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**HENAN HIGHWAY PROJECT III**  
**KAIFENG-GONGJIAPENG ROAD**  
**ZHENGYANG ROAD UPGRADING PROJECT**

**INITIAL ENVIRONMENTAL EXAMINATION  
AND  
ENVIRONMENTAL ACTION PLAN**

HENAN INSTITUTE OF ENVIRONMENT PROTECTION  
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# INITIAL ENVIRONMENTAL EXAMINATION (IEE)

## 1. PROJECT BRIEF

### 1.1 Project Description

This report is oriented to the road upgrading project under the World Bank-financed Henan Highway Project III in the poor parts of Henan Province. The project consists of 11 components, which are separately described, by code and name, as follows:

- 1-1 Xiangcheng-Shangcai road from Shangcai County seat to the boundary of Zhumadian and Zhoukou
- 2-1 Pingyu segment of Zhumadian-Xincai road
- 3-1 Shilihe-Zhangjiatucheng segment of G312 road
- 4-1 Guanji-Huabu bridge segment of G106 road
- 5-1 Zhaowanq bridge-Luoshan County seat segment of Kai-Gong road
- 5-2 Luoshan County seat-Gongjiapeng segment of Kai-Gong road
- 6-1 Guangshan-Mafan road
- 7-1 Shangcheng-Changzhuyuan road
- 8-1 Xinxian County seat-Hepu road
- 9-1 Dongjiahe-Tanjahe road
- 10-1 Zhengyang road in Zhumadian Prefecture

This document is prepared as a supplementary to the IEE, which was completed in November 1999, for these project components except for the last one.

Zhengyang road is Luhedian (k266+700) to Dalin (k294+700) in Zhengyang County, Zhumadian Prefecture, covering a distance of 28 km. It is at Grade III in plain areas, with a subgrade width of 7-12 m and a surface width of 7 m. When some segments cut short under the upgrading project, it will have a subgrade width of 12 m and a surface width of 12 m.

The before versus after technical grades and cost estimates are shown in Table 1-1. The geographic locations of these roads are illustrated in Maps 1 and 2 attached hereto.

### 1.2 Project Features

The project involves the upgrading of 11 components in rural parts of China. Zhengyang road upgrading will be achieved by widening the subgrade and improving the surface, which will increase the technical grade and capacity of existing road without additional land use and large financial requirements.

Therefore, additional land acquisition and resettlement will not be involved in any case.

### 1.3 Project Schedule

Upgrading of this component is scheduled to be commenced in 2000, and completed and put into operation before or after 2001, i.e. a construction period of 1 year.

**Table 1-1 Summary of Road Upgrading Components**

No.	Name	Length (km)	Existing Road				Upgrading Standard				Total Cost ('0000 RMB)	Construction Period	Notes	
			Grade	Traffic Volume	Subgrade Width (m)	Surface Width (m)	Degree of Congestion	Grade	Subgrade Width (m)	Surface Width (m)				Type of Surface
1	Xiangcheng-Shangcai Road from Shangcai to Boundary of Zhumadian and Zhoukou	43	III, IV	4317	12	6-7	1.46	II	12	9	Asphalt	4500	2000~2002	Present traffic volume refers to standard moderate vehicles in 1997.
2	Pingyu Segment of Zhumadian-Xincai Road	31	III	2912	16	7	1.38	II	15	9	Asphalt	4500	2000~2002	Present traffic volume refers to daily mixed traffic volume in 1998.
3	Shilihe-Zhangjiatucheng Segment of G312 Road	34	III	2297	16	7	1.33	II	16	12	Asphalt	5040	2000~2002	Present traffic volume refers to standard moderate vehicles in 1997.
4	Guanji-Huabu Bridge Segment of G106 Road	43	III	1342	16	9	1.19	II	16	12	Asphalt	5400	2000~2001	Present traffic volume refers to standard moderate vehicles in 1997.
5	Zhaowanq Bridge-Luoshan County Seat Segment of Kai-Gong Road	11	IV	1669	16	7	1.30	II	16	12	Asphalt	1650	2000~2001	Present traffic volume refers to standard moderate vehicles in 1997.
6	Luoshan County Seat-Gongjiapeng Segment of Kai-Gong Road	49	IV	1699	16	7	1.30	III	16	7	Asphalt	1960	2000~2001	Present traffic volume refers to standard moderate vehicles in 1997.
7	Guangshan-Mafan Road	32	IV	330	12	6	1.10	III	12	7	Asphalt	960	2000~2001	Present traffic volume refers to standard moderate vehicles in 1997.
8	Shangcheng-Changzhuyuan Road	45	Unclassified	265	9	5-6	1.02	IV	9	6	Asphalt	900	2000~2000	Present traffic volume refers to standard moderate vehicles in 1995.
9	Xinxian County Seat-Hepu Road	48	Unclassified	487	8	3.5	1.22	Unclassified	8	7	Asphalt	2300	2000~2002	Present traffic volume refers to standard moderate vehicles in 1995.
10	Dongjiahe-Tanjahe Road	36	Unclassified	350	9	None	1.01	Unclassified	9	7	Asphalt	2860	2000~2001	Present traffic volume refers to standard moderate vehicles in 1995.
11	Zhengyang Road in Zhumadian Prefecture	28	III	1078	12	7	1.10	II	12	12	Asphalt	3590	2000-2001	Present traffic volume refers to standard daily vehicles in 1996
		400										33600		

Note: All of the 11 segments will be upgraded on the basis of existing roads, not involving any new road, land acquisition or resettlement.

