Fujian Provincial Road Development
World Bank Loan Project

Changchun-Shenzhen National Arterial Trunkway
Yong’an-Wuping Highway (Fujian-Guangdong border) in Fujian Province

Environmental Action Plan

Constructed by:
Fujian Provincial Expressway General Commanding Office
Sanming Yong-Wu Highway Limited Company
Longyan Yong-Wu Highway Limited Company

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1. Forewords

The Environmental Action Plan of Yong'an-Wuping (Fujian and Guangdong border) Highway (Yong-Wu Highway for short) in Fujian Province is based on its Environmental Impact Assessment Report (Second Edition). The mitigation measures and the monitoring and training plans proposed in this report have been discussed by the design institute, the construction unit, the immigrant and resettlement office, and environment management department; and consensus of opinion has been achieved with the Project Office and Fujian Provincial Expressway General Commanding Office.

The implementation of the environmental action plan for Yong-Wu Highway in Fujian Province will be organized by Fujian Provincial Expressway General Commanding Office, which, together with Sanming Yong-Wu Highway Company and Longyan Yong-Wu Highway Company will be responsible for implementing the environmental protection measures for this project during the design, construction, and operation periods.

The preparation of this action plan is based on:

1. People's Republic of China Law on Environmental Protection;
3. People's Republic of China Law on Water and Soil Conservation;
4. People's Republic of China Law on Land Management;
5. People's Republic of China Law on Prevention and Control of Ambient Noise Pollution;
7. People's Republic of China Law on Air Pollution Prevention;
8. People's Republic of China Law on Solid Waste Pollution Prevention;
10. People's Republic of China Law on Road;
11. Environmental Protection Management Regulations of Construction Project [State Council ordinance No. 253, 1998.11.18];
12. Environmental Protection Management Regulations of Road Construction Project [Ministry of Communications ordinance No. 5, 2003];
16. World Bank Policies on Security Assurance;
2. Major adverse impacts on the environment

(1) Ecological environment (including soil erosion)

The main line of the proposed highway will occupy a land area of about 26,820 mu (Chinese acre) with an average of 136 mu each kilometer. The types of occupied lands include paddy fields, non-irrigated fields, vegetable plots, forestlands, and wastelands. Construction of this highway will produce certain loss to the farming lands and agricultural economy, but will not produce remarkable change to the land utilization pattern.

Subgrade excavation and earth/stone filling will produce a certain destruction to the vegetation. Small animals living and perching there will also be threatened. But through planting measures, part of vegetation areas can be restored or compensated, and the original animals may return to their original habitats. The proposed highway is situated at hilly and mountainous area, involving relatively large volumes of earth waste; a total of 5 earth borrow pits and 101 waste sites will be needed with large volume of waste works. The earth borrow pits and waste sites will destroy the vegetation, farmlands and landscape, if their locations are improperly selected, serious soil erosion will be created.

The proposed highway is basically aligning in the corridor belt of the original national road G205 and intersects with it for several times. Along the route, human activities are relatively frequent, the socialization degree is relatively high. Through investigation, no wild plant species or their centered distribution with significant value are found.

According to the prediction, if no single protective measure is taken, the water and soil erosion volume occurred during the construction period amounts to 295,884 tons/year. Because the protection works will be designed, constructed, completed, and accepted along with the main works of the project at the same time, the actually occurred water and soil erosion volume will be far smaller than the predicted volume. In addition, the implementation of highway planting will also restore the vegetation of partial slope faces and reduce water and soil erosion.

(2) Water environment

If discharged casually, the sanitary sewage produced from construction campsites will have adverse impact on the environment.

The life sewage volume produced from the two sides of Xiaotao service area (K25 + 700), Liancheng service area (K77 + 100), Caixi service area (K125 + 600), and Wuping service area (K171 + 000) is about 60t/d in total. The sewage of service areas produced during operation period can be used in tree planting in service areas after treated to satisfy discharge standard, also can be discharged into nearby ditches, thus causing minor impact on the environment.

(3) Acoustic environment

General construction noise such as the noise from transportation vehicles and roadbuilding machines will exert relatively big impact on people nearby the construction site (within 60
meters), especially the construct noise at night will affect their rest and sleep.

According to the prediction, traffic noise during highway operation period will exert relatively big impact on Guihuyang K10 + 800, Mahong K20 + 610, Wenheng township K74+500, Beicun K111 + 270, Caoying K111 + 750, Bengkantou K111 + 900, Laocheng K112 + 400, Tangwei K166 + 800, Laowuxia K173 + 150, Hewu K173+500, Huwei K176 + 000, Shifang village K177 + 100, Meikeng K179+750, Peishang K193 + 200, Mayangdong (Mayangdong elementary school) K120 + 100.

(4) Ambient air

The main environmental problems during the highway construction period are TSP and bituminous smoke pollution.

According to the prediction and analysis, under many years’ average wind speed, the NO2 concentrations in each road section within 30m from the road centerline are not excessive during each operation period for the recommended alignment, except the NO2 concentrations in Shanghang-Wuping section is slightly excessive within 30m from road centerline; the CO concentrations in each road section within 30m from the road centerline are not excessive. But under unfavorable meteorological conditions, excess may occur in partial section. Among the 85 sensitive locations along the proposed highway, the NO2 concentrations during the short and mid-term operation periods do not exceed class 2 limit values of 《Ambient Air Quality Standard》 (GB3095-1996); during long-term operation period, 3 sensitive locations (Tangwei, Xizhaishang, and Shifang) have a predicted value of 0.124mg/m³, exceeding the allowed value by 3.3%. Under unfavorable meteorological conditions, the number of sensitive locations exceeding the allowed value will be more or the excess may be larger. Therefore, the highway’s impact on the roadside ambient air is small.

In case of traffic jam in the tunnel, the vehicle speed and the wind speed greatly drop down, the pollutant concentration will increase by many times, causing the NO2 concentration in the tunnel surpassing the limit value for industrial enterprise health standard, and because the pollutant remains in the bore, it will damage human body. Moreover, the soot and other particles emitted from diesel engines will greatly reduce the visibility in the tunnel, affecting traffic safety and human body health. Therefore when the tunnel length surpasses 500m, it is extremely necessary to install mechanical ventilation devices. When the tunnel length surpasses 2000m, the ventilation speed must be increased.

(5) Social environment

The proposed highway will occupy some lands and cultivated lands; through land transit and transformation of land utilization value, the agricultural economic loss produced by land occupation can be reduced.

Immigration and resettlement organizations at municipal, county, and township level have been established to deal with the immigration and resettlement problem of this project. Because skywalk bridges, channels, and culverts for trip are reasonably set up, thus the impact on inhabitants’ life convenience is not significant along the route.

(6) Cultural relic and historical site

According to the report submitted by cultural relic department, the proposed highway will not cause destruction to existing ground cultural relics.

(7) Hazardous substance transportation risk

The probability of hazardous substance transportation accident is tiny, but once occurred, its
consequence is very serious. The emergency plan has been formulated, training and management will be strengthened to improve emergency handling capability so as to reduce the pollution risk to a minimum.

3. Mitigation measures for environmental impacts

3.1 Design period

3.1.1 Reasonable route selection

In the route selection, the design unit, the environmental assessment unit, and the construction unit have consulted and discussed many times so as to give full consideration to each environmental factors such as protection of farmlands, schools, residential quarters, and cultural relic sites, as well as flood prevention and discharge, removal quantity, city/town development plan, construction material supply and stockpile location selection on the condition of reasonable alignment and reduced construction cost; they have widely consulted with concerned experts, local governments, and people from all walks of life along the route, as a result, the present route alignment was formed.

3.1.2 Ecological restoration

The planting works and the main work of the highway project will be designed and completed simultaneously. In designing, local tree, shrub, and grass species are preferred so as to restore and compensate for the vegetation.

3.1.3 Water and soil conservation

Subgrade drainage and protection works have been designed, such as cutoff trench, side ditch, facing wall, slope protection, retaining wall, grit protection, and so on, which can stabilize the subgrade and can prevent and control soil erosion.

3.1.4 Water pollution

Drainage works have been designed so that the pavement runoff will not directly discharge into sensitive water bodies. Canals and ponds infringed or separated by the subgrade have been reconstructed or redesigned. The service areas have designed sewage treatment so to make the sewage satisfying national discharge standard.

3.1.5 Noise impact

According to the environmental assessment results, noise reduction measures are adopted in different sensitive locations during construction period such as sound barrier, removal, and soundproofing window, which have already been included into the design documents.

3.1.6 Flying dust pollution

Stone quarries and mixing stations should be located 300 meters away from residential areas. Material transportation roads should be reasonably designed to evade the residential areas as far as possible and to avoid flying dust's impact on the inhabitants.
3.1.7 Cultural relics preservation

The Sanming Yong-Wu Highwai Company and Longyan Yong-Wu Highwai Company entrusted relevant cultural relics departments (Sanming Municipal Cultural Relic Management commission, Longyan Municipal Culture and Publishing Bureau, and Longyan Archaeological Team for Yong-Wu Highway) for carrying out cultural relics investigation within the project region. The investigation conclusion is as follows:

Sanming section: there are no cultural relics units proclaimed by the governments at country, province, county (city or district) level, there are no ground relic sites with historical and artistic value, and there is no existence of complete cultural relic system.

Longyan section: there are no protected cultural relics units listed by the governments at country, province, or city level, and there are no existence of underground archaic cultural relic sites.

3.1.8 Transportation risk of hazardous substances

(1) a closed and perfect drainage system has been designed, which can lead the bridge floor runoff into subgrade drainage ditches so as to prevent hazardous substances on bridge floor from leaking into the rivers.

(2) In the entrances and exits of great bridges and tunnels, warning signs such as “Cautious Drive” (yellow) and “Speed limit 60km for hazardous cargo vehicles (red)” will be set up respectively so as to remind the drivers to be careful of safety and speed control.

(3) At 100m in front of each toll station, “Attention Sign” (blue board) will be set up to remind the drivers of hazardous cargo vehicles to drive aside, to declare, and to wait for inspection voluntarily.

(4) Tunnel safety design

① To set up management facilities for tunnel operation and to install relevant equipment

The tunnel operation management facilities is composed of 8 systems including ventilating system, power supply and illumination system, fire-fighting system, traffic control system, urgent telephone system, closed-circuit TV system, fire warning system, and central control system. Among them, the ventilating system is composed of booster air blower, air blower driving cabin, carbon monoxide monitor, and visibility monitor; the fire-fighting system is composed of fire hydrant case and chemical fire extinguisher; the fire warning system sets up alarm button.

The tunnel fire prevention will be equipped with fire extinguishers, hydrants, and aqueous film forming foam extinguishers according to the tunnel length, and in suitable position of the portal, high-level water tank will be set up to satisfy the water volume and water pressure needed by fire facilities. In addition to the firefighting facilities, necessary fire monitoring equipment, transverse gallery, and rolling screen doors will be set up for long tunnels and extra-long tunnels.

