Fujian Provincial Road Development
World Bank Loan Project

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

Summary of Environmental Assessment

Ministry of Communications Highway Research Institute

March 2006
Summary of Environmental Assessment of Yong-Wu Highway

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A. Background of the project

1. The Yong’an-Wuping (Fujian and Guangdong border) Highway (hereafter referred to as Yong-Wu Highway) in Fujian Province started in 2004, its pre-feasibility study report was completed on July 2004, and its feasibility study report was completed on March 2005. The preliminary design was completed on December 2005.

2. The Ministry of Communications Highway Research Institute (a holder of class A environmental impact assessment certificate issued by National Environmental Protection Agency) was entrusted by Fujian Provincial Expressway General Commanding Office to undertake this project’s environmental impact assessment on March 2004. On February 2005, this project’s environmental impact assessment TOR was reviewed and approved by National Environmental Protection Agency.

3. The first draft of the environmental impact assessment report (EIA) for Yong-Wu Highway was completed on December 2005. On January 2006, the World Bank environmental experts reviewed it in Fuzhou City. On February 2006, according to the advice of World Bank experts, the assessment unit has completed the EIA (second edition), EAP, and the summary.

4. In the reviewing process of this report participated by Fujian provincial environmental protection department and transportation department, opinions were widely solicited from the influenced units, non-governmental organizations, especially people subject to land acquisition, removal, and resettlement.

The preparation and reviewing of the EIA observe the environmental assessment policies, laws, and regulations for engineering projects in China, as well as 《World Bank Operational Policies and Guidelines OP/BP/GP 4.01 Environment Assessment》 (March 1999).

B. Brief description of the project

5. The Yong-Wu Highway is 196.565km long designed by an expressway standard with design speed of 80 km/h and 100 km/h, with two-way 4 lanes, and with subgrade width of 24.5m and 26.0m. This highway will build a total of 11 interchanges, 126 great bridges, and 27 tunnels, of which there are 4 service areas, 3 parking lots, and 10 tollgate stations. The highway will acquire a land area of 22740.26 mu (Chinese acres). The total budgetary estimate is 12.2874 billion yuan.

C. Description of background environment

6. Landform and topography

This project lies in the west of Fujian Province, between Wuyi Mountain Range and Daimao Mountain Range, with continuous and stretching mountain ridges along the route and great relief
variations, which are mostly hills and low mountains, and some low-to-middle mountains in local places. Among them there are developed with valley basins, river terraces of different sizes.

7. Climate and hydrology

(1) Yong’an City belongs to maritime monsoon climate of middle subtropical zone, characterized by long summer and short winter, plentiful rainfall, warmth, and moisture. In Yong’an city, the annual average temperature is 14.3 °C~19.2 °C, the average temperature in January is 4.3 °C~8.9 °C, the average temperature in July is 22.8 °C~28.1 °C, the annual average rainfall/precipitation is 1494~2059mm, forming a little-rain belt in the middle part of Fujian Province with the frost-free period of 260~302 days.

Longyan City belongs to maritime monsoon climate of south subtropical zone, characterized by mild climate, distinctive seasons, and plentiful rainfall. The annual average temperature: 18.9 °C~20.8 °C; Annual average rainfall: 1319~1922mm.

(2) Within the project area, there are Wenchuan River, Jiuxian River, and Tingjiang River systems, and within the route corridor the river valley shape changes greatly and river bend is developed.

(3) The water quality in the major water bodies is relatively good, which service as the major water source for industrial and agricultural production. The route overcrosses Wenchuan River in Xialing, where it is a class 2 water source protection zone and is one of the back-up water sources for living water and industrial water in Yong’an city.

8. Society and economy

The project area is situated in the territory of Yong’an city of Sanming Prefecture and Longyan Prefecture, the former city boasts of rich forestry and hydro-electric resources and is the main industrial energy and raw material production base in Fujian Province, while the latter is abundant in natural resources and is the main mining area and forest region in Fujian Province.

In 2004, the total population in the whole Yong’an City is 319,000 people and its annual total output value is 7.475 billion yuan; the total population in the whole Longyan Prefecture is 2.8698 million people and its annual total output value is 34.828 billion yuan.

9. Ecological environment

The vegetation in the project area is middle subtropical evergreen coniferous and broadleaf forest, evergreen Castanopsis forest zone of east Nanling mountain range, subtropical laural forest, and subtropical evergreen broad-leaf forest, with a forest coverage rate reaching 70% ~ 83.2%. The artificial vegetation mainly includes China fir forest, mason pine forest, and economic forest, and so on. The agricultural vegetation mainly includes crops or cash crops such as paddy rice, corn, sweet potato, peanut, sweet orange, and tea. Within the assessment scope along the route no wild
plants of significant value or their centered habitats are discovered and no animal habitats of important value are discovered.

The boundaries of Tianbaoyan Natural Reserve, Meihuashan Natural Reserve, and Liangyeshan Nation-level Natural Reserve are 20~50km from the highway in their shortest distance, the boundary of Guanzhaishan National Sceneric Zone is 1km from the highway in its shortest distance.