## **2. ENVIRONMENTAL SETTING**

### **2.1 Physio-Environmental Description**

#### **2.1.1 Geography and Topography**

Among the 11 road upgrading components of the project, Zhengyang road is located in Zhengyang County, Zhumadian Prefecture, in the flat and broad southern part of Huang-Huai plain, adjacent to Xincai and Xi Counties in the east, Queshan County in the west, Runan County in the north, and Luoshan and Xinyang Counties in the south. It falls within the inclining plain area of the Dabie Mountain, with gentle slopes and low mounts in the west and alluvial plains elsewhere. The land here declines from northwest to southeast, with an average elevation of 78.8 m. Rivers in this region includes Huai, Ru, Wenshu, Lu, Qingshui, Huangdagang and Tianbai. It generally lowland, flat and open.

#### **2.1.2 Climate**

Zhengyang component is in Zhumadian prefecture, in the subtropical-temperate transition zone where the continental monsoon climate is characterized by both subtropical and temperate climatic features. There are 4 distinct seasons, including hot summer and cold winter, with the rainy season coinciding with the hot one. According to the long-term meteorological data from Zhumadian Prefecture, the climatic parameters in the project area include: annual average temperature of 14.9°C (with the maximum of 27.6°C in July and the minimum of 1.2°C in January), annual average frost-free period of 228.7 days, annual sunshine duration of 2,171.9 h, and annual precipitation of 941 mm, which concentrates in the summer and autumn, especially in July. Due to the effect of air circulation, winds by north prevail in winter, whereas winds by south prevail in summer. The annual average wind speed is 2-3 m/s.

#### **2.1.3 Surface Water System**

Zhengyang County, north of the Huai River, is free from any mountain and hill. Rivers flowing through the county includes Huai, Ru, Qingshui, Lu, Tianbai, Wenshu and Huangdagang. It is generally low plains, flat and open. Groundwater is locally at a small depth. Cumulated water is found due to the blockage of surface runoff. The proposed component is located in the Huai valley, which is briefed as follows:

The Huai River has its rise in Mount Tongbai in the west part of Henan Province and flows through Henan, Anhui, Jiangsu and Shangdong. It is one of the major rivers of China, the third largest in respect of main stem length and catchment area. More than 80% of Zhumadian Prefecture contributes to this river basin. The endpoint of the project component is close to the main stem of the river.

Navigation requirement is posed on none of the major rivers in the project area.

The project will be focused on subgrade widening and surface improving, so as to have a larger capacity of the existing roads. Not involving any bridge across the above mentioned rivers, the project will not cause any impact on the surface water in these rivers.

## **2.2 Eco-Environmental Description**

Upgrading component No. 10-1 is located in plain rural areas, where the agricultural ecosystem predominates in the regional ecological structure. Surface vegetation is mainly artificial, crops are common species, and natural vegetation is mostly grass. Biological variety in the project area is average, and the ecosystem composition is relatively simple.

According to investigation results, there is no natural reserve in the project area, so the project will not cause any impact to this effect.

Investigation results suggest that both fauna and flora in the range of 10 km on both sides of the 11 roads are common species, which generally do not require demanding eco-environmental conditions. Neither rare and endangered species nor national protection species is ever found in the project area.

## **2.3 Socioeconomic Description**

The project component is in Zhengyang County on the north bank of the Huai River, adjacent to Runan, Pingyu and Xincui Counties in the north, Queshan County and Xinyang City in the west, Xi and Luoshan Counties in the southeast, with a total land area of 1,889 km<sup>2</sup> and a total population of 720,000. Zhengyang is a land-based county, where industrial activities are less developed. In 1996, the GDP was 1.80279 billion RMB, i.e. 2,504 RMB per capita. The socioeconomy is obviously at a low level. This is a large agricultural county, where agriculture plays an important role in national economy. Grain crops are mainly wheat, soybean, corn and Chinese sorghum, while cash crops mainly include rape, peanut, watermelon and sesame, etc.

### **3. ENVIRONMENTAL IMPACT CLASSIFICATION AND RESULTS**

#### **3.1 Applicable Standards**

Project components in Highway Network Improvement Program in Poverty Area can be grouped into the following 2 categories according to their environmental impacts:

Category A: This category covers projects that do not cause any significant adverse environmental impacts, including subgrade widening, surface improving and road upgrading schemes. This category does not call for considerable land acquisition and nearly does not involve new bridge/culvert construction. As stated in the World Bank EIA guidelines, it is only required to have environmental action plans (EPA) for this category.

Category B: This category refers to projects that may result in significant potential adverse environmental impacts, including new highway projects, road widening and upgrading projects which calls for considerable land acquisition, or environmental improving projects intended to improve sensitive sites along highways. According to relevant classification provisions, detailed EIA together is EAP is required for this category.

#### **3.2 Classification Results**

Project component No. 10-1 is located in rural areas, not involving any special environmental sensitive sites. It will be widened on the basis of the existing road, and main works will go to surface improvement, not involving any additional land acquisition. Better road conditions will result in reduction of traffic noise and exhaust impacts. Adverse environmental impacts will only be encountered during construction. According to the aforesaid classification standards, this component is classified into Category A, for which EAP is required.