② Special-purpose signs will be set up to remind the drivers to pay attention to safe driving.

3.1.9 Immigration and resettlement

The design for this project has always emphasized a principle of averting villages and small towns with least farmland occupation and removal. Immigrant resettlement offices have been established in each level, the "Resettlement Action Plan" (RAP) was formulated, and independent supervising organization will be established after recommended by the project
owner and approved by the World Bank. For concrete contents, see the "Resettlement Action Plan" (RAP).

3.1.10 Public consultation and information disclosure

In route selection, interchange setting-up, environmental protection, and removal and resettlement, consultations have been made with along-the-route governments, related departments, NGOs, villagers' committees, collective units and even individuals for soliciting their suggestions and for gaining public support to this project implementation. Fujian Provincial Expressway General Commanding Office will publish the environmental and resettlement notices for this project in relevant newspapers, and will put relevant environmental documents in the information offices, libraries of Yong'an City, Liancheng County, Shanghang County, and Wuping County, and has disclosed the storing places for environmental documents in newspapers, so the public can consult these relevant information without going through governmental departments.

The above measures have been manifested in the design documents, the resettlement action plan, and the project implementation plan.

3.2 Construction period

3.2.1 Protection of ecological resource

1. During construction period, it is required to strengthen the environmental protection education and publicity to construction workers, to prohibit construction workers from expanding the destructed forestland area and from hunting wild animals casually, and to reduce the adverse impacts on ecosystem as much as possible.

2. During the construction process of filling and cutting subgrade, it is required that the construction workers should construct in a good manner, should strictly follow the construction standards and specifications, wrong earth borrowing and casual piling of roadbuilding materials are forbidden.

3. Because the borrow pits are relatively deep, therefore it is required to set up warning symbols around the pits so to prevent the construction workers, villagers and domestic animals from falling into and causing accidental injury and casualty.

4. In 34#, 56#, 84# and 93# four waste sites, because large area of paddy fields will be occupied, so during the design period it is suggested to optimize the location selection as far as possible, but considering the actual situations of building road in mountainous area, the merge and optimization of site location is often difficult to realize, therefore the construction unit should first keep the topsoil (above 30cm) before waste disposal and should recover them for reclamation after waste disposal. Regarding waste disposal sites that will occupy relatively few paddy fields, topsoil should also be kept, and after waste disposal the topsoil should be recovered for reclamation measure as much as possible, casual waste disposal is forbidden.

5. For solid wastes, it is required to formulate special management measures. Waste residues, waste materials, and solid garbage and life sewage produced during the construction process are all the sources of environment pollution; regarding this, the proposed environmental protection requirement is: The life garbage should be classified for piling and for unified
processing; life excrement should be promptly processed for return to the fields; for sanitary sewage, sewage precipitating tank should be set up; waste residues and waste materials produced during the construction process should be collectively piled in suitably-designated place, or should be used as roadbuilding materials for village paths.

6. It is required to reasonably arrange the construction time limit for the project, and to avoid construction of large-size subgrade filling and cutting in rainy season so as to reduce soil erosion phenomenon.

7. In forestland road sections, construction workers must strengthen fire-use management, it is required to formulate fire-use approval system so as to prevent fire accident.

8. After a road section is constructed, its construction sites should be promptly leveled, reclaimed, or planted.

3.2.2 Water and soil conservation

1. Engineering protection measures
   ① Engineering measures for slope face
   Before construction, it is required to arrange construction of canals crossing the highway in advance, and to pave or plant perennial herbaceous plants with strong drought resistance ability in the slope faces of the road sections which have been built, it is suggested that in rainy season sandbags or straw mats can be used to suppress the slope face for temporary protection so as to reduce soil erosion in highway slope face during construction period. Moreover, in the road sections with relatively rich crevice water, blind ditches or sand settling tanks can be set up below the drainage side ditch in cutting section according to actual situations. In road sections passing through farmlands, it is required to prevent silt from entering into farmlands; In road section passing through canals, it is necessary to set up canal-passing buildings or to re-align the river course. Moreover, in subgrade cutting section, intercepting ditches should be built 5m from the slope top of cut so as to discharge the surface runoff in the slope top. In the joining places between the exits of intercepting ditches, side ditches, and longitudinal drainage ditches with natural canals, rivers, and ponds, chutes and water drop can be used to absorb the force. In construction sites nearby rivers, sand settling tanks should be set up so as to prevent the silt from entering into the water body directly.

   ② Measures for bridge and interchange
   In bridge construction, in order to maintain the bridge foundation stability and resistance to flood sluicing, conical slope should be set up by using stone pitching, flow diversion facilities should be set up to protect river bank from being sluicing. Water used in bridge and interchange construction should be discharged only after being settled down in sand settling tanks; foundation waste works of the project should not be disposed of casually in rivers and river shores. When the water flow speed in culvert exit is large, the entrance and exit must be reinforced to prevent sluicing, the culvert excavation and construction should avoid rainy season as much as possible.

   ③ Water conservation measures for earth borrow pits
   After earth borrowing, the surface ground should be smooth, random excavation and borrowing are forbidden, and the topsoil should be retained for backfilling cultivation earth for re-cultivation or re-afforestation, or to be used as ponds; after the topsoil covering is finished, the newly rented earth stock ground must be restored by vegetation so as to prevent increase of new soil erosion due to human reason. It is required to consider the land use situation around earth borrow pits to reasonably conduct the later land renovation in earth borrow pits by adopting planting measures such as
restoration of cultivated fields or afforestation so as to coordinate and integrate the earth borrow pits into surrounding environment.

4. Water conservation measures for waste disposal sites

The proposed highway intends to set up 101 waste disposal sites, which must have preliminary protection and temporary protection measures before using the waste disposal sites and during the waste disposal process. Before waste disposal, the surface topsoil of the waste disposal sites should be retained for use as surface cultivation earth. During waste disposal process, the waste should be tamped promptly in layers and management should be strengthened, chaotic and random dumping is forbidden; Moreover, under favorable conditions, temporary covering measures (for example color clothing or mesh) can be adopted for waste earth and waste debris so as to reduce rainfall’s erosion on waste earth and waste debris. For waste disposal sites with waste disposal completed, they should be protected by adopting slope reduction, grading, stone pitching protection of toe as well as planting measures such as rectifying the waste site slope and planting grass in the slope (for slope with small slopeness, grass seeds can be directly sowed, if necessary, spraying glass-seeds with net may be used), as well as to plant suitable arbor and bush plants in the top and stage of waste sites or to plant trees and hand over to local government for reclamation. The tree species should choose indigenous plants which have strong adaptability, developed root system, quick growth, easy cultivation, and easy survival.

2. Biological measures for water conservation

1. Grassing measure in slope face

The biological protection measures for side slope are mainly to guarantee side slope stability and to reduce soil erosion, followed by enriching the landscape within highway area. The grassing measure in slope face in order to prevent erosion is a part of the side slope planting works; slope face grassing is to artificially and obligatorily cultivate plant community in one time so as to promote the slope face to be rapidly covered with plant; the slope face grass must have the following characteristics:

A. Early germination, quick growth, and large degree of coverage;
B. Developed root system and strong soil consolidation, able to prevent surface soil erosion and flow;
C. Perennial plants, able to coordinate with surrounding environment.

Side slope of cutting subgrade: Because the side slope is relatively steep, and because of climate and soil conditions, the requirements on plants are extremely high, therefore, the design difficulty not only lies in the plant selection and distribution proportion, but also lies in the selection of construction program. In planting design, for the exposed slope face above the facing wall, it is recommended to use grass or shrub planting in three dimensional geotextile net for afforestation. For the slope of embankment, different afforestation programs can be used according to different earth-filling depth by using grass or shrub planting in two dimensional geotextile net, grass planting in arch skeleton slope protection, or by shrub afforestation.

2. Emergency measures for water conservation in rainy season

In the construction period, when permanent measures are not available and when there is a rainstorm, then the created water and soil erosion volume will be quite big, therefore the construction unit should keep contact with meteorological department to be informed in advance of the rainfall time and characteristic in order to tamp the filled loose earth before rainy season and to well carry out protective measures, for example to use certain quantity of straw mats or straw
curtains to cover, which can also obtain a relatively good water conservation effect.

3.2.3 Water pollution

3.2.3.1 Preventing and controlling measures for water environmental pollution during subgrade construction

1. Building materials containing toxic substances, such as asphalt, cement, and chemicals, and so on, should not be piled up in the water source protection zone of Yong’an Dongpo Water Plant, and should not be piled up near Wenchuan River, Jiuxian River, Tingjiang River, and near irrigation canals, fish ponds, water wells, and other water bodies. The piling sites should be covered, and geotextile railing should be set up in rainstorm so as to prevent building materials from entering into the water bodies by rain wash.

2. Roadbuilder’s construction campsites should not be set up in the road side that has a river in its side, wastes from these road sections are forbidden to throw into the river course. Each bid section’s construction campsite should be installed with septic tank which should be cleaned periodically and taken away (used as fertilizer). Life garbage should be loaded into dustbin can or garbage pit, which can be buried or made into rural fertilizer for local use. Sewage and garbage are strictly forbidden to be washed into water body by rainstorm, thus polluting people’s living conditions. After the construction is finished, the septic tank and the garbage pit should be cleared and buried with earth. Life sewage produced from roadbuilder’s construction campsites must be treated in sedimentation tank, after attaining the prescribed standard, the sewage is allowed to discharge into the irrigation water body of local farmlands.

3. The water drained from aggregate mixing plant and asphalt mixing plant, the production waste water and caring water from concrete pre-fabrication plant contain toxic substances, thus they should not be discharged into surface water body directly. generally it is required to set up temporary sedimentation tank in the construction site, which should be promptly cleared and buried with earth after the construction is finished.

3.2.3.2 Preventing and controlling measures for water environmental pollution during bridge construction

1. Silt and waste earth excavated from construction, or waste earth produced from boring pilers should be hauled out of river course strictly according to the specifications of Ministry of Communications, and necessary debris arresting measures should be taken. If piled nearby rivers, the piling location should be selected in a place that will not impact flood-discharge function and will not impact the flood-discharge above the maximum water level, and such location selection is subject to local water conservancy department’s approval, and cofferdam should be set up for piling. They are strictly prohibited to be disposed of in river course or in river beaches. When this place is relatively close to bridge pier, floating pipeline can be used to fill in; when this place is relatively far from bridge pier, then motor barge can be used to transport them to designated location, sludge pump can be used to inject into the cofferdam. The construction unit should have construction qualification, after the project conclusion is finished, the site should be leveled, or reclaimed for farming, or planted for afforestation, exposed earth should not be seen so as to reduce soil erosion’s pollution impact on the aquatic environmental quality.

