

Environmental Assessment Report

Summary Environmental Impact Assessment
Project Number: 41122
May 2009

Georgia: Subregional Road Corridors Development Program

Prepared by Engconsult Ltd., Canada for Asian Development Bank.

The summary environmental impact assessment is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

CURRENCY EQUIVALENTS

(as of 22 May 2009)

Currency Unit	–	lari (GEL)
GEL1.00	=	\$0.6080
\$1.00	=	GEL1.644

ABBREVIATIONS

ADB	–	Asian Development Bank
°C	–	degree Celsius
dBA	–	decibel
EHSM	–	environmental, health, and safety manager
EIA	–	environmental impact assessment
EMP	–	environmental management plan
HIV/AIDS	–	human immunodeficiency virus/acquired immunodeficiency syndrome
hr	–	hour
km	–	kilometer
km ²	–	square kilometer
m	–	meter
MOEPNR	–	Ministry of Environmental Protection and Natural Resources
MFF	–	multitranches financing facility
PPTA	-	project preparatory technical assistance
RAMSAR	–	Ramsar Convention on Wetlands
SEIA	–	summary environmental impact assessment

NOTE

In this report, "\$" refers to US dollars.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

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I. INTRODUCTION

1. This summary environmental impact assessment (SEIA) was prepared as part of the Asian Development Bank (ADB) project preparatory technical assistance (PPTA) for the Ajara Bypass Roads Development Project in Georgia.¹ The PPTA is preparing a multitranche financing facility (MFF) for the proposed Subregional Road Corridors Development Program with the Ajara bypass road (more specifically, the Kobuleti bypass road) as a key component of an ensuing project. The Executing Agency for the Project is the Ministry of Regional Development and Infrastructure and the Implementing Agency is the Roads Department under the ministry. Financing for the Project will be provided in two tranches.

2. The PPTA is to (i) package the MFF; (ii) conduct a feasibility study and preliminary engineering design for the bypass roads to Batumi and Kobuleti on the Poti–Batumi–Sarpi Highway in Ajara Autonomous Republic, including engineering, economic, social, and environmental viability tests; and (iii) undertake a road sector and institutional analysis. The 81-kilometer (km) Poti–Batumi–Sarpi road along the western coast of Georgia is a key highway and international transit route in Georgia. It connects to the major Georgian Black Sea ports, i.e., Batumi and Poti, and several holiday resorts, particularly in Batumi and Kobuleti. Heavy traffic on the existing road has resulted in a significant increase in congestion and accidents, particularly in Batumi and Kobuleti, and especially during the tourist season. The Government plans to construct two bypass roads around Batumi and Kobuleti to address these problems, and requested ADB assistance to prepare and finance these two roads.

3. As part of MFF preparation, an environmental assessment and review framework was prepared to provide a basis for preparing the environmental impact assessment (EIA) for the Project to be financed by the first and second tranche, and any EIA or initial environment examination (IEE) for projects funded by subsequent tranches. The cumulative impact assessment for the entire MFF will be prepared during MFF processing and implementation. The EIA for the Project was prepared in accordance with ADB's *Environment Policy* (2002) and *Environmental Assessment Guidelines* (2003), as well as the *Law on Ecological Examination* (2007) and *Order No. 515 of the Minister of MOEPNR of Georgia on Approval of Rules on Conduction of Ecological Examination* (2008). The EIA is based on detailed field investigations; baseline environmental monitoring; review of proposed civil works; review of the 2005/06 prefeasibility study report; consultations with relevant stakeholders during the scoping study of the EIA; public consultation; and detailed review and analysis of available spatial databases for all environmental parameters in project areas such as terrain, soils, geology, rivers, forests, protected areas, land use, and population. The EIA was prepared with the active cooperation of the Roads Department, Ministry of Environmental Protection and Natural Resources (MOEPNR), and ADB's project team in Manila.

4. Based on consultation with MOEPNR and Roads Department staff, the consultant understands that an environmental impact permit is not required at this time as no construction activity will be carried out based on the outcome of this feasibility study. An environmental impact permit is required for the revised EIA report, which will be based on the detailed design.

¹ ADB. 2008. *Technical Assistance to Georgia for Preparing the Ajara Bypass Roads Development Project*. Manila.

II. DESCRIPTION OF THE PROJECT

5. The Project will construct 42 km of new roads and widen 6 km of existing roads along the Poti--Batumi--Sarpi road, bypassing Kobuleti and Batumi (map). The project road is located close to Ispani Mire (Kobuleti Protected Areas), identified by the Ramsar Convention on Wetlands (RAMSAR) as a wetland of international importance and an area protected by the International Union for Conservation of Nature. Construction of the project road will involve new construction and rehabilitation of bridges, culverts, and other associated drainage structures; tunnel construction; land acquisition and resettlement; site preparation; land clearing; disposal of gravel, soil, vegetation, and unstable material; construction of temporary access roads to construction sites; setting up of temporary construction camps to house workers; excavation and operation of borrow pits; operation of a boulder quarry; extraction of material for embankments using cut and fill procedures; protection of landslide, rockfall, and snowfall areas; measures to protect critical side-slopes; and extraction and cartage of sand for aggregate mixtures, cement works, and asphalt plants.

