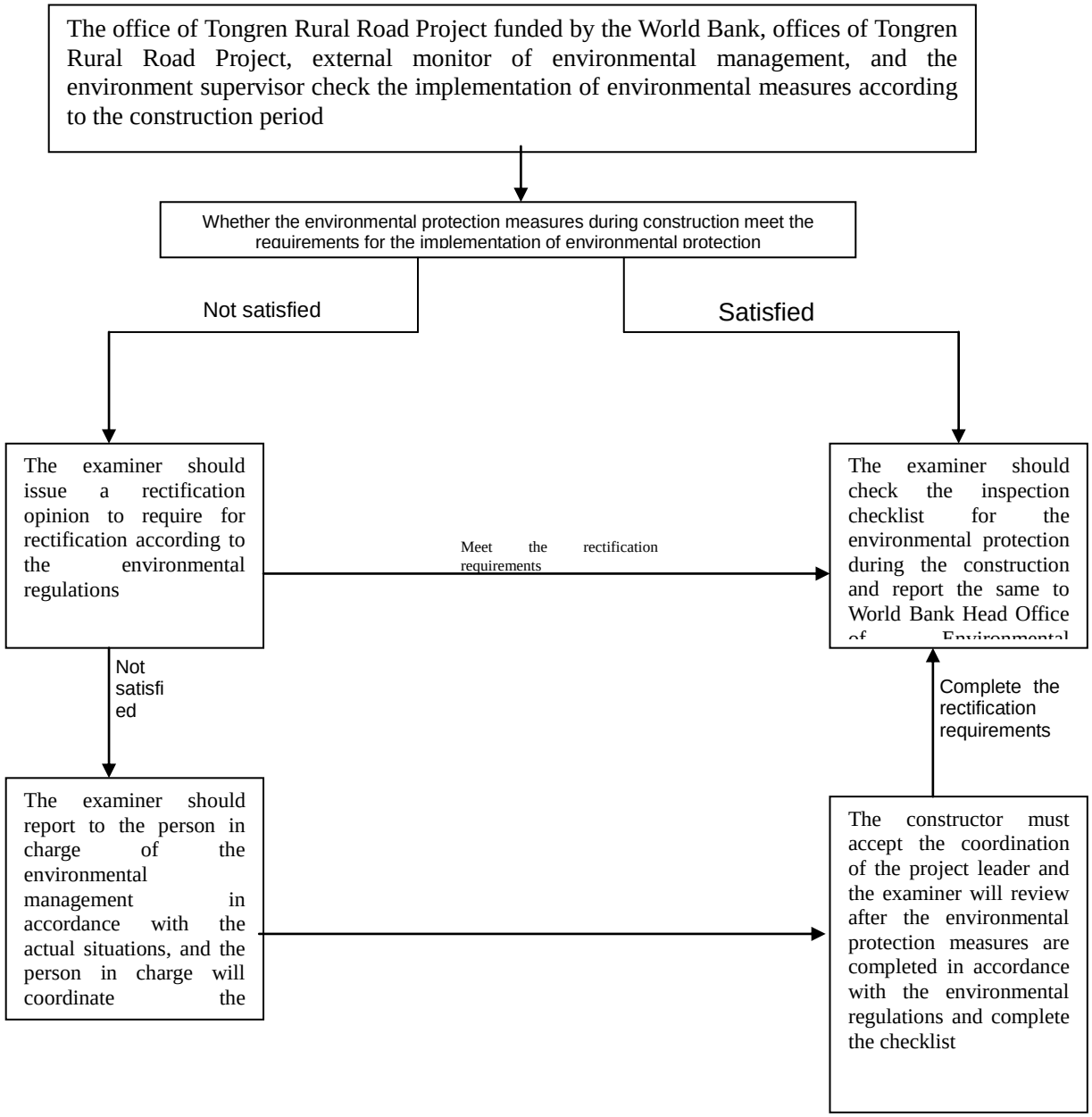

Figure 4.3-1 Environmental Supervision Workflow

4.4 Document management

During the implementation process of the Environmental Implementation Guidelines, the office of Tongren Rural Road Project funded by the World Bank, offices of Tongren Rural Road Project, external monitoring and controlling agency of environmental management, EIA unit, engineering supervisor and the constructor should carry out management over the corresponding documents, for details of which, please refer to Table 4.4-1.

