IIETA International Information and Engineering Technology Association
Advancing the World of Information and Engineering

Environmental and Earth Sciences Research Journal
Vol. 9, No. 3, September, 2022, pp. 122-131
Journal homepage: http://iieta.org/journals/eesrj

Environmental Impact Assessment of Expressway Construction from Weining to Weizhang (Guizhou and Yunnan Boundary), Guizhou Province

Haidong Jiang

School of Resources and Environmental Engineering, Guizhou Institute of Technology, Guiyang 550000, China

Corresponding Author Email: 20170783@git.edu.cn

https://doi.org/10.18280/eesrj.090306

Received: 12 July 2022
Accepted: 26 August 2022

Keywords:
highway, environmental evaluation factor, compensation method, scoring method, environmental economy

ABSTRACT

In order to evaluate the Guizhou Weining to Weizhang (qian dian) highway engineering construction affects the surrounding environment, according to the nature of the construction project, scale, location, using production technology or pollution prevention and prevention measures for analysis, through the water environment, air environment, sound environment, ecological environment four evaluation factor analysis and evaluation. Through eight working area construction waste water, sewage water quality test analysis, ambient air and sound environment sensitive point 44, and construction along the 200m land, vegetation, wildlife, wood trees four aspects of the ecological environment evaluation, and the compensation method, scoring method and analysis method of the proposed project construction project environmental profit and loss has carried on the qualitative analysis. The analysis results show that the positive benefits of environmental economy generated by the proposed expressway are predominant, so the project is feasible from the perspective of environmental protection.

1. INTRODUCTION

With the construction of expressway in full swing, the increasing total mileage is increasing, its impact and damage on the ecological environment is more and more serious, so it is necessary to carry out the expressway ecological environment impact assessment research [1-5].

"Guizhou Weining to Weizhang (Guizhou-Yunnan Border) Expressway Project" is an important part of the "second horizontal" Daxing to Weining Expressway in the "Guizhou Expressway Network Planning". This project and Yangliu to Xuanwei Yunnan section highway linking, the north proposed Duxiangguogao Liupanshui to Weining section, south under construction Hangruiguogao to Xuanwei section, and through related projects connecting Bijie to Weining highway, is the national highway network in northwest Guizhou, east Yunnan economic radiation driving extension and expansion, is the northwest Guizhou national highway, and to strengthen the regional economic cooperation in Yunnan and an important inter-provincial highway channel.

Through testing and analyzing the water quality of construction wastewater and domestic sewage in 8 working areas of the highway project from Weining to Weizhang (the boundary between Guizhou and Yunnan), 44 sensitive points of environmental air and sound environment, and the ecological environment of land, vegetation, wild animals, famous trees and ancient trees in the area of 200m along the construction were evaluated. The environmental profit and loss of the proposed construction project are analyzed qualitatively by means of compensation method and scoring method.

2. CONTENT OF THE EVALUATION

According to the characteristics of the expressway project from Weining to Weizhang (Guizhou and Yunnan boundary) and the field survey and research results of the route scheme, the main contents of the environmental impact assessment work are determined as follows:

(1) Engineering analysis;
(2) Water environmental impact assessment;
(3) Sound and environmental impact assessment;
(4) Environmental air impact assessment;
(5) Ecological environment impact assessment;
(6) Transportation risk analysis;
(7) Environmental protection measures.

3. ENVIRONMENTAL IMPACT IDENTIFICATION AND EVALUATION FACTORS

3.1 Environmental impact identification

According to the characteristics and analysis of the construction project, the impact of the generated pollutants on the ambient air, water environment, acoustic environment and ecological environment of the project area is identified and analyzed according to the environmental impact factors of long-term / short-term, reversible / irreversible, positive / negative, significant / slight, etc. The results are shown in Table 1.

Table 1. List of environmental impact identification matrix

Environmental elements	Construction period							Operating period			
	Take abandoned soil	The subgrade	road surface	Bridge culvert	The tunnel	material transport	Mechanical work	The transportation	greening	reclamation	Bridge culvert edge ditch
Properties of soil		●			●					□	
Surface water article		●		●	●						□
Ground water quality		●		●				■			□
Ambient air	●	●	●	●	●	●	●	■	□		
Acoustical environment	●	●	●	●	●	●	●	■	□		
Aquatic organism				●							
Land vegetation	●	●		●	●	●			□	□	
Terrestrial animal	●	●		●	●	●	●	■	□	□	

Note: □/●: Long-term / short-term effects; black / white: adverse / favorable effects; blank: no mutual influence

Table 2. List of evaluation factors of this project

Environmental elements	Status quo evaluation	construction period	Operating period
Water environment	pH, COD, BOD_5, NH_3-N, SS, Petroleum group, total hardness, oxygen consumption, total coliform group	SS, Petroleum group	Pavement runoff (SS, petroleum group); domestic sewage for service facilities (COD, NH_3-N)
Ambient air	NO_2, PM_{10}, $PM_{2.5}$	Dust (TSP, PM_{10}, $PM_{2.5}$)	Automobile exhaust: NO_2
Sound environment	Equivalent A sound level L_{Aeq}	Equivalent A sound level L_{Aeq}	Equivalent A sound level L_{Aeq}
The ecological environment	Land use type vegetation Wild animals	Land use type vegetation Wild animals	Land use type vegetation Wild animals

3.2 Evaluation factors

According to the environmental impact identification results, the main environmental impact factor evaluation factors of the proposed project are shown in Table 2.