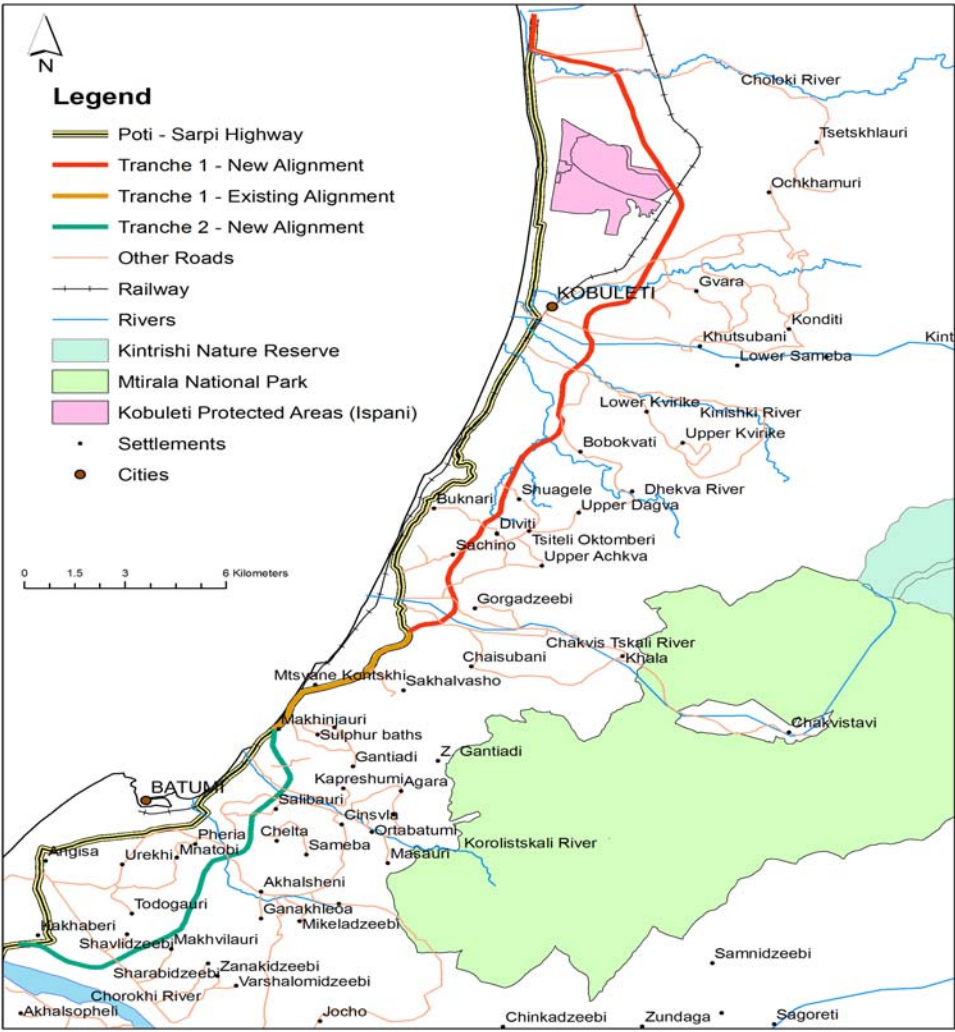


Figure 1: Location Map of Project

6. The first tranche will cover the first 34 km (km 0–34); the second tranche will finance the remaining 14 km (km 34–48). Work financed by the first tranche is expected to commence in May 2010, and work financed by the second tranche in July 2010. Each is forecast to require 3 years to complete.

III. DESCRIPTION OF THE ENVIRONMENT

7. **Topography.** The first 14 km of the project road passes through flat coastal plain with elevations ranging from 2 to 20 meters (m); the remaining 34 km passes through rolling and hilly terrain with elevations ranging from 20 to 250 m. The road passes through three hill ranges: Zeda Ackva hill range from km 20 to 26; Makhinjauri hill range from km 27 to 36; and Peria hill range from km 40 to 44. Five tunnels will be constructed along the ridges of these hill ranges (600 m tunnel from km 22.8 to 23.4 on Zeda Achkva ridge; three small 500 m tunnels from km 33.7 to 34.5 on small ridges in Makhinjauri; and a 700 m tunnel from km 41 to 41.7 on Peria ridge). The hilly sections, especially between km 27 and 36, are susceptible to soil erosion, landslides, and mudslides due to steep slopes, poor geological conditions, and higher sand content of surface soils—as noticed from the newly constructed 600 m tunnel on the existing road in this section.

8. **Soils.** Soils in the project area consist of laterite clay and loam, originating from intense weathering of volcanic rocks; and deposits of alluvial sediments. The coastal plain comprises mainly hydromorphic and alluvial soils due to abundant rainfall and the relief of the plain. Red soil predominates in hilly areas. The soils in the project area are classified into Haplic Nitisols. Surface soils are clay loam with a sand fraction of 45%, while subsurface soils are clay. Generally soils near the coastal and river alluvium consist of coarse sand with high infiltration capacity. In terms of vulnerability to soil erosion and slope stability issues, the project road can be divided into three zones: km 0–14, low vulnerability; km 14–20, medium vulnerability; and km 20–48, high vulnerability. Because of steep slopes, high sand content, good drainage, and an active geodynamic process, soils in hilly areas are susceptible to landslides. The Batumi area is within an exceptionally strained geodynamic area, hence landslides are more frequent.

9. **Climate.** The project area is located in a subtropical climate—humid with prolonged rains. Average summer temperatures range from 22 degrees Celsius ($^{\circ}\text{C}$) to 24°C in lowland areas and 17°C to 21°C in the highlands. Average winter temperatures range from 4°C to 6°C along the coast, while the interior areas and mountains average around minus 2°C .

10. Most precipitation in the project area is in the form of rain. Average annual precipitation in Batumi is 2,718 millimeters (mm). September is the wettest month, averaging 335 to 410 mm; May is the driest, averaging 92 mm. Batumi generally does not receive significant snow (accumulating snowfall of about 30 centimeters); 12 days of the year have snow cover. Average humidity ranges from 67% to 80%. Average wind speed is 15.8 km/hour (hr), reaching more than 20 km/hr during December–February with lower temperature. Winds are generally from the southwest. Average annual precipitation in Kobuleti is 2,320 mm; September is the wettest month and May the driest. Average wind speed is 11 km/hr, with a maximum of 14 km/hr during February. Wind is mostly from the southwest (30%) and northeast (23%).

11. **Geology.** The project area is located in the Ajara–Trialeti zone situated within the Meskheti, Shavshvebi, and Chakvi mountain rings. Middle Eocene-aged sediments are spread over this area. The lower part of middle Eocene is lithologically represented with tabular tuff, tuffo-gravel, argillite, and limestone. These sediments are mostly spread over the middle and upper part of the Kintrishi river and flanks of the Meskheti mountain ring, in the draw of the

Chorokhi river, and within the Chaisubani village territory. The upper part of middle Eocene is represented by a mass of fragmented volcanic breccias, tuff, and clinker stratum. In some places, andesite, basalt, tuffo-gravel, tuff, and marl can be found. Those sediments are mainly spread in the Ajara cauldron, flanks of the Chakvi and Shavshebi mountain ring, and draw of the Achara Wyali river. In the middle part of Chakvis Wyali, intrusive sediments of upper Eocene are lithologically represented by syenites and syenite-diorites. Geomorphologically, the northern part of the project area comprises the Kobuleti coastal plain crisscrossed by numerous streams; the southern part is characterized by hilly ranges with deep gorges.