Table 4.4-1 Document Management Requirements for Various Agencies

Name	Document management
Office of Tongren Rural Road Project Financed by the World Bank Loan	① Develop and supervise the implementation of the Environmental Implementation Guidelines, domestic EIA documents and the recording thereof; ② record the reports by the office of Tongren Rural Road Project funded by the World Bank every six months, and submit the relevant reports to the World Bank for archiving; ③ coordinate with other relevant departments to solve major environmental problems and record the specific measures;
Office of Tongren Rural Road Project Financed by the World Bank Loan	① prepare regulations for the environmental management of sub-projects for archiving; ② prepare and implement environmental management training and record the same; ③ organize thematic studies or related investigations, and manage and record the seminars and investigation files; ④ make a record of the complaints during the construction and operation processes; ② record the reports by the supervisor every quarter and submit reports (statements) to office of Tongren Rural Road Project funded by the World Bank; ⑥ sign the site checklist submitted by the constructor and project supervisor to verify sensitive environmental issues and record the same; ⑦ manage the reported rectification notice for archiving purpose.
External monitoring and controlling agency of environmental management	① before June 30 each year, submit to the World Bank and the environmental management agency and record the medium-term monitoring report. ② prior to December 31 of each year, submit an annual monitoring report to the World Bank and the owners and record the same. ③ after six months after the completion of environmental management, submit and record a comprehensive post-environmental management assessment report.
Constructor	① weekly record the specific circumstances and report to the project supervisor; ② together complete and record the site checklist with the project supervisor before the construction, and report to the project office of Tongren Rural Road Project funded by the World Bank; ③ in the case of urgent and emergencies, record the specific circumstances and report to the project supervisor; ④ after receiving the rectification notice, complete the rectification within three working days (when requiring administrative agency's coordination, within 10 working days) and record the files.
Project supervisor	① record the reports by the constructor and report the same to the office of Tongren Rural Road Project funded by the World Bank every week; ② together complete and record the site checklist with the project supervisor before the construction, and report to the project office of Guiyang Rural Road Project funded by the World Bank; ③ in the case of urgent and emergencies, record the specific circumstances of the constructor and report to the project organizer where the project is located; ④ raise the corrective solutions to the environmental issues occur in the construction activities conducted by the constructor and follow up the implementation thereof, including issuance of rectification notice, rectification checklist, and recording of the documents.
Unit with A-level	① prepare the Environmental Implementation Guidelines and domestic EIA

environmental impact assessment certificate	documents, and record the draft, submissions and draft for approval.
The World Bank	②record every six months the situation reported by Guiyang rural road project office.

4.5 Environmental Monitoring Plan

The purpose of the development of environmental monitoring program is to monitor the implementation of the measures, timely adjust the environmental action plan based on the monitoring results, and provide a basis for the implementation time and the program. Principles developed are based on the expected environmental impacts of each period (during construction or operation period).

As the rural roads and bridges projects are involved in the project, the subprojects are low in grade and the environmental impact is limited. To this end, the environmental monitoring plan only aims for individual subprojects of greater environmental sensitivity. According to the engineering characteristics of rural transportation, the environmental monitoring program will be developed for construction and operation periods in accordance with Table 4.5-1.

Table 4.5-1 Environmental Monitoring Plan for the Construction and Operation Periods

Subproject No.	Name	Monitoring locations	Contents	Monitoring frequency	
				Construction period	Operation period
1. Dejiang County					
1	Mingxi to Dongquan Road	100m of the downstream of Tazitou bridge of Liuchi river	pH, CODcr, NH3-N, BOD5, SS, petroleum and fecal coliform	1	1
		Baopen village primary school	Noise	1	1
		Leichong dam	TSP	1	1
6	Pingyuan to Nangan Road	Nangan river	pH, CODcr, NH3-N, BOD5, SS, petroleum and fecal coliform	1	1
		Tianjingwanxiao	Noise	1	1
		Yejia dam	TSP	1	1
		Old Phoebe and Zeng's family ancestral	Management capacility	1	-
9	Changfeng to Zhuiping highway	Changfeng river	pH, CODcr, NH3-N, BOD5, SS, petroleum and fecal coliform	1	1
		Zhuiping school	Noise	1	1
		Zhuiping	TSP	1	1
19	Hetou through the Dayuan road	Natural heritage, stone tigers	Management capacility	1	1
		Xianba elementary	Noise	1	1