10. Tourism and cultural relics

(1) Tourism resources are abundant in this project area, mainly including the Guanzhaishan Sceneric Zone in Liancheng County.

(2) Relevant cultural relics departments had been entrusted for carrying out cultural relics investigation within the project region. 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.

11. Air quality

Three representative points were laid-out for monitoring the current ambient air quality ($NO_2$, TSP), the monitored results indicate that the pollution index of single factor conforms to class 2 standard, the ambient air quality is relatively good.

12. Acoustic quality

The monitored results of current environment indicate that among the 18 measuring villages, most are not excessive in daytime ambient noise and all are not excessive in nighttime ambient noise, except that the villages close to the existing G205 are excessive in nighttime ambient noise standard, the current acoustic environment quality along the route is good.

13. Water quality

The monitored results of current water quality indicate that among the factors in the three monitored river cross-sections, except the SS in Chetou Bridge is slightly excessive of the allowed figure, each monitoring factor ($pH$, permanganate index, petroleum, SS, and $BOD_5$) satisfies the prescribed standard, which means that the water environment quality in that region is good, basically satisfying water functional zoning requirements.

14. Soil erosion

Yong'an City is located in an area with moderate soil erosion, while the Liancheng County is one of the counties in west Fujian Province with relatively serious soil erosion; Shanghang County and Wuping County are located in an area with slight soil erosion.

15. Transportation

Transportation infrastructure in Fujian Province is relatively backward, but currently it has
basically established a comprehensive transportation system composed of railway, roadway, waterway, airway, and pipeline transportation. Sanming Prefecture has national roads G205 and G316, Longyan Prefecture has national G319 and G205. The mileage of high-class highways is small, the proportion is low. Because of rapid economic development in recent years and traffic volume growth, the original roads could not meet the demand of economic development.

D. Anticipated environmental impacts and mitigation measures

17. Design stage

(1) **Reasonable route selection.** In the route selection, the design unit, the environmental assessment unit, and the construction unit have consulted and discussed route selection many times so as to give full consideration to each environmental factors such as protection of farmlands, schools, residential areas, 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.

(2) **Personal interaction.** This project has designed 141 culverts for pedestrian trip, 204 underpasses (channel), 7 overpasses (skywalk). Moreover, this project will construct a certain number of great, medium, and small bridges so as to satisfy the movement demand of local people and vehicles.

(3) **Soil erosion.** The main measures include: earth and stone transit and optimization, land reclamation, highway afforestation design, subgrade protection design, and drainage protection for cut section.

(4) **Ecological resource and reduction of land occupation.** The road section that may take up large size of fertile farmlands will change to align along hill foot or to pass by viaduct so as to avoid fertile farmlands. A temporary topsoil layer piling plan is explicitly proposed to store the topsoil (0~30cm) of land occupied by the subgrade or by the earth borrow pits. Five earth borrow pits and 101 waste disposal sites will be set up.

(5) **Land acquisition, removal, and resettlement.** The route selection has considered as much as possible to avoid villages and towns and fertile farmlands so as to reduce the land acquisition and removal quantity and occupation of fertile farmlands to a minimum. The construction unit has established immigration and resettlement organizations at municipal, county, and township levels so as to ensure a completion of the immigration and resettlement before the contractors enter into construction sites. For details please see the *Resettlement Action Plan* (RAP).
(6) **Noise pollution.** According to prediction, during the highway operation period, some schools and villages along the route with excessive noise will be designed with noise reduction measures, which are incorporated into the engineering design and tendering documents. The noise-reduction measures are presented in Table D-1, which will be completed before the operation of this highway.

<table>
<thead>
<tr>
<th>Noise-reduction measures</th>
<th>Place</th>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound barrier</td>
<td>Guihuyang, Wenheng township, Beicun, Caoying, Bengkantou, Tangwei, Hewu, Huwei, Shifang village, Meikeng</td>
<td>10</td>
<td>1000~3000 yuan each linear meter</td>
</tr>
<tr>
<td>Heightening fence</td>
<td>Mahong, Laocheng, Laowuxia</td>
<td>3</td>
<td>5000 yuan for each household</td>
</tr>
<tr>
<td>Removal</td>
<td>Peishang</td>
<td>1</td>
<td>80,000 yuan for each household</td>
</tr>
<tr>
<td>Installation of</td>
<td>Mayangdong elementary school</td>
<td>30 windows</td>
<td>2000 yuan for each window</td>
</tr>
<tr>
<td>soundproofing windows</td>
<td>4 schools and 1 nursery for elderly</td>
<td>10</td>
<td>—</td>
</tr>
</tbody>
</table>

Monitoring on sensitive locations with relatively small noise excess should also be strengthened, and suitable protective measures should be taken in accordance with actual situations.