#### **4. POTENTIAL ENVIRONMENTAL IMPACTS**

The project component is oriented to subgrade upgrading, surface widening and improving, without any additional land use, so there will not be any obvious biomass reduction along the road. Moreover, both fauna and flora in the project area are common species, which do not require any demanding ecological conditions. The project will not cause any loss of species. Therefore, it is believed that the project will not represent any significant ecosystem impacts.

Not involving any resettlement, the component will not cause by resettlement-related environmental impacts.

Upon completion of the project, the road surface will be considerably bettered, which will lead to lower dust content and higher driving speed. As a result, ambient noise and air impacts by traffic noise and exhaust in the operation stage will be considerably mitigated in comparison with the situation before the project implementation.

As investigated, there is no scenic spot, natural reserve, historical site, sanitarium or any other special environmental sensitive site in the range of 20 m on the roadside. There will be no environmental impacts on such in the construction and operation stages.

On the basis of what is described above, our environmental impact analysis is herein focused on the environmental elements of acoustic environment and ambient air in the construction stage.

##### **4.1 Standards Utilized**

The following environmental standards are herein applied to environmental impact analysis:

Acoustic environment: "Standard for Ambient Noise Levels in Urban Areas" (GB3096-93), 70dB(A) for villages in the range of 200 m on roadside in day time and 55dB(A) in night time, 55dB(A) for hospitals and schools in day and 45dB(A) in night time in this range;

Ambient air: Class II standard as defined in "Standard for Ambient Air Quality" (GB3095-1996).

##### **4.2 Environmental Impacts in Construction Stage**

The existing road has a subgrade width of 7-12 m and a surface width of 7 m. Due to long-time disrepair, there are many pits in the surface, which considerably reduces the capacity of the road. The upgrading project is to repair the surface and widen it to a width of 9 m, which will achieve a better surface and a larger capacity. Without any additional land acquisition, possible environmental impacts in the construction stage will be mainly encountered in the following aspects.

###### **4.2.1.1 Noise Impacts**

Additional acoustic environmental elements due to the construction of this project component includes:

- a. Traffic noise during construction: Many trucks will be engaged in transporting

sand, stone, asphalt and cement among other building materials, which will result in larger traffic volumes and higher traffic noise levels.

- b. Construction equipment noise: Noise to be caused by asphalt concrete batching plants, generators, spreaders and rollers among other construction equipment will also pose some environmental impacts in the construction stage. According to available analogue monitoring and forecast results, such construction equipment will cause equivalent ambient noise levels higher than 70dB(A) within 50 m around the construction site, though the impacts beyond this range will be less.
- c. Road surface construction will undoubtedly interfere with traffic and reduce driving speed, and even cause traffic jam. Also, traffic noise impacts along the alignment will be increased to some extent.

This road segment, just like rural roads in other parts of China, is in a serious situation of mixed traffic. The road passes through Luhedian, Xiazhuang, Huangshan, Gaozhuang, Wangzhai, Tongzhong, Xiaolizhuang, Baocitang, Liulijing and Dali villages and townships, which are already fairs of different sizes. Among these, Luhedian, Tongzhong and Dalin are the places of township governments. Houses in the first row on both sides of the road have been converted to shops and restaurants, few of them are resided. These shops and restaurants will act as construction noise and traffic noise barriers. Construction activities, if suspended in nighttime, are expected to only cause minor impacts, if any, on the local residents living behind.

There are hospitals and schools at the above mentioned 3 townships, but they are all at a distance of more than 200 m away from the road, essentially free from the noise impacts by construction activities. Tongzhong Middle School is only 50 m away from the road, but the 2 m high fence between the teaching building and the road acts as a noise barrier, so noise impacts during construction will be minor.

#### 4.2.2 Ambient Air Impacts

Ambient air pollution subsequent to subgrade upgrading and surface widening will be mainly in the following aspects:

- a. Fugitive dust arising out of lime-soil mixing: In light of the available conditions along the road, decentral lime-soil mixing (i.e. roadside mixing) will be employed for subbase upgrading purposes. Such fugitive dust is not large in amount, but it causes air impacts at many points at a long distance. Therefore, ambient air in the immediate vicinity may be susceptible to such fugitive dust impacts. According to monitoring results from elsewhere, fugitive dust from lime-soil mixing activities affects the range 100 m leeward of mixing sites, especially the range 50 m leeward, and TSP in ambient air is subsequently higher than the standard. As the construction period of lime-soil mixing activities is generally short, their dust impacts disappear as lime-soil mixing and subbase upgrading activities are completed.
- b. Dust from vehicles: During the road construction period, many specially-designed machines will be engaged (e.g. roller and spreader). Also, higher dust contents

will result from road construction. Construction equipment will add to the content of road dust due to normal traffic, which will worsen the ambient air impacts along the road. According to previous monitoring data, the range of traffic dust impacts during construction of roads is generally not farther than 100 m leeward. Such air impacts can be effectively controlled by road watering.