2. Sewage, garbage and other wastes (various kinds of foods, trash, waste, plastic tableware,
cup, and bag coming from kitchen, and all daily life necessities such as paper, cloth products, glass, ceramics, constructional wood, iron, paper, ash material, repair trash, and so on) produced from construction cannot enter into water bodies, they should be recycled, classified, stored, and processed. Of which the re-useable materials should be reused or submitted for purchase; the un-useable materials should be burned in kiln or stored (decontamination treatment) in a place above maximum water level, and buried in a place agreed by local environmental protection department.

3. Oil leakage from construction machinery is strictly prohibited to entering into water bodies and chemicals is strictly prohibited to entering into water bodies. Vessels for collecting oil should be set up to recycle, process, reuse or burn down leaked oil. Waste chemicals and other toxic substances should be classified for collection and treatment. Oil-cleaning rag for maintaining machines and tools should be collected separately and burned down for treatment.

4. Before construction, bridge contractors, construction workers, and project management personnel should be educated with fishery protection, and at the same time, advertising boards should be set up in an easy-to-see location in the construction site for presenting relevant knowledge on fish protection measures.

3.2.3.3 Sanitary sewage and life garbage treatment in construction campsites

Each bid section’s construction campsite should be installed with septic tank which should be cleaned periodically and taken away (used as fertilizer) so as to ensure environmental sanitation. Life garbage should be loaded into dustbin or garbage pit, which can be buried or made into rural fertilizers for local use. Sewage and garbage are strictly forbidden to be washed into water body by rainstorm, thus polluting people’s living conditions. After the construction is finished, the septic tank and the garbage pit should be cleared and buried with earth.

The contract signed between the construction unit and the roadbuilder should specify the water environment protection goals and requirements, should specify the environmental protection investment for water environment, should explicitly specify the conditions and tasks for protecting water environment, and other relevant provisions and requirements, and should specify the responsibilities as clearly as possible.

3.2.3.4 Protection measures for the water source protection zone of Yong’an Dongpo Water Plant and Shenpi Reservoir

In constructing Maping Bridge and Shangduan Bridge, it is required to pay attention to reduce the operation surfaces as much as possible, pile foundation construction should strictly follow the cofferdam drive pipe procedure, the entire construction process should be supervised by environmental supervising personnel to strictly prohibit the greasy dirt, waste dregs, and garbage entering into the water body. The silt/sludge produced from the construction should be hauled by sludge barge to reasonable area for treatment so as to protect the drinking water source and water quality in the reservoir. Construction of Maping Bridge should avoid peak water-intaking period, if the construction is in peak water-intaking period, special attention should be paid to not bring any construction material, waste, and waste water into the protection zone, and the construction material piling place and campsites should be located out of the safety distance, water quality monitoring should be conducted unperiodically.

For possible sudden/unexpected oil leakage accident during construction period, the following measures should be adopted: to observe safety working rules so as to prevent fire accident; to
finalize the training responsibility for relevant contingency plan so as to respond (report, control, eliminate, and request for rescue measure) most quickly to accidental or operational oil leakage; to install some equipment or devices for encircling, absorbing, removing, and eliminating oil, and to appoint personnel for storage and use in case of need; to sign rental contract with relevant cleaning service company or other similar department so as to respond quickly to significant oil leakage and overflow. For the oil residue and waste oil during construction period, they should be collected separately in different oil vessels; the oil with good quality and few impurities can be deposited together and can be sold; the oil residue and waste oil with many impurities but still with burning value can be used as combustion support agent for garbage burning or other uses.

Environmental protection requirements set for construction campsites: construction campsites should not be built in the water source protection zone of Yong’an Dongpo Water Plant and in Shenpi Reservoir.

The living water for construction workers and the water used for the project should not be taken from the water source protection zone, it is strictly forbidden that the construction campsite’s sanitary sewage enter into the water source protection zone and Shenpi Reservoir, sewage sedimentation tank should be established for treatment so as to guarantee the sanitary sewage will not have any adverse impact on the water quality of the protected rivers and the reservoir.

3.2.4 Noise pollution

In order to reduce construction noise’s pollution to the environment and to protect the normal life and rest of people along the route, it is suggested to take the following measures to reduce the construction noise impact on the environment:

(1) It is required to strengthen construction management and to reasonably arrange construction time so as to avoid high-noise construction at night. During construction in daytime, for sensitive locations with large noise impact, it is required to utilize portable sound barriers as noise-reduction measure.

(2) Construction unit shall select preferably low-noise construction machinery, for example substituting hydraulic tool for atmospheric pressure tool, substituting low-noise boring cast-in-place piling for striking or vibration type piling. Attention should be given to their maintenance and correct operation so as to maintain the noise of roadbuilding machinery at the lowest level. Construction machinery shall be located in a place with minimum impact on the inhabitants, and the material stock grounds, mixing stations, and asphalt mixing stations should be located 300m away from acoustically sensitive locations.

(3) Construction workers’ noise protection should be well done. According to 《Noise Health Standard for Industrial Enterprises》, the contractor should reasonably arrange the workers to operate high-noise construction machinery in turn so as to reduce their exposure to high noise, or should arrange high-noise work and low-noise work alternately. Construction workers near high-noise source should wear ear plugs or helmets, and their working time should be suitably reduced.

(4) For construction sites within 100m from centered residential areas, the high-noise construction equipment should not be allowed to work from 22:00 at night to 6:00 next day so as to protect people’s normal rest at night. If continuous construction is needed, application should
be made to local environmental protection department for continuous construction at night, and
the people should be informed.

(5) It is requested that the contractor should set up telephone in construction site for
public complaint; for such complaint, the owner should promptly contact with local
environmental protection department in order to immediately handle each kind of environmental
dispute. At the same time the construction detour road should be far away from centered
residential areas and schools so as to avoid passing through centered residential areas as much as
possible.

(6) It can be known from the predicted results in acoustically sensitive locations that
within the assessment scope along the highway, there are 27 sensitive locations exceeding the
allowed noise level figures at night during short-term operation period, of which, the excess in
Tangwei and Shifang villages is 9.6dB. For the acoustic sensitive locations with relatively large
noise excess, noise-reduction measures should be taken during construction period. The
recommended noise-reduction measures are described in Table 3.2-1.
Table 3.2-1 Environmental protection measures and technoeconomic assessment for sensitive locations along the Yong-Wu Highway

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of sensitive location</th>
<th>Height difference (m)</th>
<th>Distance to road center (m)</th>
<th>Noise excess at night during short-term operation stage (dB)</th>
<th>Technical and economic assessment, investment estimate for the recommended scheme (10,000 yuan)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Noise reduction measure and cost</td>
<td>Relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrubs, the noise reduction is only 1.0<del>1.5 dB, unable to meet requirement Recommend to adopt sound barrier with 1000</del>3000 yuan per each linear meter, implemented during construction stage.</td>
</tr>
<tr>
<td>1</td>
<td>Guiyang</td>
<td>2.9</td>
<td>30</td>
<td>5.0</td>
<td>(1) Planting cannot meet noise-reduction requirement with noise reduction of only 1.0<del>1.5 dB; (2) To enlarge removal scope, investment estimate is 500,000 yuan; (3) Sound barrier, investment estimate is 1000</del>3000 yuan per linear meter; (4) To enlarge removal scope, investment subgrade is about 15m from the first row of houses, even to densely plant arbor and shrubs, the noise reduction is only 1.0<del>1.5 dB, unable to meet requirement Recommend to adopt sound barrier with 1000</del>3000 yuan per each linear meter, implemented during construction stage.</td>
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<td>This section is a viaduct, relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrubs, the noise reduction is only 1.0<del>1.5 dB, unable to meet requirement Recommend to adopt sound barrier with 1000</del>3000 yuan per each linear meter, implemented during construction stage.</td>
</tr>
<tr>
<td>2</td>
<td>Mahong</td>
<td>3.4</td>
<td>3.8</td>
<td></td>
<td>(1) To enlarge removal scope, investment subgrade is about 15m from the first row of houses, even to densely plant arbor and shrubs, the noise reduction is only 1.0<del>1.5 dB, unable to meet requirement Recommend to adopt sound barrier with 1000</del>3000 yuan per each linear meter, implemented during construction stage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>This section is a viaduct, relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrubs, the noise reduction is only 1.0<del>1.5 dB, unable to meet requirement Recommend to adopt sound barrier with 1000</del>3000 yuan per each linear meter, implemented during construction stage.</td>
</tr>
<tr>
<td>3</td>
<td>Wenchang</td>
<td>2.6</td>
<td>4.3</td>
<td></td>
<td>(1) To enlarge removal scope, investment estimate is 500,000 yuan; (2) Sound barrier, investment estimate is 1000<del>3000 yuan per linear meter; (3) Planting cannot meet noise-reduction requirement with noise reduction of only 1.0</del>1.5 dB.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>This section is a viaduct, relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrubs, the noise reduction is only 1.0<del>1.5 dB, unable to meet requirement Recommend to adopt sound barrier with 1000</del>3000 yuan per each linear meter, implemented during construction stage.</td>
</tr>
</tbody>
</table>
Environmental protection measures and technoeconomic assessment for sensitive locations along the Yong-Wu Highway

<table>
<thead>
<tr>
<th>No</th>
<th>Name of sensitive location</th>
<th>Height difference (m)</th>
<th>Distance to road center (m)</th>
<th>Noise excess at night during short-term operation stage (dB)</th>
<th>Noise reduction measure and cost estimate for the recommended scheme (10,000 yuan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Beicun</td>
<td>2.4</td>
<td>270</td>
<td></td>
<td>To enlarge removal scope.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Thru village</td>
<td></td>
<td>① Planting cannot meet noise-reduction requirement with noise reduction of only 1.0～1.5 dB;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.7</td>
<td></td>
<td>② Sound barrier, investment estimate is 1000～3000 yuan per linear meter;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>③ To enlarge removal scope.</td>
</tr>
<tr>
<td>5</td>
<td>Caoyi</td>
<td>3.1</td>
<td>+750</td>
<td></td>
<td>To enlarge removal scope, investment estimate is 500,000 yuan;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Thru village</td>
<td></td>
<td>② Sound barrier, investment estimate is 1000～3000 yuan per linear meter;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.6</td>
<td></td>
<td>③ Planting cannot meet noise-reduction requirement with noise reduction of only 1.0～1.5 dB;</td>
</tr>
<tr>
<td>6</td>
<td>Bengk antou</td>
<td>4.0</td>
<td>+900</td>
<td></td>
<td>To enlarge removal scope, investment estimate is 80,000 yuan per each household;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Thru village</td>
<td></td>
<td>② Sound barrier, investment estimate is 1000～3000 yuan per linear meter;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4.0</td>
<td></td>
<td>③ Planting cannot meet noise-reduction requirement with noise reduction of only 1.0～1.5 dB;</td>
</tr>
</tbody>
</table>