(7) **Air pollution.** In the ambient air prediction in sensitive locations, during the entire operation period, the NO$_2$ pollution will not surpass class 2 ambient air quality standard in ordinary circumstances. Under unfavorable meteorological condition, however, the sensitive locations close to the highway may have excessive NO$_2$ pollution. The automobile exhaust pollution will be controlled by improving automobile exhaust technology, strengthening automobile exhaust inspection, and by reducing the discharge of NO$_x$ and other exhaust gases.

The highway tunnels should install ventilation system, medium and long tunnels should adopt jet-flow longitudinal induced ventilation. Service areas should be located 100m from the road center, administration stations should be located 200m from interchanges. Stone quarries, earth borrow pits, waste disposal sites, and stabilizing soil/asphalt mixing stations should be located far away from residential areas and schools.

(8) **Water pollution:** it is required to reduce the bridge substructure's impact on river waters as much as possible, especially it is required to give emphasis to Maping Bridge's impact on the water source protection zone of Yong'an Dongpo Water Plant. It is required to well conduct
water drainage design for subgrade and pavement. In the bridge section crossing water source protection zone, it is required to set up horizontal and longitudinal drainage pipes to bring the pavement runoff into sedimentation tank or other runoff collecting facilities for treatment. For service areas, parking lots, administration stations, and toll stations with staff residence, it is required to design necessary sanitary sewage treatment equipment so as to make the sewage meeting prescribed standard before discharge.

(9) Cultural relics preservation. Cultural relic unit has been entrusted to conduct the cultural relic investigation work for the entire route, and there are no protected cultural relics units.

(10) Flood prevention and control. This project has designed complete subgrade and pavement drainage system as well as enough quantity of bridges and culverts, the design flood frequency is 300 years for great bridges and 100 years for medium and small bridges.

18. Construction stage

(1) Air pollution. The main pollution source during the highway construction period is flying dust produced from stabilizing soil mixing, and continuous movement of construction vehicles and roadbuilding machines. The asphalt concrete mixing stations and the loading/unloading of roadbuilding materials can also produce a few dust and bituminous smoke pollution. The following measures will be taken:

a. Plant mixing should be adopted during the construction.

Stabilizing soil and asphalt concrete mixing station should be located 300m leeward from residential areas, hospitals, and schools. It is absolutely forbidden to use wide-open and semi-closed type asphalt melting technique. Workers should have labor protection measures such as wearing eye mask and mouth mask.

b. The construction sites and main material hauling roads should be sprayed with water regularly.

c. Management over bulky materials that are easy to lose must be strengthened, and they should not be piled nude. The stock grounds should be no less than 200m from schools, villages, and other sensitive locations.

d. Vehicles transporting roadbuilding materials should be covered to reduce spillover.

(2) Noise pollution. The noise during highway construction mainly comes from construction machinery and transportation vehicles. Long exposure to intense noise will induce many diseases and will lead to deafness. The following measures will be taken.

a. It is required to reasonably arrange construction time so as to avoid high-noise construction at night.

b. Construction unit shall preferably select low-noise construction machinery. For high-noise
construction machinery, temporary noise prevention measures should be taken. Material stock grounds and mixing stations etc, should be located 300m away from acoustically sensitive locations.

c. Construction workers should be protected by personal noise protection measures such as wearing ear plugs or helmets.

d. The construction detour roads will be far away from schools, hospitals, and centered residential areas, will not pass through acoustic sensitive locations. When there are clustered residential areas within 50m from the construction detour road, then it is forbidden to transport construction materials at night on this detour road.

e. For acoustically sensitive locations with large noise excess, it is required to adopt noise-reduction measure during the construction period.

(3) Protection of ecological resource

a. During construction period, it is required to strengthen the environmental protection education and publicity to construction workers. Construction workers must enhance fire control in forest section.

b. Construction workers should strictly follow the construction standards and specifications, mistaken earth borrowing and casual piling of roadbuilding materials are forbidden.

c. It is required to set up warning symbol around the earth borrow pits and to promptly complete the environmental protection and restoration of earth borrow pits and waste disposal sites. In digging the cultivated fields acquired, the topsoil (30cm) should be retained so as to be used in reclaiming and compensating for farmlands.

d. For solid wastes, it is required to formulate special management measures.

The above requirements will be incorporated into the contract with contractors. If the contractor violates, he will be punished.

(4) Water and soil conservation

a. Engineering protection measures

① measures for slope face
② measures for bridge and interchange
③ water conservation measures for earth borrow pits
④ water conservation measures for waste disposal sites

b. Biological measures

① grassing measure in slope face
② emergency measure for water conservation in rainy season

c. Land reclaiming measure
(5) Prevention and control of water pollution
   a. Prevention and control measures for water pollution during subgrade construction
   b. Prevention and control measures for water pollution during bridge construction
   c. In Maping Bridge section, it is required to set up horizontal and longitudinal drainage pipes to bring the bridge floor runoff into the roadside drainage ditches or sedimentation tank or other waste water collecting facilities.

