Guiyang World Bank Financed Transport Project

ENVIRONMENTAL ASSESSMENT
EXECUTIVE SUMMARY

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<th>Title</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
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</table>

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<table>
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<tr>
<th>Name</th>
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<tbody>
<tr>
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<td>Shi Lunxuan</td>
<td>Senior Engineer</td>
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<table>
<thead>
<tr>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA</td>
<td>Environmental Assessment</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>BOD</td>
<td>Biological Oxygen Demands</td>
</tr>
<tr>
<td>COD</td>
<td>Chemical Oxygen Demands</td>
</tr>
<tr>
<td>TP</td>
<td>Total Phosphor</td>
</tr>
<tr>
<td>dB(A)</td>
<td>Decibel (Acoustic)</td>
</tr>
<tr>
<td>NH$_3$-N</td>
<td>Ammonia Nitrogen</td>
</tr>
<tr>
<td>pH</td>
<td>Acidity unit</td>
</tr>
<tr>
<td>SS</td>
<td>Suspended Solids</td>
</tr>
<tr>
<td>NO$_2$</td>
<td>Nitrogen Dioxide</td>
</tr>
<tr>
<td>OP</td>
<td>(World Bank) Operational Policies</td>
</tr>
<tr>
<td>PMO</td>
<td>Project Management Office</td>
</tr>
<tr>
<td>PRC</td>
<td>The People's Republic of China</td>
</tr>
<tr>
<td>EPB</td>
<td>Environmental Protection Bureau</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>GIESD</td>
<td>Guizhou Institute of Environmental Sciences and Designing</td>
</tr>
<tr>
<td>CCP</td>
<td>Chinese Communist Party</td>
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Foreword

This report is the summary environmental impact assessment (EIA) for the World Bank (WB) financed project named as “Construction and reconstruction project for road network in urban and township area of Guiyang City”. The project includes Youxiao road project and rural traffic project. This summary EIA provides a general summary of the results from the formal EIA report for the project including legal and policy framework and applicable environmental standard, major potential adverse impacts in project area (including physical, ecological, and socio-economic impacts etc.), analysis of alternatives, mitigation measure, public consultation (environmental management plan see another report) etc., This summary EIA could serve as a concise environmental report for the project to environmental administrators, decision makers, project affected groups, non-governmental organizations, the general public and other stakeholders, and of course, to the Executive Directors of WB Board.

The summary report includes two parts, listed as below:

**PART I Youxiao Road Project**

Total length of this line is 6593m, while the length of connection line with Jianlongdong Road is 423m. There is 1 bridge for the line scheme with a total length of 371.7m, while there is 1 tunnel with a total length of 1793m. Total investment of the project is 1.04487 billion yuan.

**PART II Rural Traffic Project**

The whole project composes 44 rural roads and 46 bus stations. Most of rural road projects are reconstruction projects. The total length of rural road projects is 668 km. Bus station projects are new construction projects. Total investment of the rural traffic project is 1.18372 billion yuan.
PART I  You-Xiao Road Project

1 Introduction

With the purpose of pushing forward the overall, sustainable, and great-leap-forward socio-economic development in Guiyang City, a “Strategic decision on construction of Big Guiyang” has been approved by Guiyang Municipal Committee of Chinese Communist Party (CCP) and Guiyang Municipal Government resulting in creating a great blue-print for the future development of Guiyang City. Urban construction project for the area from Youzhaijie Street to Xiaobi area is one of the key projects to support the decision, which could connect the three areas including Xiaobi Town, Longdongbao, and Ergezhai, providing a wide space for the move of Administration center of Nanming District to Longdongbao. In addition, with the rapid socio-economic development, great demand for passenger and cargo transportation has been witnessed. And the contradiction between transportation supply and demand has emerged. To build the You-Xiao road, re-locating the south-eastern outlet of Guiyang to Youzhaijie Street, will not only alleviate the pressure of transportation in Guiyang City in a large scale but also establish the high speed transportation channel in urban area of Guiyang City. This project is listed as a sub-project in WB financed project- “Construction and reconstruction project for road network in urban and township area of Guiyang City”.

2 Brief description of the project

2.1 Brief description of the project components

Starting from the crossing point of Youzhaijie Street and Baoshannanlu Road, the proposed road line will cross Youzhaijie Street and traverse Forest Park of Guiyang through the underground tunnel with end at northern wing of CCP Cadres Training School of Guiyang Municipal Committee of CCP. After it goes out of the tunnel, it will cross the Yulianghe River and Xinzhenhu Road in Longtongbao area and connect with south-western circled line of Guiyang City. When the road reaches the Longdongbao area, a connection line between the road and the Jianlongdonglu Road will be built. Longdongbao area is cut off with downtown Guiyang by a mountain, where Forest Park and partial forest ring belt of Guiyang City is located. The road scheme can be seen in attached Fig1. Sensitive receptor’s distribution and general plane of the You-Xiao Road. Road, bridge, tunnel engineering, drainage pipe line networks, and auxiliary facilities for the project will be under the relevant technical standards. General description of the project components see table 2-1. Detailed engineering scheme sees EIA.

<table>
<thead>
<tr>
<th>No</th>
<th>Name of the index</th>
<th>unit</th>
<th>Index or abstracts</th>
<th>Note:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total length</td>
<td>M</td>
<td>6592.577</td>
<td></td>
</tr>
</tbody>
</table>
2.2 Environmental protection targets along the line

Environmental protection targets along the line see table 2-2 and 2-3.

### Table 2-2 Environmental protection targets along the line

<table>
<thead>
<tr>
<th>Environmental elements</th>
<th>Protection targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eco-system</td>
<td>Eco-system types and its service functions; basic farmland; natural vegetations and wild animals; soil cutting field and dumping field; hill fill and deep cut road section, forest park at municipal level- Guiyang Forest Park, Cultural property protection unit at municipal level- Tuyuguan</td>
</tr>
<tr>
<td>Noise and air environment</td>
<td>Residential points, schools, hospitals, etc., inside 200m from the center of the road. Details see table 2-3</td>
</tr>
<tr>
<td>Aquatic environment</td>
<td>Yulianghe River and drinking water pumping point for CCP Cadre Training School of Guiyang Municipal Committee of CCP</td>
</tr>
<tr>
<td>Social environment</td>
<td>Residents affected by land requisition and demolition as well as road blockage along the line</td>
</tr>
</tbody>
</table>

### Table 2-3 Environmental protection target such as schools, hospitals and residential area

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Line stake No</th>
<th>Distance to the road (m)</th>
<th>Average height of the building</th>
<th>Height differences with surface of the road (m)</th>
<th>Position</th>
<th>Environmental problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Location/Description</td>
<td>Distance</td>
<td>Floors</td>
<td>Offset</td>
<td>Side</td>
<td>Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------------------------------------</td>
<td>----------</td>
<td>--------</td>
<td>--------</td>
<td>------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Fulouwangdi complex</td>
<td>K0+520</td>
<td>6</td>
<td>9 and 12 floors</td>
<td>0</td>
<td>Right Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Shenshihuacheng complex</td>
<td>K0+520</td>
<td>6</td>
<td>8 floors</td>
<td>-0.5</td>
<td>Left Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Jinhong Hotel</td>
<td>K0+160</td>
<td>30</td>
<td>6 floors</td>
<td>-3</td>
<td>Left Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Residential Building for Guiyang Special Steel Co., Ltd</td>
<td>K0+160</td>
<td>3</td>
<td>8 floors</td>
<td>+0.5</td>
<td>Left Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Nanjiao Primary school of Guiyang City</td>
<td>K0+40</td>
<td>120</td>
<td>4 floors</td>
<td>-5</td>
<td>Right Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Employee’s hospital for Guiyang Special Steel Co., Ltd</td>
<td>K0+165</td>
<td>3</td>
<td>2,3 and 4 floors</td>
<td>0</td>
<td>Right Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Dongbaohuayuan complex</td>
<td>K0+165</td>
<td>3</td>
<td>8 floors</td>
<td>0</td>
<td>Left Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Jinxiujiayua complex</td>
<td>K0+435</td>
<td>3</td>
<td>8 and 12 floors</td>
<td>0</td>
<td>Right Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Qibaoyuan complex</td>
<td>K0+435</td>
<td>3</td>
<td>9 floors</td>
<td>0</td>
<td>Left Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Residential area of Yongjiang Instrument factory</td>
<td>K0+500</td>
<td>3</td>
<td>8 floors</td>
<td>0</td>
<td>Left Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Youzha Village under Yunguan Town</td>
<td>K0+500~935</td>
<td>3</td>
<td>2 and 3 floors</td>
<td>0</td>
<td>Both Wings Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>CCP Cadre Training School of Guiyang Municipal Committee of CCP</td>
<td>K3+210~K3+520</td>
<td>100</td>
<td>6 floors</td>
<td>+10</td>
<td>Right Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Sanshulin villager’s group of Mutou village under Yunguan Town</td>
<td>K3+700</td>
<td>10</td>
<td>2 floors</td>
<td>0</td>
<td>Right Noise, Exhausted Gas</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Mapaoiling villager’s group of Mutou village under Yunguan</td>
<td>K3+600</td>
<td>10</td>
<td>2 floors</td>
<td>0</td>
<td>Both Wings Noise, Exhausted Gas</td>
<td></td>
</tr>
</tbody>
</table>
3 Environmental baseline assessment

3.1 Natural environment

As the capital city of Guizhou Province, Guiyang City is located in the northern part of central Guizhou province, where the slope area of eastern Yun-GuiHighland, one of the transitional areas between eastern and western China, is located. The total area of Guiyang City is 8034 km². In the year 2003, total population of Guiyang City is 3.487 millions. Overall terrain of Guiyang City belongs to downy basin consisting of mountains and hills with elevation in the range from 506.5m to 1762.7m.. The average elevation in central Guiyang is about 1000m. Mt. Miaoling, located in the southern Guiyang City, is the watershed of Changjiang and Zhjiang river basin. With representing characteristics of highland monsoon climate, the climate of Guiyang City belongs to subtropical humid and warm climate. Generally speaking, the annual average precipitation in Guiyang is 1200mm. Heavy rain are usually concentrated in June and July. Annual predominant wind direction is NE, while the summer predominant wind direction is SE.

The proposed You-Xiao road is the connecting line between downtown Guiyang and Longdongbao area, as these two areas are cut off from each other by forest mountains (Guiyang Forest Park). Covered with nice forest, environment of these mountains are splendid. Longdongbao area, where partial of the project is located, borders on Guiyang Forest Park in the north-west, and faces the eastern outlet of Guiyang City in the north and the east, as well as neighbors Guiyang Longdongbao airport in the east. Landform of Longdongbao area is found to be higher in the northwest while lower in the southeast, with a big elevation differences. Depression is also witnessed in the partial area of Longdongbao area.

3.2 Baseline aquatic environment

Surface water

A bridge is to be built by the project for crossing Yulianghe River whose water environmental functional area class belongs to class II. Wangjiadajing, the drinking water pumping point for the Waterworks of eastern suburb of Guiyang City, is situated 7.6 km downstream of proposed bridge. There are totally 7 drinking water pumping point for Longdongbao area in Yulianghe River, among which drinking water pumping point for CCP Cadre Training School of Guiyang Municipal Committee of CCP is located right under the bridge, while the rest 3 are located in downstream of the bridge.

Baseline monitoring on 12 water quality indicators such as flow rate, quantity of flow, water temperature, pH values, COD, permanganate index, BOD₅, SS , NH₃-N, petroleum oils, TP, and fecal coliform group numbers was carried out in 5 monitoring points in Yulianghe River. Monitoring location sees attached fig 2. The monitoring results show, except the fecal coliform group numbers, all the rest water quality indicators in 5 monitoring sections can meet requirement of “Environmental Quality Standard For Surface Water” (GB3838—2002) Class II, which convinces that water environmental quality of Yulianghe is good and can basically meet the requirement of water body functional area class II.


**Groundwater**

Baseline monitoring on 9 water quality indicators such as water quantity, water temperature, pH values, permanganate index, SS, NH3-N, petroleum oils, total coliform group, and TP was carried out in 3 water wells in potential project-affected area. The monitoring results for groundwater show the coliform group in all the monitoring point exceeded the standard due to the impacts of domestic wastewater. Except the coliform group, all the rest groundwater quality indicators in inlet of tunnel and Wangjiadajing can meet the requirement of “Environmental Quality Standard for Groundwater” Class . The water could be served as drinking water only through the simple disinfection. NH3-N in original pumping point of Forrest Park exceeded standard due to the anthropogenic influence. Water in the area can not meet the requirement of “Environmental Quality Standard for Groundwater” Class . However, at present, the pumping point is no longer in operation since the water supply for Forest Park was from municipal water supply networks. Therefore, the impact on human health is slight.

3.3 Air environment

During the EIA phase, representative sensitive receptors for air pollution within 200m area along the line were screened as the air environmental monitoring points. Monitoring work was done in successive 3 days in October, 2006. The results can represent the baseline for local air environment.

According the monitor result, daily average of TSP and NO2 can meet the requirement of “Ambient Air Quality Standard” GB3095-1996 Class 2, which proves that the air in project area can be defined as clean or basically clean.

3.4 Noise environment

There are totally 14 noise sensitive points along the road line, including 2 schools, 1 hospital, 10 centralized residential areas, and 1 for the rest. Noise environmental monitoring was carried out in 11 noise sensitive points along the road.

The most serious affected point in daytime was found outside of the window in 3th floor of Employee’s hospital for Guiyang Special Steel Co., Ltd, with monitored noise value of 71.3dB(A), 11.3 dB(A) higher than the standard value.

Some points located in park or in rural areas, are more slightly affected by traffic noise. Monitoring results show that these points can basically meet the requirement of correspondent environmental functional area.