The subgrade is about 15m from the first row of houses, even to densely plant arbor and shrub, the noise reduction is only 1.0～1.5 dB, unable to meet requirement. Located in Beicun private interchange area with very high removal cost, thus economically unreasonable. Recommend to adopt sound barrier with 1000～3000 yuan per each linear meter, implemented during construction stage. Interchange ramp passes here, relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrub, the noise reduction is only 1.0～1.5 dB, unable to meet requirement. Recommend to adopt sound barrier with 1000～3000 yuan per each linear meter, implemented during construction stage. Relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrub, the noise reduction is only 1.0～1.5 dB, unable to meet requirement. Recommend to adopt sound barrier with 1000～3000 yuan per each linear meter, implemented during construction stage.
Continued Table 3.2-1  Environmental protection measures and technoeconomic assessment for sensitive locations along the Yong-Wu Highway

<table>
<thead>
<tr>
<th>No</th>
<th>Name of sensitive location</th>
<th>Distanc e to road center (m)</th>
<th>Noise excess of Height difference (m)</th>
<th>Noise exceed at night during short-term operation stage (dB)</th>
<th>Noise reduction measure and cost</th>
<th>Technical and economic assessment, investment estimate for the recommended scheme (10,000 yuan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Laocheng</td>
<td>3.0</td>
<td>30</td>
<td>5.7</td>
<td></td>
<td>Relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrub, the noise reduction is only 1.0～1.5 dB, unable to meet requirement. Recommend to heighten the fence for the first row of houses, investment estimate is 5,000 yuan per each household, implemented during short-term operation stage. Mostly storeyed houses, relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrub, the noise reduction is only 1.0～1.5 dB, unable to meet requirement. Recommend to adopt sound barrier with 1000～3000 yuan per each linear meter, implemented during construction stage.</td>
</tr>
<tr>
<td>8</td>
<td>Tangwushu</td>
<td>0</td>
<td>9.6</td>
<td></td>
<td></td>
<td>Relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrub, the noise reduction is only 1.0～1.5 dB, unable to meet requirement. Recommend to heighten the fence for the first row of houses, investment estimate is 5,000 yuan per each household, implemented during short-term operation stage. Mostly storeyed houses, relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrub, the noise reduction is only 1.0～1.5 dB, unable to meet requirement. Recommend to heighten the fence for the first row of houses, investment estimate is 5,000 yuan per each household, implemented during short-term operation stage.</td>
</tr>
<tr>
<td>9</td>
<td>Laowuxia</td>
<td>4.0</td>
<td>30</td>
<td>3.7</td>
<td></td>
<td>Relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrub, the noise reduction is only 1.0～1.5 dB, unable to meet requirement. Recommend to heighten the fence for the first row of houses, investment estimate is 5,000 yuan per each household, implemented during short-term operation stage. Mostly storeyed houses, relatively high removal cost, subgrade is about 15m from the first row of houses, even to densely plant arbor and shrub, the noise reduction is only 1.0～1.5 dB, unable to meet requirement. Recommend to heighten the fence for the first row of houses, investment estimate is 5,000 yuan per each household, implemented during short-term operation stage.</td>
</tr>
</tbody>
</table>

① To enlarge removal scope; investment estimate is 100,000 yuan per each household; ② Sound barrier, investment estimate is 1000～3000 yuan per linear meter; ③ Planting cannot meet noise-reduction requirement with noise reduction of only 1.0～1.5 dB.

① To enlarge removal scope; investment estimate is 5,000 yuan per each household; ② Sound barrier, investment estimate is 80,000 yuan per each household; ③ Planting cannot meet noise-reduction requirement with noise reduction of only 1.0～1.5 dB.

① To enlarge removal scope; investment estimate is 5,000 yuan per each household; ② Sound barrier, investment estimate is 1000～3000 yuan per linear meter; ③ Planting cannot meet noise-reduction requirement with noise reduction of only 1.0～1.5 dB.
## Environmental Action Plan of Yong-Wu Highway

### Continued Table 3.2-1 Environmental protection measures and technoeconomic assessment for sensitive locations along the Yong-Wu Highway

<table>
<thead>
<tr>
<th>No</th>
<th>Name of sensitive location</th>
<th>Distance to road center (m)</th>
<th>Noise excess at night during short-term operation stage (dB)</th>
<th>Noise reduction measure and technical and economic assessment, investment estimate for the recommended scheme (10,000 yuan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Hewu</td>
<td>3.1</td>
<td>5.6</td>
<td>① To enlarge removal scope, investment estimate is 80,000 yuan per each household;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td></td>
<td>② Sound barrier, investment estimate is 1000~3000 yuan per linear meter;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30</td>
<td></td>
<td>③ Planting cannot meet noise-reduction requirement with noise reduction of only 1.0~1.5 dB.</td>
</tr>
<tr>
<td>11</td>
<td>Huwei</td>
<td>2.5</td>
<td>6.4</td>
<td>① To enlarge removal scope, investment estimate is 80,000 yuan per each household;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+000</td>
<td></td>
<td>② Sound barrier, investment estimate is 1000~3000 yuan per linear meter;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50</td>
<td></td>
<td>③ Planting cannot meet noise-reduction requirement with noise reduction of only 1.0~1.5 dB.</td>
</tr>
<tr>
<td>12</td>
<td>Shifang village 0.5 gh</td>
<td>9.6</td>
<td></td>
<td>① To enlarge removal scope, investment estimate is 100,000 yuan per each household;</td>
</tr>
<tr>
<td></td>
<td>K177</td>
<td></td>
<td></td>
<td>② Sound barrier, investment estimate is 1000~3000 yuan per linear meter;</td>
</tr>
<tr>
<td></td>
<td>+100</td>
<td></td>
<td></td>
<td>③ Planting cannot meet noise-reduction requirement with noise reduction of only 1.0~1.5 dB.</td>
</tr>
<tr>
<td>13</td>
<td>Meike village 5.7 gh</td>
<td>5.7</td>
<td></td>
<td>① To enlarge removal scope, investment estimate is 100,000 yuan per each household;</td>
</tr>
<tr>
<td></td>
<td>K179+750</td>
<td></td>
<td></td>
<td>② Sound barrier, investment estimate is 1000~3000 yuan per linear meter;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>③ Planting cannot meet noise-reduction requirement with noise reduction of only 1.0~1.5 dB.</td>
</tr>
<tr>
<td>No</td>
<td>Name</td>
<td>Height difference (m)</td>
<td>Distance to road center (m)</td>
<td>Noise excess at night during short-term operation stage (dB)</td>
</tr>
<tr>
<td>----</td>
<td>---------------------</td>
<td>-----------------------</td>
<td>-----------------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>14</td>
<td>Peisha</td>
<td>2.4</td>
<td>30</td>
<td>5.9</td>
</tr>
<tr>
<td>15</td>
<td>Mayangdong</td>
<td>-29.7</td>
<td>30</td>
<td>11.1</td>
</tr>
<tr>
<td>16</td>
<td>Wangcuo, Maopu, Jiqingtang, Lijiafang, Xibe, Gushibei, Shizhencun, Laojunkeng, Liantangxia, Laoxiongwu, Xizhaishang, Woli, Longjing village, Xincun, Yanqian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Shenxiang, Liping, Xiayangdi, Shangqiao village, Huangshitan, Chenkang village, Xiawang village, Rongshui village, Dapingli, Gushibei, Liangfeng, and Xiongxin village</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Total cost for the recommended scheme</td>
<td></td>
<td></td>
<td>Total cost for the recommended scheme</td>
</tr>
</tbody>
</table>
3.2.5 Ambient air pollution

The contract signed between the owner and the contractor should include the contractor’s responsibility and the duty to protect the environment, and attention should be paid to the following points:

1. Because the roadside mixing technique will produce dust pollution, so plant mixing is recommended. Material stock grounds and lime/soil mixing stations should be located in open places, 200m within which there should not be centered residences and schools; The material stock grounds, construction material hauling roads and detour roads should be sprayed with water periodically so as to reduce the dust.

2. The construction sites and main material hauling roads should be sprayed with water regularly so as to prevent dust flying. The water spraying time should be mainly in dry weather, twice each day, in the morning and in the afternoon.

3. When transporting lime and bulky materials, they should be covered with tarpaulin so as to avoid flying dust’s pollution to the atmosphere; when piling, they should be covered with tarpaulin, and when necessary railing should be set up to prevent rain sluicing and polluting the surrounding environment; during construction it is required to strengthen maintenance and caring, and to well conduct the technique arrangement so as to prevent secondary pollution.

4. Asphalt concrete mixing station should be located in proper place, according to the distance classification stipulation for health protection, the asphalt concrete mixing station should be located in 300m leeward from residential areas (by prevailing wind direction). Moreover, it is absolutely forbidden to use wide-open and semi-closed type asphalt melting technique.

5. In filling subgrade, water should be sprayed according to the requirement of material compaction, the contractor should also spray water regularly after material compaction so as to guarantee the material not flying dust.

6. Contractor must strengthen management over the bulky materials that are easy to lose, which should not be piled nude. The stock grounds should be no less than 200m from schools, villages, and other sensitive locations.

7. According to the highway’s tunnel ventilation system design, it is intended to adopt jet-flow longitudinal induced ventilation for the proposed medium and long tunnels.

3.2.6 Transportation management plan

(1) In the intersections between the highway and other existing roads, construction detour road will be built in one side of the original road to guarantee a smooth operation of the original road; after the interchange is open to traffic, the detour road will be built into the subgrade of the highway.

(2) Management over the transportation on national road 205 should be strengthened by limiting traffic time and avoiding peak time to transport the materials; at the same time the contractor is required to make good transportation plan.

(3) To prepare materials ahead of time. Sand and stone and other materials should be stored in a time with relatively light traffic.

(4) To coordinate with local public security and traffic control departments to promptly move traffic jams and to deal with traffic accidents so as to guarantee an unimpeded transportation.

(5) The contractor is required to take measures to cover easily-lost materials so as to prevent from flying and spilling during transportation.
3.2.7 Cultural relics protection

In construction, if unexplored underground cultural relics are discovered, then the construction should stop immediately, the supervising engineer should protect the site, and cultural relic department should be notified for treatment.

3.2.8 Health of construction workers

(1) Construction campsites should set up septic tanks and dustbins, cleared by the contractor on time so as to prevent disease breakout. In the construction site, drinking water conforming to hygienic standard should be provided.

(2) Contractors must provide ear plugs or helmets to construction workers according to labor protection regulations, and should examine their health periodically.

(3) Construction campsites should be staffed with professional health workers to provide medical service to the construction workers and to conduct hygienic publicity and education to the construction workers regularly.

3.2.9 Public participation

Complaint telephone number for environmental protection should be marked in a conspicuous place in the construction site; for a complaint, the owner and the contractor will promptly contact with local environmental protection department and will solve the environment dispute on time.

3.2.10 Implementation of “Three Simultaneousness”

Sound barriers and sewage treatment facilities in service area should be designed, constructed, and put into operation simultaneously with the main works by the contractors in respective bid sections.

The above measures will be implemented by contractors and will be specified in the tendering documents.