- c. Dust and asphalt smoke from asphalt batching plant: The road will be paved with asphalt to be mixed at central batching plants. As the road is proposed to be divided into two lots, at least 2 batching plants will be provided in the construction stage. A certain amount of dust will be produced by material hauling and asphalt concrete mixing equipment. This part of dust will be collected and discharged through air conduits, representing point-source pollution discharge. Additionally, the existing asphalt concrete mixing equipment at these two sites is equipped with any dust removing facilities, so there will not be any major dust impacts in the leeward. Another characteristic pollutant from asphalt concrete batching plants is asphalt smoke, which mainly stems from the asphalt melting process and represents central point-source pollution discharge. As asphalt melting is mostly carried out by low-temperature melting technologies, the amount of resultant smoke is not large, and the concentration and rate of smoke discharge meet Class II standard of “Comprehensive Standard for Air Pollutant Discharge” (GB16297-1996). According to previous monitoring results, asphalt smoke from asphalt concrete batching plants affects the area 50 m leeward, but such impacts beyond 50 m are minor.

#### 4.2.3 Other Environmental Impacts

As this segment will be upgraded on the basis of the existing road, without additional land acquisition, it will not cause any further farmland damage or ecosystem impact along the alignment.

Since bridges and culverts involved in the road are not many in number, and all of them will be consolidated or widened on the basis of existing ones, without any new bridge and culvert, there will not be any obvious impacts on surface runoff systems and irrigation facilities during the construction stage.

The proposed road is located in plain areas with a small number of slopes, there is thus less soil erosion. With a low subgrade structure and less slopes, soil erosion will not be further aggravated in the construction stage.

### 4.3 Environmental Impacts in Operation Stage

Environmental impacts in the operation stage of this road will be mainly in the aspect of traffic noise and vehicle exhaust. The wider and better road surface free from pits will greatly reduce traffic noise. Assuming an equal traffic volume, traffic noise impacts on both sides of the road will be significantly less in comparison with the situation without the project. At the same time, higher speed will enable vehicles to go at economical speed, low speed and even idling will be considerably reduced. As a result, CO and other polluting materials contained in vehicle exhaust will be cut down to some extent, and ambient air impacts will be subsequently reduced. The improved

road surface will result in less dust on the road, and air impacts by fugitive dust will be also reduced.

#### 4.3.1 Traffic Noise Impacts

With the road upgraded, the induced traffic volume increase, plus the original traffic volume increase due to economic growth, will be considerably larger than the present volume. According to relevant studies and also forecast results of other Grades II and III roads, when traffic volumes are larger than 4,000 vehicles/d (converted to standard moderate vehicles), equivalent traffic noise levels in the immediate range on the roadside (generally 50 m) during day peak traffic volumes and in night time may exceed the standard, i.e. higher than 70dB(A) and 55dB(A) respectively. The traffic volume on this road will be increased to more than 4,000 vehicles/d from 2016, so traffic noise levels exceeding the standard will not be encountered until that year.

As above mentioned, this is a township-village road subject to serious mixed traffic where it passes through villages and townships, and buildings on both sides of the road are used as shops and restaurants, which act as effective traffic noise barriers. As a result, traffic noise levels are cut down by about 10dB(A), and ambient noise levels at the houses behind do not exceed the standard values. Most of the traffic volume on this township-village road happens in night time, so equivalent ambient noise levels at the houses in night time will not exceed the standard, either.

Hospitals and schools except for Tongzhong Middle School are all 200 m beyond the road, so they will be essentially free from traffic noise impacts in the operation stage. The said middle school is on the east side of the road, at a distance of only 50 m, but the 2 m high fence between the teaching building and the road will attenuates traffic noise, so noise impacts during the initial operation stage, if any, will be minor. However, major impacts will be encountered in the late operation stage. For the purpose of noise impact control, it is recommended that the north fence be raised from 2 m to 3 m.

#### 4.3.2 Ambient Air Impacts

Exhaust from vehicles will be the major air pollution source in the operation stage. The improved surface will result in lower dust contents, so fugitive dust arising out of vehicles and subsequent dust pollution will not be significant.

Based on ambient air impact forecasts from other highways in plain areas, CO hourly and daily average concentrations under general diffusion conditions do not exceed the standard. When the traffic volume is larger than 5,000 vehicles/d, excess of NO<sub>x</sub> hourly average concentrations are sometimes found in the immediate range on both sides of the road during day peak traffic volumes, but the range is generally not larger than 50 m on both sides. The traffic volume on the proposed road will not be so large until 2019, so NO<sub>x</sub> hourly average concentrations during day peak traffic volumes in the range of 50 m will not exceed the standard until that year.

#### 4.3.3 Other Environmental Impacts

With a low subgrade structure adopted, the upgraded road will cause neither adverse impacts on the normal communication of the local residents, nor significant social

segregation.

With the road improved, the local communication will be more convenient, which will be helpful for promoting the regional socioeconomic development and improving the people's livelihood.

#### **4.4 Conclusions**

##### **4.4.1 Construction Stage**

The project component will be upgraded on the basis of existing road. Main works will be mainly in the field of subgrade/surface upgrading and widening for the purpose of a larger capacity, without any additional land acquisition and resettlement. Thus, the environmental impacts in the construction stage will be mostly encountered in the following aspects.