3.5 Ecosystem

The area You-Xiao road passing through including urban residential area, Forest Park, barren hills, and cultivated land etc., The original vegetations were already destroyed in urban residential areas where the urban ecosystem has already come into being. Vegetations in project
area are principally distributed in Forest Park and the cultivated land section in Longdongbao area. For many times in history, vegetations in Guiyang Forest Park suffered from the anthropogenic damages, which leaded to the disappearance of original vegetations of Forest Park. Meanwhile, major vegetations there consist of forest planted in 50’s and 60’s, and the second and third generations of the secondary forest. The representative vegetations are the following: Pinus massoniana Forest, Cunninghamia lanceolata Forest, Camellia oleifera Forest, Robinia pseudoacacia L. Forest, Thicket, and the farmland vegetations including paddy, corn, rapeseed plant, and vegetables etc., As shown in the results of remote sensing investigation, Major vegetation types in project area consist of the following: broad leave vegetation, shrub vegetations, needle leave vegetations, grassland vegetations, paddy field vegetations, and dry land vegetations.

There are totally 100 families, 240 groups, and 600 species of vegetations in project area, which all belong to transplanted vegetation. Precious wild vegetations that under the verge of extinction haven’t yet been found in project area.

Due to the urbanization of major part of the areas along the road and the intensive anthropogenic activities, large scaled wild animals were disappeared. Major animals there include macaque (artificial feeding), squirrel, rabbits, and serpentry. Precious wild animals that under the verge of extinction haven’t yet been found in project area.

Hydropower erosion is the major form of the soil erosion in project area, while gravitational erosion takes the second position. In addition, rill erosion and corrosion were also found in partial project areas. According to the remote sensing investigation, total soil erosion area in project areas is 1.66km², taking up 36.89% of total areas.

Guiyang Forest Park is located in the southern suburb of Guiyang City, with a total area of 733hm², among which, forest area is 620hm², accounting for 85% of total area. Forest park is well known for its natural mountain forest landscape and the perfect integration of natural landscape and human landscape. Precious tree species such as Chinese dove tree, camphor, and shaddock etc., that is under the national protection (class one) were transplanted in the park. Animals such as thrust, owl, squirrel, macaque (artificial feeding) etc., was also found in the park. Proposed You-Xiao Road is to traverse the park from the northwestern wing of the park, via the planned Fengshan, Tuyun, Songfenggu, and Yingminggu scenic spots and go out of the park at Xiaoyakou mountain forest scenic spot, in a way of underground tunnel. Positional relationship between the project and Forest Park see fig 3-1.
Fig 3-1 The relationships of proposed You-Xiao Road and the planned scenic spots in Guiyang Forest Park

- Inlet of the tunnel
- Outlet of the tunnel
- CCP Cadres Training School of Guiyang
- Boundary of the Forest Park

W o r l d  B a n k  F i n a n c e d  G u i y a n g  T r a f f i c  P r o j e c t  E I A                                    E x e c u t i v e  S u m m a r y
3.6 Social environment

In the year 2004, GDP of Guiyang City is 44.363 billion Yuan (RMB), 13.7% higher than that of the previous year, while the GNP per capita is 12.683 thousand Yuan, 13% higher than that of the previous year. Pure income per capita for farmer is 2.809 thousand Yuan, 11.9% higher than that of the previous year. In the year 2004, GDP of Nanming District is 8.248 billion Yuan (RMB), 13.1% higher than that of the previous year, while the GNP per capita was witnessed a rapid growth reaching 16.346 thousand Yuan. The total annual agricultural production hits 53.42 million Yuan, 2.0% higher than that of the previous year.

3.7 Cultural heritages

According to the site survey along the road by technicians dealing with the EIA, a cultural property protection unit at municipal level – Tuyunguan, was found in the Forest Park section of proposed line. Historically, Tuyunguan served as the gateway connecting Guiyang City and Hunan as well as Guanxi Province. Relics that symbolize Tuyuguan are ancient stone monument and some stone inscriptions produced during the Tongzhi Period of Qing Dynasty, which are located inside the western gate of Forest Park and serve as one of the human scenic spots of the park. The horizontal distance of the spot to the proposed tunnel is 0.4km with a relative height difference of +85m.
4 Environmental Impacts

4.1 Social environmental impacts

**Impacts on public facilities**

During the construction period, direct impacts on traffic will be imposed on Youzhajie Street, Yuanlinlu Road, and the traffic pressure will be increased in a large scale in the roads such as National Road 321, Qingnian Road, Jianlonglu Road, Shinanlu Road, and Fuyuanbeilu Road in surrounding areas. Scientific timetable for construction and the reasonable leading of traffic can effectively alleviate the traffic pressure to be brought about during construction period. After the project is put into operation, traffic pressure in National Road 321 and Jianlonglu Road will be alleviated in a large scale. The problems such as heavy traffic and vehicle retarding in those roads will be effectively solved. During the construction period, Resettlement Office of the project will be in charge of the communication and coordination with public facilities owners involved for any damages of power lines, telephone lines, roads, and green belts, as well as the different kinds of underground pipelines that is to be brought by the construction of the project. Detailed recovery or rebuilt plan will be worked out, which enable the recovery of affected infrastructural facilities as soon as possible. If compensation in the forms of currency is required, it should be done in time. And the Resettlement Office should coordinate with relevant sectors during the process of recovery of above-mentioned power, telecommunication and transportation facilities.

**Impacts on social security**

Duration for the construction period is 3 years. Beside of the employment of local workers, large numbers of employee will come from other places. The routine management and training of construction workers on environmental protection, law and public security, and health need to be strengthened to avoid the impacts on the life of local residence.

**Impacts of blockage of both wings of the road due to the construction of the road**

The proposed road will pass through several rural residential points. The enclosed high speed channel may produce inconveniences on the traveling, cultivation activities of local farmers, as well as the passage of livestocks. Pedestrian passageway- bridge crossing the trunk line, will be built between two centralized residential area that is located in somewhere between K4+720 and K5+480 in Longdongbao area.

**Impacts on cultural heritage**

The cultural property protection unit at municipal level – Tuyunguan, that was found in Forest Park section of the proposed line, is one of the human scenic spots of Forest Park. The minimum horizontal distance of the spot to the construction site of proposed project is 0.4km.
According to the feasibilities study of the project, designed elevation of tunnel is 1099m while the ground elevation is 1184m. And moreover, tunnel engineering will be done completely inside the mountain bodies. Therefore, proposed project will not produce impacts on the stone monument stone inscriptions. No other cultural properties have yet been found along the proposed line. In the case that new cultural properties are found during the construction period, construction unit will notify relevant cultural property administrative bodies right away and take effective protection measures.

**Impacts on the tourism development of Forest Park**

The tunnel of the proposed project is located in the food of the mountain of Forest Park. The proposed project will not bring about the traffic convenience for the western gate of the park. Furthermore, although the outlet of the tunnel is located inside the park, the proposed project may not bring about the radical change of the current traffic situation of the park to outside areas seeing that no interchange or intersection will be set in the park by the proposed project. Therefore, it seems that the proposed project may not directly stimulate the tourist numbers of the park. However, in the long run, the planned northern entrance and exit of Forest Park will, to some extent, bring about the convenience for tourists to enter or leave the park and so as to stimulate the tourist numbers. On the issue of tourist numbers, the director of the park states that they are managed to realize the sustainable development of the tourism of the park through upgrading the service facilities, environmental protection, quality of service personnel, and infrastructural facilities of Forest Park.

4.2 Impacts of resettlement

3 villages of Yunguan Town of Nanming District will be involved in the land requisition scope for the project with a total requisite land of 405mu. The total households affected by land requisition is 41 with a total affected population of 177. Total residential areas involved in the land requisition of the project will be 15,915 thousand m$^2$, including 225 households with a total population of 984. Totally 45 shop fronts will be involved in the land requisition of the project. The affected operator numbers are 99. 4 enterprises and institutions will be involved in the land requisition of the project, with a total areas of 6,971 thousand m$^2$ to be demolished, and a total affected employees of 98.

Demolition during the construction period of the project is a sensitive social issue. Problems concerned are not only the economic issue but also the future development of residence after the demolition and resettlement is done. The full consideration over legal rights of persons involved in the demolition and resettlement need to be taken strictly under the relevant resettlement
policies of China and the non-voluntary settlement policies of WB (OP4.12). A resettlement office will be established for dealing above-mentioned issues. Detailed resettlement policies see “Resettlement Action Plan” for You-Xiao Road project.

Generally, resettlement of the household to be demolished is to be done by currency compensation, allocation of economically affordable housing and allocation of second hand housing nearby. With the purpose to ensure the life quality and housing conditions, the project will, on the basis of sufficiently considering the benefits of affected people and the other factors, provide them with multiple choices to ensure the profits gaining of these households from the project and improve the housing conditions of the majority of these people. The improvement of housing conditions of affected people will also be sure.

Affected shop fronts will be compensated by resettlement office through: 1) Currency 2) newly-built shop fronts inside the nearest resettlement communities, 3) newly-built specific market nearby. Affected shop fronts owners can make the choice according to their own willingness.

Yongjiang Instrument Factory in Youzhajie Street, Nanming District, is the enterprise that will be affected mostly by the project. According to the initial negotiated resettlement plan, the enterprise will be moved to Naming Science and Technology Zone. Based on the results for our site survey and consultation, no toxic or hazardous substances were found in the raw materials and products of the factory, and also, no toxic or hazardous substances were involved during the production and transportation process of the factory. Therefore, environmental risk due to the remained toxic or hazardous substances after the factory is moved will not take place.

4.3 Impacts on aquatic environment

Construction phase

As the major aquatic environmental protection target, Yulianghe River belongs to water body class II. In order to avoid the impacts of wastewater produced by construction workers and bridge building during the construction phase on Yulianghe River, Following principals are supposed to be followed: 1) construction camps should try to be located as far away from the bank of Yulianghe River as possible, 2) the wastewater should be discharged into the wastewater collecting pipe line along the Yulianghe River after being simply treated by septic tank, 3) wastewater should not be discharged into Yulianghe River directly. Wastewater from tunnel construction consists of water burst from tunnel excavation and the construction wastewater from construction process. Wastewater from tunnel construction should be discharged along the lower places of surrounding areas after being treated in treatment tanks that is supposed to be built in inlet and outlet of tunnel. Piers in the water will not be built so that the disturbance and impacts of
the piers construction on the river is slight. Domestic wastewater from construction camps for bridge engineering should be discharged into the wastewater collecting pipe line along the Yulianghe River after being simply treated by septic tank.

The impacts of proposed project on underground water of Forest Park may be due to the tunnel excavation. According to the analysis on the regional hydrogeologic map and the site survey, due to the high ratio of clay minerals in the minerals constituent of coal measure strata, the aquosity of either slightly weathering bedrock or strongly weathering belt in these strata is bad, which perform the function of confiningbed in regional hydrogeologic environment. Average depth for tunnel excavation in Forest Park is 80m from the ground surface, which is already in the scope of slightly weathering belt. Therefore, project will not produce impacts on the occurrence forms of underground water of Forest Park.

Tunnel engineering area is located in Yulianghe River Basin. However, it will not produce impacts on water catchment in Yulianghe River. Elevation of tunnel excavation is higher than elevation of water surface of Wangjiazhai Reservoir, Wangjiadajing and Yulianghe River. Elevation of tunnel excavation is 1080m while the elevation of water surface of Wangjiadajing is 1050m. As a result, The impacts of proposed project on Wangjiadajing is slight.

### Operational phase

Pollutants from bridge will bring about more serious impacts on water quality of Yulianghe River when they are brought to the river by precipitation. Consequently, concentration of CODcr TP in the river will be 2.5 and 0.1 times higher than the standards respectively. Yulianghe River belongs to Water functional area class II, where, according to relevant regulations, any forms of wastewater discharging outlet should not be set. Therefore, wastewater produced by the proposed project during operational phase should be discharged into wastewater collecting pipeline along Yulianghe River after being collected.

The drinking water pumping point for CCP Cadre Training School of Guiyang Municipal Committee of CCP is located right under the proposed bridge. In order to reduce the impacts of the proposed project during the construction and operational phases on the pumping point, the pumping house is supposed to move 100m away from the proposed bridge in upstream direction.

### 4.4 Air impacts

#### Construction phase

Major air pollution sources during the construction phase are the following: 1) dust from the processes of mixing of construction materials, asphalt concrete production and transportation. 2) asphalt gas from the processes of asphalt concrete preparation and road surfacing.
**Operational phase**

Based on climate characteristics in Guiyang City, NO\textsubscript{2} diffusion concentration on both wings of the road has been done employing the prediction model recommended by State Environmental Protection Administration (SEPA). From road section point of view, NO\textsubscript{2} has certain impacts on Youzhajie Street which is much closer to the proposed road. However, for the road section in Longtongbao, there are basically no impacts. From prediction time point of view, no standard exceeding take place for daily average NO\textsubscript{2} concentrations during initial operational phase, while there are totally 10 points where the daily average NO\textsubscript{2} concentrations exceed the standard during medium and long operational phases. However the standard exceeding times are not high, with a maximum of 0.7.

Prediction of tunnel gas emission has been carried out employing the area source model. The results show that NO\textsubscript{2} concentration contributed by tunnel emission is 0.116mg/m\textsuperscript{3} which can meet the requirement of standard class 2.

**4.5 Impacts on sound environment**

**Construction phase**

Major noise sources during the construction phase consist of noises from construction machines and vehicles. There are many noise sensitive targets along the proposed line, particularly in road sections of urban areas. Analysis based on the distribution of construction sites show that construction activities of proposed project will produce more serious disturbance to the rest of residents in certain scope. Generally, the location of construction machines can meet the requirement of standard GB12523-90 when they are located 40m away from construction site during daytime and 200m away from construction sites during the night.