		school			
		Xianba village	TSP	1	1
43	Chaodi to Chenyuan road	Wujiang	pH, CODcr, NH3-N, BOD5, SS, petroleum and fecal coliform	1	1
		Chenda tuo	Noise	1	1
		Chenda tuo	TSP	1	1
44	Wujiagou tu xujiashan Road Pianyan bridge, guanyin bridge	Pianyan River - a tributary of the Liuchi river	pH, CODcr, NH3-N, BOD5, SS, petroleum and fecal coliform	1	1
		Moziyan	Noise	1	1
		Moziyan	TSP	1	1
48	Mati Creek to Meijia Road	Mati Creek	pH, CODcr, NH3-N, BOD5, SS, petroleum and fecal coliform	1	1
		Mei Jiashan	Noise	1	1
		Mei Jiashan	TSP	1	1
2. Sinan County					
25	Qinglong bridge	Xiaoxi River - Longdi River tributary	pH, CODcr, NH3-N, BOD5, SS, petroleum and fecal coliform	1	1
		Longdi River	Management capacility	1	1
72	Tangben to shuanghe road	Heitan river	pH, CODcr, NH3-N, BOD5, SS, petroleum and fecal coliform	1	1
		Anjia dam	Noise	1	1
		Anjia dam	TSP	1	1
77	Lancaocha to Meizibao road Juanzi bay bridge	Qingdu River	pH, CODcr, NH3-N, BOD5, SS, petroleum and fecal coliform	1	1
79	Shangguanqing to Langan road	Yangjiaao - a tributary of the Liuchi river	pH, CODcr, NH3-N, BOD5, SS, petroleum and fecal coliform	1	1
		Siye Tun Nature Reserve	Management capacility	1	1
		Shangguangqing group	Noise	1	1
		Shangguangqing group	TSP	1	1
81	Liangshuijing to Guankou	Indian River tributaries	pH, CODcr, NH3-N, BOD5, SS, petroleum and fecal coliform	1	1
		Moyan Elementary School	Noise	1	1
		Lijiagou	TSP	1	1
84	Dongqingao to	Wujiang	pH, CODcr,	1	1

	Dongjiawan		NH3-N, BOD5, SS, petroleum and fecal coliform		
		Yanjing school	Noise	1	1
		Shangzhai	TSP	1	1

4.6 Capacity building and training programs

For the successful and effective implementation of this project, all employees, especially the construction workers, should be trained for environmental knowledge and skills. In addition to explanation of the importance and the implementation significance of the proposed project to all the staff, different trainings should be targeted to workers of different positions. Specific trainings should combine those conducted at home and abroad according to the management levels and importance of the environmental protection positions. Environmental training and education should include the following contents:

(1) Before the project, the project organizer should assign specialized environmental professional to conduct environmental protection training for civil engineering contractor and construction supervisor.

(2) Before the construction by the civil engineering contractor, education and training as well as assessment, including environmental protection, sanitation and other relevant laws and regulations should be conduct to the site workers.

(3) the civil engineering contractor shall conduct an annual training on the content of risk contingency plans for all workers, and also organize drills.

(4) the civil engineering contractor shall arrange occupational health training and examination every six months for works engaging in toxic and hazardous operation, and instruct the operator to proper use personal protective equipment and occupational protective equipment.

Initial training program is shown in Table 4.6-1.

Table 4.6-1 Training Program for Environmental Protection Technician

Personnel	Contents	Method	Number	Duration (day)
Construction environmental officials	Basic theory of environment, monitoring method and the preparation of monitoring reports as well as job training	Domestic training	2 for each construction segment	2
Environmental supervising engineer and the environmental officer of the construction	Environmental regulations, construction planning, environmental monitoring standards and norms	Domestic training	1-2 and 2-4 of the construction side for each construction segment	2
	Ambient air monitoring and	Domestic training	6	2

side	control technology, noise monitoring and control technology			
Environmental senior officers and environmental engineers	Advanced traffic management experience and environmental noise control measures	Domestic training	4	1
Total				7

4.7 Investment estimate for the environmental protection

For this Project, the total investment in environmental protection is estimated to be about RMB 13.345 million as shown in Table 4.7-1, or 0.92% of the total investment.