4. EVALUATION CRITERIA

4.1 Water environment evaluation criteria

Refer to Tables 3 and 4 for rivers, lakes and groundwater along the highway. Sewage standards for sewage discharge during construction period and service facilities during operation period, please refer to Table 5 [6].

4.2 Acoustic environment evaluation criteria

The areas within 35m outside the boundary line of the existing national roads and provincial roads shall implement the Acoustic Environment Quality Standard, as referred to Table 6 for [7, 8].

Table 3. Evaluation criteria for water environment

Standard category	pH	COD (mg/ L)	Petroleum Classs (mg/ L)	SS (mg/L)	BOD_5 (mg/L)	NH_3-N (mg/L)	Oxygen consumption(mg/L)
Surface Water Environmental Quality Standards (GB3838-2002) Class III standard	6~9	≤20	≤0.05	≤30*	≤4	≤1.0	≤6

Note: "*" is the third-level standard of Surface Water Resources Quality Standard (SL63-94)

Table 4. Groundwater environmental quality standard

Standard category	pH	Total hardness ($CaCO_3$) (mg/ L)	NH_3-N (mg/L)	Total coliform bacteria (MPN^b/100mL)	Oxygen consumption (mg/ L)
III class standard	6.5~8.5	≤450	≤0.5	≤30	≤3.0

Table 5. Comprehensive sewage discharge standard

Standard category	pollutants						
(GB8978-1996) Primary standard	pH	COD (mg/ L)	Animal and plant oil (mg/ L)	SS (mg/L)	Petroleum (mg/L)	BOD_5 (mg/L)	NH_3-N (mg/L)
	6~9	≤100	≤10	≤70	≤5	≤20	≤15

Table 6. Sound environment quality standard: Unit: dB

Sensitive target	Daytime	Nighttime	Class
The status of acoustic environment in hospitals and schools	55	45	Class 1
Residential residence within 35m outside the highway boundary line	70	55	Class 4a
Residential residence located 35m outside the highway boundary line and 35m outside the railway boundary line	60	50	Class 2
Residential residence within 35m outside the railway boundary line	70	60	Class 4b

5. EVALUATION METHOD

This project is a linear development project, with the characteristics of many sensitive points and a wide impact area. The evaluation is conducted by various means of investigation, monitoring and theoretical analysis.

In this environmental impact assessment, the environmental risk analysis adopts the probability analysis; the traffic noise impact assessment during the operation period; the impact of tunnel exhaust gas on the environment mainly follows the original environmental assessment, analogy and analysis, and the current situation monitoring, analogy analysis and model calculation.

6. EVALUATION RESULTS

6.1 Monitoring and evaluation of surface water environment status

The surface water bodies involved in the proposed highway include Shanlitou Reservoir, Maoshui River, Xiangchang River, Jindou River, Mabugou River, Kedu River and other rivers and lake reservoirs. The above surface water bodies are all divided into class III water functional areas.

According to the water flow of rivers and lakes on site, four monitoring sections were set up in this evaluation. The detailed monitoring sections and section characteristics are detailed in Table 7.

The detection method and detection limits of the surface water monitoring factors of this project are shown in Table 8.

6.1.1 Evaluation methodology

1) Standard index of a single water quality parameter at point i at point j:

$$S_{i,j}=c_{i,j}/c_{si}$$

where: $S_{i,j}$ ——The standard index of the i th pollutant in j;

$C_{i,j}$ —— The measured concentration value of the ith pollutant at point j(mg/L);

C_{si} —— Assessment criteria for pollutants i (mg/L) (mg/L).

2) pH value standard index calculation formula:

$$S_{pH,j}=\frac{7.0-pH_j}{7.0-pH_{sd}} \quad pH_j \leqslant 7.0$$

$$S_{pH,j}=\frac{pH_j-7.0}{pH_{su}-7.0} \quad pH_j > 7.0$$

where:

SpH,j -- standard index of a single water quality parameter pH at the j point;

PHj—— the pH value at point j;

PHsu ——the upper limit of pH specified in the surface water quality standard;

PHsd ——the lower limit of pH specified in the surface water quality standard.

If the standard index of water quality parameter > 1, it indicates that the water quality parameter exceeds the specified water quality standard and cannot meet the use requirements.

According to the monitoring results, see Table 9 for the evaluation results of the current situation of surface water environmental quality.

As can be seen from the above table: the standard index of all current situation evaluation factors of surface water bodies along the Project is less than 1, indicating that the current situation of water environmental quality in the evaluated reach of the Project meets the requirements of Class III standard of Surface Water Environmental Quality Standard (GB3838-2002).