**Operational phase**

Most seriously affected household by traffic noise during the daytime and the night is the households in first row facing the road. Sound insulation measures should be adopted for these households. The impacts of traffic noise on the households in the back will be much slight due to the obstruction of the households in the front.

Prediction on the impacts of traffic noise on sensitive targets shows that noise level of all sensitive targets will basically exceed the standard for daytime during long operational phase, with a range for standard exceeding of 1.3~14.7dB. Highest noise level appears in the point of Employee’s hospital for Guiyang Special Steel Co., Ltd, while the noise level of all sensitive targets will exceed the standard for night during long operational phase, with a range for standard exceeding of 4.9~20.6dB. Highest noise level also appears in the point of Employee’s hospital for
Guiyang Special Steel Co., Ltd. Due to the increase of vehicle in traffic, the predicted noise level is 3.4dB higher than the baseline value for the daytime while 7.0 dB is for the night.

4.6 Impact on ecosystem

**Land occupation**

Some 27 hm$^2$ of land will be permanently requisitioned by the project, of which, paddy field is 0.07 hm$^2$; dry land is 6.33 hm$^2$; forest land is 17.4 hm$^2$; and barren land is 3.2 hm$^2$. In addition, some 15 hm$^2$ of land will be temporarily occupied by dumping field, of which, paddy field is 0.5 hm$^2$; dry land is 10 hm$^2$; barren land and grass hills is 4.5 hm$^2$.

**Vegetation**

Precious wild vegetations that under the verge of extinction haven’t yet been found in project area. However, the original surface vegetation will be affected by the activities such as excavation, filling, and spoil during the construction phase. The major affected vegetations include Pinus massoniana Forest, Camellia oleifera Forest, Robinia pseudoacacia L. Forest, Thicket, and the farmland vegetations etc., However, the population of affected vegetation will not become extinct due to the limited affected area and numbers. Vegetation recovery or land rehabilitation will be carried out in the temporarily occupied land such as dumping field, pioneer road, and temporal work shed etc., right after the project is put into operation. Therefore, the damage to vegetation can be offset to some extend.

**Animals**

Precious wild animals that under the verge of extinction haven’t yet been found in project area. However, the damage of the vegetations produced by the construction of the project, construction noise and other construction activities will bring about certain impacts on terrestrial vertebrate distributed along both wings of the road. Small amounts of the animals distributed in the surrounding areas of construction sites will be forced to move to somewhere else due to the shriek of living space, and the lose of propagation space. The area involved in project area is only the small part of the overall territory of animals. However, if the management is malfunctioned, some construction worker may hunt animals. Therefore, during the construction phase, the training of the construction worker on environmental protection should be strengthened and hunting should be avoided. In addition, no midway stations for migratory bird are involved in project areas, the proposed project will only produce slight impacts on migrate of birds.

**Forest Park**

Tunnel engineering will start from Yukaoqiao of Youzha Village, Yuguan Town, the edge of Forest Park (K0+935), via Fores Park, end in Sankuaitian in northern wing of CCP Cadre Training
School of Guiyang Municipal Committee of CCP (the planned Xiaoyakou forest scenic spot of Guiyang Forest Park, K2+728), and intersect with fire control channel of Forest Park. Except for Pinus massoniana Forest, Camellia oleifera Forest, no other natural and human landscapes were found in the project area. The proposed project may produce certain damage to artificial vegetations and thus bring about impacts on parts of mountain and forest landscapes. However, the impacts can be overcome through the in time vegetation recovery. Temporal construction fields and facilities such as slope mine, dumping field and transportation channel for construction will not be set in the planned area of Forest Park. Therefore, both main work and auxiliary work of the proposed project will only produce the slight impacts on human and natural landscape of Forest Park. Furthermore, the tunnel engineering will not bring about impacts on the animals in the park as there are not above-mentioned fields or facilities, and as the engineering is done underground.

**Key engineerings**

1) Tunnel engineering

In order to effectively control the impacts of tunnel engineering on the environment, the construction activities on side slope beside the mouths of the tunnel should strictly observe the principals of “early entering and late going out, while reducing the excavation areas on sloping surface” and carry out the afforestation or proof measure on sloping surface. The earth and stone from the tunnel engineering should try to be used as the fill materials for roadbed and bus stop construction. Earth and stone from the whole line should be allocated rationally and the total amounts of spoil should be put under control.

When tunnel engineering is done in the coal measure strata, gas will possibly appears. The monitoring on the gas should be done strictly under relevant regulations. One the gas concentration exceeds the national standard, safety measures such as ventilation should be taken to prevent the accidents from happening.

2) Bridge engineering

With the elevation of surface of bridge at water level of centennial flood, the propose Yulianghe Bridge will be free from the constraint of flood water level. The proposed engineering will occupy certain amounts of cultivated land and will damage certain proportions of farmland vegetations. At the same time, construction activities such as bridge foundation excavation, and concrete casting etc., will bring about, to some extent, the soil erosion. Solid wastes such as spoil, construction materials, and domestic rubbish as well as domestic wastewater from construction workers should not be poured or discharged directly into Yulianghe River.

3) Dumping field engineering

Specific soil taking field will not be set in the project. All the earth and stone necessary for
the project will be supplied by the spoil from the tunnel engineering. Total amounts of excavation are 0.56792 million m$^3$, of which, amounts for fill are 0.3129582 m$^3$, amounts of used are 0.227168 m$^3$, amounts for borrowing are 0.857602 m$^3$, and amounts for spoil are 0.340752 m$^3$.

Shanshulin of Mutouzhai Village, the dumping field for the proposed project is only 1.5km away from the planned Xiaoyakou scenic spot of Forest Park where the tunnel engineering--the major spoil engineering for the proposed project, is located. The proposed dumping field has a total area of 15hm$^2$, of which paddy field is 0.5hm$^2$, dry land is 10hm$^2$, barren land and grass hills is 4.5hm$^2$, and with a total storage capacity of 0.4 million m$^3$. The dumping field can basically meet the requirement for the proposed project. Except for a water supply pipeline of CCP Cadre Training School of Guiyang Municipal Committee of CCP, exposure drinking water sources, cultural properties, and precious animals and vegetations under national protection have yet been found in the spoil filed site. Site selection for the dumping field is in line with the relevant regulations, while it is located in buffering area of the drinking water source conservation of Yulianghe River.

**Water and soil conservation**

The soil erosion potentially brought about by the project may cause the following impacts: impacts on water and soil resources, impacts on the safety of the operation of the project, impacts on the flood leading of downstream river course, the impacts on the overall function of water and soil conservation, impacts on the water environmental function of downstream waters. The prediction on the soil erosion for the project indicates that the construction of the project will, to some extent, produce the disturbace of damage to the land structure, if no measures are taken, large volume of soil erosion may take place. In additional certain amount of temporal slag stacking during the construction phase is another factor to cause the soil erosion. If no proper measure is adopted, disaster may take place under the flushing of the heavy rain.

Detailed engineering measures include blockage engineering, water collecting engineering etc., vegetation measures include street tree, vegetation recovery etc., land arrangement measures include earth up and rehabilitation of the temporally occupied land etc., and the temporal measures include the temporal control measures during the construction phase.

**4.7 Impacts of solid wastes**

**Construction phase**

Solid wastes produced by the proposed project are principally from construction phase, including spoil, construction trash, domestic trash from construction workers.

Domestic trash is the solid wastes from the utility area of construction workers, including
food wastes, slag, food packaging materials etc., The daily output of domestic trash per capita is about 1kg/d. Construction trash consist of the construction materials from demolished housing, waste earth and stone when the road is damaged, waste construction materials from construction activities etc., The amounts of the construction trash and domestic trash is not huge, which will not produce impacts on vegetation or land use after the end of construction phase, on the condition that the proper dispatch measures are adopted.

**Operational phase**

The amounts of solid wastes during the operational phase are small. If periodical cleaning or transportation is done the impacts of solid wastes on surrounding environment during the operational phase will be slight.

### 4.8 Impacts on landscape

**Adverse impacts**

Adverse impacts of road on the landscape along the road are the following: 1) After the road put into operation, roadbed that is higher than the surface of the ground will become the visual obstruction, and the visual unwell will be brought about due to the irregular cut of the original landscape. 2) Large scale structure such as overpass etc., will produce the incoordination with the original landscape. 3) Excavation of mountain body will divided the mountain body into two parts and the color and the shape of the road can hardly harmonize with the surrounding landscape.

**Positive impacts**

After the road put into operation, if the proper measures are adopted for ecological recovery, a “green channel” will be formed, and the road itself will become a unique landscape.

### 4.9 Risk assessment

**Risk from the hazardous cargo transportation**

After the road put into operation, once the transportation accident break out due to the hazardous cargo transportation, the serious pollution will take place in the surrounding areas. The cargos of this kind may consist of toxic, hazardous, inflammable, or explosive substances. Viewing that transportation accident of hazardous cargos are the emergency in traffic accidents, the probation for the risk of the accident of these kind can be dropped down by strengthening management. Once it takes place, the fire control and environmental protection sectors need to be notified in time. The key pollution accident should be reported to the upper administrative bodies. If the proper measures are adopted, the risk for transportation of hazardous cargos should be small.

**Risk of Yulianghe Bridge during the operational phase**
The operation of Yulianghe Bridge will produce certain impacts on the aquatic environment of Yulianghe River, particularly when the vehicles transporting the toxic or hazardous substances turn over on the bridge and drop into the river, the serious pollution of the water in the river will be thus produced, and will even bring about the threats to the living and the health of resident in downstream areas. Therefore the risk assessment for such accidents is necessary. Traffic pollution accident due to the transportation of toxic and hazardous substances will endanger the water quality of Yulianghe River. The river section under direct threat is 200m. According to the calculation, the probation of traffic pollution accident is 0.019%. Therefore the probation for traffic pollution accident in Yulianghe Bridge is small.

5 Mitigations

5.1 Designing phase

Social environment

Before the construction, resettlement and demolition administrative office should be established. And the propaganda on relevant national laws or regulations on the issues of land requisition and resettlement should be strengthened. The protection of the legal rights of villager, urban citizens, enterprises and institutions involved in land requisition and resettlement should be done through adopting multiple ways of compensations.

During the improvement of traffic conditions, full attentions should be given to the disadvantaged groups. The designation of sidewalks and its width, dummy drift, crossover, culvert, wheelchair channel etc., should observe the conception of “humanized designation” and sufficiently consider the requirement of pedestrians, disadvantaged groups such as the old aged, the kids, the handicapped and the patients etc.,

Aquatic environment

There will be no service area in the whole line of You-Xiao Road. Therefore, the domestic wastewater is mainly from construction phase. Biological anaerobic treatment will be employed for the treatment of domestic wastewater from construction phase. The typical facilities employed will be the regulatory septic tank.

The discharging of rainfall in the surface of the bridge should be taken into consideration. Rainfall will finally be drained into wastewater collecting pipeline that was already built along the bank of Yulianghe River after being collected by the rainfall pipeline under the vehicle channel. The rest water drainage plans for road surface see the feasibilities study of the project.

The drinking water pumping point for CCP Cadre Training School of Guiyang Municipal
Committee of CCP is located right under the proposed bridge. In order to reduce the impacts of the proposed project during the construction and operational phases on the pumping point, the pumping house of CCP Cadre Training School of Guiyang Municipal Committee of CCP is supposed to move 100m away from the proposed bridge in upstream direction.

**Ambient air**

Yuanlinlu Road in Forest Park should not be used as the transportation channel for construction materials to avoid the impacts of the dust produced in the process of transportation on the ecosystem of Forest Park. In order to avoid the impacts of the exhausted gas on the buildings along the road, newly-built building should be located 20m outside the red line of the proposed road, while within 40m outside the both wings of the red line, sensitive targets such as hospitals and schools etc., should not be built.

**Acoustic environment**

1) Gradient should be reduced as much as possible to reduce the noise level increase due to the climbing of vehicles during the process of longitudinal slope designation. 2) The structure of road surface material should use the one producing low noise value to reduce the noise produced from the friction between the tyre and the road surface. 3) Plank stuff for median strip and guard rail should use the materials with high deadweight and thickness should be increase as much as possible (more than 3mm). 4) Traffic instructive marks along the road need to be improved. Surface of the road should be kept even by reduce the elevation differences due to the subgrade treatment. Vibration and the noise level increase due to the braking, acceleration should be reduced as much as possible. 5) Sensitive targets such as hospitals, schools, residential area should not be built within the 40m from the boundary of the road. The existing housing within 50m from the boundary of the road are supposed to removed based on the urban and township planning when the reconstruction of old house need to be done.

**Designing of the dumping field**

Huge amount of spoil will be produced by the proposed project. A rational selection of spoilfield need to be further discussed in the designing phase. Shanshulin of Mutouzhai Village was selected as the dumping field site. The site is only 1.5km away from the planned Xiaoyakou scenic spot of Forest Park where the tunnel engineering--the major spoil engineering for the proposed project, is located. The designed reservoir capacity is 0.4 million m³.

**Landscape designation**

During the process of the designing phase of the project, landscape designing should be taken into consideration so as to make road, crossovers, bridges be in accord with surrounding environment.
5.2 Construction phase

Social environment

1) Centralized residential area

The following mitigation measure should be adopted to alleviate the adverse impacts of construction activities on residential area.

- All the road reconstruction activities in urban area should be organized in a way of semi-closure. And the channels for pedestrian, bicycles and the vehicle should be kept.