3.3 Operation period

3.3.1 Ecological recovery

1. During the later construction period or early operation period, it is required to complete tree and grass planting in the proposed highway’s side slopes, medium separators, interchanges, service areas, as well as in afforestable places within the right-of-way of the highway according to the highway planting design requirements so as to achieve the goals of vegetation restoration, subgrade protection, road beautification, road landscape improvement, soil erosion reduction, reduction of pavement runoff pollution on roadside water bodies during rainy season, and so on. But the plant species for afforestation must be quarantined so as to avoid from introducing plant diseases from outside region and create serious consequences.

2. It is required to promptly restore the damaged vegetation and ecological environment.

3. Water and soil conservation measures during operation period

It is required to further implement various planting works for the highway according to the highway planting design requirements by scientifically and reasonably realizing a vertical
planting pattern combining grasses and flowers with bushes and arbors, especially the soil side slope should be conducted with planting maintenance and prompt replanting work during later construction period so as to achieve subgrade slope stability protection, soil erosion reduction, and reduction of road pavement runoff's scouring, and other goals. During the operation period, management and maintenance for the biological protection measure for subgrade side slope and the planting measures for earth borrow pits should be strengthened, and suitable replanting measures should be carried out so as to perfect the afforestation measures within highway scope and to reduce soil erosion for a better landscape beautification effect.

3.3.2 Water and soil conservation

It is required to further perfect each engineering measure, planting measure, and land reclaiming measure for water conservancy according to the design requirements by scientifically and reasonably realizing a vertical planting pattern combining grasses, flowers, bushes, and arbors, especially the soil side slope should be planted promptly so as to achieve subgrade slope stability protection and soil erosion reduction.

3.3.3 Water pollution

1. For the sanitary sewage and other waste water in service areas, parking lots, or toll stations, the Xiaotao service area, Liancheng service area, Caixi service area, and Wuping service area should set up sewage treatment facilities in the roadside according to the size of the service area, staff population, moving population and total daily sewage discharge quantity, the anticipated sewage is approximately 60t/day, it is recommended to adopt the sewage treatment equipment proposed in this report. After treatment, the sewage can meet class 1 standard and requirement of the 《Sewage Comprehensive Discharge Standard》 GB8978-1996. The toll station has a small staff, small-sized sanitary sewage treatment equipment can be selected, the sewage after treatment can be used in agricultural irrigation.

2. It is required to guarantee the strength of anti-collision guardrail of bridges in road section of long rivers and streams so as to reduce the possibility of vehicles falling into water body and polluting environment in case of accident.

3. For the water source protection zone of Yong'an Dongpo Water Plant, in addition to the above-mentioned protective measures, attention must be paid to that the Maping Bridge section should set up horizontal and longitudinal drainage pipes for leading the bridge floor runoff through the drainage pipes to roadside drainage ditches or sedimentation tank and other sewage receptive facilities, which should be located above the reservoir's maximum water level so as to guarantee that in the initial rainstorm period the bridge floor runoff will not flow into water source protection zone; it is necessary to design high-strength bridge guardrail or to use double-decked bridge guardrail so as to reduce the possibility of vehicles falling into the water source protection zone in case of accident. The highway operation unit should strengthen the routine maintenance during operation period, when guardrails and drainage pipes are discovered to be damaged, or leakage is found, they should be promptly repaired so as to protect the water quality of the water source protection zone from every aspect and in different period.

During the operation period, it is required to well conduct the management measures and emergency plan and program for accident risk in the water source protection zone (for details see section 5.2.3.3) so as to prevent chemical hazardous substances from entering into the water source.
Environmental Action Plan of Yong-Wu Highway

3.3.4 Noise pollution

(1) Control of driving noise

According to the *Ambient Noise Pollution Preventing and Controlling Regulations in People's Republic of China*, management on transportation and road maintenance should be strengthened, vehicles with noise exceeding the allowed figure are not allowed to run on the highway. The allowable noise standard for motor vehicles is listed in Table 3-3-1.

(2) Acoustic environmental protection in sensitive locations

According to the environmental assessment results, the effect of noise-reduction measures adopted in each sensitive location will be checked to decide whether to take remedial measures or not.

For households with non-excessive noise but with obvious increase in noise, because they are relatively far from the highway (more than 60 m generally), thus the noise reduction effect of existing measures is not good. Through consulting with the possibly influenced households and by obtaining their agreement, noise monitoring during operation period will be strengthened, according to the monitored results it is to determine whether to adopt removal, installing soundproofing windows or to give certain economic compensation.

(3) To implement noise monitoring plan. For the 27 sensitive locations such as Wangcuo, noise follow-up monitoring should be conducted during the mid and long-term operation periods according to the *Ambient Noise Measurement Method*. The $L_{Aeq}$ is used to assess the monitored figures, the monitoring points should be located outside of buildings, 1m from the window (or door) and 1.2m from the ground. Noise reduction measures should be taken according to actually monitored results.

Table 3-3-1  allowable noise standard for automobiles (GB1495-79)

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Noise standard: dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>8t ≤ truck &lt; 15t</td>
<td>89</td>
</tr>
<tr>
<td>Truck</td>
<td></td>
</tr>
<tr>
<td>3.5t ≤ truck &lt; 8t</td>
<td>86</td>
</tr>
<tr>
<td>truck &lt; 3.5t</td>
<td>84</td>
</tr>
<tr>
<td>Light jeep</td>
<td>84</td>
</tr>
<tr>
<td>4t ≤ total weight &lt; 11t</td>
<td>86</td>
</tr>
<tr>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>total weight &lt; 4t</td>
<td>83</td>
</tr>
<tr>
<td>Car</td>
<td>82</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>84</td>
</tr>
<tr>
<td>Wheel tractor (below 60 horsepower)</td>
<td>86</td>
</tr>
</tbody>
</table>
3.3.5 Ambient air pollution

1. The area the proposed highway passes through is mostly forestland in mountainous terrain with high plant coverage rate and a climate suitable to plant growth, therefore, it is suggested to promptly plant local vegetation on bare grounds caused by the construction, which can not only purify and absorb the pollutant of vehicle exhaust, and reduce the total suspended particle in the atmosphere, but also can beautify the environment and improve the highway landscape effect along the route.

2. It is required to strengthen the management over vehicles transporting bulky materials that are easy to lose, which should be covered by tarpaulin in transporting.

3. It is required to strictly enforce automobile exhaust discharge inspection, the automobile exhaust can be inspected by sampling in toll stations so as to limit the highway access to the vehicles with seriously excessive exhaust discharge.

4. Air blowers installed in medium and long tunnels should be inspected periodically so as to maintain its good operating condition.

6. It is suggested that in planning construction along the route, the planning department should not approve building residences, schools, hospitals, and hotels, and other air sensitive locations near the highway.

3.3.6 Solid waste

Laws and regulations will be formulated and publicized to forbid passengers to randomly throw drink bags and cans on the highway so as to guarantee traffic safety and clean roadsides.

3.3.7 Management of hazardous substance transportation

As far as this project is concerned, the following management measures for hazardous substance transportation are enforced:

1. Before hazardous substance vehicles enter into the highway, the drivers should ask for declaration forms from Yong-Wu Highway management organization and should be subject to the sample-inspection by public security or transportation management departments in the entrance, and should submit the declaration form which should be filled with such items as hazardous goods transportation license number, freight type, rank and serial number, names of the consignor and consignee, loading and unloading place, and freight characteristics, and so on. The hazardous substance vehicles should be generally arranged to move in a time with small traffic volume (for example at night) and should be forbidden to run under bad climate so as to strengthen an effective management on hazardous substance vehicles.

2. Considering that some drivers do not understand highway driving environment, it is suggested to prepare booklets such as "Safe Driving Guide for Yong-Wu Highway" and distribute them in the highway entrance. The booklet will be prepared by traffic safety experts, its content will include: handling methods for urgent accidents, mailing address and telephone number of public security, fire, and environmental protection departments along the route.

3. To implement inspection method for hazardous substance vehicles, to set up a hazardous substance transportation declaration point in the extra-wide lane (outmost lane) of the entrance. For vehicles applying for hazardous substance transportation, Three Licenses and One Bill should be inspected which include "cargo license", "driver license", and "guardian license" and the hazardous...
substance transportation road bill, vehicles with incomplete "Three Licenses and One Bill" are not allowed to run on the highway. Besides license inspection, if necessary it is required to have safety inspection on the vehicles for hazardous substance transportation so as to find out hidden danger. Vehicles with hidden danger should not move on the highway before such dangers are removed.

④ The biggest latent threat of hazardous substance transportation on the environment is that the toxic and poisonous substances enter into water body and air, but this kind of substance is generally transported in sealed vessels, therefore, in the entrance it is required to inspect the tankers and vessel vehicles that do not declare and do not have hazardous substance transportation symbols. Vehicles carrying hazardous substance but do not have relevant licenses or do not have hazardous substance transportation symbols are not allowed to enter the highway.

⑤ In case that vehicles transporting toxic and poisonous substance occur accident on the proposed highway, especially on bridges, thus leading to water body or air pollution, then it is required to promptly use the urgent telephone set up on the highway to report to the monitoring and telecom sub-centers in Yong’an City and Longyan City, and to promptly contact with the local public security, fire, and environmental protection departments so as to take urgent rescue measures. In case of grand accident of hazardous chemical substance, the 《Emergency and First-aid Program for Grand Accident of Hazardous Chemical Substance in Fujian Province》 should be initiated.

3.3.8 Tunnel pollution risk prevention

(1) Tunnel management stations are in charge of the daily maintenance, repair and emergency rescue for the 27 tunnels of the project so as to guarantee the normal work and control of ventilating, lighting, fire reporting, fire control, closed-circuit TV, emergency call, signal lamp, etc.

(2) Tunnel management staff shall be trained, which will be incorporated into the training plan so as to improve their ability and management level to handle accident.

(3) Air quality in the tunnel shall be monitored, which will be included in the environmental monitoring plan and the monitoring data will be reported in time.

(4) To strengthen management over hazardous substance transportation

① To enforce declaration system; ② To enforce sample-check system; ③ to forbid hazardous substance transportation vehicles enter tunnel under unfavorable climatic conditions.

The above-mentioned two activities ② and ③ are implemented by tunnel management staff.

3.3.9 Emergency plan for hazardous substance traffic accident

(1) In case of accident, any person who discovers should immediately report to the central control room through roadside emergency call or other communication means.

(2) After receiving the accident report, the central control room should immediately notify nearby highway policemen to go to the accident site to control the site; meanwhile, local fire department shall be notified who shall send fire-fighting vehicles and firemen to rescue.

(3) If the hazardous substance is of solid state, they can be cleaned and handled, and the accident shall be recorded in file.

(4) If the hazardous substance is gaseous and highly toxic, firemen should wear gas masks to deal with; In case that the hazardous substance will leak unavoidably, local environmental protection department and public security department shall be notified immediately, and when necessary, people in the pollution range along the route shall be evacuated to avoid poisoning, injuries and
(5) If the hazardous substance is of liquid state, and has already entered into public water body, local environmental protection department should be notified immediately. The environmental protection department should immediately notify downstream units (especially water plant) to stop taking water, and at the same time shall send environmental experts and monitoring personnel to monitor the site and to salvage in time the hazardous substance container which falls into the water body.