6.2 Monitoring and evaluation of groundwater environment status

In this evaluation, the well springs of Hongshiyan Group in Maoshui Village along the line were sampled and monitored. The layout of the current monitoring points is shown in Table 10.

The monitoring data of groundwater quality status are shown in Table 11.

The evaluation method of this evaluation:

1) Standard index of single water quality parameter point i at point j:

$$S_{i,j}=c_{i,j}/c_{si}$$

where: $S_{i,j}$ - standard index of the ith pollutant in J;

$C_{i,j}$ - the measured concentration value of the ith pollutant at point j (mg/L);

C_{si} - Evaluation criteria for the i pollutant (mg/L).

Table 7. List of monitoring sections of surface water environmental quality status

NO.	Name of surface water body	Pile number	Geographic position	Monitoring section location	Monitoring project
W1	Shanlitou Reservoir	K0+268	E104°22'53.79" N26°47'57.82"	The middle of Shanitou Reservoir	pH, SS, TP, COD, BOD_5, NH_3-N, petroleum
W2	Jindou River	K19+50	E104°17'33.66" N26°41'28.50"	Jindou interconnects 200m downstream across the river	
W3	Mabugou River	K24+855	E104°15'37.47" N26°39'09.41"	The highway crosses 200m downstream of the river	pH, SS, COD, BOD_5, NH_3-N, petroleum
W4	Kedu River	K28+138	E104°15'06.61" N26°37'30.10"	The highway crosses 200m downstream of the river	

Table 8. Surface water monitoring and analysis methods

Detection and analysis items	Test method	Method basis	Minimum detection limit value
water temperature	The thermometer method	GB13195-1991	——
pH Value	glass electrode method	GB6920-1986	0.01pH
COD_{cr}	dichromate titration	GB11914-89	10mg/L
BOD_5	Dilution and inoculation method	HJ505-2009	2 mg/L
SS	gravimetric analysis	GB/T11901-89	0.5 mg/L
NH_3-N	N's reagent colorimetric method	HJ535-2009	0.025mg/L

Table 9. Evaluation list of the test results of the monitoring section of this project

Monitoring section	Evaluation factor	pH	SS (mg/L)	COD (mg/L)	BOD_5 (mg/L)	NH_3-N (mg/L)	TP (mg/L)	petroleum
Evaluation Criterion		6~9	≤30*	≤20	≤4	≤1.0	≤0.05	≤0.05
W1	Range of detected values	7.22~7.29	9~10	10~12	1.6~1.9	0.602~0.613	0.03~0.04	0.01L
	Mean Value	/	9.33	11	1.7	0.608	0.033	0.01L
	Standard index	0.11~0.14	0.31	0.55	0.43	0.61	0.66	0.1
	over standard rate%	0	0	0	0	0	0	0
	Maximum excess multiple	0	0	0	0	0	0	0
W2	Range of detected values	7.33~7.39	22~25	5~6	0.6~0.9	0.152~0.157	/	0.01L~0.01
	Mean Value	/	23.33	5.67	0.77	0.155	/	0.003
	Standard index	0.165~0.195	0.78	0.28	0.19	0.16	/	0.06
	over standard rate%	0	0	0	0	0	/	0
	Maximum excess multiple	0	0	0	0	0	/	0
W3	Range of detected values	7.33~7.38	15~18	5~7	0.6~0.8	0.472~0.481	/	0.01L~0.01
	Mean Value	/	16.67	6	0.67	0.476	/	0.003
	Standard index	0.165~0.19	0.56	0.3	0.17	0.48	/	0.06
	over standard rate%	0	0	0	0	0	/	0
	Maximum excess multiple	0	0	0	0	0	/	0
W4	Range of detected values	7.51~7.59	12~15	6~8	1.0~1.3	0.174~0.185	/	0.01L
	Mean Value	/	13.67	7	1.13	0.178	/	0.01L
	Standard index	0.255~0.295	0.46	0.35	0.28	0.18	/	0.1
	over standard rate%	0	0	0	0	0	/	0
	Maximum excess multiple	0	0	0	0	0	/	0

Table 10. List of the monitoring points of groundwater environmental quality status

NO.	Name	Pile number	geographic coordinates	Monitoring site location	Monitoring factor
S1	Hongshiyanjing spring	K0+980	East longitude 104°22'39.09" North latitude 26°47'39.26"	Sampling in wells about 118m southwest of Highway K0 + 970	PH, oxygen consumption, total hardness, NH_3-N, and total coliform group

Table 11. Monitoring results of groundwater environment status Unit: mg/L (pH SS)

NO.	Water name	Monitoring date	water temperature (℃)	pH	NH_3-N	Total Hardness	oxygen consumption	total coliform group
S1	Hongshiyan jing spring	September 19	12.2	7.63	0.257	288	1.8	4
		September 20	12.6	7.59	0.253	283	1.6	4
		September 21	12.3	7.68	0.266	286	1.6	4

2) pH value standard index calculation formula:

$$S_{pH,j} = \frac{7.0 - pH_j}{7.0 - pH_{sd}} \quad pH_j \leqslant 7.0$$

$$S_{pH,j} = \frac{pH_j - 7.0}{pH_{su} - 7.0} \quad pH_j > 7.0$$

where: $S_{pH,j}$ - standard index of a single water quality parameter pH at the JTH point;

PH_j - the pH value at point j;

PH_{su} - the upper limit of pH specified in the surface water quality standard;

PH_{sd} - the lower limit of pH specified in the surface water quality standard.