(6) Construction campsite
   a. Construction campsites should set up septic tanks and dustbins, cleared by the contractor on time. In the construction site, drinking water conforming to hygienic standard should be provided. After the construction is finished, the septic tanks and garbage pits should be cleared and buried with earth.
   b. Sewage and garbage are strictly prohibited to enter water body due to the sluicing of rainstorm.
   c. 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.

(7) Cultural relics
   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.

(8) Construction transportation management plan
   a. 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 subgrade of the highway.
   b. Management over the transportation on G205 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.
   c. To prepare materials ahead of time. Sand and stone and other materials should be stored in a time with relatively light traffic.
   d. 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.
   e. The contractor is required to take measures to cover easily-lost materials so as to prevent from flying and spilling during transportation.

(9) Accident risk. In order to guarantee safety, during the construction period, the
temporary detour roads should be installed with lighting devices and safety symbols, traffic laws and regulations should be strictly enforced.

(10) Public participation. Telephone number for environmental protection complaint 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.

28. Operation stage

(1) Traffic noise control

a. Highway transportation and maintenance management should be strengthened, vehicles with excessive noise should not be allowed to run on the highway.

b. For acoustic environmental protection in sensitive locations, noise-reduction measures can be adopted in the noise-exceeding places, such as sound barriers, removal, and soundproofing windows according to the prediction.

c. It is strictly prohibited to build schools and hospitals within 200m from the road center line and residential houses within 150m from the road center line.

d. To enforce noise monitoring plan, supplementary acoustic environmental protection measures should be adopted according to the monitored results.

(2) Ambient air pollution control

a. Management of vehicles carrying easily-lost materials should be strengthened, tarpaulin is needed to cover when hauling the above materials.

b. Vehicles with seriously excessive exhaust discharge should be constrained to run on the highway.

c. Tunnel air blowers should be well maintained so as to guarantee good ventilation within the tunnel.

d. The two roadsides will be planted so as to be helpful to absorb the flying dust on the highway and to protect the ambient air quality along the route.

e. Do not to build residential quarters, schools, hospitals, and hotels, and other air sensitive buildings close to the highway.

(3) Ecological restoration and water and soil conservation

a. To maintain the planted vegetation in road side slopes, medium separators, interchanges, and service areas so as to achieve environmental protection goals of vegetation restoration and soil erosion reduction.

b. To promptly restore the damaged vegetation and ecological environment.

c. The biological protective measures in subgrade side slope and planting measures in earth
borrow pits should be regularly managed and maintained, and complementary planting can be done suitably.

(4) Preventing and controlling of water pollution
   a. The sewage treatment facilities in service areas and parking lots should be maintained so as to guarantee the sewage satisfying the discharge standard.
   b. To enforce water quality monitoring plan, supplementary environmental protection measures should be adopted according to the monitored results of water quality.
   c. Immediate cleaning of waterflow culvert.

(5) Hazardous substance transportation
   a. Before hazardous substance vehicles enter into the highway, the drivers should ask for declaration forms and should be subject to the sample-inspection by public security or transportation management departments in the highway entrance, and should submit the declaration form.
   b. It is suggested to distribute "Safe Driving Guide for Yong-Wu Highway" to drivers in the highway entrance.
   c. For hazardous substance vehicles, it is required to implement an inspection method of Three Licenses and One Bill including the “cargo license”, “driver license”, and “guardian license” and the hazardous substance transportation road bill. Vehicles with hidden danger should not move on the highway before such dangers are removed.
   d. 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.
   e. In case that vehicles transporting toxic and poisonous substances occur accident on the proposed highway, thus leading to water body or air pollution, then it is required to promptly take urgent rescue measures jointly with local public security, fire, and environmental protection departments. If necessary, the "Emergency and First-aid Program for Grand Accident of Hazardous Chemical Substance in Fujian Province" should be initiated.
   f. When vehicles carrying detonators and explosives need to pass a tunnel in the highway, the tollgate staff should immediately notify the tunnel management personnel so as to escort such vehicles to pass through the tunnel.

E. Environmental monitoring

19. Environmental monitoring plan was formulated, according to which the noise monitoring will be conducted by the environmental supervising engineer of the supervising station while other monitoring will be conducted by local monitoring stations entrusted by the construction unit.
The environmental monitoring plan refers to EAP.

F. Environment management organization

20. The environmental management of the proposed project is in the charge of Fujian Provincial Expressway General Commanding Office for organization of its implementation, the Sanming Yong-Wu Highway Company and Longyan Yong-Wu Highway Company are responsible for the specific environmental management and removal and resettlement during construction period for this project.

Fujian Provincial Environmental Protection Agency is responsible for the daily routine supervision of and local environmental protection bureaus are responsible for a unified supervision of environmental works within their respective jurisdictions. They are all liable to supervising the implementation of EAP and to supervising according to laws and regulations.

G. Competence development and environmental protection training plan

21. The environmental protection management training plan for this project includes training of 4 kinds of personnel:

① training of environmental protection supervising engineer; ②training of environmental management personnel; ③ training of contractor’s environmental protection personnel; ④ training of hazardous cargo inspectors. The total training cost is 520,000 yuan.