12. **Seismicity.** The project area is located in a seismic intensity zone of Richter scale 7. The intensity of tectonic zones is calculated for 2% probability (expectation time 50 years) according to the Richter scale. On a modified Mercalli scale, the project area is in an earthquake intensity zone of IV (moderate intensity). The eastern part of the project area, in the eastern part of Kobuleti near Ozurgeti, is in a high earthquake intensity zone.

13. **Water Resources.** The project area has significant surface water resources. The project road crosses three major rivers (more than 15 km long), six medium-sized rivers (from 10 to 15 km long), and a several small streams and hillside drainage systems. The major rivers along the alignment are the Choloki (km 3.80), Kintrishi (km 15.00), and Chaqvistskali (km 26.10). The Chorokhi, the third largest river in Georgia, is located about 1 km away from the southern end of the project road. Discharges of all the rivers in the project areas were estimated for return periods of 10, 100, and 200 years.

14. The project area north of Kobuleti and south of Batumi is in low runoff areas of less than 1,000 mm. However the main project area is located in middle runoff areas, where annual runoff ranges from 1,000 to 2,000 mm. The eastern project area is mostly mountainous with high runoff zones. River water in the project area is extensively used for municipal drinking water supply, irrigation, industries, hydropower, fisheries, and construction. In addition, sand, gravel, and stones from these rivers are used extensively for construction.

15. Groundwater is the major source of drinking water. All towns and major villages in the project area have central water distribution systems, while smaller villages and isolated dwellings depend on private wells and springwater. Shallow aquifers of alluvial deposits are located near the major rivers and their floodlands. These aquifers generally comprise pebbles and sand with intermediate lenses of clay. Generally aquifers are in direct hydraulic interaction with the river waters and are excellent sources of drinking water. A well field comprising eight bore wells located along the Kintrishi riverbank at km 16 (on the upstream side) supplies water to the Kobuleti water supply system. In general, the water table is very shallow in flat and coastal areas with depth varying from 3 to 6 m.

16. **Quarries and Borrow Pits.** The quarries and borrow pits required for construction activities are located in several river sites. Two major quarry sites in the Chaqvistskali and Chorokhi rivers are located near the project road. The sand, gravel, and stones from these sites are suitable for road construction. Several stone-crushing plants are located on the banks of the Chorokhi River near Batumi. Material extraction from these sites is regulated and a permit for the Chorokhi site is issued to a local company with quantity restrictions; the Chaqvistskali site will require a permit from MOEPNR.

17. **Water Quality.** The quality of the water in all the rivers is generally very good, except for Choloki because of high turbidity (5.53 nephelometric turbidity units [NTU]) and low dissolved oxygen (1.8 milligrams per liter). All other rivers have turbidity of less than 0.65 NTU and

dissolved oxygen of more than 7 milligrams per liter. The rivers all have potable water with total dissolved solids ranging from 75 to 164 milligrams per liter. All the rivers are excellent sources of water for drinking and construction. No petroleum hydrocarbon or agriculture pollution was identified in the river water.

18. **Noise.** Noise was measured at three locations to assess background noise along the project alignment, noise along the existing road, and noise along the railway line. Background noise along the project alignment on new roads measures 30 decibel (dBA). Average hourly noise

25 m from the center of the existing road is 65 dBA. Noise 25 m from the railway line when loaded trains are moving is 77 dBA, and when empty trains are moving 73 dBA. The average hourly noise 25 m from the railway line is 58 dBA

19. **Air Quality.** Traffic, industries, and port operations are the major sources of air pollution in the project area. Until 1991, air quality monitoring in Georgia was carried out regularly and systematically in 11 cities, including Batumi. Dust, carbon monoxide, nitrogen dioxide, and sulfur dioxide were measured continuously three times a day. The most recent air quality monitoring data for Batumi is from 1995 to 2004, with the average yearly concentrations of dust, sulfur dioxide, and nitrogen dioxide slightly exceeding the norms. The highest dust concentration exceeded maximum permissible levels by 1.2 times. In more recent years of the data, the concentration of nitrogen dioxide increased substantially, while hydrogen sulfide pollution decreased.

20. **Ispani Mire.** Ispani Mire, a national protected area and RAMSAR wetland site (number 894), is located near the project road from km 6 to 12. The project road passes well beyond the safe buffer zone of the mire.² The mire, a part of the Kolkheti lowland system of wetlands, is included in the RAMSAR list because (i) Ispani II Mire is one of two percolation bogs discovered worldwide (another one is Imnati, which also occurs in the Kolkheti lowland, about 20 km north of Ispani II Mire); and (ii) vegetative cover of the Ispani I and Ispani II peatland complex contains relict plant communities (e.g. *Carex lasiocarpa*, *Molinia litoralis*), northern Palaearctic species (e.g., *Drosera rotundifolia*, *Sphagnum (S) imbricatum*, *S. palustre*, *S. papillosum*, *S. rubellum*, *S. auriculatum*), Kolkheti elements (e.g., *Rhododendron luteum*, *Rhododendron ponticum*, *Rhynchospora caucasica*, and *Vaccinium arctostaphyllum*), as well as species such as *Frangula alnus*, *Rubus spec.*, or *Alnus barbata* at the margin of the peatlands.

21. **Flora.** Natural vegetation of the project area comprises mostly grasses and bushes such as *Vaccinium artostaphyllum* and *Rhododendron luteum*. In hilly areas, the vegetation mostly includes board-leaved trees; the main species are *Fagus orientalis*, *Casatanea sativa*, *Carpinus caucasica*, *Quercus dachorocalis*, *Tilia caucasica*, *Acer platanoides*, *Pinus sosnovsky*, and *Picea orientalis*. The Ispani I and Ispani II peatland complex is also important because of its floristic composition. The peatland vegetation includes a high percentage of peat-moss (*Sphagnum*) species in the cover, and low density of vascular plant species. The existence of boreal (tundra and taiga) flora elements like *Drosera rotundifolia*, *Sphagnum imbricatum* (which is rather an unusual phenomenon for subtropical latitudes), as well as Colchic flora elements like *Rhododendron ponticum*, *R. luteum* is another feature of the uniqueness of these peatlands.

² The alignment agreed upon by the authority of the Kobuleti Protected Area runs with a 100-m distance from the buffer zone for a 500-m stretch in its narrowest gap and with a 500-m distance for a 1.5-km stretch.