- Temporal road and bridge should be built for the convenience of the traveling of residents and employees from enterprises and institutions around the construction sites. Necessary safety measures should be adopted to ensure the traveling safety of residents and employees from enterprises and institutions around the construction sites. Impacts of construction activities in major communities on the correspondent community can be reduced through centralized construction and speeding up the construction progress.

- Construction in the road section where schools are located should be done in vacations so as to reduce the impacts on the traveling of students.

- Construction materials should be placed with order in specific location according to its types. Specific persons are responsible for the management of construction materials. Waste material of construction should be transported in time to avoid the land occupation and traffic jam due to the stacking of construction.

2) The move of power supply wires and telecommunication lines

Coordination work with power and telecommunication administrative bodies should be done before the construction. Specific safety supervisors taking charge of the safety work should be employed. Safety warning such as warning line or warning lamp should be adopted.

3) Local traffic and transportation

To prevent the traffic stop due to the construction activities, which may affect the traveling of residents of partial enterprises and institutions, construction will be done in a way of semi-closure. Public transport bicycles will be allowed while the vehicle in transit will be prohibited.

Construction in a way of closure should not be carried out in the crossing of road sections where the traffic is heavy. The construction a way of semi-closure should be employed, while the one-way traffic should be adopted to ensure the smooth passage of public transport.

Traffic management and organization need to be strengthened. Restriction of vehicles types that is allowed for passage should be done in relevant road sections. One-way traffic should be practiced in some of road sections. Rational layout of traffic signals should be done in order to
reduce the traffic flow in a maximum scale.

4) Land utilization

Construction management should be enhanced. Construction activities should be done in specific construction location. Farmland or forest land occupation at will should be prohibited. Construction vehicles should run in the given road, and construction of new channels at will by occupation of farmland should be prohibited.

5) Cultural and historic relic along the road

Proposed project will not produce impacts on the stone monument and stone inscriptions.

In the case that new cultural properties are found during the construction period, construction unit will notify relevant cultural property administrative bodies right away and take effective protection measures.

6) Forest Park

In order to reduce the impacts of dust and noise during the tunnel construction, measures such as timely transportation of spoil in a way of closure, increase of the water spraying frequency, noise blockage structure, and prohibition of night operation will be practiced. With above-mentioned measures, the adverse impacts during the construction phase on the surrounding environment of Forest Park can be reduced efficiently.

Construction management should be intensified and the construction announcement board should be made notifying the engineering details, contact person, and complaint telephone, etc., during the construction phase. At the same time, the detailed environmental management and monitoring plan should also be worked out.

7) Training of construction workers

The arrival of large numbers of construction workers may bring about certain impacts on local public security and environmental protection. Therefore training on law and regulations as well as environmental protection aiming at construction worker will be necessary. In addition, in order to ensure the construction safety and the health of construction workers, training on safety, health (especially the precaution of epidemic diseases and HIV/AIDS) aiming at construction workers is also necessary. Propaganda materials such as poster or pamphlet might as well be prepared by construction organization or contractors.

Aquatic environment

1) Domestic wastewater treatment facilities in construction site: Domestic wastewater will be treated with the biological anaerobic methodology.

2) Treatment measures for production wastewater of construction site: Settlement tank and
separation system for oil and water will be employed for the treatment of the production wastewater. Multitray clarifier will be built near the vehicle washing sites in construction area. Production wastewater from workshop of heavy vehicle and light vehicle as well as the maintenance will be treated in multitray clarifier after collected by wastewater collecting pipelines.

3) Wastewater control for construction of pile foundation work and surface of the bridge: During the excavation of the foundation of the pier, settlement and filtration of sludge should be done to prevent the river course from filling up so as to reduce the impacts on river course.

**Ambient air**

During the construction of the road, dust may be produced in the processes such as land leveling, piling, excavation, materials transportation, loading or unloading, materials mixing, particularly in dry season. Water spraying should be done to control the dust pollution. Water spraying with a frequency of 4-5 times a day can reduce the dust concentration in air by 70%.

As the construction sites are located near the environmental sensitive targets such as schools, and hospitals, dust control measures should be done more carefully. More efficient dust control measures should be adopted to avoid the direct impacts of dust on students and residents, for an instance, increase of the frequency of water spraying, construction of dike dam and timely contraction.

Remodeled vehicle with cover board should be employed for the transportation of construction materials such as sands, earth and stone etc., to avoid the scattering along the road. Scattering of construction materials along the road will likely to bring about secondary pollutions and impacts on the landscape if no mitigation measures are adopted.

Road for construction should be kept even. Specific persons taking charge of the maintenance, cleaning of the road should be employed to keep the cleaning and the good operation status of the road.

Dust, and pollutant from oil combustion is harmful to the health. Labour security measures should be adopted for the affected construction workers.

In order to avoid the impacts of dust produced during the process of transportation on ecosystem of Forest Park, Yuanlinlu Road in Forest Park should not be served as the line for materials transportation of the project.

**Acoustic environment**

Construction machines with low noise level should be employed. Slowing the speed and prohibition of horning should be carried out for transportation vehicles when they are getting close to acoustic environmental sensitive targets such as hospitals etc.. As residents live within 200m area of construction sites, the rational time arrangement for construction should be carried out. Construction employing the machine with high noise level should be done in daytime. If night operation of such kind of machines has to be done, an approval in written forms from local
government or environmental administrative bodies should be applied.

Individual noise protection measures such as earplug or helmet etc., are supposed to be adopted to reduce the impacts of noise of construction machines on the construction workers.

Static blasting technologies are to be employed for reducing the impacts on animal in Forest Park and surrounding communities.

**Ecosystem**

1) Land resources protection

The protection of basic farmland should be enhanced. Basic farmland involved in the land requisition of the project should be compensated according to the relevant state compensation regulations. Fertile land and basic farmland conservation should try to be avoided during the line selection. High fill embankment is supposed to be replaced by bridge in the road sections where the basic farmland conservation is located. Soil taking and dumping field, temporal construction sites, and road should not use basic farmland.

2) Forest resources protection

Training on environmental protection to construction workers should be carried out to enhance the environmental protection awareness of construction workers. Denudation should be banned during the construction phase, while the soil taking and spoil should be done strictly under the relevant regulations to reduce the damage to surrounding grass land and shrub. Construction camp should not be stationed in forestland. Vegetation protection should be done carefully particularly in Forest Park. Vegetations in selected road line should try to be replanted to other places and the denudation in such road sections should be prohibited.

3) Environmental protection in Forest Park

Initial analysis on underground water impacts shows that tunnel engineering will not bring about impacts on water supply for the growth of surface vegetation in ground surface. If the impacts are produced during the tunnel engineering, water supply for vegetations can be done by spraying or drop irrigation through water supply pipeline to be built in forest. However, the cost is relatively high.

4) Construction workers should cherish and protect wild animals. Any hunting activities will be prohibited. Wild animals should be removed to the safe place, once they are found during the process of construction.

5) Slag dam will be built in dumping field. The principal of “Slag dam in advance and spoil afterwards” should be practiced in the process of spoil. Slag dam engineering should be arranged staged manner. Water discharging channel should be built at the top and the sides of the spoils to avoid the direct flushing of rainfall. Afforestation with grass should be done in the part of spoil
exposure to the air. Soil from the plough horizon should be peeled off for serving as the amendment of lean soil of surrounding areas or to be stacked aside within dumping field to serve for the afforestation or secondary ploughing by the end of service life of dumping field.

6) Afforestation will be carried out according to the requirement of afforestation designing right after the roadbed is formed. 2 or 3 years after the operation of the road, vegetation covering rate along the road should be recovered to the original level.

7) Blasting should be done strictly under the guidance of blasting technologies in proper seasons.

8) Soil from the plough horizon in farmland requisitioned should be stacked aside to serve the amendment of land newly cultivated, land with lean soil, or the rest of kinds of cultivating land.

9) Water supply pipeline in dumping field should be protected. Once damaged, it should be rebuilt. Local water resources facilities should be under perfect protection.

**Solid waste**

1) Large amounts of construction trash will be produced during the process of demolition of house and workshop building. Construction trash can be partially recycled as the construction materials for resettlement housing for affected residents and therefore reach the goal of reduction and utilization of solid wastes. Construction trash can not be utilized should be transported to the pointed places or trash landfill field for treatment. Stacking at will should be prohibited to avoid the impacts on landscape.

2) Domestic trash from construction workers should be stacked in a centralized manner. Domestic trash from road sections near rural areas can be used as the fertilizer, while domestic trash from urban area will be sent to trash landfill field for treatment after being collected by environmental sanitary sectors.

3) Spoil is mainly from the tunnel engineering. Certain amount of spoil will be used for the land leveling on both side of bridge construction site while the certain amount will be used for vegetation recovery in road section in bridgehead during the late stage of construction phase.

4) Earth and stone from the project should try to be utilized. Those can not be utilized should be transported to the pointed dumping field for stacking. Stacking at will should not be allowed to avoid soil erosion and impacts on urban landscape.

**5.3 Operational phase**

**Surface aquatic environment**

The area pollution in surface of road during the operational phase will only has limited impacts on water in river. Serious water pollution will take place only when traffic accidents occur
for the vehicles transporting hazardous cargos. Experiences show that the probation of pollution due to the traffic accidents on the bridge is very low. However, correspondent measures should be taken to completely put the pollution under control. Runoff (rainfall) of surface of the bridge should not be discharged directly into the river during the designing and construction phase. Runoff from surface of bridge should be discharged after being carried to bund. Buffering tanks in discharging outlet will be set, in another word, buffering tanks will be built on both ends of Yulianghe Bridge.

Wastewater during operational phase should be discharged into the wastewater collecting pipelines along the banks of Yulainghe River. Wastewater should not be discharged directly into Yulianghe River.

**Ambient air**

Driving speed of the vehicles should be ensured for the alleviation of air pollution. Control measures for pollution sources are the following: prohibition of the passage of vehicles with exhausted gas exceeding the standards, enhancing the check and maintenance of vehicles, and reduction of dust on road surface. And the control measures for diffusion of air pollutants include vegetation plantation along the road and the planning measures.

**Acoustic environment**

As far as the proposed project is concerned, in the noise seriously affected urban road sections where the space is not enough for afforestation, the control measure of acoustic shield construction is proposed by the EIA. Details are the following: folded plate acoustic shield with height of 3.5m will be constructed along both sides of road bridge sections. The material for acoustic shield should be in accord with surrounding landscape. Total length of the acoustic shield is $500 \times 2m$ with a total investment of 2.5 million Yuan. Along the road section between the end of road bridge to the inlet of tunnel, dormitory of Yongjiang Instrument Factory and residents of Youzha Village are located. Noise control measure proposed by the EIA will be done through installation sound proof windows for first row of residents facing the both sides of the road. Total households involved in the implementation of the measure are 60 with a total investment of 0.324 million Yuan.

However, there are many intersections in the road bridge section. Except the contribution of the proposed project, Shinan Road, Baoshannan Road, Qingnian Road and Fuyuan Road also make contribution to the regional impacts of noise. Therefore, overall consideration of regional control based on the regional planning should be done for the regional noise control. Only through this way, the residential areas can meet the correspondent requirement of acoustic environmental functional areas planning.
**Ecosystem**

1) Afforestation in slope side of road and land requisitioned should be done according to the requirement of road designation. Therefore, the purposes of vegetation recovery, soil erosion reduction, reduction of pollution of water bodies on both sides of road due to runoff of road surface can be reached.

2) Maintenance of afforestation and vegetation recovery in spoil and temporal land occupation should be done.

3) Vegetation recovery plan should be implemented. Firstly, as the afforestation is a systematic engineering, vegetation recovery and secondary ploughing should be done after the end of main work and side slope engineering. Secondly, detailed afforestation proposal are the following: Plants such as herbaceous plant and liane etc., that adapted to local conditions should be employed for side slope afforestation, while the evergreen tree such as kapor should be employed as the street tree.

4) Monitoring for tunnel engineering will be carried out. And efficient ecological protection measure will be adopted to recover the original ecological function when the water sources in surrounding areas and that for the growth of vegetation at the top of the tunnel are reduced or even dried up.

**Traffic management**

Traffic management should be enhanced and better traveling conditions should be provided. Periodical and random checking over the noise and exhausted gas will be done. If the noise or exhausted gas of vehicles under checking exceed the emission standards, These vehicles will not be allow for passage.

Public propaganda and training on the relevant laws and regulations on noise and air pollutants of vehicles will be carried out.

**Pollution accidents management and counter plan for accidents**

Accidental pollution caused by vehicles traversing the bridge should be put under control. In order to prevent the leakage of the vehicles transporting hazardous cargos from happening licenses should be issued by administrative bodies of both transportation and public security. In case of accident, and emergent measures will be taken by local administrative bodies of environmental protection, transportation and public security.

The outburst traffic pollution accident should be dealt with under the guidance of “Safety
first, precaution crucial”. For some outburst oil pollution accident or the other pollution accidents, it can only be dealt with in a manner of emergency.
6 Engineering schemes comparison

According to the feasibilities study, there are add up to 8 line schemes for You-Xiao Road. Preliminary scheme screening over the passage capacity, engineering difficulty, economic estimation, and environmental sensitivities was done, and then scheme K, A and B are chosen for further comparison.

Line schemes for line scheme K, A and B are to be carried out as follow. Fig for the three line schemes sees fig6-1.