If the standard index of water quality parameter > 1, it indicates that the water quality parameter exceeds the specified water quality standard and cannot meet the use requirements.

This analysis of groundwater quality standards is shown in 12.

According to the analysis results in Table 12, the standard indexes of the monitoring factors selected in this EIA are all less than 1, indicating that the water quality of Hongshiyanjingquan can meet the class iii standard of Groundwater Quality Standard (GB/T14848-2017).

6.3 Monitoring and evaluation of current air environment

Combined with the characteristics of the project and the environmental characteristics along the route, the project has set up a total of 3 ambient air quality monitoring points. The locations of monitoring points are shown in Table 13.

The monitoring and analysis methods and detection limits are shown in Table 14.

Evaluation methodology:

Single-factor pollution index method is used, and the calculation formula is as follows:

$$I_i = c_i / c_{oi}$$

where: C_i — monitoring value of the ith pollutant, μg/m^3;

C_{0i} —is the quality standard limit value of the ith pollutant assessment in the functional area, μg/m^3;

I_i— single factor pollution index of the ith pollutant.

If the single factor index is all greater than 1, it indicates that the current situation of ambient air quality in the project area does not meet the standard requirements.

The current monitoring results of ambient air quality are shown in Tables 15 to 17 respectively.

As can be seen from Table 18, the single standard indexes of the conventional monitoring factors NO_2, PM_{10} and $PM_{2.5}$ within the evaluation range along the line are all less than 1, indicating that the ambient air quality of the areas along the line meets the secondary standard in the Ambient Air Quality Standard (GB3095-2012).

(8) Present situation evaluation results

According to the above monitoring results, the current evaluation results of ambient air quality are shown in Table 18.

6.4 Monitoring and evaluation of acoustic environment status

A total of 14 acoustic environmental quality status monitoring points were set up in this evaluation. See Table 19 for specific details.

The evaluation results according to the current situation of the acoustic environmental quality of the monitoring points are shown in Table 20.

Table 12. Statistical table of groundwater quality monitoring results of Hongshiyanjing spring

Monitoring site	Evaluation factor	Monitoring results (mg/L, except pH) The maximum Value	Evaluation standard (mg/L, except pH)	Standard index	The standard situation
Hongshiyanjing Spring	pH	7.68	6~8.5	0.45	Up to standard
	Ammonia nitrogen	0.266	0.5	0.53	Up to standard
	Oxygen consumption	1.8	3.0	0.6	Up to standard
	Total coliform bacteria (MPN^b/100mL)	4	30	0.133	Up to standard
	Total hardness (mmol/L, In terms of $CaCO_3$)	288	450	0.64	Up to standard

Table 13. Monitoring points of ambient air quality

NO.	Name	Pile number	geographic coordinates	Monitoring site location	Monitoring project
G1	Hongyan Group, Maoshui Village, Jinzhong Town 2)	K1+125	E104°22'38.65" N26°47'32.08"	About 35m site open space on the left side of highway K1 + 125	NO_2, PM_{10} and $PM_{2.5}$
G2	Hongshi village Hongshi Primary school,Jindou town	K18+392	E104°17'27.57" N26°41'49.09"	About 130m left of the school open space of highway ZK18 + 392	
G3	Partial rock Hongyan group Xiangling village,Jingdou town	K26+119	E104°15'26.04" N26°38'30.53"	Highway K26 + 119 right side of about 120m village site open place	

Table 14. Monitoring and analysis method of ambient air status evaluation factor

Detection and analysis items	Test method	Test method	Minimum detection limit value
NO_2	Spectrophotometry	HJ479-2009	0.05μg /m^3
PM_{10}	gravimetric analysis	HJ618-2011	0.01μg /m^3

Detection and analysis items	Test method	Test method	Minimum detection limit value
$PM_{2.5}$	gravimetric analysis	HJ618-2011	0.01μg /m^3

Table 15. Ambient air monitoring results of Hongyan Group 2) in Maishui Village, Jinzhong Town (Unit: μg/m^3)

Sampling site: Hongyan Group, Maishui Village, Jinzhong Town 2) (G1)					Atmospheric pressure at sampling site: 79.0~88.7kPa			
Sampling site air temperature: 15~22℃					Relative humidity at sampling site: 70~92%			
Mean wind speed at sampling site: 1.3m/s					Wind direction at sampling site: no sustained wind direction			
Sampling instrument model: KB-6120 comprehensive atmospheric sampler								
Monitoring project	Sampling period	Sampling date						
		9.19	9.20	9.21	9.22	9.23	9.24	9.25
NO_2 hourly mean concentration	2:00—3:00	18	19	17	20	21	16	20
	8:00—9:00	25	27	24	26	28	25	27
	14:00—15:00	41	44	43	41	45	40	43
	20:00—21:00	24	25	24	22	23	25	26
NO_2 Daily average concentration		27	28	25	27	30	26	29
PM_{10} Daily average concentration		49	50	47	48	48	47	50
$PM_{2.5}$ Daily average concentration		34	31	30	32	29	33	35