22. **Fauna.** Despite its small size and proximity to an urbanized zone, the Ispani I and Ispani II peatland complex and its adjacent areas provide habitats to *Lutra lutra* (species of Georgian Red List), *Canis aureus*, *Felis silvestris*, *Myocastor coypus*, *Meles meles*, *Erinaceus concolor*, *Rattus norvegicus*, *Rattus rattus*, *Sorex volnuchini*, *Mus musculus*, *Myotis blythii*, and *Pipistrellus pipistrellus*. They also serve as a good refuge for migratory birds from Eurasia and Africa: *Circus cyaneus*, *Egretta garzetta*, *Merops apiaster*, *Lymnocyptes minimus*, *Falco vespertinus*, *Grus grus*, *Egretta alba*, and *Haliaeetus albicilla*. The area's small population of reptiles (herpetofauna) includes *Emys orbicularis*, *Elaphe longissima*, *Lacerta agilis*, *Lacerta media*, *Natrix tessellata*, and *Natrix natrix*. Amphibians include *Triturus vulgaris*, *Triturus cristatus*, *Rana ridibunda*, *Hyla arborea*, *Bufo viridis*, and *Bufo verucosissima*. Various habitats support large numbers of invertebrates.

23. **Fish, Fisheries, and Aquatic Biology.** The rivers in the project area are populated by a wide variety of fish. Major types in the Kintrishi and Chorokhi rivers, and the Black Sea are sturgeon (*Acipenser guldenstadi* Brandt); beluga; salmon; and grey mullet species including Mugil cephalus, ramada risoo, Mugil saliens risoo, and Mugil cephalus risso. Other prominent fish include barbell, bullhead, and herring. Fish species noted in the Ispani wetland system are *Siluris glanis*, *Leuciscus cephalus*, and *Cyprinus carpio*. No marine protected areas, mangroves, or coral reefs are located near the project area.

24. **Land Use.** The project area includes swamps, badlands, temporal dwellings, perennial plantations (e.g., tea, citrus), an industrial area, agricultural lands, arable lands, and forest. The road mostly passes through arable land comprising pastures, agricultural lands, and tea and citrus plantations. The locations of settlements are included on the map. Corn, the major agricultural product, is widely grown on all agricultural land. Vegetables are the second major product.

25. **Population.** Ajara has a population of 378,000 (2007 estimates). Its ethnic groups include Laz, Russians, Armenians, Greeks, and Abkhaz. The project area is within the administrative units of Kobuleti municipality, Batumi city, and Khelvachauri municipality. The project road passes through 16 villages and settlements, which fall under 10 *sacrebulos* (subdistrict administrations) and two *rayons* (districts).

26. **Economic Resources.** Tourism is the major industry in the project area; extensive resort infrastructure is located along the existing road in Batumi and Kobuleti. Other major industrial activities include an oil refinery; port; shipyard; and machine-building, zinc-plating, and furniture factories; as well as a range of light industries. In addition, several stone-crushing factories and an asphalt plant are located near Batumi. Industries and municipal infrastructure along the project road include an oil terminal, Kobuleti drinking water pumping station, and electrical substations. Agriculture, including tea and citrus plantations, is the major economic activity in the project area.

IV. ALTERNATIVES

27. During the prefeasibility study, three alignments were examined between the Cholokhi River and Sarpi to recommend an alignment for the Kobuleti and Batumi bypass roads. The present feasibility study reviewed the three alignments and made modifications to the prefeasibility-recommended alignment, considering environmental, engineering, and social issues. It also recommends a final alignment. The environmental, social, and engineering issues considered for assessing various alternate alignments are (i) location of Ispani Mire; (ii) cultural sites, such as cemeteries; (iii) land acquisition and resettlement; (vi) geological features such as

stability, landslides, and cut and fills; (vi) design standards of the Roads Department and other applicable international standards; and (vii) impact on infrastructure facilities such as the water pumping station of Kobuleti, substations, and industries along the corridor.

28. Alternatives for the Section from Kilometer 0 to 14. Various alignments were considered in this section to avoid impact on Ispani Mire. The prefeasibility alignment passes parallel to the 3.3 km long Ispani Mire (from km 2.4 to 5.7) through a narrow strip of land between a strip of residential development and a bund constraining the mire. The prefeasibility alignment is located very close to the mire (within 140–200 m) for about 1.6 km (from km 4.22 to 5.70). Road development on the narrow strip on the prefeasibility-recommended alignment will damage the peatland system and its hydrological integrity, and nullify all recent efforts to establish general awareness among the population of the natural value of the unique ecosystem of the mire. The feasibility study recommends an alternative alignment that passes to the eastern side of the mire and is well away from the safe buffer zone of the mire.

29. To meet the Project's design standards, two possible alternatives were studied for the starting point of the Project. One alignment leaves the existing Poti–Batumi road north of the Choloki River (immediately south of the amusement park), thus starting the project road in Juria province. It then crosses the Choloki on a new bridge and turns east toward the railway line. The alternative start is similar to the prefeasibility-preferred alignment and exits the existing road just south of the Choloki River using a modified trumpet interchange. The advantage of the second option is that it is about 0.5 km shorter and requires only an additional two-lane bridge over the Choloki River. The disadvantage is that the alignment is constrained within the first kilometer and is below the geometric standard for a high class road. The consultant recommends the first alignment starting south of the amusement park.

30. Alternatives for the Section from Kilometer 14 to 28. The main objective in assessing alternatives for this section is to avoid impact on the physical environment such as soil and geology; and existing infrastructure facilities such as the pumping station, substation, and cemetery. The proposed alignment generally follows the prefeasibility alignment except from km 14 to 17 and km 18 to 20. In the former case, the line is moved slightly eastward to avoid a chemical factory and then a water pumping area and associated substation. In the latter case, the line is moved to avoid a new cemetery, avoid going on top of an existing minor road, and allow sufficient height to pass over a new minor access road and bridge. At km 22, the prefeasibility alignment cuts through the Zeda Achkva ridge. A closer inspection of this section indicates that the cut would be deep in erodible material, require demolishing several houses, cut a significant access road, and require steep approach grades. The consultant proposes replacing this cut with a 400 m tunnel.

31. Alternatives for the Section from Kilometer 28 to 34. At km 28.5, the new alignment joins the recently reconstructed existing road and goes through an existing 600 m tunnel to descend to the old road at km 32. This section was constructed as a two-lane road, however, the tunnel is twin bore with a total of four lanes; earthworks have been mostly completed for four lanes. Significant slope protection will be required. This section of the alignment follows the existing Kobuleti–Batumi road parallel to the coast and the railway line, and is heavily developed. The road will require widening to four lanes plus adequate shoulders as this section will carry both through and local traffic. Acquisition will be required for about 10 buildings, part of a school frontage, and a hotel parking area. An alternative alignment moving east of the existing road from km 32 to 34 would encounter steep terrain and still be in residential built-up areas; therefore it is not recommended.