H. Public consultation and information disclosure

22. The assessment unit has carried out 3 public consultations and investigations on November 2004, July 2005, and November 2005, respectively, in the cities, counties, and townships along the route.

The public consultation and investigation adopted 3 forms: (1) household or individual interview, (2) group interview (3) seminar with governmental departments and non-governmental organizations.

The total participants in the consultations and seminars are 900 people (household); 17 seminars with governmental departments and non-governmental organizations were held with a participant number of 418 people.

The investigation contents are as follows:

(1) To introduce the necessity, route alignment, construction scale, technical standard, and basic principles of route selection to the public.

(2) To describe this project’s main environmental problems and to introduce proposed environmental protection measures to the public by the assessment unit.
(3) To introduce the national and regional relevant compensation policies on land acquisition, removal, and resettlement for highway construction to the public.

(4) To solicit the public's suggestions and requirements on the highway construction and its environmental impact produced as well as mitigation measures.

The public opinions are summarized as follows:

(1) The local governments and inhabitants along the route fully support the construction of this highway and expect an earlier construction of this highway.

(2) To try great effort to occupy as little farmlands and fertile farmlands as possible; to well conduct the highway planting and beautification work and promptly restore the damaged vegetation, and finalize the construction of greenbelt at the two sides of the highway.

(3) To well conduct the compensation for land acquisition, removal and resettlement; to pay the resettlement compensation directly to the households to be removed.

(4) To strengthen management during construction stage so as to reduce the construction noise and dust's impact on the environmental quality along the route.

23. In terms of route selection, interchange and channel establishment, environmental protection, and immigration and resettlement, opinions from all circles have been solicited so as to obtain full support from the public for the implementation of this project. Fujian Provincial Expressway General Commanding Office will publish the environmental and resettlement notices for this project in relevant papers, and will disclose the environment documents such as the environmental impact report and the environmental action plan to the public. The construction unit will put relevant environmental documents in the information offices of relevant cities and counties along the route for a convenient consultation by the public. From now on, relevant information will be disclosed in the newspapers non-periodically.

Regarding the public's opinions, the construction unit and the design unit paid great emphasis to them and have adopted them in route design, such as the setting-up of interchanges in each county and the comparison of different alternative route schemes.

The route is under further optimization to evade Jiuxian middle school, Jiuxian elementary school, and other sensitive locations.

I. Immigration and resettlement

24. Design of this project has always emphasized the principle of avoiding villages and towns, and of few removal and occupation of farmlands. Immigration and resettlement offices have been established at each level and the “Resettlement Action Plan” (RAP) was formulated, and independent supervising organization was hired.
25. Land will be adjusted and the original cultivated fields will be improved according to related Chinese policies; the land compensation payment and the resettlement subsidy will be used to develop agriculture, industry, sideline occupations, as well as service sectors, the villagers' production and life should be well arranged.

J. Summary

26. After implementing the EAP environmental protection measures, each kind of adverse impacts can be reduced to an acceptable degree or can be basically eliminated, thus they will not cause significant and irreversible environment harm.

27. Under the cooperation of cultural relic department, this project has carried out a cultural relic investigation. During the construction the stipulations of national cultural relic law will be enforced. Therefore, this project will not destroy the cultural relics.

28. This project's hazardous substance transportation risk is not big. It will not produce big impact on flood control along the route.

29. The resettlement for land acquisition and removed people will be settled locally, thus it will not cause massive migration of rural population into cities.

30. It does not have impact on wild animals and plants and is beneficial to the development and utilization of tourism resource along the route.

31. The environmental protection investment for the proposed highway is 217.8332 million yuan, about 1.77% in the total project investment which is 12.2874 billion yuan. The environmental benefits produced by the development and operation of this project are bigger than the environmental losses. The adverse impacts produced by the project development are acceptable to the environment.

32. In order to finalize and implement each environmental protection work, special environmental protection organization was established, and competence development and training will be conducted.

33. The environment action plan, the environmental monitoring plan, and the resettlement action plan were formulated.
Fig. 1 Geographical location of proposed road
Project route alignment and environment investigation and Monitoring points

Scale: 1:300,000

Legend:
- Monitoring Point for acoustic environment Status quo construction period
- Monitoring Point for acoustic environment Status quo working period
- Monitoring Point for surface water environment Status quo construction period
- Monitoring Point for surface water environment Status quo working period
- Monitoring Point for environmental air status quo working period
Appendix I: Key EAP factors

<table>
<thead>
<tr>
<th>Environmental problem</th>
<th>Actions taken or to be taken</th>
<th>Implementing responsible organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Design stage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Rout 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>
</tr>
<tr>
<td>2. Disturb people for people's trip</td>
<td>204 underpasses (passageways) and 141 culverts which are used also</td>
<td>Design unit</td>
</tr>
<tr>
<td></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></td>
</tr>
<tr>
<td>3. Soil erosion</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>
</tr>
<tr>
<td>4. Dust/air 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>
</tr>
<tr>
<td>5. Water pollution</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>
</tr>
<tr>
<td>6. Noise</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>
</tr>
<tr>
<td>7. Flood</td>
<td>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).</td>
<td>Design unit</td>
</tr>
</tbody>
</table>
### Summary of Environmental Assessment of Yong-Wu Highway