(6) Handling measures for hazardous substance accident within tunnel

In addition to the above handling measures for hazardous substance accident, special attention should be given to the clearing of accident site and to the repairing of ventilation and warning equipment so as to eliminate the toxic and noxious gas’s pollution on the environment as soon as possible.

After the above measures are implemented, the adverse impacts on the environment caused by this project can be reduced to an acceptable degree.

4. Implementing organizations and obligations for environmental management

4.1 Implementing organization

The environmental management of the proposed project is in the charge of Fujian Provincial Expressway General Commanding Office for organization of implementation, the Sanming Yong-Wu Highway Company and Longyan Yong-Wu Highway Company are responsible for the specific environmental management for this project. The environmental management organizations for this project during construction and operation periods are shown in Fig. 4-1 and 4.2.

Fig. 4-1 Environmental management organizations during construction period
Sanming Yong-Wu Highway Limited Company and Longyan Yong-Wu Highway Limited Company are the implementing organizations of this project; on May 5, 2005, a coordination leading group of three parties (project, environmental protection, and resettlement) was established, which includes the environmental protection group and the immigration and resettlement group, staffed with 3-6 persons, of which one environmental expert, whose major obligations are:

1. To prepare the environmental impact assessment report and the environmental action plan for this project.
2. To be responsible for this project’s environmental management and immigration and resettlement.
3. To finalize environmental protection provisions into the contract, to cooperate with environmental protection supervising engineer, and to provide the implementation situation of environmental protection during construction.
4. To sign environmental monitoring contract with local environmental monitoring station, to inspect the implementation of environmental monitoring plan, and to submit the implementation situation and the monitoring report.
5. To coordinate the relationship among the environmental protection supervising engineer, the contractor, and the designer.
6. To be responsible for receiving environmental protection complaint and the supervision from local environmental protection departments.
7. To purchase manual noise automatic monitoring meter, to be responsible for the noise monitoring during operation period.

In the construction period of this project, each bid section will be staffed with an environmental protection supervising engineer, whose responsibilities are:

1. To supervise the implementation situation of the environmental protection measures stipulated in EAP and in the tendering document;
2. To be responsible for the noise monitoring during the construction period.

During the construction, each contractor will appoint more than one professional environmental protection persons, whose responsibilities are:

1. To be responsible for strictly enforcing and finalizing the environmental protection
measures and environmental protection works specified in the contract and the bidding
documents for his contracted works;

(2) To cooperate with the environmental supervising engineer, to inspect and correct
behaviors not conforming to environmental protection during construction.

After completion, this project will set up 2 highway management companies for the entire
route, each company will have a professional environmental protection person to be in charge
of all environmental protection works within its governed section.

4.2 Environment management plan

This project’s management plan is shown in Table 4-1, its EAP key factors are listed in
Table 4-2.
Table 4-1 Environmental management plan for this project

<table>
<thead>
<tr>
<th>Potential environmental impact</th>
<th>Mitigation measures</th>
<th>Implementing organization</th>
<th>Responsible organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Planning and designing stage</td>
<td>1. To design meticulously</td>
<td>Fujian Provincial Expressway</td>
<td></td>
</tr>
<tr>
<td>1. Reduced floodwater discharge ability</td>
<td>2. To formulate and carry out just and proper resettlement plan</td>
<td>General</td>
<td></td>
</tr>
<tr>
<td>2. Migration and forced resettlement of residents in road right-of-way</td>
<td>and to compensate for</td>
<td>Commanding</td>
<td></td>
</tr>
<tr>
<td>3. Loss of land resource</td>
<td>3. To occupy as few lands(good farmland ) as possible</td>
<td>Design unit</td>
<td></td>
</tr>
<tr>
<td>4. Loss of environmental beautification</td>
<td>4. To meticulously design so as to make it in harmony with landform (landscape)</td>
<td>Local government</td>
<td></td>
</tr>
<tr>
<td>5. Blocked way from house to farmland, increased walking time</td>
<td>5. To provide suitable number of passageways in suitable locations</td>
<td>Yong-Wu Highway Company,</td>
<td></td>
</tr>
<tr>
<td>6. Soil erosion caused by open or blind drainage ditches on the soil lower than subgrade</td>
<td>6. To increase number of water outlet, to set up good outlet in order to avoid cascade effects, to pave the scouring surface with stone or concrete</td>
<td>Longyan Yong-Wu Highway Company,</td>
<td></td>
</tr>
<tr>
<td>7. Road runoff pollution</td>
<td>7. To make the road runoff not enter into water source/farmland irrigation directly</td>
<td>Sanming Yong-Wu Highway Company,</td>
<td></td>
</tr>
</tbody>
</table>

II. Construction stage
1. Increased river sediment due to erosion in construction site, road cutting and waste disposal
2. Oil/engine oil/fuel and paint’s pollution to soil and water produced in equipment ground and bituminous mixing station
3. Ambient air pollution in bituminous mixing station/stabilizing soil mixing station
4. Dust, noise and air pollution in construction site
5. Unexplored underground historical relics found during construction
6. Landform disruption produced from embankment/fill and stone production

<table>
<thead>
<tr>
<th>Potential environmental impact</th>
<th>Mitigation measures</th>
<th>Implementing organization</th>
<th>Responsible organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To use coverings or fiber to protect sensitive surface, to plant reliable plants as soon as possible.</td>
<td>1. To use coverings or fiber to protect sensitive surface, to plant reliable plants as soon as possible.</td>
<td>Sanming Yong-Wu Highway Company,</td>
<td></td>
</tr>
<tr>
<td>2. To collect recycled lubricant, to prevent accidental spillover by good operation.</td>
<td>2. To collect recycled lubricant, to prevent accidental spillover by good operation.</td>
<td>Longyan Yong-Wu Highway Company,</td>
<td></td>
</tr>
<tr>
<td>3. To install and open air pollution control devices, to choose suitable place</td>
<td>3. To install and open air pollution control devices, to choose suitable place</td>
<td>Company,</td>
<td></td>
</tr>
<tr>
<td>4. To regularly sprinkle water on temporary road, to install silencer on equipment and to maintain in time.</td>
<td>4. To regularly sprinkle water on temporary road, to install silencer on equipment and to maintain in time.</td>
<td>Longyan Yong-Wu Highway Company,</td>
<td></td>
</tr>
<tr>
<td>5. To stop construction and to notify historical relics administrative department for protection</td>
<td>5. To stop construction and to notify historical relics administrative department for protection</td>
<td>Company,</td>
<td></td>
</tr>
<tr>
<td>6. To make it integrated into landform (landscape) through design, to repair the broken earth surface</td>
<td>6. To make it integrated into landform (landscape) through design, to repair the broken earth surface</td>
<td>Longyan Yong-Wu Highway Company,</td>
<td></td>
</tr>
<tr>
<td>7. To sign agreement with related departments, to relocate</td>
<td>7. To sign agreement with related departments, to relocate</td>
<td>Company,</td>
<td></td>
</tr>
</tbody>
</table>
7. Interference to facilities along the highway (electricity/telecommunication, etc.)
8. Existing road driving conditions impacted during construction.
9. Formidable sewage facilities and solid waste in construction site.
10. Possible infectious disease dissemination among workers and local people.
11. Temporary germ (mosquito) breeding habitat produced such as stagnant pool on sunny side.
12. Influence to land yield produced by large earth borrowing.

III. Operation stage
1. Ambient air pollution and noise pollution produced by vehicle driving.
2. Persistent soil erosion
3. Highway runoff pollution
4. Sewage and oil-containing waste water pollution in service areas
5. Disorderly roadside
6. Toxicant spillover/injury or death caused by accident of vehicle traffic and transportation

after being first open so as to reduce impacts
8. To strengthen traffic administration in possible traffic conflict points.
9. To provide suitable lavatory and dustbin, to strengthen environmental management.
10. To regularly examine workers' health, to handle when needed.
11. To adopt necessary measures to avoid producing reproducible place.
12. To keep the topsoil and to pile collectively, to level land as soon as possible after construction, and to recover the topsoil so as to shorten temporary land use time.
1. To install soundproofing window or other noise-prevention measures, to control the technological state of vehicles running in the highway, to reduce air pollution, and to strengthen public transportation and traffic managerial ability.
2. To meticulously maintain/afforest/add protection works.
3. To make the road runoff not enter into farmland irrigation system/water source directly.
4. To use sewage treatment facilities.
5. To provide treatment equipment, to formulate regulation forbidding throwing out waste.
6. To formulate and enforce emergency accident handling plan, to set up necessary organizations and management procedures to inhibit dangers caused by accidents.
Environmental Action Plan of Yong-Wu Highway

Table 4-2 Key EAP factors

<table>
<thead>
<tr>
<th>Environmental problem</th>
<th>Actions taken or to be taken</th>
<th>Implementing organization</th>
<th>Responsible organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Design stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Route selection</td>
<td>16 partial comparison route schemes have been optimized and compared so as to minimize adverse impacts on environment and society, and similarly so as to avoid unfavorable geological conditions and cultural relic sites.</td>
<td>Design unit</td>
<td>Fujian Provincial Expressway General Commanding Office, Sanming Yong-Wu Highway Company, Longyan Yong-Wu Highway Company</td>
</tr>
<tr>
<td>2. Disturb people</td>
<td>204 underpasses (passageways) and 141 culverts which are used also for people’s trip have been designed so as to satisfy trip and traffic demand of inhabitants and vehicles.</td>
<td>Design unit</td>
<td>Sanming Municipal Yong-Wu Cultural Relic Management Commission, Longyan Company, Longyan Yong-Wu Highway Company</td>
</tr>
<tr>
<td>3. Soil erosion</td>
<td>In side slopes and appropriate roadside places, it is to plant bush, grass as well as to set up retaining walls, catch drains, mortar pitching to prevent soil erosion.</td>
<td>Design unit</td>
<td>Sanming Municipal Yong-Wu Cultural Relic Management Commission, Longyan Company, Longyan Yong-Wu Highway Company</td>
</tr>
<tr>
<td>4. Dust/air pollution</td>
<td>temporary and permanent drainage systems have been designed, affected irrigation ponds will be dug again to keep soil erosion and influence on water conservation dam to a smallest degree.</td>
<td>Design unit</td>
<td>Sanming Municipal Yong-Wu Cultural Relic Management Commission, Longyan Company, Longyan Yong-Wu Highway Company</td>
</tr>
<tr>
<td>5. Water pollution</td>
<td>Except for the actions in item “1”, earth borrow pits, material stockpiles, waste banks, stabilizing earth mixing station and asphalt mixing station have been identified that they are necessary to consider dust pollution on residences and educational and cultural areas.</td>
<td>Design unit</td>
<td>Sanming Municipal Yong-Wu Cultural Relic Management Commission, Longyan Company, Longyan Yong-Wu Highway Company</td>
</tr>
<tr>
<td>6. Noise</td>
<td>The service areas, parking lots and other facilities have been designed with sewage treatment facility to make the waste water discharged into public water body after satisfying designated standard.</td>
<td>Design unit</td>
<td>Sanming Municipal Yong-Wu Cultural Relic Management Commission, Longyan Company, Longyan Yong-Wu Highway Company</td>
</tr>
<tr>
<td></td>
<td>Except for the actions in item “1”, sufficient measures such as removal and sound barrier have been confirmed and incorporated into the design and tender documents.</td>
<td>Design unit</td>
<td>Sanming Municipal Yong-Wu Cultural Relic Management Commission, Longyan Company, Longyan Yong-Wu Highway Company</td>
</tr>
<tr>
<td>7. Cultural relics</td>
<td>Cultural relic investigation has been carried out and no cultural relics sites were found along the route.</td>
<td>Design unit</td>
<td>Sanming Municipal Yong-Wu Cultural Relic Management Commission, Longyan Company, Longyan Yong-Wu Highway Company</td>
</tr>
</tbody>
</table>
8. Flood

Bridge and culvert have been sufficiently designed so as to satisfy flood discharge requirement (1/300 years for great bridge, 1/100 years for others).