Table 16. Ambient air monitoring results of Hongshi Primary School, Hongshi Village, Jindou Town (Unit: μg/m^3)

Sampling place: Hongshi Primary School, Hongshi Village, Jindou Town(G2)					Atmospheric pressure at sampling site: 78.9~86.8kPa			
Sampling site air temperature: 14~23℃					Relative humidity at sampling site: 73~90%			
Mean wind speed at sampling site: 1.1m/s					Wind direction at sampling site: no sustained wind direction			
Sampling instrument model: KB-6120 comprehensive atmospheric sampler								
Monitoring project	Sampling period	Sampling date						
		9.19	9.20	9.21	9.22	9.23	9.24	9.25
NO_2 hourly mean concentration	2:00—3:00	16	13	14	15	14	13	15
	8:00—9:00	22	23	25	20	23	22	24
	14:00—15:00	34	36	35	33	32	30	35
	20:00—21:00	22	21	24	20	21	25	23
NO_2 Daily average concentration		23	26	25	22	23	21	27
PM_{10} Daily average concentration		45	47	49	47	46	43	45
$PM_{2.5}$ Daily average concentration		30	33	34	30	31	35	32

Table 17. Ambient air monitoring results of Hongyan Group, Xiangling Village, Jindu Town (Unit: μ g/m^3)

Sampling site: Hongyan Group, Xiangling Village, Jindu Town (G3)					**Atmospheric pressure at sampling site: 82.2~99.8kPa**			
Sampling site air temperature: 14~22℃					Relative humidity at sampling site: 75~92%			
Mean wind speed at sampling site: 1.2m/s					Wind direction at sampling site: no sustained wind direction			
Sampling instrument model: KB-6120 comprehensive atmospheric sampler								
Monitoring project	Sampling period	Sampling date						
		9.19	9.20	9.21	9.22	9.23	9.24	9.25
NO_2 hourly mean concentration	2:00—3:00	13	16	14	15	12	15	16
	8:00—9:00	25	24	21	24	20	22	23
	14:00—15:00	35	37	34	35	34	36	38
	20:00—21:00	27	29	28	29	28	30	29
NO_2 Daily average concentration		24	27	24	26	23	24	27
PM_{10} Daily average concentration		37	40	38	40	37	41	42
$PM_{2.5}$ Daily average concentration		24	26	25	24	23	25	27

Table 18. Monitoring and evaluation results of ambient air quality status

Monitoring site	**Monitoring factor**	**Monitoring period**	**Range of measurement(ug/m^3)**	**Standard limits (ug/m^3)**	**Maximum single-factor index**	**over standard rate (%)**	**Maximum excess multiple**
(G1)	NO_2	Hourly average	16~45	200	0.23	0	0
		Daily average	25~30	80	0.38	0	0
	PM_{10}	Daily average	47~50	150	0.33	0	0
	$PM_{2.5}$	Daily average	29~35	75	0.47	0	0
(G2)	NO_2	Hourly average	13~35	200	0.18	0	0
		Daily average	21~27	80	0.34	0	0
	PM_{10}	Daily average	43~49	150	0.33	0	0

Monitoring site	Monitoring factor	Monitoring period	Range of measurement(ug/m^3)	Standard limits (ug/m^3)	Maximum single-factor index	over standard rate (%)	Maximum excess multiple
(G3)	$PM_{2.5}$	Daily average	30~35	75	0.47	0	0
	NO_2	Hourly average	12~38	200	0.19	0	0
		Daily average	23~27	80	0.34	0	0
	PM_{10}	Daily average	37~42	150	0.28	0	0
	$PM_{2.5}$	Daily average	23~27	75	0.36	0	0