Table 4.7-1 Investment Estimate for the Environmental Protection of the Proposed Project
Unit: (10 thousand yuan RMB)

	Contents		**Investment**	
			Estimate	**Total**
Construction period	Social environment	Media, and advance notice	5	25
		Construction site signs	5	
		Sidewalk, and dense mesh enclosure, etc.	15	
	Atmosphere	Hardened construction site	20	63
		Cleaning of wheels	10	
		Watering	10	
		Enclosure of construction site	15	
		Monitoring	8	
	Noise	Equipment insulation boards, temporary housing, etc.	15	19
		Monitoring	4	
	Wastewater	Treatment of the wastewater from the construction of works	90	110
		Monitoring	20	
	Solid waste	Project waste processing	30	40
		Garbage disposal	10	
	Soil and water conservation	Engineering control, and biological control	650	650
	Unforeseen		90.7	90.7
	Total		997.7	
Operation period	Ecological compensation	Replant flowers, and transplanting trees	80	80
	Atmosphere	Road maintenance	50	55
		Monitoring	5	
	Noise	Greening, the deceleration lane, soundproofing, etc.	150	153
		Monitoring	3	
	Unforeseen		28.8	28.8
	Total		316.8	
Training fees			20	20
Total			1334.5	

Annex 1: Checklist for Environmental Inspection During the Construction Period

Elements	Implementation status		Not applicable	Remark
	Implemented	Not implement		Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,
1. Air pollution control				
1.1 Whether the construction site reduces the construction dust by watering				
1.2 Whether the powdery material disposal site is covered				
1.3 Whether the vehicle shipping powder is covered or watered before leaving the venue				
1.4 Whether the spraying and other dust suppression measures have been taken for the construction demolition				
1.5 Whether a closed container is used for the construction waste removal				
1.6 Whether road block-type fence is used when the highway construction crosses through sensitive environmental point (district)				
1.7 Whether the construction site earthwork is stacked and covered				
1.8 Whether the vehicle has been removed of its surface dirt before leaving the site				
1.9 Whether the material storage and large formwork yards in the construction site is flat and solid				
1.10 Whether the prevailing wind and the surrounding environmental protection objectives are considered and whether the yield of fine particulate dust materials locates beyond 300m from the environmental protection objectives				
1.11 Whether the dusty highways are hardened, covered with sand or frequent watered				
1.12 Whether the construction sidewalk sets up the speed limit, and limited speed signs				
1.13 Whether the fuel construction machinery and vehicle are used in a normal state and whether there is any case of black smoke during operation				
1.14 Whether there are incinerations of waste				
1.15 Others (please specify)				

Elements	**Implementation status**		**Not applicable**	**Remark**
	Implemented	**Not implement**		**Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,**
……				
2. Water pollution control				
2.1 Whether the wastewater treatment systems of the construction site (such as temporary sedimentation tank) are under normal use and maintenance				
2.2 Whether the wastewater has been effectively treated and used				
Whether the construction wastewater has been discharge to rainwater channels				
2.4 Whether there is any facility introducing the wastewater collected to the sedimentation tank (such as soil ridge ditch or U-groove)				
2.6 Whether sludge has been conducted for the U-type tank				

Checklist for Environmental Inspection During the Construction Period (continued)

Elements	Implementation status		Not applicable	Remark
	Implemented	Not implement		Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,
2.6 Whether sludge has been conducted for the temporary sedimentation tank				
2.7 Whether the vehicles and equipment are cleaned before entry into and exit from the construction site				
2.8 The maintenance situation of the washing facilities and whether there are any prevention and control measures guarding against sediment spill				
2.9 Whether the washing facilities are settle down and regularly excluded				
2.10 Whether the public roads, site entrance, temporary fences, etc. are kept				
2.11 Whether the sewage is properly handled				
2.12 Whether the faeces have been timely cleaned				