#### Continued: Key EAP factors

<table>
<thead>
<tr>
<th>Environmental problem</th>
<th>Actions taken or to be taken</th>
<th>Implementing Responsible organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Hazardous cargo transport</td>
<td>Drainage system will be designed, contingency plan will be formulated so as to prevent impact on water body because of hazardous cargo transportation accident. Cultural relic investigation has been carried out and no new cultural relics sites were found along the route.</td>
<td>Sanming Municipal Cultural Relic Management Commission, Longyan Municipal Culture and Publishing Bureau</td>
</tr>
</tbody>
</table>

#### B. Construction stage

1. Dust/air pollution
   - 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.
2. Soil erosion/water pollution
   - 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.
   - All reasonable measures will be taken to prevent the waste water produced in construction from entering into river courses and irrigation canals directly.

Contractors

- Fujian Provincial Expressway General Commanding Office, Sanming Yong-Wu Highway Company, Longyan Yong-Wu Highway Company
Summary of Environmental Assessment of Yong-Wu Highway

Continued: Key EAP factors

Environmental problem  Actions taken or to be taken  Implementing Responsible organization

3. Construction campsite

- Garbage can and sanitary disposal facility will be provided in construction camp sites, and will be cleaned up regularly.
- The drinking water will satisfy Chinese national drinking water Contractor 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 Contractor 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.

4. Noise

- 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.
Continued: Key EAP factors

- 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 watchdog 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.

6. Accident risk

- 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 commission completes the cultural relic confirmation.

7. Cultural relics

- 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).

8. Traffic and transportation

- A construction material transportation plan will be formulated to avoid transportation in rush hour, especially on existing roads.

- Fujian Provincial Expressway General Commanding Office, Sanming Yong-Wu Highway Company, Longyan Yong-Wu Highway Company
- Contractor, Sanming Municipal Cultural Relic Management Commission, Longyan Municipal Culture and Publishing Bureau
- Contractor, Fujian Provincial cultural Relics Administration, Sanming Yong-Wu Highway Company, Longyan Yong-Wu Highway Company
- Contractor, Fujian Provincial Expressway General Commanding Office, Sanming Yong-Wu Highway Company, Longyan Yong-Wu Highway Company
- Contractors
Summary of Environmental Assessment of Yong-Wu Highway

Continued: Key EAP factors

C. Operation

1. Hazardous cargo leakage risk

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

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

See Appendix II Environmental monitoring plan
### Appendix II: Environmental monitoring plan

<table>
<thead>
<tr>
<th>Environmental problem</th>
<th>Actions taken or to be taken</th>
<th>Implementing organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Environmental monitoring</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Construction stage
- **Monitoring item:** TSP, bituminous smoke
- **Monitoring frequency:** twice/month
- **Monitoring time:** 1 day
- **Monitoring point:** one unpaved construction road near residence and one concrete mixing stations near residence

#### Operation stage
- **Monitoring item:** NOx
- **Monitoring frequency:** twice/year (winter)
- **Monitoring time:** 2 days, continuous monitoring in 24 hours
- **Monitoring point:** Tangwei, Xizhaishang, and Shifang

#### Ambient air
1. **Ambient air monitoring**

#### Noise
2. **Noise monitoring**
   - **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.**
   - **Monitoring point:** Wangcun, Maopu, Jiqingtang, Lijiafang, Xibeig, Gushibei, Shizhencun, Laojunkeng, Liantangxia, Longxiongwu, Xizhaishang, Wolix, Longjing village, Xincun, Yanqian

#### Water quality
3. **Water quality monitoring**
   - **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

#### Water quality monitoring
   - **Monitoring item:** pH, petroleum, SS, permanganate index, BOD5
   - **Monitoring frequency:** once/month, 2 days for each time
   - **Monitoring time:** once in the morning and afternoon of each day
   - **Monitoring point:** sewage outlets of 4 service areas and 4 parking lots
### Appendix III: Environmental supervision plan

<table>
<thead>
<tr>
<th>Stage</th>
<th>Organization</th>
<th>Supervision contents</th>
<th>Supervision purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility study</td>
<td>China National Environmental Protection Agency Fujian</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>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></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 Fujian Provincial Environmental Protection Agency</td>
<td>1. To review preliminary design for simultaneousness” and the environmental protection and EAP environmental protection measures promised in EAP.</td>
<td>1. To strictly enforce “Three</td>
</tr>
<tr>
<td></td>
<td>World Bank</td>
<td>2. To make sure whether the environmental protection investment protection investment is available in full sum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>China National Environmental Protection Agency Fujian Provincial Environmental Protection Agency Prefectural, municipal and county</td>
<td>3. To inspect whether the locations of stock grounds, concrete mixing station, stabilizing soil mixing station and bituminous mixing station are reasonable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>World Bank</td>
<td>4. To reduce impacts on surrounding environmental pollution, to determine construction construction, to enforce relevant laws, regulations and standards of environmental protection</td>
<td>4. To inspect dust and noise environment caused by engineering protection time</td>
</tr>
</tbody>
</table>
Summary of Environmental Assessment of Yong-Wu Highway