Table 19. Monitoring point arrangement of sound environment quality status

NO.	Name	Pile number	geographic coordinates	Monitoring site location	Monitoring project	Noise type
N1	Hongyan Group, Maoshui Village, JinzhongTown 1)	K0+866	E104°22'45.47" N26°47'36.51"	Left 36m + 866 K, 1.2m from the ground	L_{Aeq}	railroad noise
N2	Hongyan Group, Maoshui Village, JinzhongTown 2)	K1+125	E104°22'38.91" N26°47'31.92"	Left side 46m of highway K1 + 125,1.2m from the ground		Traffic noise, record the traffic flow
N3	Yuanzitou Shuitang Group, Maoshui Village	K1+948	E104°22'29.34" N26°47'08.42"	Left side 104m of highway K1 + 948,1.2m from the ground		
N4	Dagengzi Yinpo group, Midou village	K3+150	E104°22'37.76" N26°46'31.35"	About 18m on the right side of highway K3 + 150,1.2m away from the ground		
N5	Yiming Dumu group, Midou village	K4+750	E104°22'16.65" N26°45'45.21"	About 21m on the left side of highway K4 + 750,1.2m away from the ground		
N6	Yinyuan Yinyuan Group, Dashu Village, Yaozhan Town	K7+945	E104°21'05.17" N26°44'26.57"	Highway K7 + 945 left side 73m, 1.2m from the ground		
N7	Pingzi Pingzi Group, Dashu Village	K9+492	E104°20'14.29" N26°44'06.67"	The right side of highway YK9 + 492 is 109m, 1.2m from the ground		
N8	Liangyan Liangyan Group, Chongzi Village, Jindou Town	K14+940	E104°17'19.50" N26°43'38.26"	The right side of highway YK14 + 940 is 70m, 1.2m from the ground		
N9	Hongshi Primary school,Hongshi Village ,Jindou Town	K18+392	E104°17'27.52" N26°41'48.97"	Left side of highway ZK18 + 392 is 30m, 1.2m from the ground		ambient noise
N10	Health Center, Jindou Town	K19+165	E104°17'32.54" N26°41'23.05"	Right side of highway YK19 + 165 is 21m, 1.2m from the ground		
N11	Zhujiapo Village, Jindou Town	K24+000	E104°15'57.38" N26°39'29.13"	Right side of highway YK24 + 000 is 116m, 1.2m from the ground		
N12	Pianyan Hongyan Group, Xiangling Village, Jindou Town	K26+119	E104°15'26.50" N26°38'30.52"	126 + 119 about 110m, 1.2m from the ground		
N13	Mabugou Village,Jin Dou town	K27+378	E104°15'28.75" N26°37'47.79"	About 123m on the left side of highway K27 + 378,1.2m away from the ground		
N14	Tongchanghe, Louzishan Group, Yaozhan community Yaozhan Town Community	L1K0+256	E104°16'11.79" N26°44'07.12"	The right side of highway LK0 + 256 is about 126m, 1.2m from the ground		

Table 20. Traffic noise and traffic flow monitoring results

NO.	Monitoring site	Monitoring time		Vehicle / (during the monitoring period)		
		Date	time interval	Oversize vehicle	Medium-sized car	landaulet
N2	Hongyan Group, Maoshui Village, JinzhongTown 2)	2018.9.22	Daytime	36	64	76
			Nighttime	9	12	15
		2018.9.23	Daytime	32	53	82
			Nighttime	10	9	13

The monitoring results show that the daytime acoustic environment quality of the Hongshi Primary School and Jindu Town Health Center within the evaluation scope of the project exceeds the standard is mainly caused by human activities in the school and around the hospital (Table 21). In addition, the acoustic environment quality of the other monitoring points

within the evaluation range along the line meets the corresponding standard limits of the Acoustic Environment Quality Standard (GB3096-2008).