Drainage system will be designed, contingency plan will be formulated so as to prevent impact on water body because of hazardous cargo transportation accident.

9. Hazardous cargo transport

B. Construction stage

- During construction period water will be sprayed, especially on stabilizing earth mixing station and asphalt concrete mixing station and detour road. When filling subgrade, water will be sprayed to compact the material, after material compaction, water will be sprayed regularly to prevent dusting.
- Warehouses and stock grounds will be covered, unless the material is used immediately.
- Vehicles transporting roadbuilding materials must also be covered to reduce spillage and fall.
- Stabilizing earth mixing station and asphalt concrete mixing station must be at least 300m leeward from residences.
- Mixing equipment must have good sealing and the vibrators must be installed with dust removal device, the workers shall pay attention to labor protection.
In suitable places such as side slope and roadside, trees and grass will be planted, especially on high-fill and deep-cut sections, stone walls will be covered and grass will be planted.

If existing irrigation, drainage system or pond are damaged, they will be rebuilt or reconstructed.

When lime and other easily-flying materials are piled together, they will be fenced by bricks or earth walls and be kept from water body.

In constructing permanent drainage system, temporary canals and culverts will be constructed for irrigation and drainage.

All necessary measures will be taken to prevent the earth ad stone from blocking river and canal course or current irrigation and drainage system.

Garbage can and sanitary disposal facility will be provided in construction campsites, and will be cleaned up regularly.

The drinking water will satisfy Chinese national drinking water standard.

Hygienic propaganda and education will be regularly provided to the construction workers.

It is to strictly enforce industrial enterprise noise standard so as to prevent workers from noise damage, the workers close to strong acoustic source will wear ear plug and helmet, and their working duration will be limited.

When there are large residences 150m within construction site, noisy construction shall not undertake at night (22:00 - 6:00).

Machinery and vehicle maintenance will be strengthened to keep their noise to a minimum.

If construction machinery noise produces disturbance on schools, mobile sound barrier should be established.

When there are large-sized residences 50m within detour roads, transportation of construction materials should be forbidden at night on these detour roads.

In order to protect forestland from damage, earth shall not be borrowed from forestland, and materials shall not be piled and temporary campsite shall not be built in forestland.

Farmland shall not be used as earth borrowing pits, if inevitable, the topsoil (30cm) will be retained, and promptly backfilled.

Education on construction workers will be strengthened to protect natural resources and wildlife animals and plants, hunting is strictly forbidden.

Construction vehicles will run on temporary detour roads so as not to damage farmland and vegetation.
Environmental Action Plan of Yong-Wu Highway

6. Accident risk

- In order to guarantee construction security, effective lighting devices and safety signals will be installed on temporary roads, and at the same time full traffic regulations will be adopted and enforced.
- During construction stage, the blasting time, signal and security guard will be regulated; vehicles in dangerous areas will be immediately evacuated.
- Before blasting, careful and thorough inspection must be taken.
- Safety watchout post will be set up so as to prevent people and vehicles from passing before blasting; during rush peak hours, blasting will not be conducted so as to avoid traffic jam and personnel casualty.
- Blasting material management and use will strictly follow public security department’s safety requirements.

7. Cultural relics

- If there discovered any fossils, ancient coins, architecture or other remains of archaeological and geological value, construction should stop immediately, and such discovery shall be reported to local cultural relic department immediately until authorized protection department completes the cultural relic confirmation.

8. Traffic and transportation

- Local construction materials shall be used as much as possible so as to avoid long-distance transport of construction materials, especially the earth and stone works.
- When there is traffic jam during construction stage, enough traffic mobilizing measures shall be taken with coordination from transportation and public security departments.
- In the interchange places of the proposed highway with other roads, temporary access roads will be built.
- Materials can be considered to prepare in advance in seasons with fewer traffic jams (Jan/Feb and Sept/Oct).
- A construction material transportation plan will be formulated to avoid transportation in rush hour, especially on existing roads.
C. Operation stage

- Prefectural or municipal transportation departments will set up respective coordinating organizations for chemical hazardous cargo transportation.
- Chemical hazardous cargo transportation implements the system of "cargo license", "driver license" and "guardian license" issued by transportation department. All vehicles engaged in hazardous chemical freight transportation should use unified special-purpose sign.
- Public security, transportation management and fire fighting departments shall designate driving route to vehicles transporting hazardous cargo. The vehicles transporting chemical hazardous cargo must be parked in designated parking lot.
- Regarding this project's hazardous cargo transportation management, the highway administration department will manage through registration system.

1. Hazardous cargo leakage risk

- In case of hazardous cargo leakage, such accident must be reported to concerned departments immediately, and must be handled according to formulated emergency plan.
Environmental Action Plan of Yong-Wu Highway

2. Vehicle management

- It is to strengthen inspection on vehicle’s noise and exhaust tail gas. If the vehicle’s noise exceeds the allowed standard or does not comply with discharge standard, they are not allowed to run on the highway.
- Announcement and education will be strengthened to people on relevant laws and regulation concerning vehicle air pollution and noise.
- Massive cargo transportation of coal, cement, sand and simply-packaged chemical fertilizer and others may possibly spill along the route and pollute the road. Entrance inspection will be strengthened, vehicles that do not have enough measures to prevent such spillage will not be allowed to run on this highway.

3. Noise

According to the monitored results, sound barriers and other noise-reducing measures will be taken in places with serious noise interference.

4. Maintenance of drainage system

Drainage system will be desilted periodically so as to ensure a smooth operation.

5. Other

New buildings are forbidden to build within 100m from the roadside, and schools and hospitals are forbidden to build within 200m from the roadside.

D. Environmental monitoring

1. Ambient air

   (1) Construction stage
   a. Monitoring item: TSP, bituminous smoke
   b. Monitoring frequency: twice/month
   c. Monitoring time: 1 day
d. Monitoring point: one unpaved construction road near residence and one concrete mixing stations near residence.

(2) Operation stage
a. Monitoring item: NOx
b. Monitoring frequency: twice/year (winter)
c. Monitoring time: 2 days, continuous monitoring in 24 hours
d. Monitoring point: Tangwei, Xizhaishang, and Shifang

(1) Monitoring frequency
a. Construction stage: once/month, one day for each time
b. Operation stage: twice/year, 2 days for each time

(2) Monitoring point
a. Construction stage

- Monitoring points need to be set up in villages and schools within 150m from the road.
- Monitoring points can be properly set up in residences nearby earth borrow pits, stone quarries and hauling roads.

b. Operation stage

- Wangcuo, Maopu, Jiqingtang, Lijiafang, Xibei, Gushibei, Shizhencun, Laojunkeng, Liantangxia, Laoxiongwu, Xizhaishang, Woli, Longjing village, Xincun, Yanqian

Construction stage
a. Monitoring item: pH, petroleum, SS, permanganate index, BODs
b. Monitoring frequency: once/month, 2 days for each time
c. Monitoring time: once in the morning and afternoon of each day
d. Monitoring point: about 200m downstream the bridge sites of Maping Bridge, Chetou Bridge, Shanghang Bridge, and Shangduan Bridge, 3 drop lines in 20 m from each river bank and in the river center

3. Water quality

Operation stage
a. Monitoring item: pH, petroleum, SS, permanganate index, BODs
b. Monitoring frequency: 2 times/year from 2010 to 2025, 2 days for each time
c. Monitoring time: once in the morning and afternoon of each day
d. Monitoring point: sewage outlets of 4 service areas and 4 parking lots
4.3 Supervising organizations

The environmental protection works of this project are subject to the supervision of China National Environmental Protection Agency, Fujian Provincial Environmental Protection Agency, Sanming and Longyan environmental protection bureaus. The environmental management and supervision plan is shown in Table 4-3.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Organization</th>
<th>Supervision contents</th>
<th>Supervision purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility</td>
<td>China National Environmental Protection Agency</td>
<td>1. To review TOR of environmental assessment.</td>
<td>1. To guarantee that the EIA contents are complete, topic identification is appropriate, the key points are highlighted.</td>
</tr>
<tr>
<td></td>
<td>Fujian Provincial Environmental Protection Agency</td>
<td>2. To review EIA report</td>
<td>2. To guarantee that the great potential problems produced by this project have been already reflected.</td>
</tr>
<tr>
<td></td>
<td>World Bank</td>
<td>3. To review EAP (Environmental Action Plan) draft.</td>
<td>3. To guarantee that the mitigation measures are specific and feasible.</td>
</tr>
<tr>
<td>Design and construction stage</td>
<td>China National Environmental Protection Agency</td>
<td>1. To review preliminary design for environmental protection and EAP</td>
<td>1. To strictly enforce “Three simultaneousness” and the environmental protection measures promised in EAP.</td>
</tr>
<tr>
<td></td>
<td>Fujian Provincial Environmental Protection Agency</td>
<td>2. To make sure whether the environmental protection investment is available in full sum.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>World Bank</td>
<td>3. To inspect whether the locations of stock grounds, concrete mixing station, stabilizing soil mixing station and bituminous mixing requirements are reasonable.</td>
<td></td>
</tr>
</tbody>
</table>
4. To inspect dust and noise pollution, to determine construction time

5. To inspect whether the management methods and measures for loading/unloading and piling poisonous, harmful substances are applicable or not, to inspect whether the air pollutant discharge satisfies the corresponding discharge standard

6. To inspect whether the discharge and treatment method of sewage and engine oil in the construction site are suitable or not

7. To restore and handle earth borrow pits and waste banks

8. To inspect the "Three simultaneousness" of environmental protection facilities, to determine final completion time

9. To inspect whether the environmental protection facilities meet design standard

10. To inspect whether there are underground relics damaged

4. To reduce impacts on surrounding environment caused by engineering construction, to enforce relevant laws, regulations and standards of environmental protection

5. To reduce impacts on surrounding environment caused by engineering construction, to enforce relevant laws, regulations and standards of environmental protection

6. To guarantee surface water is not contaminated

7. To guarantee that the landscape and land resources are restored as soon as possible

8. To guarantee the "Three simultaneousness" of environmental protection facilities

9. To accept environmental protection facilities

10. To guarantee that relics are not damaged
Environmental Action Plan of Yong-Wu Highway

1. To inspect the implementation of EAP (environmental action plan)
   1. To finalize the environmental requirements proposed in EAP.
   2. To inspect the implementation of environmental monitoring plan.
   3. To inspect whether it is necessary to take further environmental protection measures (environmental problems not estimated originally)
   4. To inspect whether the environmental quality of environmental sensitive locations meets their corresponding quality management.
   5. To inspect whether the sewage disposal of parking lot is up to standard requirement.
   6. To inspect whether the road not polluted surface water is entered into drinking water source.
   7. To strengthen supervision to prevent emergency accident, to eliminate accident-hidden danger.