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 contaminated
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

1. To inspect the implementation of
EAP (environmental action plan)
1. To finalize the environmental
during operation stage. requirements proposed in EAP.
2. To inspect the implementation of
2. To finalize the implement contents
environmental monitoring plan. of the environmental monitoring plan.
3. To inspect whether it is necessary
3. To protect the environment
to take further environmental conscientiously so as to minimize
protection measures (environmental the impacts on environment caused by
problems not estimated originally the project construction and operation.
may occur)

Fujian Provincial Environmental Protection Agency

China National Environmental Protection Agency

Fujian Provincial Environmental Protection Agency

Fujian Provincial Relics Administration
Fujian Provincial Environmental Protection Agency Prefectural, municipal and county environmental protection bureaus

4. To inspect whether the environmental quality of environmental sensitive locations meets their corresponding quality management, to protect people's life quality conscientiously.

5. To inspect whether the sewage discharge disposal of parking lot is up to meet standard requirement.

6. To guarantee drinking water source surface water is entered into drinking water source.

7. To strengthen supervision to prevent emergency accident, to eliminate accident-hidden danger.

To formulate in advance urgent accident handling plan so as to eliminate dangerous in time in case of accident and to ensure hypertoxic material is not leaked in the accident.
## Appendix IV: List of environmental protection investment

<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></td>
</tr>
<tr>
<td></td>
<td>Planting or reclaiming in earth</td>
<td>place</td>
<td>106</td>
<td>3.0</td>
<td>321</td>
<td>The size of greenbelt should be 40% of the total size</td>
</tr>
<tr>
<td>4</td>
<td>Water spraying, dust reduction, tarpaulin fence, and sewage treatment in construction campsite</td>
<td>year</td>
<td>4</td>
<td>60</td>
<td>240</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>Maping 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>32.1</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>Construction period Operation period</td>
<td>year</td>
<td>4</td>
<td>30</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Environmental monitoring cost</td>
<td>year</td>
<td>15</td>
<td>20</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Environmental supervision for construction</td>
<td>year</td>
<td>4</td>
<td>150</td>
<td>600</td>
<td>Not included into the environmental protection investment</td>
</tr>
<tr>
<td>14</td>
<td>Cultural relics protection</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>Reserved</td>
</tr>
<tr>
<td>15</td>
<td>Contingency</td>
<td>(1+2+3+4+5+7+8+9+10+11+12) *5%</td>
<td>960.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>21783.32</td>
<td></td>
</tr>
</tbody>
</table>
### Appendix V: Summary of public participation investigation

<table>
<thead>
<tr>
<th>Type</th>
<th>Person number</th>
<th>Percentage (%)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Do you agree with construction of this highway?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>427</td>
<td>99.8%</td>
<td>1 interviewee did not fill in this column, accounting for 0.2%</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Do not know</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Do you agree with the route scheme of this highway?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>421</td>
<td>98.4%</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Do not know</td>
<td>7</td>
<td>1.6%</td>
<td></td>
</tr>
<tr>
<td><strong>Is construction of this project beneficial to the economic development in this region?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>427</td>
<td>99.8%</td>
<td>1 interviewee did not fill in this column, accounting for 0.2%</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Do not know</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Construction of this project needs to acquire some farmlands, to remove some houses, do you have objection to this?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>398</td>
<td>93.0%</td>
<td>9 interviewees did not fill in this column, accounting for 1.2%</td>
</tr>
<tr>
<td>Yes</td>
<td>14</td>
<td>3.3%</td>
<td></td>
</tr>
<tr>
<td>Do not know</td>
<td>7</td>
<td>1.6%</td>
<td></td>
</tr>
<tr>
<td><strong>Do you understand the compensation policies on land acquisition, removal and resettlement?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>120</td>
<td>28.0%</td>
<td>7 interviewees did not fill in this column, accounting for 1.7%</td>
</tr>
<tr>
<td>Some</td>
<td>205</td>
<td>47.9%</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>96</td>
<td>22.4%</td>
<td></td>
</tr>
<tr>
<td><strong>Do you obey with land acquisition, removal and resettlement?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>259</td>
<td>60.5%</td>
<td>9 interviewees did not fill in this column, accounting for 2.1%</td>
</tr>
<tr>
<td>Conditionally</td>
<td>168</td>
<td>39.3%</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>Noise</td>
<td>351</td>
<td>82.0%</td>
<td></td>
</tr>
<tr>
<td><strong>What kind of relatively big impact do you think the project construction will exert on you?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automobile exhaust</td>
<td>77</td>
<td>18.0%</td>
<td>6 interviewees did not fill in this column, accounting for 2.1%</td>
</tr>
<tr>
<td>Dust</td>
<td>141</td>
<td>32.9%</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>73</td>
<td>17.1%</td>
<td></td>
</tr>
<tr>
<td>Road planting</td>
<td>342</td>
<td>80.0%</td>
<td></td>
</tr>
<tr>
<td>Sound barrier</td>
<td>129</td>
<td>30.1%</td>
<td></td>
</tr>
<tr>
<td>Far away from village</td>
<td>56</td>
<td>13.1%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>19</td>
<td>4.4%</td>
<td></td>
</tr>
</tbody>
</table>