- a. The vicinity of construction sites will be affected by noise from construction equipment and hauling trucks. With half of the width remaining open to traffic while construction proceeds on the other half, normal traffic noise on the road will also cause some environmental impacts.
- b. Due to the air impacts by fugitive dust and asphalt smoke arising out of lime-soil mixing, building material hauling and asphalt concrete mixing activities, TSP contained in the ambient air close to construction sites may exceed the standard.
- c. Investigation suggests that there is neither scenic spot and natural reserve among other special sensitive sites, nor rare and endangered species in the range 10 km.
- d. Since bridges and culverts involved in the road are not many in number, and all of them will be consolidated or widened on the basis of existing ones, without any new bridge and culvert, there will not be any obvious impacts on surface runoff systems and ecosystems during the construction stage.

Eco-environmental impacts during the construction stage, if any, will be minor either.

This component, as being located in plain and microhilly areas, will not cause any considerable increase of soil erosion in the construction stage.

##### **4.4.2 Operation Stage**

- a. When the roads are completed and put into service, the considerably better road surface free from pits will greatly reduce traffic noise. Assuming an equal traffic volume, traffic noise impacts on both sides of the road will be significantly less in comparison with the situation without the project. At the same time, higher speed will enable the reduction of pollutants contained in vehicle exhaust, which will mitigate exhaust pollution to some extent.
- b. Due to the normal growth and induced growth, the traffic volume on improved road will be larger and larger from year to year, subsequently traffic noise impacts on both sides of the road will be more and more serious. In this case, equivalent traffic noise levels above the standards will be sometimes encountered during day peak traffic volumes in the early and middle operation periods.

- c. In the middle and late operation periods, NO<sub>x</sub> hourly average concentrations will be found above the standard in some cases, but the duration will not be long, and ambient air quality will not be obviously deteriorated.
- d. This project component, when completed, will do good to promoting the regional socioeconomic progress and improving the people's living standard and quality of life.

## ENVIRONMENTAL ACTION PLAN

### 5. ENVIRONMENTAL ACTION PLAN

- Basis of Preparation
  - a. State Council Order No. 253 “Regulations for Environmental Management of Construction Projects”
  - b. “Circular Letter on Enhancement of EIA Management under International Financing Organization-Financed Construction Projects” issued by the State Planning Commission, State Economic and Trade Commission, People’s Bank of China and National Environment Project Agency in letter No. 324 (1993)
  - c. World Bank Operational Manual, OP, BP, GP4.01, January, 1999
- Organization of EAP
  - a. Environmental management program: develop environmental impact mitigation/offsetting measures
  - b. Environmental supervision program: prepare action plans for the implementation of various environmental impact mitigation/offsetting measures
  - c. Environmental monitoring program: prepare environmental monitoring programs for both construction and operation stages
  - d. Environment protection cost estimate: prepare cost estimates required for the various environmental impact mitigation/offsetting measures

#### 5.1 Environmental Management Program

##### 5.1.1 Environmental Management Laws and Regulations

- a. Law of Environment Protection, PRC
- b. Law of Air Pollution Control, PRC
- c. Law of Water Pollution Control, PRC
- d. Regulations for Noise Pollution Control, PRC
- e. Law of Soil Conservation, PRC
- f. Tentative Regulations for Water Pollution Management in Huai Basin
- g. Regulations for Environmental Management under Construction Projects

##### 5.1.2 Applicable Standards

- a. Standard of Ambient Air Quality (GB3095-1996)
- b. Standard of Ambient Noise in Urban Areas (GB3096-93)
- c. Noise Limits for Boundary of Construction Sites (GB12523-90)
- d. Comprehensive Standard of Sewage Discharge (GB8978-1996)
- e. Comprehensive Standard of Air Pollutant Discharge (GB16297-1996)

##### 5.1.3 Environment Protection Action Plan for Feasibility Study State

Environment protection action plans for the feasibility stage mainly include IEE and EAP. This task is undertaken by Henan Institute of Environment Protection as commissioned by Henan Department of Transportation.

##### 5.1.4 Environment Protection Action Plan for Design Stage

As prove by many facts, adequate attention to various adverse impacts in construction and operation stages and provision of corresponding mitigation/offsetting measures in the design stage is an economical, efficient and reasonable way to avoid or mitigate the possible adverse environmental impacts subsequent to the project construction. The following engineering measures are required to be incorporated into the design

stage of the project for which is report is prepared:

- a. Longitudinal allocation of soil works will be properly arranged, in light of the project features, to minimize borrow area operations. Where large quantities of soil are required for subgrade upgrading purposes, soil materials will be taken from side ditches, wherever possible, so as to minimize farmland damages.
- b. Adequate attention will be given to surface drainage in the project design, with side ditches improved together roads to ensure smooth drainage and avoid surface drainage directly flowing into farmland.
- c. For the roads in mountainous and heavy hillyland areas, slope protection of road embankments will be properly handled and retaining walls will be considered for road segments with large excavations, such that soil erosion will be reduced.
- d. Afforestation for slopes and both sides will be designed together with the main works, with plant species properly selected and afforestation costs ensured.
- e. The designer will conduct detailed investigation of environmental features along the alignment, with asphalt concrete batching plants properly selected (or lime-soil mixers where central lime-soil mixing will be applied) and located far from any residential site, hospital and school among other sensitive sites, at a distance of more than 200 m on the leeward of such.
- f. The annual precipitation in Xinyang is over 1,000 mm, so construction activities will be arranged to escape the rainy season from June to September, whenever possible.