32. **Alternatives for the Section from Kilometer 34 to 48.** In the prefeasibility study, three alignments were examined for this section. The westernmost alignment encroaches on the Batumi Municipal Development Area and passes through some heavily built-up areas; even more built-up now than when the prefeasibility study was carried out. The advantage of this alignment is that it is 0.5 km shorter and passes through easier terrain, obviating the need for a tunnel. After inspecting other two alternatives,

33. The prefeasibility-recommended alignment first rises to cross the rail line, turns southeast through three short tunnels, and descends to the Chakvis Korolistskali River, crossing the river (km 36) and some commercial structures on a 600 m bridge. It then follows the slope of the land to descend to the Bartskhana River, also crossing this and the riverside commercial development on a 600 m bridge (km 39); both bridges are about 10 m above ground level, but will need long spans. The alignment then gradually rises, following the line of the Batumi Municipal Development Area to the west of Batumi, and runs along but outside the development plan margin. At km 40.5, the alignment crosses a 200 m bridge to enter a 700 m tunnel, and then descends to cross the Batumi–Alkhalsikhe road at km 44.5, with an interchange, to then turn west to join the Senaki–Poti–Sarpi road at km 48. This alignment ends at the existing bridge over the Chorokhi River.

34. The proposed third alignment follows the second alignment for the first 5 km and then proceeds further east, bypassing the developed area around the Bartskhana River and staying up to 2–3 km east of the Batumi Development Plan boundary. It also uses a 400 m tunnel, rejoining alignment two just before the Batumi–Alkhalsikhe road. This alignment is 0.5 km longer and an estimated 8% more expensive.

35. Both alignments two and three were inspected. Both have some new residential development. In addition, alignment three passes through a new cemetery close to Bartskhana River; this would be difficult to avoid without demolishing residential houses. Thus the prefeasibility advantages of alignment three appear to have disappeared. Therefore, except for a minor realignment at km 45 to avoid the cement factories and another minor alignment change in the vicinity of the tunnel to minimize demolition of houses, the consultant recommends an alignment close to the prefeasibility alignment two. The length of the tunnel will need to be increased to 700 m to reduce the tunnel grade to 3%.

36. **Do-Nothing Option.** The do-nothing or without-project option is not really an alternative since the objective of the Project is to construct bypass roads to divert traffic from already congested roads in Kobuleti and Batumi. Congestion and accidents on the existing road have increased significantly, especially during the summer tourist season. The without-project scenario will continue to increase the negative impacts generated by increased traffic loads on the existing road, which lacks adequate capacity (e.g., traffic jams, noise, low speed, higher emissions, accidents). With continuous growth of tourist and residential infrastructure, the existing road will continue to deteriorate affecting travel by local residents, tourists, and other transit road users.

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

37. Anticipated environmental impacts of the Project, on the basis of the EIA study, are broadly classified into three categories: preconstruction, construction, and operation.

(i) **Preconstruction.** Anticipated impacts include

- (a) pedestrian and high-speed traffic,
 - (b) land acquisition issues for new right-of-way areas, and
 - (c) compensation issues for other fixed assets from acquired right-of-way land.
- (ii) **Construction.** Environmental impacts could include
- (a) increased soil erosion, landslides, and/or siltation, including increased risks to downstream rivers and coastal resources as a result of cut and fill operations;
 - (b) impacts of clearing right-of-way, removing vegetation (trees and shrubs), and disposing of spoil;
 - (c) impacts of extracting and transporting construction material from existing quarry sites;
 - (d) impacts of temporary use of land immediately adjacent to the road for siting of contractor's yard, asphalt plant, and construction camps;
 - (e) reduced air quality and visibility (air quality impacts and/or noise pollution from construction activities, quarry sites, material storage sites, temporary diversion roads, excavations, vehicle and equipment use, and asphalt mixing plant);
 - (f) water pollution (water and soil pollution) at bridge rehabilitation sites from improper handling and disposal of wastes and materials;
 - (g) drainage from construction camps, material stockpiles, excavations, and quarry activities;
 - (h) interruption to smooth traffic flow, increased traffic congestion, and public safety problems; and
 - (i) social conflicts due to project activities.
- (iii) **Operation.** Possible environmental impacts include
- (a) increased traffic volume and related air, noise, and public safety concerns; and
 - (b) possible spills from the transport of hazardous cargo.

38. Perceived benefits from the Project include

- (i) reduction of traffic congestion on Kobuleti and Batumi and hence improved air and noise quality, and road safety;
- (ii) reduced soil erosion and landslides due to slope stabilization measures;
- (iii) improved access in the project area and resulting economic development;
- (iv) faster route for international traffic between Poti and Sarpi; and
- (v) improved access to tourist facilities.

39. Usually implementation of civil works does not have major or long-term impacts, but localized, short-term impacts can be addressed in detailed designs and through application of site-specific environmental management plans (EMPs). These construction-related impacts can be mitigated by (i) the contractors' work practices, especially those related to the storage of construction materials and cleanliness of work sites; (ii) cooperation of local authorities with the contractor for traffic management and use of public space and utilities; (iii) project management's strict enforcement of adequate construction practices and standards; and (iv) the incorporation of mitigation measures identified in the EIA. An environmental management and

monitoring plan (including cost estimates) was prepared to mitigate the negative environmental impacts of the Project (Appendix 1).

40. **Soils and Materials.** The project road is a new alignment with the first 22 km passing through high, fertile, arable agricultural land. The main impacts on the soil during construction will be from (i) loss of topsoil from construction sites; (ii) conversion of existing land uses such as agriculture and plantations to stockpiles of materials, and damage to temporarily acquired land; (iii) cut and fill operations; (iv) extraction of fill materials from the cut section and/or borrow pits; (v) soil erosion on mountainous slopes, side slopes, borrow pits, and uncompacted embankments; and siltation; and (vi) land contamination from hazardous and toxic chemicals and construction material spillage. In addition, site preparation activities generate spoils involving crop residue, grasses, trees, and earth.