The environmental protection supervising and monitoring organizations within the project region are shown in Fig. 4-3. The environmental monitoring during construction period for this project will be conducted by local environmental monitoring departments (except construction noise) and the environmental monitoring during operation period for this project will be conducted by Sanming Yong-Wu Highway Company, Longyan Yong-Wu Highway Company, and local environmental monitoring departments.
5. Environmental monitoring plan

(1) Formulation purpose

According to the environmental impacts listed in the environmental assessment report and the mitigation measures specified in this plan, the environmental monitoring plan is formulated so as to provide precise information of environmental impacts, to check the effectiveness of mitigation measures, and if necessary, to adopt remedial measures.

(2) Monitoring items

According to the anticipated environmental impacts and assessment results, the monitoring items during construction period are identified as TSP, bituminous smoke, construction noise and water quality; the monitoring items during operation period are identified as traffic noise, ambient air, and water environment.

(3) Environmental monitoring organization

Noise monitoring during construction period will be carried out by environmental supervising engineer. Other monitoring can be entrusted to local environmental monitoring stations in Sanming and Longyan. The construction unit should sign monitoring contract for construction period with the monitoring stations before construction, and sign monitoring contract for operation period with the monitoring stations before the project is open to traffic.

(4) Environmental monitoring plan

The environmental monitoring plan for this project is detailed in section 4-2.

(5) Monitoring cost

The monitoring cost during construction period is about 300,000 yuan each year, of which 100,000 yuan for noise monitoring, 130,000 yuan for air monitoring, and 70,000 yuan for water quality monitoring, thus a total of 1.2 million yuan in 4 years. The monitoring cost during
operation period is 200,000 yuan each year, of which 120,000 yuan for noise monitoring, 50,000 yuan for air monitoring, and 30,000 yuan for water quality monitoring, thus a total of 3 million yuan in 15 years. The total monitoring cost for this project is 4.2 million yuan.

(6) Reporting system for monitoring

The reporting system for monitoring is illustrated in Fig. 5-1. After each monitoring, the monitoring unit should submit a monitoring report to higher organizations in a hierarchical manner. Sanming Yong-Wu Highway Company and Longyan Yong-Wu Highway Company should submit the environmental monitoring plan to World Bank once in every quarter during construction period and once every half year during operation period.

![Reporting system for monitoring](chart.png)

Fig. 5-1 Chart of reporting system for monitoring

(7) Environmental value value

The environmental monitored results will take reference to the valve values in Table 5-1 to Table 5-6 to determine whether remedial measures are required or not.

<table>
<thead>
<tr>
<th>Construction stage</th>
<th>Major noise source</th>
<th>Noise limit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth/stone works</td>
<td>Bulldozer, excavator, loader, etc</td>
<td>75</td>
</tr>
<tr>
<td>Piling</td>
<td>Various pilers</td>
<td>85</td>
</tr>
<tr>
<td>Structure</td>
<td>Concrete mixer, vibrator and electric saw, etc</td>
<td>70</td>
</tr>
<tr>
<td>Decoration</td>
<td>Crane and elevator, etc</td>
<td>65</td>
</tr>
</tbody>
</table>

Table 5-1 GB12523-90 *Construction Boundary Noise Level Limit*

unit: $L_{eq}$ (dB)
Environmental Action Plan of Yong-Wu Highway

Table 5-2  
Acoustic environmental standard during operation period  
unit: $L_{eq}$ (dB)

<table>
<thead>
<tr>
<th>Sensitive location and standard class</th>
<th>Daytime</th>
<th>Nighttime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools and hospitals apply class 1 standard of GB 3096-93</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>Residential areas apply class 2 standard of GB 3096-93</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 5-3  
Ambient air quality standard  
unit: mg/m$^3$

<table>
<thead>
<tr>
<th>Pollutant name</th>
<th>TSP</th>
<th>NO$_x$</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 2 limit value of GB 3095-1996</td>
<td>Daily average</td>
<td>0.30</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>1-hour average</td>
<td>-</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Table 5-4  
Discharge standard for bituminous smoke (new pollution source)

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Production</th>
<th>Max. allowable Concentration limit value for Bitumino Asphalt melting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>40～75</td>
</tr>
</tbody>
</table>

Table 5-5  
Applicable limit values for water quality  
unit: mg/L (except pH)

<table>
<thead>
<tr>
<th>Water quality index</th>
<th>pH</th>
<th>Nate Petroleu</th>
<th>SS</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(mg/L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limit value for water quality assessment</td>
<td>6～9</td>
<td>≤6</td>
<td>≤0.05 (≤50)*</td>
<td>Excerpt SS enforces class 1 standard of GB5084-92, other indexes enforce class 3 standard of GB3838-2002.</td>
</tr>
</tbody>
</table>

Table 5-6  
Sewage discharge limit value in service area  
unit: mg/L (except pH)

<table>
<thead>
<tr>
<th>Water quality index</th>
<th>pH</th>
<th>COD$_{cr}$</th>
<th>Petroleu</th>
<th>SS</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limit value for sewage discharge in service area</td>
<td>6～9</td>
<td>100</td>
<td>≤5</td>
<td>70</td>
<td>Excerpt from class 1 standard of GB 8978-1996</td>
</tr>
</tbody>
</table>

6. Competence development and environmental protection training plan

In order to strengthen the project organization's environmental managerial ability, it is planned to train relevant personnel with environmental protection, the following environmental
Environmental Action Plan of Yong-Wu Highway

A training plan for environmental protection for the project is formulated (See Table 6-1).

Table 6-1 Environmental protection training plan

<table>
<thead>
<tr>
<th>No</th>
<th>Trainee</th>
<th>Training content</th>
<th>Time</th>
<th>Place</th>
<th>Size (10,000 yuan)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Environmental protection training plan for supervising engineer</td>
<td>National environmental protection regulations and standards, this project's main environmental questions, environmental protection supervising engineer's duty, use of noise monitoring instrument, etc.</td>
<td>Within 2 months before project construction</td>
<td>Fuzhou</td>
<td>20 persons, 15 days</td>
<td>12.0</td>
</tr>
<tr>
<td>2</td>
<td>Project environmental management personnel</td>
<td>Study the advanced environmental management experience of foreign countries, and apply the knowledge learnt to the environmental management of the project.</td>
<td>From half year to 12 months after project starts construction</td>
<td>Foreign country</td>
<td>6 persons, half month</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>Contractors' environmental protection personnel</td>
<td>National environmental protection regulations, standards and this project's main environmental questions, environmental protection precautions and environmental measures during construction, duty of environmental protection staff member.</td>
<td>Within 1 month before project construction</td>
<td>Fuzhou</td>
<td>20 persons, 15 days</td>
<td>12.0</td>
</tr>
<tr>
<td>4</td>
<td>Inspection personnel for hazardous cargo transportation</td>
<td>Relevant national regulations and management rules on hazardous cargo transportation, rudimentary knowledge of hazardous cargo, vehicle declaration and inspection program,</td>
<td>Within 2 months before project operation</td>
<td>All toll station</td>
<td></td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>for hazardous cargo transportation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Remarks:*
- Implemented in institutional enhancement
- Training contents and cost listed separately, the cost is shown in Table 7-2-1
- Listed in the operational expense for the project
7. Implementation progress and cost estimate

The implementation progress of major environmental protection measures is shown in Table 7-1, the cost estimate for environmental protection for this project is listed in Table 7-2.

Table 7-1 Implementation progress of major environmental protection measures

<table>
<thead>
<tr>
<th>Item</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land acquisition and removal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal for environmental purpose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sound barrier</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installing soundproof window</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewage treatment facility in service area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental monitoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training of supervising personnel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training of environmental protection personnel of contractor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training of environmental management personnel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training of accident emergency ability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Environmental protection and management during construction stage

**Note:** The environmental protection and management during operation period last for the whole highway operation period, including monitoring and maintenance of environmental works.

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit price (10,000 yuan)</th>
<th>Estimated cost (10,000 yuan)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Planting in medium separator and side slope</td>
<td>km</td>
<td>197</td>
<td>50</td>
<td>9850</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Planting in interchange</td>
<td>place</td>
<td>11</td>
<td>150</td>
<td>1650</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Planting and beautification in service areas</td>
<td>place</td>
<td>4</td>
<td>100</td>
<td>400</td>
<td>The size of greenbelt should be 40% of the total size</td>
</tr>
<tr>
<td>4</td>
<td>Planting or reclaiming in earth borrow and waste disposal sites</td>
<td>place</td>
<td>106</td>
<td>3.0</td>
<td>321</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water spraying, dust reduction, tarpaulin fence, and sewage treatment in construction campsite</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Removal for environmental purpose, fence heightening, sound barrier</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1506</td>
<td>Including the reserved cost</td>
</tr>
<tr>
<td>6</td>
<td>Device for collecting bridge floor runoff</td>
<td>m</td>
<td>494</td>
<td>0.0050</td>
<td>2.47</td>
<td>Mapping bridge</td>
</tr>
<tr>
<td>7</td>
<td>Sewage and trash treatment in service areas</td>
<td>place</td>
<td>4</td>
<td>25</td>
<td>100</td>
<td>Service area is built in two roadsides</td>
</tr>
<tr>
<td>8</td>
<td>Newly-added water conservancy works</td>
<td>km</td>
<td>197</td>
<td>18</td>
<td>6333</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Accident emergency vehicle</td>
<td>vehicle</td>
<td>5</td>
<td>30</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Personnel training</td>
<td>times</td>
<td>5</td>
<td>10</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Environmental monitoring</td>
<td>year</td>
<td>4</td>
<td>30</td>
<td>120</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th></th>
<th>Environmental Action Plan of Yong-Wu Highway</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Operation period</td>
</tr>
<tr>
<td>14</td>
<td>Environmental supervision for construction</td>
</tr>
<tr>
<td>15</td>
<td>Cultural relics protection</td>
</tr>
<tr>
<td>16</td>
<td>Contingency</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>