Elements	Implementation status		Not applicable	Remark
	Implemented	Not implement		Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,
2.13 Whether it is strictly prohibited to store construction materials, such as bitumen, oil, chemicals, etc.				
2.14 Whether the bridge and culvert construction is selected during the dry season to shorten the construction time so as to reduce the disturbance of the water body				
2.15 Others (please specify)				
……				
3. Noise Control				
3.1 Whether or not hold a valid construction noise permit within the period when there is restriction on noise				
3.2 Whether the construction noise permit is attached to the construction entrances				
3.3 Whether the idle equipment within the construction site is turned off or under throttling damping state				
3.4 Whether effective noise reduction measures (vibration, noise silencer, noise barriers, etc.) have been taken				
3.5 Whether the low-noise equipment is used				
3.6 Whether the construction time is reasonably scheduled				
3.7 Whether the machinery and equipment of greater noise are set up in the location as far as possible away from the residential zone				
3.8 Whether regular and effective maintenance and repair have been conducted for all mechanical equipment				

Elements	Implementation status		Not applicable	Remark
	Implemented	Not implement		Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,
3.9 Whether the requirements for the construction, machinery and vehicles operating personnel, and procedures, etc. have been strengthened.				
3.10 Others (please specify)				
. . . . .				
4. Solid Waste Management				
4.1 Whether the construction site is clean and tidy				

Checklist for Environmental Inspection During the Construction Period (continued)

Elements	Implementation status		Not applicable	Remark
	Implemented	Not implement		Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,
4.2 Whether part of construction waste is subject to comprehensive utilization together with simultaneous small civil works projects and road projects				
4.3 Whether the remainder of construction waste is stacked in designated yard in the construction site and timely removed to the township landfill in each project site for dealing				
4.4 The spoil includes part of mellow; whether it is used for the reclamation and wasteland afforestation and whether the remaining earthworks are used as a highway project				
4.5 Whether an appropriate spraying is conducted in advance for construction waste removal				
4.6 Whether the garbage				

Elements	Implementation status		Not applicable	Remark
	Implemented	Not implement		Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,
is transported to the landfill after being collected by using trash bag				
4.7 Whether there is the phenomenon of incineration of poisonous and harmful substances				
4.8 Whether there are oil spill, and whether the contaminated soil is cleaned up immediately				
4.9 Whether the asbestos waste is processed by a registered professional				
4.10 Others (please specify)				
5. Hazardous waste and chemical waste				
5.1 Whether the chemicals have been properly stored and labeled				
5.2 Whether the storage of dangerous goods conforms to the store type, data and other provisions of the certificate				
5.3 Whether, during the maintenance period of the machinery equipment, the oil and other wastes have been collected by a special container				
5.4 Whether the antifouling emergency kits / sand / saw mill and other tools and materials have been equipped to absorb the leakage of chemicals.				
5.5 Others (please specify)				
……				
6. Protection of animals, plants and cultural relics				
6.1 Whether the disturbance on terrestrial plants is reduced to a minimum degree and whether the plant is protected				
6.2 Whether there are rare animals				
6.3 Whether cultural relic is occasionally found in the construction, and if found, whether				

Elements	Implementation status		Not applicable	Remark
	Implemented	Not implement		Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,
protective measures have been taken				
6.4 Others (please specify)				

Checklist for Environmental Inspection During the Construction Period (continued)

Elements	Implementation status		Not applicable	Remark
	Implemented	Not implement		Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,
7. Protection of sensitive areas				
7.1 Whether the earth borrowing and spoil, construction camps, etc. have set up in the sensitive area				
7.2 Whether the avoidance and protection measures have been taken for the old trees along Siye Tun Nature Reserve or destroyed				
7.3 When Siye Tun Nature Reserve is involved, before the entry, whether the constructor has signed a liability form, sanitation liability form and liability form for forest and wildlife protection with Sinan Forestry Bureau				
7.4 Whether exotic species have been used for the greening along the road and whether the quarantine is conducted for variety of wood packaging				
7.5 Whether the constructors or individuals are prohibited from illegally gathering wild plants, or destruct their growth environment or the education on forest fire has been strengthened				
7.6 Whether sewage, waste water and muddy water are discharged into the river (especially Xiaoxi river)				
7.7 Whether the design of Qinglongzui bridge fits for Wujiang Bailu scenic area - Longdi River, Xiaoxi River				
7.8 Whether any new cultural relics are found				

Elements	Implementation status		Not applicable	Remark
	Implemented	Not implement		Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,
during the construction and whether they are protected and reported to local authorities of cultural relic protection				
7.9 For the stone horse located at the left of Hetou to Dayuan in Quankou, Dejiang, whether protection measures have been strengthened; whether a clear sign is established; whether the road is expanded to the left; whether blasting construction is applied for this section and whether the cultural relic is protected				
7.10 Others (please specify)				
.....				
8. Resource Conservation				
8.1 Whether the pipes burst and wastage are prevented				
8.2 Whether the diesel-powered equipment is turned off when it is not in use in order to reduce fuel consumption				
8.3 Whether energy-saving measures have been taken				
8.4 Whether the metal or other alternatives is or are used to reduce the use of wood				
8.5 Whether the material storage conditions are good to prevent material degradation or waste				
8.6 Others (please specify)				
.....				