41. Topsoil of cultivated land used for temporary work areas will be stripped off and stockpiled, to be replaced when construction is completed and the cultivated land rehabilitated. Contractors will be encouraged to minimize usage of productive agricultural land and convert it to its original state after completion of civil works. Embankments should be monitored during construction for signs of erosion; long-term material stockpiles will be covered to prevent wind erosion. A balanced cut and fill approach is designed for the Project. Deep cuts through Zeda Achkva ridge near km 22.8 and Makhinjauri ridges at km 34 will be avoided by constructing tunnels. Excess cut, if any, will be used to shape the embankment side slopes, strengthen the toe of the high slopes road bench, and fill the low-lying government lands for plantation in preapproved areas. Contractors will submit a spoil plan to the Roads Department for approval. The spoil plan should show the location of any borrow pits to be used, fill location for excess cut, and measures to rehabilitate these pits and cuts upon finalization of the Project. The spoils generated from the site preparation will be disposed of in these preapproved sites.

42. **Soil Erosion and Slope Stability Problems.** Construction activities in zones that are highly vulnerable for soil instability, especially in hilly areas, will intensify the effects of natural soil erosion unless precautionary measures are taken. In addition, construction activities will cause soil erosion due to cut and fill at different locations especially in hilly sections, and bridge and tunnel sites. The impacts of soil erosion and unstable side slopes are (i) increased runoff and sedimentation causing a greater flood hazard to downstream areas; (ii) loss of topsoil affecting the growth of vegetation resulting in ecological imbalances; (iii) destruction of the aquatic environment in nearby rivers, streams, and sea caused by erosion and/or deposition of sediment damaging the spawning grounds of fish; (iv) destruction of vegetation by burying or gullyng; and (v) development of unsightly cuts and fills that have been riddled by uncontrolled erosion and gullyng.

43. Soil erosion and landslides will be minimized by preventive measures incorporated in the engineering design, such as (i) constructing 12,250 m of retaining wall near the deep-cut sections, bridges, overpasses and tunnels; (ii) planting shrubs buffer strips and grass; (iii) ensuring appropriate compaction, rock lining, and slope walls near the proposed overpasses, tunnels, and existing tunnels; and (iv) constructing side ditches, berms, dikes, sediment basins, fiber mats, mulches, and drainage channels. Engineering design also considers cross-drainage and floodwater flows for road links on elevated fills that could obstruct natural drainage. Any cut and fill that results in a slope steeper than 45 degrees will need to be secured by a protective wall and protected by bioengineering methods. As a long-term mitigation measure, land degradation must be stopped. Maintaining a vegetative cover in mountain areas will reduce erosion through runoff, and land and mud slides. The EIA recommends planting trees and landscaping along the roads. The landscaping will beautify the

road and protect it from soil erosion. To reduce maintenance, the trees and bush species that naturally grow in the project area are recommended for plantations (*Juglans regia*, *Populus nigra*, *Quercus iberica*, *Crataegus kyrtostyla*, *Spiraea hypericifolia*, *Rosa canina*, *Jasminum fruticans*, *Corylus avellana*).

44. **Water.** The project road crosses nine major rivers and several small streams, and could affect the surface runoff flow pattern. All drainage works are designed based on historical flood data and flood forecasting. Design discharges for all the rivers are prepared for return periods of 50, 100, and 200 years. The design of drainage facilities considered soil protection measures in addition to water resources management. A design discharge for a return period of 50 years is considered for culverts and 100 years for bridges. The Project will construct 18 major bridges with lengths ranging from 12 to 600 m, and 7 small 12 m bridges. In terms of water quality, the Project will increase the silt load during construction at bridge sites. Embankments and construction materials (fill, sand, and gravel) are subject to washout with rainwater. Hydrocarbon leakage and spills could occur from storage and mixing plants, discharge of sewerage from work camps to water resources, or percolation through seepage and contamination of the local water table.

45. To mitigate this, (i) small drainage structures are proposed in the engineering design to divert water flow near the bridge sites, i.e., for road sections across streams, soil and stones will be disposed of properly so that they do not block the rivers and streams; (ii) open surfaces will be covered by grasses and creepers to reduce material that can be washed away; (iii) hydrocarbons will be stored in secure, impermeable, and bounded compounds away from surface waters; and all contaminated soil will be properly handled (as a minimum, these areas will be contained such that any spills can be immediately contained and cleaned up; any petroleum products used in the preparation of bitumen mixes must be carefully managed to avoid spills and contamination of the local water table; (iv) construction and work sites will be equipped with sanitary latrines that do not pollute surface waters, and contractors will submit a simple sewage management plan; (v) cofferdams, silt fences, sediment barriers, or other devices will be included in the design to prevent migration of silt during excavation and boring operations within streams (dewatering and cleaning of cofferdams will be performed to prevent siltation by pumping from cofferdams to a settling basin or a containment unit); (vi) discharge of sediment-laden construction water (e.g., from areas containing dredged spoil) directly into surface watercourses will be forbidden (sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge); and (vii) drainage systems will be periodically cleared to ensure adequate storm-water flow.

46. Water for construction activities is available from three rivers: the Choloki (km 3.80), Kintrishi (km 15.00), and Chaqvistskali (km 26.10). Water quality of these rivers is suitable for drinking and construction. Quarterly water quality monitoring will be undertaken during construction at each major bridge site to assess the impact of bridge construction on water quality and implementation of necessary mitigation measures.

47. **Air Quality.** During construction, air quality is likely to be degraded by exhaust emissions from the operation of construction machinery; fugitive emissions from asphalt plants; and dust generated from haul roads, unpaved roads, exposed soil, and material stock piles. The dust will settle on trees and crops, and may cause some degree of respiratory stress for nearby residents. To mitigate these, the following will be implemented: (i) Construction equipment will be maintained to a good standard and idling of engines will be discouraged. Machinery causing excessive pollution (e.g., visible smoke) will be banned from construction sites. (ii) The contractor will submit a dust suppression program prior to construction. The plan will detail

actions to be taken to minimize dust generation (e.g., spraying of roads with water, vegetation cover in borrow sites), and will identify equipment to be used. (iii) Construction materials will be stored away from residential areas and be properly covered. (iv) Asphalt plants will be located a minimum of 500 m away from settlements, according to government Decree # 234n (Ministry of Health and Social Welfare of Georgia, 6 Oct 2003), to avoid direct impact of emissions on local settlements. This decree also specifies that the concrete production plants are to be located more than 300 m and borrow sites more than 100 m from settlements. The construction and road machinery used during construction will comply with national environmental requirements for emission and noise pollution.