#### 5.1.5 Environment Protection Action Plan for Construction Stage

According to the mentioned environmental impact analysis as previous stated in this document, environmental impacts in the construction stage will be mainly in the field of noise and dust resulting from construction activities, so environment protection measures will be accordingly as follows:

- a. Any land for the use of camps and other temporary works will be identified in wasteland or less cultivable land, wherever possible, so as to minimize the use of farmland.
- b. Construction schedules will be properly arranged to avoid construction activities from 22:00 pm to 6:00 am where any residential site, hospital or school is at a distance of less than 200 m, thus avoiding construction noise impacts on such sensitive sites.
- c. To minimize construction noise impacts on any school close to the road segment, the fence on the side facing the road will be raised, as appropriate, prior to the start of any construction activities.
- d. The contractor for each lot will be obliged to carry out adequate education among his personnel, and require them not to step on farmland and avoid vegetation damage. During construction of the roads in mountainous and heavy hillyland

areas, the construction works will be ensured against hunting.

- e. House refuse from camps will be gathered delivered to designated places for proper disposal on a regular basis. Sanitary sewage from camps will be simply treated before discharged, rather than directly led to surface waters.
- f. Subgrades under construction, or earth roads for hauling trucks, or any other sites giving rise to dust will be watered at least twice a day, once in the morning and once in the afternoon, or more frequently in the dry season.
- g. Bulk material hauling trucks will be covered, and stockpile areas will be located adequately far from any residential site, hospital and school, or on the leeward of such sensitive sites, with a distance of more than 200 m kept in between. Materials will be covered in the event of rainy, snowy and windy days.
- h. Lime-soil and asphalt concrete mixing will be performed in enclosed equipment, whenever possible, and low-temperature melting technologies will be applied to asphalt melting.
- i. Close cooperation will be sought from highway administration and traffic police departments, to facilitate normal traffic management, traffic accident prevention and traffic jam reduction in the construction stage. This will mitigate traffic noise and exhaust impacts along the roads.
- j. Afforestation will be completed simultaneously with the main works.

#### 5.1.6 Environment Protection Action Plan for Operation Stage

- a. Vehicle management will be strengthened, and any vehicle failing to meet the national traffic noise and exhaust standards will not be allowed onto the road.
- b. Horning will be forbidden in night times, with marks to this effect provided 100 m in front of residential sites, hospitals and schools. Lamps instead of horns will be used for overtaking purposes in night times. Driving speed will be limited, as necessary, at the above mentioned sensitive sites.
- c. Separating facilities will be provided at residential sites, hospitals and schools where there are frequent human activities, and pedestrian crossings will be provided for the purpose of personal safety.
- d. Trucks carrying any toxic, harmful and dangerous matters will be accompanied by permits issued by public security and highway administration authorities, and every possible measure will be taken for the avoidance of traffic accidents.
- e. The provision of residential sites, hospitals and schools among other facilities requiring high environmental quality will not be allowed in the range of 100 m on both sides.

The sensitive sites where fences will be raised in the construction and operation

stages, together with the time for action, are summarized in Table 5-1.

**Table 5-1 Summary of Sensitive Sites for Fence Raising**

Component No.	Sensitive Site	Distance from Road (m)	Measure	Time for Action
10-1	Tongzhong Middle School	50	Raising 85 m fence on roadside from 2 m to 3 m	2000

The above listed fence will be raised by 85 m. Assuming a unit cost of 70 RMB/m<sup>2</sup>, the financial requirement is estimated at 60,000 RMB.

## 5.2 Environmental Supervision Program

To guarantee the earnest implementation of various environment protection measures as proposed in the environmental management program, an environmental supervision program is herein developed as shown in Table 5-2.

## 5.3 Environmental Monitoring Program

### 5.3.1 Objective

The objective of environmental monitoring is to keep informed of the environmental quality in the construction and operation stages, especially the environmental quality at sensitive sites, such that control and mitigating/offsetting measures will be taken, against the environmental problems revealed by monitoring results, to ensure against any obvious environmental quality deterioration due to the construction and operation of roads.

### 5.3.2 Responsibilities

In consideration of the project features and the capabilities of the local environmental monitoring agencies, environmental monitoring under component No. 10-1 in both construction and operation stages will be commissioned to Zhumadian Prefecture Environmental Monitoring Station.

**Table 5-2 Environmental Supervision Program**

Interval	Responsibility	Task	Target
Feasibility Study Stage	World Bank Henan Department of Transportation	Completion of IEE and EAP	1. IEE is required to reflect the present environmental features and potential environmental impacts in the project area; 2. Environmental impact mitigating/offsetting measures will be proposed, with adequate schemes developed to ensure their implementation.
Design & Construction Stages	Project office, environment protection agency	1. Review of environment protection design and cost estimate included in preliminary design; 2. Review of asphalt concrete batching plants (and also lime-soil mixers for	1. Environmental facilities will be designed, constructed and operated simultaneously with main works; 2. Full-scale implementation of

		some roads), bulk material stockpile areas and camps; 3. Review of various construction noise and dust control and mitigation measures proposed in EAP; 4. Check and supervision of sewage and solid wastes discharge from camps; 5. Inspection and supervision of environmental monitoring program implementation for construction stage; 6. Investigation and treatment of any environmental accidents during construction.	EAP will be ensured; 3. Construction dust and noise impacts on villages, hospitals, schools and any other sensitive sites will be minimized; 4. Sewage discharge from camps will be ensured against major environmental impacts.
Operation Stage	Transportation agency, environment protection agency	1. Review of EAP implementation during construction; 2. Review of environmental monitoring program in operation stage; 3. Review of environmental quality at villages, hospitals, schools and other sensitive sites; 4. Cooperation in respect of investigation and treatment of environmental accidents.	1. Earnest implementation of EAP will be ensured; 2. Environmental monitoring program will be guaranteed; 3. Villages, schools and hospitals among other sensitive sites will be ensured of good environmental quality and human health; 4. Possible adverse impacts by traffic accidents will be mitigated and prevented.