Checklist for Environmental Inspection During the Construction Period (continued)

Elements	Implementation status		Not applicable	Remark
	Implemented	Not implement		Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,
9. Soil and water conservation				
9.1 Whether the topsoil stripping and protection are applied before roadbed construction				
9.2 Whether the shoulder ridge and temporary chute are set up				
9.3 Whether the settling basin is set up for the roadbed gutter outlet				
9.4 Whether the coagulation stir field is hardened				
9.5 Whether there is a settling basin set in each concrete mixing station				
9.6 Whether dregs, slope, drainage measures are taken around the temporary spoil (slag)				
9.7 Whether the plant measures (native species) have been taken				
9.8 Whether the bare slope is timely repaired to reduce the slope exposure time				
9.9 Others (please specify)				
.....				
10. Construction safety and emergency measures				
10.1 Whether the integrity of all buildings within the construction site has been ensured				
10.2 Whether appropriate first aid equipment has been equipped in the construction site				
10.3 Whether correct signs have been hanged for hazardous areas, equipment, materials, safety measures, emergency exits and so on				
10.4 Whether the constructor have identified and provided for construction workers appropriate personal protective equipment				
10.5 Whether the constructor has established the procedures and systems for reporting and recording the occupational accidents and diseases and the				

Elements	Implementation status		Not applicable	Remark
	Implemented	Not implement		Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,
dangerous accident				
10.6 Whether health education has been conducted for construction workers				
10.7 Whether the accident or incident is being reported and verified and whether there are any corrective and preventive measures and records				
10.8 Others (please specify)				
……				

Construction phase: _____Checked on: _____Checked at: _____

Weather conditions: _____

Signature of the site examiner: _____Signature of the person in charge of the environmental supervision: _____

Note: ① In the remark, the problems found can be filled and for the failure situations, explanations should be noted, and the information on the proposed corrective action and prevention actions should be stated.

② When there is any failure situations or to-be-improved ones, the environmental supervisor should issue immediately "green rectification notice" to the contractor and record the number of "green rectification notice" in the Remarks column. The details of the corrective actions by the contractor should be otherwise recorded.

③ The form is the environment checklist general for the Guizhou Tongren Rural Road Project Financed by the World Bank Loan. For specific sub-projects and environmental issues, it may be increased or adjusted in combination of local environmental conditions and related construction contents and appropriate environmental protection measures should be taken.

Annex 2: Environmental Rectification Notice Issued by the Environmental Supervisor to the Contractor

Project name:		**Construction site:**	
Contract number and location of the sub-project:		**Construction phase:**	
Inspection problems:			
Contractor's analysis and improvement measures proposed:			
Rectification opinions of environmental protection department (if necessary):			
Environmental supervisor: Date Time limit for rectifications: within days The Recipient: Date			
Findings:			

Reviewed by:	Date

Annex 3: Checklist before Environmental Acceptance

Project name:		**Daily weather conditions:**	
Construction site:		**Examiner:**	
Construction phase:		**Contract number and location of the project:**	
Checked on:		**Specific time:**	

Items examined	**Implementation status**		**Not applicable**	**Remark**
	Implemented	**Not implement**		**Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,**
1. Whether the construction waste of the construction site is removed to the township landfill where the project is located				
2. Whether the measures have been taken for the targets along the sound environment				
3. Whether the sound environment of the targets along the road meets the requirements of the relevant standards				
4. Whether the ecological restoration measures have been taken for the temporary spoil (slag) fields				
5. Whether the existing township road is worse, and whether the traffic is smooth				
6. Whether the hardened concrete mixing field is dismantled				
7. Whether land remediation, rehabilitation or greening measures have been taken for the temporary covering of concrete mixing field				
8. Whether the temporary sedimentation pond and grit chamber have been removed				
7. Whether land remediation, rehabilitation or greening measures have been taken for the temporary covering of sedimentation tank and grit chamber				
10. Whether the temporary retaining ridge and temporary chute have been removed and appropriate measures for ecological restoration have been taken				
11. Whether the surface mellow saved is used for ecological restoration				
12. Whether there are trees planted in both sides of the road				
13. Whether the type of street				