48. The project road is planned in a completely new alignment with only background concentration. During road operation, emission of particulates matter, hydrocarbon, carbon monoxide, nitrogen oxides, and sulfur dioxide from diesel and gasoline engines on the highway will increase. The air quality in tunnel sections will deteriorate. However, all tunnels will have limited access and prevent the entrance of pedestrians. The annual emissions along the project roads are estimated for 2010, 2014, 2025, and 2033 for both with- and without-project scenarios. Pollutant concentration along the bypass roads will be localized and not pose any threat to the population. Project implementation should reduce emissions along the existing road considerably.

49. **Noise and Vibration.** During construction, the main potential impact from noise on residential areas will be temporary: noise will emanate from maintenance workshops and the operation of earthmoving equipment. Operation of heavy machinery and rock-blasting activities can generate significant noise and vibrations. Health centers, schools, and prayer halls are sensitive receptors; and residential areas, in general, are the major receptors in the project corridor. Strong vibrations resulting from compaction equipment and rock blasting can damage nearby houses and other structures. To prevent noise and vibration, these operations will be restricted between 0600 to 2100 hours within 150 m of settlements and 500 m from sensitive receptors (hospitals and schools).

50. During operation, noise along the project roads will increase due to higher traffic volume. Noise along the project road is predicted using the Federal Highway Administration Traffic Noise Model (FHWA TNM 2.5). Noise quality data exceeds standards in the flat terrain. To mitigate noise pollution in residential areas, 341 m of noise barriers are incorporated in the project design from km 8 to 22.

51. **Quarry Sites.** Existing quarry sites in Chaqvistskali and Choroki rivers will be used to procure construction material. Generally quarry sites are major sources of environmental impact due to dust and noise pollution, loss of biodiversity, and generation of spills. The operating procedure for borrow pits will consider the following principles: (i) maximize the amount of fill that can be effectively used from the pit, (ii) minimize erosion and sedimentation, (iii) preserve water quality of the rivers, (iv) protect air quality during excavation, (v) prevent wildlife from falling into the pit, and (vi) reinstate the site after construction.

52. The mitigation plan to be followed by the contractor at the borrow sites includes (i) use only existing borrow areas approved by the environmental authority for the Project; (ii) ensure pit management (including restoration if it follows the completion of certain works) fully complies with all applicable environmental standards and specifications; (iii) conduct excavation and restoration of borrow areas and their surroundings in an environmentally sound manner to the satisfaction of MOEPNR and the Roads Department; and (iv) grade borrow pit areas to ensure drainage and visual uniformity or to create permanent tanks and/or dams. Additional borrow

pits, if necessary, will not be opened before restoration of areas no longer in use, and without the approval of MOEPNR. Topsoil from the opening of borrow pits will be saved and reused to revegetate the pits to the satisfaction of MOEPNR. At the gravel extraction sites (quarries), the proposed mitigation plan is to (i) use resources already being exploited to prevent proliferation of extraction sites, and make control and reinstatement more manageable; (ii) if new gravel extraction sites must be opened, conduct investigations to identify possible fossil deposits at a distance from active river beds; (iii) when extraction is approved from gravel bars along existing riverbanks on the inside margins of meander curves, do not remove gravel from within 2 m of the upper water level at the time of extraction (to protect the currently active river channel); and (iv) when extraction is in areas with less sensitive, shallower river flows, consider permitting removal of gravel to the level of the existing riverbed. The existing valley grade will be maintained and the operating area should be protected by a low 1–2 m gravel bank.

53. **Flora and Fauna.** Construction and operation of the Project will have only a minimal effect on existing flora and fauna. Flora degradation is expected to occur marginally as a result of road construction. The work will directly cause minor degradation of the local ecology through the clearance of areas of vegetation (ground cover) at major work sites and ancillary sites. During construction, a short-term impact on ecology along the road is likely to occur in and around the quarry sites, material stockpiling areas, and worksites due to vegetation clearance. A permanent but relatively minor impact on ecology is likely to occur due to the alignment of any unstable section. Vegetative cover stripped from these locations will be kept for landslide and slope protection. Contractors will be responsible for putting new vegetation in removal sites. Construction vehicles should use temporary roads constructed to minimize damage to agricultural land and local access roads. Where local roads are used, they will be repaired to their original condition after the completion of work. Compaction around trees will be performed carefully to avoid damage to the tree drip-line.

54. Potential impacts from construction worker camps include poaching of edible animals and birds in the locality, despite prohibitions. The contractors' environmental health and safety manager will be responsible for providing adequate knowledge to workers regarding the protection of fauna. Workers will be trained regarding nature protection and the need to avoid cutting down trees during construction. Contractors will be responsible for supplying appropriate fuel in the work camps to prevent fuelwood collection.

55. **Fish, Fisheries, and Aquatic Biology.** The main potential impacts on aquatic flora and fauna in the watercourses are increased suspended solids from earthworks erosion, bridge construction and quarry site operations, sanitary discharge from work camps, and hydrocarbon spills. The management plan proposed for impacts on water resources and quarry sites will also mitigate this problem.

56. **Protected Areas and Sensitive Environmental Receptors.** The only protected area located in the project area is Ispani Mire (para. 20). The consultant had discussions with the management authority about the boundaries of the nature reserve and the impact of the project road on the protected area. Based on the consultations, the management authority revised the boundaries of the protected areas to include buffer zones to avoid any development in the buffer zone. The project road does not pass through the buffer zone and will not have any impact on the protected area. During construction, measures will be taken to restrict encroachment into protected areas, such as (i) no construction camp will be located from km 6 to 14 in the protected area section of the road; (ii) asphalt and mixing plants will be set up outside the protected area section and transport the material to overlay the pavement in the protected section; (iii) solid waste will be strictly managed in the nature reserve, (iv) a roadside fence will

be built for the protected area section; and (v) road signs, an awareness display board, and bylaws will be developed to explain and deal with violations and encroachments.

57. **Social Impacts.** Road improvement under the Project requires considerable land acquisition and resettlement. A resettlement and compensation framework was prepared for the Project. Campsites for construction workers have significant impacts, such as health and safety hazards on local resources and infrastructure of nearby communities. This may lead to antagonism between residents and workers. To prevent such problems, the contractor will provide temporary worksite facilities such as health care, eating space, and praying places. In addition, a mechanism will be established to allow local residents to raise grievances arising from the construction process. The use of local labor during construction will increase benefits to the local community and resolve such conflicts. The construction sites may impact public health through the spread of malaria, HIV/AIDs, and other sexually transmitted diseases. Mitigation measures include creating a good environment at work sites and educating construction workers. Awareness campaigns for the education of road users on the importance of the culturally sensitive sites normally help with their preservation. Improved road signage and awareness display boards will be placed at sensitive religious sites: the cemetery and churches located along the project roads. These will alert construction workers and road users. During construction, extreme precautions will be taken to ensure that cemetery and sensitive religious places are protected and respected. Contractors should consult with local residents during civil works close to these sites.