**Fig 6-1 Comparison for three line schemes**

**Content of engineering scheme**

Line K scheme: Line K will be located in the area between Fuyuanlu Road and Longdongbao area. The road is the shortest one among the three line with a characteristics of being straight and small longitudinal slope. Started from the crossing point between Fuyuanlu Road and Dongzhanlu Road, the line will connected with planned southern circled line, where a interchange will be set for resolve the vehicle interchange between You-Xiao road and Fuyuan Road, Southern circled line and Fuyuan Road and Dongzhanlu Road. Then it will traverse the mountains in southern wings of Forest Park in the way of underground tunnel at K0+170. When it comes out of the tunnel at K1+840, it will go through Primary School of Mutou Village and traverse Yulianghe
River through a bridge with a total length of 410m that will be built at K3+340. Finally it will go southwards and connect with Southwestern Circled line after passing through Xingzhenglu Road of Longdongbao area. Total length of this line is 5237.948m, of which, total length of high speed line is 3700m; while the length of trunk line class in Longdongbao area is 1537.948m; and the length of connection line with Jianlongdonglu Road is 792.789m. There are three bridges for the line scheme with a total length of 693m, while there are 2 tunnels with a total length of 1920m. The minimum plane curve for the line is 1200m.

Line A scheme: Line A will be located in the area between Youzhajie Street and Longdongbao area. Due to the complicated terrain and the special characteristics of the geographical position, the line direction will be affected by Forest Park. Started from the crossing point of Shinanlu Road and Baoshannalu Road, where a cloverleaf junction will be built to resolve the interchange of You-Xiao road and the inner circled line, eastern line of central circled line of Guiyang City, Fuyuanlu Road, the line will enter the tunnel along the Yuanlinlu Road at K0+937.5, and then go out of the tunnel at the northern wing of CCP Cadre Training School of Guiyang Municipal Committee of CCP. Afterwards it will traverse Linjingdui Village, and the bridge on Yulianghe River with a length of 317.7m, and finally connect with southwestern circled line after passing Primary School of Kaifabaoguan. Total length of this line is 6592.577m, of which, total length of high speed line is 2489.131m; while the length of trunk line class in Longdongbao area is 2916.891m; and the length of connection line with Jianlongdonglu Road is 423.071m. There is 1 bridge for the line scheme with a total length of 371.7m, while there is 1 tunnel with a total length of 1793m. The minimum plane curve for the line is 300m.

Line B scheme: Line B scheme for You-Xiao Road is based on the reconstruction of original national road 321. Due to the low plane line form index, the minimum radius of original national road 321 is only 25m, while the maximum longitudinal slope is 7%. According to the functional positioning, the road class of You-Xiao Road is defined as the integration of urban truck line and high speed road. Therefore, the optimization of plane line forms and road longitudinal slope will be done for the line, which means that curve cut-off will be carried out in many locations of the line. Starting from crossing point between Shinanlu Road and Baoshannanlu Road, it will go through central circled line downwards after deviating the Guanyingdong, a cultural property protection unit, and enter Moutouzhai Village via Tangbaguan, Kavass Training School of
Guiyang, Guizhou Bank School, Auto School, and Training School of Policeman of Guizhou Province, and finally connect with Laolipo cloverleaf junction of eastern outlet via Jianlonglu Road. Total length of this line is 8231.688m, of which, total length of high speed line is 4400m; while the length of trunk line class in Longdongbao area is 3582.633m. There are 4 bridges for the line scheme with a total length of 480m, while there is 1 tunnel with a total length of 400m. The minimum plane curve for the line is 250m.

**List scoring for line scheme K, A, and B**

The major factors impact the line scheme for the proposed project consist of convenience of line scheme K, A, and B to connect urban groups, estimated total investment, passage capacity, total length of the road, impacts on environment, total areas of urban demolition, distance of road in section with unfavorable geologic conditions. Detailed comparison process is shown in EIA report.

**Statistics for scoring of line scheme K, A and B**

<table>
<thead>
<tr>
<th>Content for comparison</th>
<th>Convenience</th>
<th>Estimated total investment</th>
<th>Passage capacity</th>
<th>Total length</th>
<th>Environmental impact</th>
<th>Demolition areas</th>
<th>Geologic condition</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>scheme K</td>
<td>10</td>
<td>15</td>
<td>6</td>
<td>10</td>
<td>6</td>
<td>15</td>
<td>0</td>
<td>62</td>
</tr>
<tr>
<td>scheme A</td>
<td>20</td>
<td>12</td>
<td>15</td>
<td>5</td>
<td>0</td>
<td>10</td>
<td>10</td>
<td>72</td>
</tr>
<tr>
<td>scheme B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>6</td>
<td>6</td>
<td>27</td>
</tr>
</tbody>
</table>

As shown in the table 6-1, line scheme A has highest score, line scheme K is in second position, while line scheme B is lowest one. Therefore, line scheme A was chosen as the scheme to be proposed.

**Comparison with the scheme of “without the project”**

Scheme of “without the project” means that the proposed project will not be carried out. Compared with the implementation of the proposed project, Scheme of “without the project” will obviously not produce any environmental impact in a short term. However viewing in a long term way, increase of traffic flow in the future will not only become the “bottleneck” for the regional development, but also bring about more traffic accidents and losses for property and lives.
Furthermore, traffic congestion will contribute to air and noise pollution. Therefore, the implementation of the proposed project has obvious advantage over the scheme of “without the project”

**Conclusion for the comparison**

According to the above-mentioned comparison, detailed line scheme comparison over the starting and ending points of You-Xiao Road, traffic flow of the road, geologic conditions of bridge, tunnel engineering, and environmental impacts was done based on the function definitions of You-Xiao Road. The line scheme A has been chosen as the proposed line scheme.

**7 Public consultation**

Public consultation, aim at extensively collecting the opinions and demands of persons from different sectors in the areas along the proposed road over the impacts of the project on natural and social environment, has been done in various way. Two rounds of public consultation have been carried out during the EIA: the first round at the preparation TOR of the EIA on March of 2006, and the second round at draft of EIA reports on October of 2006. The primary technique used in public consultation includes public meeting, panel discussion, and public opinion questionnaires. The people consulted include those who will be affected directly by the project, relevant governmental and non-governmental organizations and experts of environmental protection and urban planning. Totally 193 individuals took part into the first round of public consultation while 93 individuals is for the second round. For the second round of public consultation, the progress of adopted good suggestion that had been propose in the first round of public consultation has been informed. The local affected residents, administers and employees of Forest Park, and administers of townships and villages in surrounding areas, as well as the teachers from the local schools participated the public meeting (The meeting statistic can be seen in table 7-1). The scope of the public consultation covers basically all the regions to be directly or indirectly affected by the project. Details are the following: Youzhajie Street, Forest Park, Longdongbao area. The major personal structure of public consultation are the following: the affected urban and townships residents, farmers, teachers and employees of schools, employees from hospitals, administers and employees of Forest Park etc., The opinions from the residents, shops, enterprises and institutions
near the proposed line was the focus for the public consultation since relatively large numbers of residential areas, shops, enterprises and institutions are distributed along the proposed line.

Table 7-1 Public consultation summary

<table>
<thead>
<tr>
<th>Location</th>
<th>Time</th>
<th>Participants</th>
<th>Participants number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First round of public meeting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guiyang Forest Park</td>
<td>In the morning on 6, April, 2006</td>
<td>Managerial personnel and employees of Forest Park</td>
<td>20</td>
</tr>
<tr>
<td>Administrative office of Youzhajie Street</td>
<td>In the afternoon on 6, April, 2006</td>
<td>Governmental officer and fellow citizens</td>
<td>12</td>
</tr>
<tr>
<td>Administrative office of Longdongbao Development Zone</td>
<td>In the morning on 7, April, 2006</td>
<td>Governmental officer and fellow citizens</td>
<td>9</td>
</tr>
<tr>
<td>Villager’s Committee of Mutou Village</td>
<td>In the afternoon on 7, April, 2006</td>
<td>Villagers</td>
<td>14</td>
</tr>
<tr>
<td><strong>Second round of public meeting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administrative office of Youzhajie Street</td>
<td>30, October, 2006</td>
<td>Governmental officer and fellow citizens</td>
<td>10</td>
</tr>
<tr>
<td>Longdongbao</td>
<td>31, October, 2006</td>
<td>Citizens</td>
<td>9</td>
</tr>
<tr>
<td>Administrative office of Longdongbao Development Zone</td>
<td>31, October, 2006</td>
<td>Villagers</td>
<td>12</td>
</tr>
<tr>
<td>Forest Park</td>
<td>31, October, 2006</td>
<td>Managerial personnel and employees of Forest Park</td>
<td>6</td>
</tr>
</tbody>
</table>

**Information disclosure**

Information disclosure was carried out in the media with highest circulation such as “Guiyang Daily” etc., presenting the time and location for publication of the EIA report and the contact forms for responding information with which the EIA can make proper revision and improvement. Part of road section is located in the remote rural areas where the education level of farmers is low. Information disclosure, employed the way understandable to the local public, is considered to be carried out.

Draft of EIA for publication presents the environmental impacts, mitigation measures, response of suggestions based on the adopted good suggestions from public consultation.
According to the requirement of WB, location of information disclosure is chosen in the place where is reachable freely by local residents free of charge of means of transportation.

**8 Environmental Management Plan**

An environmental management plan (EMP) has been developed in a separate and stand alone document. The EMP includes policies basis and applicable environmental standards, environmental system, mitigation measures and monitoring plans for both construction and operation phases.

**8.1 EMP purpose**

As predicted by the EIA, major project-involved pollution is from vehicle noise and exhaust. This EMP has detailed contents such as environmental impact mitigations, environmental management, supervision and monitoring. It will act as the instructive document in implementing those actions in ways of:

1. to identify the environmental impact mitigations for affected objects. The PMO, EIA compiler, and design party have conducted field investigation and confirmation towards the environmental sensitive objects and make out effective environmental impact mitigations which have been enclosed into the engineering design document.

2. to provide an instructive document regarding environment-related issues. This EMP will be distributed to construction supervision agency, and environmental management agency and other parties concerned after it has been evaluated and approved by World Bank.

3. to sort out the role and responsibilities for each party. This EMP has clearly defined the role and responsibilities for involved administrative and operating departments or agencies, and presented the channels and methods by which these departments communicate with each other.

4. to propose the monitoring plan for construction and operation phases. This EMP has drafted out the environmental monitoring plan in order to ensure the environmental mitigations be put into practice and to do the preparing work to prevent and control the unpredictable or accidental pollutions.

**8.2 Frame structure of environmental management organ**

See Fig 8-1 for frame structure of environmental management organ.
8.3 Environmental monitoring program

According to the engineering character of urban transportation project, the environmental monitoring program is divided into two parts towards the construction and operation phases respectively, as shown in Table 8-1.

Table 8-1  environmental monitoring program in construction and operation phases

<table>
<thead>
<tr>
<th>Category</th>
<th>Item</th>
<th>Monitoring program (divided into two phases)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Construction phase</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operation phase</td>
</tr>
<tr>
<td>Ambient air</td>
<td>Pollution source</td>
<td>Flying dust from construction activity</td>
</tr>
<tr>
<td></td>
<td>Monitoring item</td>
<td>TSP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vehicle exhaust</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NO₂</td>
</tr>
<tr>
<td>Monitoring spot</td>
<td>Boundary of the construction site, and sensitive spots nearby</td>
<td>Monitoring frequency</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Performed by</td>
<td>Environmental monitoring station of Guiyang city</td>
<td>Environmental monitoring station of Guiyang city</td>
</tr>
<tr>
<td>Pollution source</td>
<td>Noise from construction machines</td>
<td>Traffic noise</td>
</tr>
<tr>
<td>Monitoring item</td>
<td>LAeq(dB)</td>
<td>LAeq(dB)</td>
</tr>
<tr>
<td>Monitoring spot</td>
<td>Boundary of the construction site and sensitive spots nearby</td>
<td>Hospital of Guizhou Steel Group, and Jinxiu jiyuan residential area</td>
</tr>
<tr>
<td>Monitoring frequency</td>
<td>One day per month, twice per day (at day time and at night)</td>
<td>Two times per year, two days per time (at day time and at night for each sampling)</td>
</tr>
<tr>
<td>Performed by</td>
<td>Environmental monitoring station of Guiyang city</td>
<td>Environmental monitoring station of Guiyang city or a monitoring station newly built</td>
</tr>
<tr>
<td>Administred by</td>
<td>EPB of Guiyang city</td>
<td>EPB of Guiyang city</td>
</tr>
</tbody>
</table>

### Noise environment

| Pollution source | Noise from construction machines |
| Monitoring item | LAeq(dB) |
| Monitoring spot | Boundary of the construction site and sensitive spots nearby |
| Monitoring frequency | One day per month, twice per day (at day time and at night) |
| Performed by | Environmental monitoring station of Guiyang city |
| Administred by | EPB of Guiyang city |

### Water environment

| Pollution source | Wastewater from construction activities |
| Monitoring item | pH, NH3-N, CODcr, CODMn, BOD5, petroleum, TP, coliform bacteria |
| Monitoring spot | Yuliang River at the water intake port of Party School of CPC Guiyang Municipal Committee |
| Monitoring frequency | Twice per month in construction phase |
| Performed by | Environmental monitoring station of Guiyang city |
| Administred by | EPB of Guiyang city |

According to requirements of Chinese management policies and regulations towards construction projects, and stipulations of World Bank business, the environmental monitoring agency should prepare the Staged Report of Environmental Monitoring. Staged monitoring report should be prepared twice per year for construction phase, and once per year for operation phase.
8.4 Environmental protection investment

Through the above analysis, we draw the following conclusions regarding environmental protection investment (multiple-purpose environmental protection works and operation cost for the environmental protection works are not included):

(1) the investment for direct environmental protection works is 9,814,400 Yuan.

(2) in the construction phase, the investment for environmental protection works is 6,700,000 Yuan.