Project name:		**Daily weather conditions:**	
Construction site:		**Examiner:**	
Construction phase:		**Contract number and location of the project:**	
Checked on:		**Specific time:**	

Items examined	**Implementation status**		**Not applicable**	**Remark**
	Implemented	**Not implement**		**Problems or irregularities found in checking and the rectification and prevention measures proposed, etc.,**
trees belongs to the region				
14. Whether the embankment slope is greened				
15. Whether the road drainage system is perfect				
16. Whether there is a visual pollution along the road				
17. Whether the avoidance and protection measures have been taken for the old trees along Siye Tun Nature Reserve or destroyed				
18. Whether the design of Qinglongzui bridge fits for Wujiang Bailu scenic area - Longdi River, Xiaoxi River				
19. Whether the cultural relics of Dejiang County Quankou Township have been protected or destroyed				
20. Whether the cities and counties have participated the relevant training and education				
21. Whether the local public is satisfied with the construction of road works				
Instructions: This form is common inspection checklist for construction and environmental protection; for specific sub-projects, local environmental conditions and related environmental protection measures, if necessary, they may be increased or adjusted. * When there is any record of "not implemented", it indicates that there may be cases of illegal irregularities or to-be-improved situation. At this time, the environmental supervisor should issue immediately "green rectification notice" to the contractor and record the number of "green rectification notice" in the Remarks column. The details of the corrective actions by the contractor should be otherwise recorded.				
Signature of the site examiner: Date:				
Signature of the person in charge of the environmental supervision: Date:				

Annex 4: Termis of References for External Environmental Monitoring Consultant

According to relevant requirements of World Bank Group, during the implementation of the environmental management, the project management office (PMO) will choose external monitoring agency with environmental management experiences to control and evaluate the implementation of environmental management and recovery actions, so as to ensure that environmental management is performed in accordance with *Environmental Practice.*

I. Purpose of external monitoring

External monitoring and evaluation is implemented by a qualified agency, which is independent on PMO and environmental assessment agency, the purpose is to monitor and evaluate social disruption, sewage treatment, conservation of cultural relics, safety and health, air pollution, soil erosion, recovery of noise monitoring, and put forward the evaluation opinions and recommendations. Take systematic steps to identify problems, taking remedial measures together with timely tracing through external monitoring and evaluation systems, thus to ensure the implementation effect of environmental protection.

II. In order to successfully complete the independently external monitoring work, the PMO will entrust professional agency with sufficient experiences to specialize in external monitoring work of this project. When selecting personnel involved in external monitoring work, and the main factors need to be considered are as follows:

1. The personnel engaged in the external monitoring work should have been involved in similar work, and they have sufficient experience in social investigation, together with full understanding of relevant environmental management of World Bank Group *Environmental Practice*, know well about relevant national and local policies and regulations with respect to environmental management.

2. The personnel should be with the ability of independently engaged in social investigation and study, good communication and exchange qualities, hardworking.

III. According to preliminary schedule of the project, experienced independent external monitoring agency will be entrust to conduct external monitoring and assessment. The job scope of the independent monitoring agency is as follows:

1. Offer technical assistance and training.
2. Assist the implementation of the destroyed ecological environment during the construction and make (recovery) plans.
3. Conduct a regular (quarterly) on-site inspection for the implementation of environmental protection measures of the project construction site In accordance with requirements of *Environmental Management Plan*.
4. Carry out the necessary environmental monitoring in accordance with the

monitoring plan requirements of *Environmental Management Plan*.

5. Prepare to provide the PMO and World Bank Group with external monitoring and assessment report.

IV.Reporting system of external monitoring

The external monitoring agency writes the external monitoring report based on the information obtained through observation and investigation. The following is the reporting cycle of external monitoring agency to World Bank Group and PMO:

1. The on-site inspection results will be submitted to the PMO of Tongren City (together with Dejiang County and Sinan County) quarterly;

2. Assist the PMO to prepare a semi-annual environmental monitoring report that is to be submitted to World Bank Group every six months.