Appendix VI: Environmental standard value values

Table 1  Ambient air assessment standards (excerpt)  unit: mg/m$^3$

<table>
<thead>
<tr>
<th>Assessment standards</th>
<th>NO$_2$</th>
<th>TSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Air Quality Standard (GB3095—1996) class 2 criteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily average</td>
<td>0.12</td>
<td>0.30</td>
</tr>
<tr>
<td>1 hour average</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>Maximum allowable discharge concentration of bituminous smoke mixing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(GB16297-1996) The Air Pollutant Comprehensive Discharge Standard</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 GB12523—90  Construction Boundary Noise Level Limit  unit: Leq(dB)

<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>Daytime: 75  Nighttime: 55</td>
</tr>
<tr>
<td>Piling</td>
<td>Various pile drivers</td>
<td>Daytime: 85  Nighttime: Forbidden</td>
</tr>
<tr>
<td>Structure</td>
<td>Concrete mixer, vibrator and electric saw, etc</td>
<td>Daytime: 70  Nighttime: 55</td>
</tr>
<tr>
<td>Decoration</td>
<td>Crane and elevator, etc</td>
<td>Daytime: 65  Nighttime: 55</td>
</tr>
</tbody>
</table>

Table 3 GB3096—93 Noise standard in urban district (excerpt)  equivalent sound level L$_{Aeq}$: dB

<table>
<thead>
<tr>
<th>Area</th>
<th>Applicable Standard</th>
<th>Standard Limit Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Quarters</td>
<td>Class II</td>
<td>Daytime: 60 dB</td>
<td>Daytime:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nighttime: 50 dB</td>
<td>6:00—22:00</td>
</tr>
<tr>
<td>Schools, Hospitals, etc</td>
<td>Class I</td>
<td>Daytime: 55 dB</td>
<td>Nighttime:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nighttime: 45 dB</td>
<td>22:00—6:00</td>
</tr>
</tbody>
</table>

Table 4 GHZB1—1999  Surface water quality standard (excerpt)  unit: mg/m$^3$

<table>
<thead>
<tr>
<th>Assessment standard</th>
<th>pH</th>
<th>Petroleum (mg/L)</th>
<th>SS (mg/L)</th>
<th>Permanganate index (mg/L)</th>
<th>B O D$_5$ (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Surface Water Environmental Quality Standard) (GB3838-2002) class III limits</td>
<td>6~9</td>
<td>≤0.05</td>
<td>150*</td>
<td>≤6</td>
<td>≤4</td>
</tr>
<tr>
<td>(Surface Water Environmental Quality Standard) (GB3838-2002) class IV limits</td>
<td>6~9</td>
<td>≤0.5</td>
<td>150*</td>
<td>≤10</td>
<td>≤6</td>
</tr>
<tr>
<td>Farmland Irrigation Water Quality Standard (GB5084-92) class I limits</td>
<td>5.5~8.5</td>
<td>≤1.0</td>
<td>≤150</td>
<td>—</td>
<td>≤80</td>
</tr>
<tr>
<td>Sewage Comprehensive Discharge Standard (GB8978-1996) class I limits</td>
<td>6~9</td>
<td>≤5</td>
<td>≤70</td>
<td>—</td>
<td>≤20</td>
</tr>
</tbody>
</table>
Appendix VII: List of relevant reports

(1) "Environmental Impact Assessment Report for Yong’an-Wuping Highway (Fujian-Guangdong border) of the Changchun-Shenzhen National Arterial Trunkway in Fujian Territory." Ministry of Communications Highway Research Institute, Mar. 2006;

(2) "Environmental Action Plan for Yong’an-Wuping Highway (Fujian-Guangdong border) of the Changchun-Shenzhen National Arterial Trunkway in Fujian Territory." Ministry of Communications Highway Research Institute, Mar. 2006;

(3) "Environmental Impact Assessment Summary for Yong’an-Wuping Highway (Fujian-Guangdong border) of the Changchun-Shenzhen National Arterial Trunkway in Fujian Territory." Ministry of Communications Highway Research Institute, Mar. 2006;

(4) "Resettlement Action Plan for Yong’an-Wuping Highway (Fujian-Guangdong border) of the Changchun-Shenzhen National Arterial Trunkway in Fujian Territory." Ministry of Communications Highway Research Institute, Feb. 2006;