Table 21. Evaluation of current monitoring results of sound environment quality

NO.	Monitoring site	Monitoring time	Monitoring results and meeting the standards			Background value (dB)		Represents sensitive points
			L_{eq}(dB)	standard	Overstandard situation			
N1	Hongyan Group, Maoshui Village, JinzhongTown 1)	2018.9.22 Daytime	55.4	4b	Up to standard	Daytime	55.4	Itself
		2018.9.22 Nighttime	47.6		Up to standard			
		2018.9.23 Daytime	54.7		Up to standard	Nighttime	48.1	
		2018.9.23 Nighttime	48.1		Up to standard			
N2	Hongyan Group, Maoshui Village, JinzhongTown 2)	2018.9.22 Daytime	61.3	4a	Up to standard	Daytime	61.3	Itself
		2018.9.22 Nighttime	42.7		Up to standard			
		2018.9.23 Daytime	60.5		Up to standard	Nighttime	42.7	
		2018.9.23 Nighttime	40.3		Up to standard			
N3	Yuanzitou Shuitang Group, Maoshui Village	2018.9.22 Daytime	41.6	2	Up to standard	Daytime	42.4	Itself, Daqing Group, Shuitangbian
		2018.9.22 Nighttime	34.3		Up to standard			
		2018.9.23 Daytime	42.4		Up to standard	Nighttime	35.5	
		2018.9.23 Nighttime	35.5		Up to standard			
N4	Dagengzi Yinpo group, Midou village	2018.9.22 Daytime	44.9	2	Up to standard	Daytime	44.9	Itself
		2018.9.22 Nighttime	35.4		Up to standard			
		2018.9.23 Daytime	43.7		Up to standard	Nighttime	35.8	
		2018.9.23 Nighttime	35.8		Up to standard			
N5	Yiming Dumu group, Midou village	2018.9.22 Daytime	45.2	2	Up to standard	Daytime	45.9	Itself
		2018.9.22 Nighttime	36.1		Up to standard			
		2018.9.23 Daytime	45.9		Up to standard	Nighttime	36.9	
		2018.9.23 Nighttime	36.9		Up to standard			
N6	Yinyuan Yinyuan Group, Dashu Village, Yaozhan Town	2018.9.22 Daytime	44.7	2	Up to standard	Daytime	44.7	Itself
		2018.9.22 Nighttime	34.3		Up to standard			
		2018.9.23 Daytime	43.6		Up to standard	Nighttime	35.4	
		2018.9.23 Nighttime	35.4		Up to standard			
N7	Pingzi Pingzi Group, Dashu Village	2018.9.22 Daytime	45.5	2	Up to standard	Daytime	45.5	Itself, Dashu Pingzi
		2018.9.22 Nighttime	36.2		Up to standard			
		2018.9.23 Daytime	44.7		Up to standard	Nighttime	36.6	
		2018.9.23 Nighttime	36.6		Up to standard			
N8	Liangyan Liangyan Group, Chongzi Village, Jindou Town	2018.9.22 Daytime	44.2	2	Up to standard	Daytime	45.6	Itself
		2018.9.22 Nighttime	35.4		Up to standard			
		2018.9.23 Daytime	45.6		Up to standard	Nighttime	35.4	
		2018.9.23 Nighttime	35.1		Up to standard			
N9	Hongshi Primary school,Hongshi Village ,Jindou Town	2018.9.22 Daytime	57.8	1	**Overstandard**	Daytime	57.8	Itself, Hongshi group
		2018.9.22 Nighttime	41.5		Up to standard			
		2018.9.23 Daytime	56.3		**Overstandard**	Nighttime	41.5	
		2018.9.23 Nighttime	40.7		Up to standard			
N10	Health Center, Jindou Town	2018.9.22 Daytime	54.3	1	**Overstandard**	Daytime	54.3	Iitself, Yanjiayuanzi
		2018.9.22 Nighttime	38.6		Up to standard			
		2018.9.23 Daytime	53.4		**Overstandard**	Nighttime	38.6	
		2018.9.23 Nighttime	38.2		Up to standard			
N11	Zhujiapo Village, Jindou Town	2018.9.22 Daytime	42.9	2	Up to standard	Daytime	43.2	Iitself, Zhujiapo village group
		2018.9.22 Nighttime	34.5		Up to standard			
		2018.9.23 Daytime	43.2		Up to standard	Nighttime	34.5	
		2018.9.23 Nighttime	33.4		Up to standard			
N12	Pianyan Hongyan Group, Xiangling Village, Jindou Town	2018.9.22 Daytime	43.6	2	Up to standard	Daytime	43.6	Iitself
		2018.9.22 Nighttime	35.4		Up to standard			
		2018.9.23 Daytime	43.2		Up to standard	Nighttime	35.4	
		2018.9.23 Nighttime	34.9		Up to standard			
N13	Mabugou Village,Jin Dou town	2018.9.22 Daytime	41.3	2	Up to standard	Daytime	41.3	Iitself
		2018.9.22 Nighttime	34.8		Up to standard			
		2018.9.23 Daytime	40.6		Up to standard	Nighttime	35.4	
		2018.9.23 Nighttime	35.4		Up to standard			
N14	Tongchanghe, Louzishan Group, Yaozhan community Yaozhan Town Community	2018.9.22 Daytime	54.8	2	Up to standard	Daytime	54.8	Iitself
		2018.9.22 Nighttime	39.2		Up to standard			
		2018.9.23 Daytime	53.5		Up to standard	Nighttime	39.7	
		2018.9.23 Nighttime	39.7		Up to standard			

6.5 Evaluation of the ecological environment status quo

(1) Land resource evaluation

According to the statistics of remote sensing data (Table 22), the ecological evaluation area along the project is 2125.27hm^2, among which the soil erosion type is mainly micro-erosion, followed by mild erosion, moderate erosion and strong erosion.

(2) Ecological environment evaluation

According to the investigation and analysis, the ecological comparison and analysis along the proposed highway is as follows (Table 23).

Table 22. Statistical table of land use type and area in the evaluation area

NO.	Land type			Area (hm^2)	The proportion of the total area is (%)
	First class	Secondary class	Third class		
1	Agriculture and forestry land	plough	paddy field	74.88	3.52
			dry farm	1034.12	48.66
		forest land	forest land	419.50	19.74
			shrub land	271.37	12.77
		meadow	—	230.76	10.86
		Other agricultural land	waters	5.29	0.25
		subtotal		2035.92	95.80
2	Construction land	—	—	56.10	2.64
		subtotal		56.10	2.64
3	Unused land	—	—	33.27	1.57
		subtotal		33.27	1.57
amount to				2125.27	100.00

Table 23. Comparison of the ecological environment status before and after the proposed highway