(3) in the operation phase, the investment for direct environmental protection works and their management and operation is 6,700,000 Yuan.

The total investment for this project is 1,044,871,100 Yuan, of which the environmental protection accounts for 21,014,400 Yuan, that is 2.01% of the total.

9 Conclusions for EIA

According to the comprehensive analysis on the results from each chapter of the EIA, and the principal of EIA examination and approval, the conclusions of the EIA are proposed as follow:

(1) Starting from Youzhajie Street, the proposed road line will enter the mountain bodies of Forest Park through tunnels started from Yuanlinlu Road, and then reach Longdongbao area after going out of the tunnel at northern wing of CCP Cadres Training School of Guiyang Municipal Committee of CCP. The line direction is in line with “Planning of Urban Road Networks of Guiyang City” and “The Controlled Detailed Planning of Longdongbao Area, Guiyang City (revised version)”.

(2) The construction of the project will stimulate and optimize the transportation and economic development in the area along the road, which is also significant to the transportation and economic development in Longdongbao area. Therefore the construction of the proposed project is the need for the development of Longdongbao area, and is the important channel for the future development of Longdongbao area.

(3) Certain impacts of the proposed project on the ecosystem, acoustic, air, aquatic, and social environment in the area along the both sides of the road will be unavoidable. However, if the
mitigation measures proposed by the EIA and EMP can be carried out; the “three simultaneous implementation”- simultaneous designation, construction and operation of environmental protection facilities and main works can be practiced, management and maintenance of environmental protection facilities for ensuring the normal and efficient running of environmental protection facilities can be enhanced by contractor of the project, the targets of mitigation of the adverse impacts brought about by the project, the coordinative development of transportation and environmental protection, and the integration of transportation construction, economic development, and environmental efficiency can be achieved. And the sustainable socio-economic and ecological development can be upgraded. Therefore, from environmental protection point of view, the project is acceptable.
PART II  Rural Road Project

1 Background of the project

1.1 Background of the project

With the purpose of supporting the strategic goal of “construction of Big Guiyang City” and pushing forward the great-leap-forward development of transportation in downtown and suburban of Guiyang City, the following goals have been listed in the “Planning for Road Network in Guiyang City during the year 2002 to 2020” by Guiyang Municipal Government. 1) Constructing or reconstructing annually of road at county or township level with total length of 500km; 2) constructing annually 1000km of hardening road for impoverished villages; 3) Within 3 years time, constructing or reconstructing 3000km road with quality equal or above tertiary road for several impoverished villages; constructing entrance road with quality equal or above tertiary road for each impoverished village; and at the same time strengthening the management and maintenance of roads at county, township as well as countryside level under the maintenance scope of Guiyang City.

However, with the constraints of both socioeconomic development and the geographical condition, the existing transportation infrastructure system in Guiyang City can hardly support the platform of development for “construction of Big Guiyang City”. The “bottleneck” for transportation in Guiyang City hasn’t been broken through from the root despite that transportation networks within limited area have already come into being through years of construction. Meanwhile, overall system of urban transportation networks in Guiyang has not yet come into being for the reason of the absence of cycled line connections among different trunk lines in Guiyang City, and of the radioactive channels, which are able to perform sufficiently the urban function. In addition, roads connecting counties and villages are characterized by low classification and poor passage and reachable function due to the late startup of construction, which becomes one of the factors holding back the socioeconomic development in villages along the line.

In order to raise fund for construction of urban and township transportation infrastructure system in Guiyang City, loaning application to World Bank has been proposed by Chinese Government. Viewing the real situation of urban and township transportation infrastructure system in Guiyang City, the loaning project was listed in the loaning plans of World Bank for the fiscal year of 2007. At the same time, the project was also listed by State Council of China in a three year plan for utilizing loans from World Bank. Approved by Development and Reform Committee of Guizhou Province in February 2005 with the document Qianfagaiwaizi No[2005]167, total investments for the project are 1.6 billion Yuan(RMB), among which 800 millions Yuan are from World Bank(Converted into 100 millions USD), while the rest will be raised by Chinese side.

1.2 Purposes of EIA

Purposes of EIA include:
1 Identifying the major environmental problems for the sub-project
2 Assessing the direct and potential environmental impacts
3 Proposing the control and mitigation measures for the specific environmental problems.
2 General description of the project

The whole project composes 44 rural roads and 46 bus stations. See fig 2-1.

Fig 2-1 Distribution map of Guiyang rural roads
3 Natural and social environments in the project area

3.1 Description of natural environment

Guiyang city is in the area from 106°07' to 107°16' east longitude and from 26°11' to 27°21' north latitude. It is located in the slope belt of east Yun-Gui plateau, with the highest point, elevation 1749.6 m, at the Mt. Nanji top of north-east Xifeng County, dwarfing Wujiang River whose surface elevation is no higher than 600 m. In topography, it is high in south west and low in north east, gently sloping into valleys. Guiyang city is located in subtropical humid monsoon climate zone. Affected by south east monsoon due to its low latitude and high elevation, climate in Guiyang city shows the following features: mild climate in four seasons, abundant rainfall and gentle wind power.

Guiyang city, where the project is inhabited, has rich water resource in form of river runoff. However, the distribution of rivers is not even in space and has the same pattern as the rainfall volume. Affected by the monsoon, these rivers have distinct wet period and dry period.

The vegetation in the area belongs to middle subtropical evergreen broad-leaved forest. Due to human disturbance, the original vegetation has been destroyed into a small area, and the secondary vegetation becomes the dominating one. Vegetation here can be divided into two categories, natural and cultivated. Among these, the natural vegetation consists of acid-soil plant and calcareous-soil plant, and cultivated vegetation covers agricultural crops, economic forests and fruit forests.

Cultural relics

After field investigation and consultation to the local units of cultural relics protection, it is found that there is no cultural relics existing near the project sites. Thus we can say that construction activities, such as road reconstruction, new road building, and bus station building in rural areas, will not bring direct impacts to cultural relics. In particular, there are few spots of cultural relics along or surrounding the project sites, but most of them are a member of human landscapes within some certain scenic site which is already under protection.

Involvements between scenic sites and the project

Guiyang city boasts a large number of scenic sites, for example National Scenic Site Hongfeng Lake National, and a batch of Provincial Scenic Sites such as Baihua Lake, Huaxi, Xiuwen, Kaiyang, and Xiangzhigou. The involvements between these scenic sites and the proposed project are shown in Table 3-1-1.
<table>
<thead>
<tr>
<th>No</th>
<th>Name of the scenic site</th>
<th>Protection level</th>
<th>Name of the sub-project</th>
<th>Role of the road</th>
<th>Location relationship</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tianhetan in Huaxi district</td>
<td>provincial level</td>
<td>Tianhetan-Gairong</td>
<td>1) For agricultural products out transportation; 2) As tourism line to connect Tianhetan with outside.</td>
<td>The sub-project is the extended part of Huaxi-Tianhetan road, and located at the south side of scenic site.</td>
<td>This scenic site is well-known for its karst cave, it is not a natural habitat, without rare and endangered species.</td>
</tr>
<tr>
<td>2</td>
<td>Xiangzhigou in Wudang district</td>
<td>provincial level</td>
<td>Dagu-Laping</td>
<td>1) For agricultural products out transportation; 2) For rural villagers’ going in-and-out; 3) As tourism line to connect Xiangzhigou with outside.</td>
<td>The section K15+600~K17+180 is located at the left of the core zone of Xiangzhigou.</td>
<td>This scenic site is well-known for its human landscape and natural landscape. There are rare species living within its scope.</td>
</tr>
<tr>
<td>3</td>
<td>Yangming in Xiuwen county</td>
<td>provincial level</td>
<td>Xiaoba-Shetian</td>
<td>1) As poor-relief traffic line for poor rural areas; 2) As tourism line to connect Wugongqiao, Yangming group (including Sanren tomb, Tiansheng bridge, Lihua garden) and other village-based scenic sites.</td>
<td>The section K12+200~K12+650 goes through Wugongqiao.</td>
<td>This scenic site is well-known for its human landscape and natural landscape. It is not a natural habitat, without rare and endangered species.</td>
</tr>
<tr>
<td>4</td>
<td>Baihuahu</td>
<td>provincial level</td>
<td>Wangchengpo-Xiaoshanbian</td>
<td>1) to improve traffic condition for peri-Baihua lake areas; 2) to upgrade the tourism image of Baihua Lake; 3) to contribute to the goal of all the villages within the township having access to the road.</td>
<td>The sub-project is located at the southeast of Baihua Lake. The reconstruction of the road will not cause direct impacts to the scenic site.</td>
<td>This scenic site is well-known for its human landscape and natural landscape. It is not a natural habitat, without rare and endangered species.</td>
</tr>
</tbody>
</table>
3.2 Social environment

Guizhou city, briefly called as Zhu, is the capital of Guizhou province. Located in the middle of Guizhou province, Guiyang acts as the political, scientific & technical, education, and culture center of Guizhou province. As a front, open and multiple-purposed city, it plays a big role in the development of south west China. Guiyang city governed 6 districts, 1 city, 3 counties (Yunyan district, Nanming district, Huaxi district, Wudang district, Baiyun district, Xiaohe district, qingzhen city, Kaiyang county, Xiuwen county, and Xifeng county) with an administrative area of 8034 sq km.

According to the statistical data provided by public security bureau of Guiyang city, at the end of year 2004, Guiyang city has total 93403 households and population is 3,478,132, of which male accounts for 1,790,133, 51.47% of the total, and female accounts for 1,687,999, that is 48.53% of the total. The population of non-agricultural people is 1,692,254, that is 48.65% of the total, that of the agricultural people is 1,785,878, 51.355 of the total. The population density in Guiyang city is 437 persons per sq km.

Within Guiyang city territory, there live 15 ethnic minorities, for example Buyi, Miao and etc. The ethnic minorities whose population is more than 10,000 include Miao, Buyi, Tujia, Yi, Dong, Gelao and etc.

GDP for Guiyang city in 2004 is 44.363 billion Yuan, 13.7% higher than that for the last year, among which, total production for the first industry is 3.177 billion Yuan, 7.6% higher than that for the last year; total production for the secondary industry is 23.324 billion Yuan, 15.6% higher than that for the last year; total production for the tertiary industry is 17.862 billion Yuan, 12.3% higher than that for the last year.

Per Capita GDP for Guiyang city in 2004 is 12,683 Yuan, 13.0% higher than that for the last year. Net Income per Farmer is 2,809 Yuan, 11.9% higher than that for the last year, taking out the price factor, the actual increase rate is 7.4%.

At the end of year 2004, the road mileage of Guiyang city extends to 3843 km, of which highway accounts for 123.33 km. In 2005, the freight volume of road transportation amounts to 54.67 million tons, and passenger capacity amounts to 260 million persons.

4 Rural road engineering

4.1 Environmental impacts during construction period and mitigation

The rural traffic project basically locate within the area where the soil resources quality
relatively worse. Certain impacts on ecological resources and land use along the road will take place when rebuilding or partial newly building road.

These roads will be reconstructed for standardard national 3rd or 4th Grade. The typical engineering activities for the project are the following: roadbase widening/ height raising Earth work, concrete work, and bridge construction. The implementation of above-mentioned engineering activities will produce impacts on the surrounding environment of project area in some extent.

**Analysis for water environmental impact**

While the roads were constructed, soils for the earthen embankment were collected from roadside areas leaving these borrow areas as ponds, and as such majority of the roads have a large number of roadside ponds In rural areas these ponds have potential and multi-purpose use including bathing, washing and pisciculture. Road improvement will require roadside pond-filling impacting their potential uses A reduction in the pond area from embankment widening and/height raising will not only affect the potential household use of the pond, but also will reduce the fish-yield and cause the difficulty of the agricultural irrigation. The impact can be avoided/minimized by:

- Widening of the embankment towards opposite side of the pond, and,
- Providing earth retaining structure (slope cut-off) at the pond side.

These measures will not only save the pond but will also ensure the durability of road-embankment at the pond location (since at the pond location slope stabilization of embankment becomes difficult in most cases).

Groundwater wells are generally used for small portion of the inhabitants. Mitigation measures are the same with roadside pond, another word, widening of the embankment towards opposite side of the pond.

Water pollution occurs from increased water turbidity due to carrying away of eroded soil by water that ultimately reaches nearby waterbodies Such impact is a potential threat to some fish species. The way of minimizing/avoiding such pollution is to protect the erosion as well as embank the ponds/waterbodies (where possible) so that eroded soil can not reach these waterbodies. It is strongly recommended, such countermeasures should be implemented where the waterbody is used as drinking water source.

Main wastewater during the construction is washing wastewater from concrete mixer with the main pollutants of suspended substance and residue of building material. It is prohibited to discharge the wastewater into the environment at will. Sedimentation tank should be built near the
mixer. Wastewater should be reused to production after treated. Wastewater treatment facilities should be paid more attention to the location where there are important rivers or water source protection area, as to avoid water pollution.

With lots of rivers, mid-size and small bridges should be rebuilt or newly built, bridge construction may cause some influence on the rivers. During the construction, such as desilting, pile driving, damming, water becomes muddy, where aquatic organism live should be influence, sometimes the fish and shrimp change their action line. Excavating river-ban and making cofferdam may destroy aquatic plant community of alluvial flat, influence aquatic animal on finding food. But the influence is temporary, which would be decreased in short time after the construction.