The responsibility for environmental supervision will be with the local highway administration, transportation and environment protection agencies involved in the project.

### 5.3.3 Tasks

Environmental monitoring tasks to be accomplished in construction and operation stages are separately given in Tables 5-3 through 5-6.

**Table 5-3 Environmental Monitoring Program for Construction Stage**

Environmental Element	Component No.	Monitoring Point	Monitoring Frequency
Ambient Noise	Construction site and boundary	2 points on the road	Irregular spot check, not less than 4 times a year, 2 consecutive days each time, once in the morning and once in the afternoon
	10-1	2 points, one at Xiazhuang and another at Tongzhong	Not less than 4 times a year, in the middle of January, April, July and October respectively, 2 consecutive days each time, once in the morning and once in the afternoon
Ambient Air	ditto	The same as above, but only 1 point at each sensitive site	Measurement of dust in and on leeward of each construction site, with dust catchers replaced on a monthly basis; twice a year

			elsewhere (in January and July), consecutive 5 days each time
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**Table 5-4 Environmental Monitoring Factors in Construction Stage**

Environmental Element	Monitoring Factor
Ambient Noise	Equivalent ambient noise levels day and time
Ambient Air	Asphalt smoke (only applicable to asphalt concrete batching plant), TSP, dust (in construction site and leeward)

**Table 5-5 Environmental Monitoring Program for Operation Stage**

Environmental Element	Component No.	Monitoring Point	Monitoring Frequency
Ambient Noise	10-1	2 points, one at Xiazhuang and the other at Tongzhong	4 times a year, in the middle of January, April, July and October respectively, 2 consecutive days each time, once in the morning and once in the afternoon
Ambient Air	ditto	The same as above, but only 1 point at each sensitive site (outside school)	Twice a year (in January and July), consecutive 5 days each time

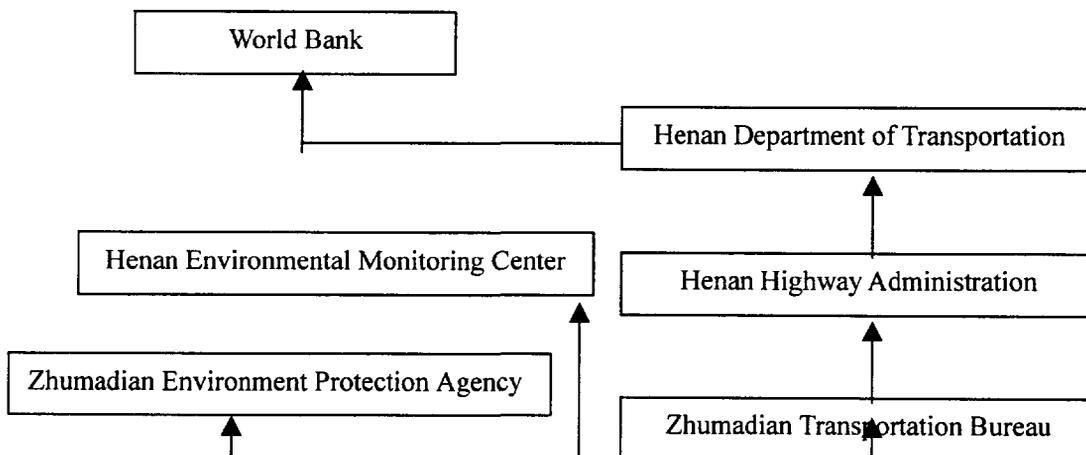
**Table 5-6 Environmental Monitoring Factor in Operation Stage**

Environmental Element	Monitoring Factor
Ambient Noise	Equivalent ambient noise levels day and time
Ambient Air	NO <sub>x</sub> , CO, TSP

#### 5.3.4 Process for Submission of Environmental Monitoring Data

Environmental monitoring data to be obtained in both construction and operation stages will be submitted in the process as shown below.

**Figure 5-1 Process for Environmental Monitoring Data Submission**



#### 5.4 Environmental Cost Estimate

The cost estimate for the project is as shown in Table 5-7.

**Table 5-7 Environmental Cost Estimate**

Item	Cost ('0000 RMB)	Environmental Benefit
Raising of hospital/school fence on roadside	0.6	Reduction of noise impacts in construction and operation stages
Provision of watering car	10	Mitigation of dust pollution in construction stage
Road afforestation	8	Mitigation of noise and exhaust impacts in operation stage
Personnel training	2.5	Improvement of environmental knowledge
Environmental monitoring in construction stage	7.5	Understanding of environmental quality, technical support for pollution control measures
Environmental monitoring in operation stage (20-year service life)	25	
<b>Total</b>	<b>53.6</b>	

#### 5.5 Personnel Training

Zhumadian Prefecture and Zhengyang are involved in the project component. Full-time environmental managers of the prefecture/county highway administration agencies and part-time environmental managers of the contractors, 3 in total, will be trained together with those responsible for Zhumadian expressway including its connecting roads. As tentatively arranged, the place of training will be Zhengzhou, and the duration will be one month, but the specific time is to be determined under the expressway.