Evaluating indicator	The original eia phase	This evaluation
Evaluation scope	The total area within the evaluation scope is 1771.37 hm^2 (the temporary land area is not counted).	The evaluation area is 2125.27hm^2 (including permanent and temporary occupation).
Ecological sensitive area	uninvolved	uninvolved
Through the ecological function area	In the ecological function zoning of Guizhou Province, it belongs to the IV western version of moist subtropical needle broad leaf mixed forest, —— IV1 Qianxi Plateau mountain needle broad leaf mixed forest, grass mountain agriculture and animal husbandry ecological subregion.	In the ecological function zoning of Guizhou Province, it belongs to the IV western version of moist subtropical needle broad leaf mixed forest, —— IV1 Qianxi Plateau mountain needle broad leaf mixed forest, grass mountain agriculture and animal husbandry ecological subregion.
Vegetation status	The natural vegetation in the evaluated area was divided into two vegetation series, including 3 vegetation type groups, 4 vegetation types, and 6 groups. Artificial vegetation is divided into two vegetation series, including two vegetation type groups, two vegetation types, and four groups.	The natural vegetation in the evaluated area was divided into two vegetation series, including 3 vegetation type groups, 4 vegetation types, and 6 groups. Artificial vegetation is divided into two vegetation series, including two vegetation type groups, two vegetation types, and four groups.
Animal status	About 115 species of terrestrial wild vertebrates were distributed in the evaluated region, accounting for 13.89% of the 828 species in the province.	About 115 species of terrestrial wild vertebrates were distributed in the evaluated region, accounting for 13.89% of the 828 species in the province.

7. ECONOMIC PROFIT AND LOSS ANALYSIS AND CONCLUSION OF ENVIRONMENTAL IMPACT

The environmental profit and loss of the proposed construction project are qualitatively analyzed by using the compensation method and the scoring method. The results are shown in Table 24.

The results of environmental profit and loss analysis show that the positive environmental benefit of the proposed project is about 2.5 times of the negative benefit, indicating that the positive environmental and economic benefits generated by the proposed expressway are dominant. The project is feasible from environmental protection.

Table 24. The economic benefit analysis table of the environmental impact of the proposed project

NO.	Environmental elements	Influence, measures, and investments	Influence, measures, and investments	Notes
1	ambient air, acoustical environment	Sound and gas environment quality decrease on both sides of road (-3)	-1	Make 1,2 and 3 points according to the influence degree respectively; "+" positive benefit; and "-" negative benefit
		Sound and gas environment on both sides of the existing urban roads is improved (+ 2)		
2	water quality	Crossing rivers, hazards (-2)	-1	
3	population health	No significant adverse effects, convenient transportation convenient for medical treatment (+ 1)	+1	
5	plant	Do not occupy a piece of forest land, no significant adverse effects, all kinds of greening projects, increase vegetation coverage	0	

NO.	Environmental elements	Influence, measures, and investments	Influence, measures, and investments	Notes
6	sightseeing resource	Promote the development of tourism in Weng'an County and Huangping County	+1	
7	mineral products	It is conducive to the exploitation and utilization of mineral resources	+1	
8	agriculture	Accelerate the logistics exchange in urban areas	+1	
9	Related planning	Coordinate with the transportation system planning	+1	
10	Landscape greening and beautification	Increase investment in environmental protection and improve environmental quality along the route	0	
11	conservation of water and soil	There were no significant adverse effects	0	
12	Demolition and resettlement	Demolition and reconstruction of houses, power and wire facilities	-1	
13	land value	The value of the land on both sides of the highway is increased	+1	
14	Direct social benefits	Save time, reduce fuel consumption, improve safety and other three benefits	+2	
15	Indirect social benefits	It should reflect the principle of common social progress and fairness, improve the investment environment, promote economic development, and enhance environmental awareness	+2	
16	anti-pollution measures	Increase project investment	-1	
	amount to	Positive benefit: (+ 10); negative benefit: (-4); positive benefit / negative benefit =2.5	+6	

REFERENCES

[1] Zhou, J. (2006). Study on ecological environment impact assessment index system for expressway construction. Enterprise Technology Development, 25(5): 36-37. https://doi.org/10.3969/j.issn.1006-8937-B.2006.05.013

[2] Cheng, G., Wang, X. (2007). Study on environmental impact assessment index system for expressway construction. Journal of Anhui Institute of Architecture: Natural Science Edition, 15(2): 101-104. https://doi.org/10.3969/j.issn.1006-4540.2007.02.029

[3] Xu, W.L., (2019). Analysis of common problems and key points of environmental Impact assessment of highway construction projects. Environment and Development, 31(6): 2. https://doi.org/10.16647/j.cnki.cn15-1369/X.2019.06.012

[4] Liu, S.Y. (2020). Analysis of common problems and key points of environmental Impact assessment of highway construction projects. Encyclopedia Form, (15): 263-264. https://doi.org/10.12253/j.issn.2096-3661.2020.15.501

[5] Qu, Y.H., Wu, X.Y., Zhang, X., Qu, L.X. (2022). Environmental impact assessment of expressway construction projects based on comprehensive weight. Transportation Technology and Economy, 24(2): 64-75.

[6] Xu, G.P., Xu, J., Wang, J., Chen, S.Q., Ma, X.W. (2016). Evaluation of landscape visual influence in expressway planning and construction -- a case study of lebai expressway project. Chinese Highway Society. China Highway Society, pp. 133-141.

[7] Li, X.F. (2021). Analysis of key points of acoustic environmental impact assessment of expressway reconstruction and expansion project. Northern Environment, 33(1): 78-92.

[8] Li, Q.S. (2016). Discussion on technique and method of post-assessment of sound environmental impact of expressway. Journal of Shanxi Coal Management Cadre Institute, (3): 216-217.