During the construction, builders live together in different road section, domestic sewage is large. According to analogical investigation, common 100 builders live one place,. According to the calculation of one person need 60L water, with 75% domestic sewage, domestic sewage one place should be 4.5 ton one day, pollutants volume discharged may be BOD 5kg/d, COD₉ 6kg/d. If the part of sewage has been discharged directly without treated, which may influence nearby water environment. So temporary treatment facilities of domestic sewage, such as septic tank, should be built in large construction area with a lot of builder. The effective volume of facility is 60 m³, wastewater delayed time is 3 days. Removal rates of the tank are BOD₃ 30~40%, COD₉ 50%. Domestic sewage should be treated before discharge or reuse as crop irrigation water. Try to avoid discharging directly to water body, and reduce the pollution influence on water environment.

**Analysis of air environment impact**

Dust nuisance occurs due to handling of soils during construction and mainly from lack of watering of earth surface. Such nuisance is also a function of weather condition- in dry season nuisance is more, during rainy season, because of rain, dust nuisance subsidizes. In concentrated residential area as well as crops' cultivation region, the dust nuisance to the inhabitants and crops’ growth would happen during the construction time. Only frequent and extensive watering of earth surface during construction can control dust nuisance.

Flying dust may be caused during the concrete mixing, asphalt gas may be caused during asphalt boiling. Flying dust can cause the influence to the concentrated residential area and cultivated area during the construction period, which may influence residents and crops. During
the construction, concrete should be mixed using inclosed technology and working with dust eliminating device. Asphalt should be transported in non hot-source or high-temperature container to construction site. Concrete mixing and asphalt simmering should be carried out in relatively concentrated way, with the distance of more than 100m from down-wind direction of environment sensitive spot, so as to prevent flying dust and waste gas from pollution.

**Noise impact**

Concrete mixer, air compressor, windlass machine, road roller may cause building noise and blast noise, which may influence the roadside objectives such as Residents-concentrated area, school, hospital. The protection work should be done according to the provision of “Noise limits for construction site” (GB12523-1990). Construction during the night and important days for student exam is strictly forbidden in these area.

**Impact on ecological environment**

Since there are farmlands extensively located at both sides of roads, some farms may be occupied in road widening, which cause land loss. The loss is permanent and non-restored. More and more attention has been paid to farmland preservation with a growing population, however the influence of road widening is unavoidable. To decrease farmland occupation, using sunk fence to protect the filling roadbed slope should be considered in design, while roadbed stability is required. Land loss should be compensated to the owners.

Topsoil is the invaluable ingredient for agricultural crop yield. The present practice for soil collection involves cutting of agricultural lands with shallow depth, which causes losses of enamours topsoil loss reducing the quantity of agricultural lands in the area and resulting in the loss of crop production.

Such impact can be avoided by collection of earth from barren lands. Another option may be to collect earth from existing borrow areas to the use of roadbed height raising. Generally, it should be avoided to do high filling and deep excavating, and try to reduce the excavating and abandoning amount in it.

Because the project is alteration and extension, the limited amount of woodland would considere to be occupied while no forest farm and large woodland would be destroied. As long as enough attention is payed to preserve forest during the construction, and through transplanting the removed trees and prohibiting random wood-cutting, the influence should be small. Resource
owner should get equal compensation for loss.

Vegetation of roads includes secondary vegetation, artificial vegetation and farm vegetation on shoulders of the road embankment, while the protogenic vegetation has almost been destroyed in the past. Over 95% of the total length of all the roads go through the rural areas and most of the roads have extensive vegetation coverage. However, it is necessary that all roads will require clearing of vegetation due to the roads widening. Vegetation clearance results in increased soil erosion and slope destabilization of the embankment in addition to their loosing support for ecology. One side widening of the embankment rather than both side widening would require minimal vegetation disturbance. Some important roadside bushes/large old trees can be preserved by doing limited widening/disturbance to minimize the impact on roadside ecology. In addition, planting diversified trees and bushes/grasses on batter slopes is one of the suggested measures to recover the losses.

Soil erosion occurs from the exposed loose earth-surface (from where soils have been collected) to the rainwater/flood water during monsoon and mainly due to lack of compaction as well as vegetation coverage, and then induces the nearby waterbodies pollution in terms of increased water turbidity. Considering surface water and vegetation cover along the road, soil erosion exists with relatively bad vegetation cover.

Obstruction to natural drainage of floodwater/rainwater would occur from road widening and/or height raising that might require, at some locations, partial/full filling of natural drainage channels would cause this type of effect as key issue. Measures suggested for saving these channels or reconstruction would work as preventive/mitigation measure in this case.

The road construction will inevitably destroy the natural scenery. Main influence comes from physiognomy destruction of borrow pits and vegetation elimination. During the construction, limited and regular borrow pits should be considered to mitigate the impact on landscape. Diverse vegetation along both sides of the road can improve the roadside landscape after 2 or 3 years (Depends on the types of trees and regional soil).

**Impact of social environment**

Because most of roads link town and larger village, house, residence and poultry-cultivation shed may be removed for road widening. Part route change may avoid large removal. But sometime route can not be changed with terrain reason, settlement of the removal
should be made better to compensate for the owners.

Main pollution is dust and gas pollution caused during the construction around working site and dwelling district. The engaged labors must use mask on their mouth and nose in order to prevent them from fince particles. Mixing workplace should be positioned with the distance of 100m away from the dwelling area.

**Impact of infrastructure**

Road widening or road heightening should fill in part or all of irrigation canal. The mitigation measures are showed as following. When the irrigation canals pass through the road in cross-shape, culvert should be reserved or improved. When the irrigation canals run parallel to the road, the measure is as same as that of pond protection mentioned above.

Public facilities like hydraulic projects, electrical power, communications and local roads will be given abundant attention, while some influence is inevitable, which can bring the inconvenience for residents and enterprises. The project management part should coordinate with interrelated units, strengthening the protection to these facilities, so as to ensure the needs of local people.

**4.2 Impact of operation period and mitigation**

The aim of road rebuilt is to improving local basic condition of rural poor village, facilitating the farmers’ selling activities, corresponding them with better commerce and service facilities nearby. Road operation could bring positive influence on the local peasants’ transportation activities and economic development, and especially for the minorities.

During operation, land ownership, land-use type and landscape change may cause extensive variation. Such as, roadside farm lands may be changed into residential and commercial land. With convenient transportation, land type may be changed, which are considered to be positive.

At the same time, some indirect influences may be induced on nearby scenic spots, some are favorable and others are unfavorable.

**Acoustical environment**

Through noise prediction, the influence on protective objectives is fundamentally few, but with crowded house on both sided of the roads, there lies some influence. Considering relocating or planting tall broad-leaf tree on both sides of the road and setting non-beep symbol, the influence
can be mitigated. Moreover the schools always locate in crowed area, the safety of the students and pedestrian should be paid enough attention, the decrease-speed symbol should be set in these sensitive spots.

**Atmospheric environment**

Before construction, most of roads are made of sand rock. There are a lot of flying dust after automobile running away in dry season. Roadside crops have been seriously influenced by the flying dust. With the leaf absorption, natural crops-growth have been hindered, so the production hence has been reduced. Influence of the dust on crops and resident along the road should be decreased largely after the reconstruction of the project. And the human health should be protected with concreted road surface.

On the other hand, waster gas from vehicles should become an obvious environmental problem with the improvement of road and increase of the traffic. In rural area, because of stronger air diffusion, the influence of waste gas can be small under suitable management measure and good traffic planning.

**Minority**

There are 15 minorities in Guiyang, such as Miao, Buy, with the population of 57.39 ten thousand, who live in remote rural area. When road improved, they may contact with outer world and minority culture may be spread abroad. In addition, unique minority culture (traditional holiday, dance and so on) has been thought as potential non-substance culture value. Local travel industry should be improved with the road change, so the local economy is expected to be promoted.

On the other hand, though the transportation improvement can bring the positive influence on the folk culture exchange, those minorities in disadvantage may undertake increased mental pressure, and their traditional living habits and value concept face challenge.

**Road transportation**

After road rebuilt, transportation become rapider and safer. Hence, all the roads project should cause active influence.

It is very likely that development of some secondary and tertiary roads linking these roads within some remote rural areas will occur due to the road improvement. An unplanned road development can be a disaster to the environment and therefore it is suggested to take an
integrated approach for overall development in the rural areas rather than undertaking segregated development approach for development.

**Impact on land use**

Changes in roadside landuse will occur from the induced demand for roadside human settlement and commercial values, which will likely convert the agricultural lands into the same use. Because of their location advantages, these roads will provide better road accessibility to their respective district/divisional towns. And because of the same reason, roadside areas have already comparatively high demand for such changes. An integrated and planned approach for the roadside landuse can optimize the benefits from such changes while the reverse can be a harmful to the environment affecting the overall benefits of such changes.

**Impact on landscape**

Impact on landscape will occur from the change in roadside landuse, roadside avenue trees. Such changes will occur as a medium to long-term effect and consequently change in landscape will be a function of time.

**Indirect impact on scenic spot near the roads**

Road reconstruction should make indirect influence on scenic spot along the road. The road to scenic spot should be quick and comfortable, which is potentially the main aspect on attracting tourists. So tourists number should be increased because of road improvement. The more tourist and income, the more pressure on ecological environment. The pressure induced from the tourist action mainly are garbage, man-made vegetation destruction, man-made fire, climbing the mountain, evacuation, interfering animal, and land subsidence with lots of tourists. Most of the above influences are not remarkably destructive to scenic spots, while accumulated and unceasingly affected may cause big disaster to the ecosystem. A good management ability of the scenic spot and some basic facilities are important to subsidize the capacity construction as to mitigate the ecosystem pressure while tourists increase.

After on-the-spot investigation and inquiry from local officials, main scenic spots are shown as following:

**Tianhetan scenic spot in Huaxi**

Tianhetan-Gairong Road lies in the south of Tianhetan scenic spot. Gairong road will be connected with the projected road. After reconstruction of Tianhetan-Gairong road, it is easy to communicate from Huaxi center to Tihetan, which may shunt the tourists from Huaxi park –Qinyan old town to Tianhetan (13km away from the previous). This may finally cause the
management pressure.

**Xiangzhigou scenic site in Wudang District**

The proposed project, involving with the scenic site, consists of the construction of Dagu-Laping road, which is to be newly built into a Grade-3 one. It starts from Dagu(where is joining Xiuwen county-Yangchanng town road and intersecting Road S104 Wudang district-Kaiyang county in the territory of Xinbao township), and ends at Laping (where is joining Wudang district-Baiyi town road). The construction of this road will refresh the record that there is no road directly connecting Dashi and Laping. It will extend southward to Wudang district and Guiyang city, northward to Kaiyang county, westward to Xiuwen county, and then a complete traffic network comes into form. This project will provide traffic convenience to public who live along the road routine, and also it will lay a concrete foundation for the development of Xiangzhigou tourism.

Due to the improved traffic condition, more tourists will be attracted and visit this scenic site. Subsequently the large number of tourists will bring forward more environmental pressure which challenges the environmental management of this scenic site.

**Yangming scenic site in Xiuwen County**

The proposed project is the reconstruction of Xiaoba—Shetian road which will come across one of the scenic plots, Tiansheng bridge scenic site. Tiansheng bridge scenic site comprises two cultural scenic spots, Sanren tomb and Wugong bridge. This project will have potential impacts upon these two spots, not involving with the natural scenic spot of Tiansheng bridge since it is about 500m away.

Due to the improved traffic condition, more tourists will be attracted and visit this scenic site. Subsequently the large number of tourists will bring forward more environmental pressure which challenges the environmental management of this scenic site.

**Baihua Lake scenic site**

The proposed project, the reconstruction of Wangchengpo—Xiaoshanbian road is located at the south side of Baihua Lake. The major role it will play is to provide convenient transportation for the surrounding people and contribute to the aim of Every Village Having Access to Road. At present, it is easy to communicate between Baihua Lake scenic site and Guiyang city, for example, there are shuttle buses departing from Guiyang bus station everyday. Either the construction or the operation of the project will not cause direct impacts to this scenic site. And increase of the tourist number, which is brought by the traffic improvement, will be in a limited degree.
**Analysis on scenic site’s management capacity**

In order to know well the management capacity of the above four scenic sites, we have inquired and shared ideas with the management and service personnel who engaged in these scenic sites. Firstly we told them the potential impacts which may be brought by these project constructions, and then asked them some questions respecting the management capacity. Their answers showed that the scenic sites have a weak management capacity when encountering indirect impacts and we suggested: environmental protection training should be held in order to improve service and management personnel’s environmental protection consciousness, which will play a big role in achieving sustainable development and ecological preservation for the scenic sites. Such training courses should be proposed and executed by Guiyang World Bank PMO, and the training cost be included in the project budget.

Except the training, we have draw out other recommendations:

1) To increase financial input, and support the environmental protection work of the scenic sites; and separate the ownership from the management right.

2) To expand the area of scenic sites, and speed up the construction of new scenic spots, in order to disperse the mass tourists and keep the touring resource away from more human disturbance, since the increase of tourists number have cause considerable pressure on scenic sites and in some spots the ecological environment has been damaged.

3) To slow down the construction speed, enlarge the protection scope, compress new projects, and improve project’s quality for the scenic sites whose environment has been damaged. At the same time, to handle the visional pollution or ecological destruction as soon as possible to stop such damage growing.

4) To improve the guides’ personal quality. A qualified guide can spread the environmental protection idea to the tourists through his speech, for example, tell tourists how to handle garbage which is generated during the touring activity, or tell them the fact that painting or writing randomly is an action damaging the cultural relics or landscapes. About the touring garbage, it can be solved by means of installing more dustbins along the touring routine, or by strengthening maintenance and round inspection.
5 Rural bus station project

5.1 Environmental impacts and mitigation during construction period

Atmosphere environment

Generally speaking, bus stop is located in the population densely distributed area. Demolition engineering will produce some environmental problems such as the dust etc., on the condition that the demolition of some buildings is to be carried out due to the proposed project. In that case, dust proof measures such as the water spraying to the buildings under demolition should be adopted.