Training services will not be arranged for the personnel of Zhumadian/Xinyang Environmental Monitoring Station as they have already received strict technical training.

### 6. PUBLIC PARTICIPATION

Public participation was conducted by the IEE team during the investigation of environmental status. This was mainly carried out by means of interviews, which involved a total number 30 people in different trades, including 2 county/city NPC/CPPCC (National People's Congress/Chinese People's Political Consultative Conference) members, 25 farmers (83%) and 4 people (13%) in other trades.

According to the consultation results, as the project will neither require any additional land acquisition and resettlement, nor involve the immediate interests of the local

people while greatly benefiting the local communications and people's livelihood, the public is all for the construction of the project and willing to render active support and corporation such that the project will be started as soon as possible.



**Subtable Summary of Environment Protection Measures by Stages**

Environmental Issue	Environment Protection Measure	Implementation Responsibility	Supervision Responsibility
<b>Design Stage</b>			
Soil Works	Longitudinal allocation of soil works will be properly handled to minimize borrow area operations. Where large quantities of soil are required for subgrade upgrading purposes, soil materials will be taken from side ditches, wherever possible, so as to minimize farmland damages.	Designer	Henan Department of Transport, Henan Highway Administration Agency, World Bank
Soil Erosion	1. Attention will be attached to slope and roadside afforestation, with plant species carefully selected.		
Noise Disturbance	1. Low-noise construction equipment will be selected; 2. Trucks in good conditions will be used for transporting of building materials.		
Air Pollution	1. Asphalt concrete batching plants (lime-soil mixers) will be properly selected and located on the leeward of any environmental sensitive sites, with a distance of at least 200 m in between; 2. Enclosed equipment will be selected for asphalt concrete batching plants (or lime-soil mixers), with dust removers provided to reduce dust discharges.		
Water Pollution	Adequate attention will be given to road surface drainage, with side ditches improved at the same time of subgrade upgrading. Surface drainage will be directly discharged into farmland.		
<b>Construction Stage</b>			
Land Use	Land use for temporary purposes will be located in wasteland or less cultivable land, wherever possible, to minimize the use of farmland. Where it does be necessary to use any farmland, adequate compensation will be made according to the time of occupation and restoration.	Contractor	Henan Department of Transport, Henan Highway Administration Agency, Zhumadian transport, highway and environment protection agencies
Construction Noise	1. School/hospital fences within 200 on the roadside will be raised prior to the start of construction; 2. Construction will be suspended from 22:00 pm to 6:00 am; 3. Normal traffic management will be strengthened to avoid/mitigate traffic accidents and jams.		
Construction Dust	1. Construction sites, or earth roads for hauling trucks, or any road segments giving rise to dust will be watered at least twice a day, once in the morning and once in the afternoon, or more frequently in the dry season; 2. Bulk material hauling trucks will be covered, and stockpile areas will be also covered in the event of rainy, snowy and windy days; 3. Lime-soil and asphalt concrete mixing will be carefully located on the leeward of sensitive sites, with a distance of at least 200 m kept in between; 4. Bulk material stockpile areas will be properly identified on the leeward of sensitive sites, with a distance over 200 m kept in between.		

Environmental Issue	Environment Protection Measure	Implementation Responsibility	Supervision Responsibility
Ecological Impact	<ol style="list-style-type: none"> <li>1. Any surface vegetation damaged as a result of temporary land use will be recovered as soon as construction is completed;</li> <li>2. Afforestation will be completed simultaneously with the main works.</li> </ol>		
Camp	Sanitary sewage from camps will be simply treated before discharged. House refuse will be gathered and delivered to designated places for regular disposal.		
<b>Operation Stage</b>			
Traffic Noise	<ol style="list-style-type: none"> <li>1. Honning will be forbidden in sensitive sites, with marks to this effect provided 100 m in front of such sites;</li> <li>2. Lamps instead of horns will be used for overtaking purposes in night times;</li> <li>3. Driving speed will be limited, as necessary, at sensitive sites;</li> <li>4. It is recommended that Tongzhong Middle School fence be raised from 2 to 3 m as construction goes on.</li> </ol>	County highway administration and traffic police authorities	County transport, public security & environment protection authorities
Vehicle Exhaust	<ol style="list-style-type: none"> <li>1. Exhaust discharge monitoring will be strengthened, and any vehicle failing the applicable national standard will not be allowed on the road;</li> <li>2. It is inadvisable for any new residential site, school, hospital and any other sensitive site to be built in the range of 200 m on both sides.</li> </ol>		
Traffic Safety	<ol style="list-style-type: none"> <li>1. Separating facilities will be provided at residential sites, hospitals and schools where there are frequent human activities, and pedestrian crossings will be provided for the purpose of personal safety;</li> <li>2. Enhanced education in traffic safety will be carried out;</li> <li>3. Trucks carrying any toxic, harmful and dangerous matters will be accompanied by permits issued by public security and highway administration authorities, and every possible measure will be taken for the avoidance of traffic accidents.</li> </ol>		