Dust impacts will take place during the earth and stone work during construction period, if water spraying to the surface soil doesn’t carry out. Climate conditions usually tend to play an important role during such a process. In the dry season, for an instance, in winter or in Autumn, impacts of dust is more serious; while in the Spring or in the Summer, when the rainfall is more frequent, impacts of dust is less serious. Possible impacts of dust on residents or crop may be produced as construction work is to be done in residential area or in the crop cultivation area. Residential areas are more centralized near the bus stop where the potential targets to suffer from the impacts are centralized. Moreover, the scale of the residential is relatively larger. Therefore, key environmental problems such as the impacts of dust will be produced during construction period. Periodical water spraying to construction area during construction period is necessary.

Dust will also be produced during the mixing of concrete materials and pitch gas will be produced during the process of for making pitch. Possible impacts of dust on residents or growth of the crops may take place as construction work is to be done in residential area or in the crop cultivation area. During the construction period, closed mixing process with dust remover should be employed for concrete materials mixing; and transportation of pitch with containers of high temperature or container without thermal sources should be employed for pitch producing. Moreover, the places for the concrete materials mixing and the pitch producing should be as centralized as possible and should be located in somewhere 100m away from the environmental sensitive points in the downwind direction to avoid the direct impacts of dust and pitch on environmental sensitive points.

Noise environment

Population densely distribution area especially the schools, hospital etc., near the project cite need to be protected. Relevant regulation of “Noise value limitation for construction cite” (GB12523-1990) need to be carried out. For an instance, construction should be prohibited during the night or during the period of important examination for students in above-mentioned noise sensitive areas.
Aquatic environment

Soil erosion due to earth and stone work will ultimately cause the increase of turbidity in the neighboring water bodies such as reservoirs, rivers, and pools, which will endanger the life or production of fish species involved. To avoid such an impact, dam need to be constructed in the water bodies under protection to prevent soil from entering the water bodies. The relevant protection measures will be even more important for water bodies where the drinking water pumping points are located.

Soil erosion

If pressing or vegetation recovering are not carried out in the surface of loose soil after the land leveling, soil erosion may take place due to the flushing by flood and rainfall so as to increase the turbidity of neighboring water bodies and produce secondary pollution. Therefore, construction activities should try to be avoided during the rain seasons.

Population densely distribution areas

Generally speaking, bus station is located in the population densely distributed area if requisition of house site and demolition of building is to be carried out during construction period, it should be done strictly under relevant regulation and proper compensation should be made to the landowners.

5.2 Environmental impacts and mitigation during operational period

Noise

Certain impacts will take place on the surrounding areas of some of the bus stops points where the residential areas are more centralized. To avoid the impacts, the following control measures need to be take into consideration: 1) demolition and resettlement; 2) plantation of some broad-leave tree species near the bus stops; 3) setting up signals inside the bus stops prohibiting the trumpet.

Air pollution

Exhausting gas will be produced in the parking lot. Major pollutants include CO, NOx, HC, TSP etc., which will produce certain impacts on the surrounding residential areas. Therefore, bus stops should be placed in the downwind direction of local annual dominant wind direction. The parking lots should be avoided to place in the upwind direction of centralized residential areas. And the administrative offices of bus stops should try to be placed in the upwind direction of parking lots.

Water pollution
Major water pollution sources of bus stops come from the wastewater for washing automobiles and the domestic wastewater. Impacts of wastewater may be produced on the neighboring water bodies (pools and brooks). Major pollutants include COD, SS and petroleum group etc., In addition, wastewater from toilette may become the potential impact factor for the underground water bodies. The following control measures need to be taken to avoid the pollution of surface or underground water bodies caused by the bus stops:

1. Rain and wastewater drainage systems should be separated, independent rain collecting and drainage systems need to be constructed;
2. Leaking proof measures should be adopted to avoid the leaking towards underground;
3. Wastewater is to be discharged into the neighboring discharging ditches or water bodies after it is treated and meet requirement of relevant emission standards.

**Solid wastes**

Solid wastes include package material for cargos, relinquished cargos, food residues of passengers and the domestic rubbish from employees of the bus stops. Solid wastes will be treated in the way of landfill after it is collected and transported to the rubbish field by local environmental and sanitation administrative bodies.

**Passenger and cargo transportation**

Thanks to the proposed project, local passenger and cargo transportation conditions and the traveling condition of local farmers especially the local minority ethnic groups will be improved greatly, and the transportation and transaction of local agriculture products will be even more convenient.

**Land use**

Same as rural road project

**Improvement of transportation conditions**

Originally, there are no bus stops in the market towns of the proposed project. Therefore, automobiles are usually parked in the streets of the towns, which not only produce adverse impacts on the orders of local transportation and become the potential factors for traffic accidents.

Thanks to the construction and operation of new bus stops, streets of these market towns will be more spacious and the local traffic will be much smoother, which are all the positive factors for improving the local transportation conditions.

**Security of bus station**

The safety and fire system in the station should be built up and perfected, the location and deploy of fire plugs and extinguishers indoors and outdoors should meet the relevant provisions of
Code for Fire Protection Design of Buildings (GBJ16—2001). It is urged to pay more attention to those main fireproofing sites within the station, establish and perfect the system of post’s responsibilities and relevant criterion of safety operations. And it demands to enhance employee’s senses of safety and do the best to prevent fire potentials.

The facility of fuel store in the station should be located in a place far away from open fire and forbidding smoking. Exploding-proofing illuminations should be used in works of maintenance or checks. Electricity distributor house, boiler house and other establishments with high fire risk should be designed into independent buildings and separated away from each other.

It is urged to strengthen supervising and managing on traffic safety in the station area, and only qualified bus drivers can be employed.

6 Public Participation

6.1 Brief description

The public participation is conducted to gather opinions and advices from people living along the project routine, respecting the impacts on natural and social impacts.

For this project, three times of public consultation (one is in March ~ April of 2006, one is in August of 2006 for 8 road routines, and the other is in October ~ November of 2006 for the new added 38 bus stations) have been carried out in forms of public meeting, group discussion and questionnaire survey, when the EIA is undergoing. The participants, identified as local villagers, governmental officials, teachers, management and service employees of the scenic sites, included the affected groups, relative governmental organs and non-governmental organs, amounting to 1,800 plus persons. Total 71 public meetings have been held for this project-- 44 road routines and 46 bus stations. For the first time of public consultation, 1690 copies of questionnaire forms have been distributed and filled out. The scope of the public consultation covers the areas directly affected by this project implementation, mainly the sizable villages and schools along the road routine.

6.2 Result of public consultation

Results of personal questionnaire survey

1. 93.5% public thought that the project can accelerate local economical development, 87% public thought that the project can improve their life quality and 95% public can accept the fact that the project demand house relocation or land acquisition. At the same time 95% public will
accept the arrangement on land occupation and resettlement according to relative polices. 86% public said that they can accept the environmental impacts, when questioned “if they would accept the environmental impacts that were caused by the project construction”. Through statistic conclusions, most of public support the construction of this project.

2. Many public expected that the roads be built as soon as possible when facing the column “opinions and suggestions”. It is an urgent need for local people who have been deeply bothered by the inconvenient traffic condition for a long time. In addition, for some sub-projects, public proposed requirements on resettlement and protection on drinking water, schools, ancient and rare trees.

Such opinions and suggestions showed that those publics have an improved environmental protective consciousness, for example they thought protecting drinking water and trees were very important. On the other hand publics’ concerning about the resettlement reflected that they are actively appealing to their own interest, and this was also the intention and meaning of public participation. In addition, during the public consultation held in schools, teachers put forward the noise issue and suggested that we should protect schools from noise disturbing.

**Results of questionnaire survey towards groups**

The groups attending the public participation consist of village committee, government offices, schools, hospitals and others who inhabit along the project routine.

From the result of the questionnaire survey, we can see that the surveyed agencies support the construction of this project.

The opinions and suggestions from agencies are very similar to those from individuals. Agencies have the same concerns with individuals and support the construction of the project. Also they gave suggestions on how to protect schools, and how to protect irrigation works.)

**Information release**

(1) The information should be published in the hot medias, such as Guiyang Daily newspaper. There should be a notification published in the newspaper, carrying the date and location the EIA report will be shown openly, and contact information for feedback. With the feedback, we can revise the EIA report. Since the project is located in a rural area where the education level is relative low, the information release should be performed in a simple and clear way.

(2) The first script of the EIA report shown will disclose information such as, project’s environmental impacts, mitigation measures, feedback information from the first public participation event, and etc. As required by the World Bank, the information disclosure should take place in the location where public can easily and freely reach, without any cost, and no need to take a bus.
6.3 Acceptance of public suggestion

The acceptance for the public’s suggestions see in sub-report of Guiyang rural traffic project.

7 Environmental Management Plan

7.1 EMP purpose

As predicted by the EIA, major project-involved pollution is from vehicle noise and exhaust. This EMP has detailed contents such as environmental impact mitigations, environmental management, supervision and monitoring. It will act as the instructive document in implementing those actions in ways of:

(1) to identify the environmental impact mitigations for affected objects. The PMO, EIA compiler, and design party have conducted field investigation and confirmation towards the environmental sensitive objects and make out effective environmental impact mitigations which have been enclosed into the engineering design document.

(2) to provide an instructive document regarding environment-related issues. This EMP will be distributed to construction supervision agency, and environmental management agency and other parties concerned after it has been evaluated and approved by World Bank.

(3) to sort out the role and responsibilities for each party. This EMP has clearly defined the role and responsibilities for involved administrative and operating departments or agencies, and presented the channels and methods by which these departments communicate with each other.

7.2 Frame structure of environmental management organ

See Fig 7-1 for frame structure of environmental management organ.
Management and execution organs

Transportation Bureau of Guiyang City

Project management office

Contractor

Design agency

EIA agency

Supervising organs

EPB of Guizhou province

Local EPB

Design and construction phases

Operation phase

Local Operation Company

Monitoring department

Environmental protection sector

Fig 7-1 Frame structure of environmental management organ for Guiyang rural traffic project
7.3 Environmental monitoring plan

The purpose of making a monitoring plan is: to supervise whether each environmental protection program has been taken into practice; to provide realtime monitoring results based on which to adjust environmental protection action; to provide basis for drafting time schedule and implementation mode for environmental protection program. Preparing of the monitoring plan is based on the predicted environmental impacts in every phase (construction and operation phases).

For this project consists of many small-scaled subjects, which aim to prompt the rural development and have limited impacts on the environment, so we only need to select some representative subprojects to conduct monitoring plan. Environmental monitoring program for construction and operation phases are made upon the characteristics of rural transporation projects. Refer to Table 7-1 for the monitoring program.

Table 7-1 environmental monitoring program for construction and operation phases

<table>
<thead>
<tr>
<th>Subproject</th>
<th>Name</th>
<th>Monitoring spot</th>
<th>Monitoring items</th>
<th>Monitoring frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>R13</td>
<td>Zhaiji-Xinshan</td>
<td>Qingshuijiang River</td>
<td>regular indicators of water quality of rivers</td>
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<td>R14</td>
<td>Tianhetan-Gairong</td>
<td>Lengfan River</td>
<td>indicators of water quality of rivers</td>
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<td></td>
<td></td>
<td>Tianhetan scenic spot</td>
<td>management capacity</td>
<td>– 1</td>
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<td>R20</td>
<td>Dagu-laping</td>
<td>Baishui River</td>
<td>regular indicators of water quality of rivers</td>
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<td>Xiangzhigou scenic spot</td>
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<td>R30</td>
<td>Shetian-wugongqiao-xiaoba</td>
<td>Xiuwen Yangming</td>
<td>Management capacity</td>
<td>– 1</td>
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<tr>
<td></td>
<td></td>
<td>scenic spot</td>
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<td></td>
</tr>
<tr>
<td>R36</td>
<td>Wangchenpo-xiaoshanbian</td>
<td>Baihua Lake</td>
<td>Regular indicator of water quality of surface water</td>
<td>1 1</td>
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</table>
### 7.4 Training plan

Personnel training plays a big role in achieving fluent and effective project implementation. The training should focus on environmental protection knowledge and environment-friendly work skills towards the construction workers. In addition to explaining the importance and implications of the project construction to all the workers, the training will also take different forms and apply different courses towards different groups who have been sorted out according to their posts. Generally the training locations have two alternatives, in domestic and abroad.

### 8 Conclusion and suggestion

This project will promote the construction of Urban-Rural connecting road network in Guiyang city, and contribute a lot in solving the road problems such as too narrow, in lower grade, difficult to reach remote areas.

This project also contributes a lot to the poverty relief, environmental improvement, living and education level lifting for this area.

Several roads in this project are the tour routes that prolong to the scenic sites, but we do not need to worry about it, the construction of this project won’t destroy the cultural and historic monuments and the tour spots along the routine; on the contrary, it will drive the development of the local tour industry significantly. As for the indirect impacts coming form road reconstruction, the affected scenic sites have any possibility to transfer them into a positive one if they take proper countermeasures in hardware and software aspects.

Due to the similarity in terrain, all the sub-projects have the common points regarding environmental issue. Aside from terrain and geography, there are other impacts such as, social and economic, resettlement, safety and etc. How to mitigate such impacts is described in other reports.

Through design optimization, and implementation of good environmental management plan, the environmental impacts brought by the project will be mitigated not very difficulty. So the environmental impacts caused by this project are not very intensive.
Attached Fig 1 Monitoring Sites of You Xiao Road

- A1 Air Mon. Site
- N1 Sound Mon. Section
- W1 Surface Water Mon. Section
- Q1 Groundwater Mon. Section