VI. ECONOMIC ASSESSMENT

58. Environmental mitigation and monitoring costs for the project area estimated at \$6,364,875. The main environmental mitigation costs will be associated with activities, such as landslides, soil erosion, noise, rockfalls, stripping of topsoil, and plantation and ecosystem disturbance. The budget includes environmental management and monitoring during construction and operation. Capacity-building programs are proposed to strengthen the environmental monitoring capabilities of the implementing agencies. The environmental costs will be included in the economic analysis to estimate the economic internal rate of return. The economic assessment of the Project is under way.

59. The economic benefits of the Project are expected to include

- (i) reduced traffic loads on existing roads that lack sufficient capacity (e.g., traffic jams, noise, low speed, higher emissions, accidents);
- (ii) decreased vehicle operating cost and travel time costs due to improved road facilities, and shorter route between Poti and Sarpi;
- (iii) improved tourist infrastructure and facilities;
- (iv) improved air and noise quality in Kobuleti and Batumi as a result of fewer traffic jams due to construction of bypass roads;
- (v) reduced soil erosion and landslides due to slope stabilization measures;
- (vi) improved commercial activity in the project area resulting in economic uplift of the people of the project area; and
- (vii) improved access of rural residents to the markets in Kobuleti and Batumi

VII. ENVIRONMENTAL MANAGEMENT PLAN

60. An EMP was prepared to address all the anticipated impacts of the Project. Locations of the impacts, mitigation measures, costs, institute responsible, and monitoring measures are

listed (Appendix 1). The following institutes are responsible for implementing and monitoring the mitigation measures:

- (i) The Ministry of Regional Development and Infrastructure is responsible for planning, constructing, operating, and maintaining regional, national, and provincial infrastructure in Georgia; the Roads Department is responsible for overall management of roads. The Project Management Unit of the Roads Department will be in charge of project management to ensure that the contract provisions are properly maintained.
- (ii) The Roads Department and its regional authorities will undertake routine and random monitoring of specific EMPs addressed in this EIA.
- (iii) The supervision consultants under the Roads Department are responsible for environmental monitoring and management of project implementation, and for helping ensure implementation of environmental management practices at each stage of construction.
- (iv) MOEPNR will be consulted if complicated issues arise during construction and operation stages.

61. Implementation of mitigation measures presented in the EMP and monitoring plan during construction will be the responsibility of the contractor. The representative of the Roads Department and environmental specialists of the supervision consultants will supervise the monitoring of implementation of mitigation and monitoring measures during construction. The national environment specialist will coordinate with the international environment specialist to resolve complicated issues that arise in the field and provide continuously updated information for reports to be submitted to the Roads Department and ADB.

62. The Roads Department has limited experience, resources, and equipment for environmental, social, and resettlement management and monitoring. It will have difficulty efficiently supervising monitoring of the environmental and social safeguard parameters. National and regional officials of the Roads Department require environmental and social management training to increase their understanding of road-related environmental issues, implementation of mitigation measures, and subsequent monitoring and capacity building. Training for the officials is crucial for proper environmental, social, and resettlement monitoring addressed in the EIA. Environmental, social, and resettlement training will be provided to Roads Department officials (a small unit comprising one environment specialist and one land asset assessor exists in the Roads Department). In addition, the supervision consultants in association with the contractor's environmental, health, and safety manager will provide hands-on training for the contractor at the construction site. The objectives of this training program are (i) to help build the capacity and procedures of the Roads Department to undertake analyses of environmental, social, and resettlement impacts of road construction projects including incorporation of environmental, social, and resettlement factors in engineering design and preparation of environmental, social, and resettlement impact management plans in accordance with Government regulations and development partner guidelines; and (ii) to provide training on environmental, social, and resettlement management to the Roads Department and regional road maintenance offices.

63. A budget of approximately \$6,364,875 is allocated for implementing the environmental monitoring program and mitigation measures provided in the EIA. The proposed environmental mitigation cost is \$4,495,275; it is included as a civil works package. The environmental management budget under the Roads Department during construction and operation is \$832,000. In addition, a budget of \$119,800 is provided for a road safety campaign,

procurement of office equipment for the environmental and resettlement unit of the Roads Department, and environmental and social management training. The total budget is divided into \$4,508,000 for the first tranche and \$1,856,875 for the second tranche. The Roads Department will retain a recognized organization for environmental monitoring and ensure that the road is monitored regularly for the first 3 years of its operation.

64. During project implementation, the supervision consultants in cooperation with the Roads Department and MOEPNR will be required to

- (i) develop an environmental auditing protocol for use during construction, and formulate a detailed monitoring and management plan; and
- (ii) regularly supervise the environmental monitoring, and submit quarterly reports based on the monitoring data and laboratory analysis report.

The contractor will be responsible for subcontracting data collection of environmental monitoring to a recognized organization. The cost for this monitoring is included in the environmental mitigation budget.

65. The Roads Department will submit the following environmental reporting documentation to ADB:

- (i) **Baseline monitoring report.** The report, to be submitted to ADB prior to commencement of civil works, will include a detailed environmental management and monitoring plan (including data collection locations, parameters, and frequency), baseline environmental data, relevant standards, and data collection responsibilities.
- (ii) **Environmental monitoring reports.** The reports will include environmental mitigation measures and monitoring activities undertaken, details of monitoring data collected, analysis of monitoring results, recommended mitigation measures, environmental training conducted, and environmental regulatory violations. The environmental monitoring reports will be submitted to ADB quarterly during construction and quarterly for 3 years after completion of construction.
- (iii) **Project completion environmental monitoring report.** Three years after completion of construction, the Roads Department will submit a project completion environmental monitoring report to ADB summarizing the overall environmental impacts of the Project.

VIII. PUBLIC INVOLVEMENT AND DISCLOSURE

66. The EIA process included stakeholder and public participation and consultation to help the Roads Department achieve public acceptance of the Project. Two types of consultations were conducted: (i) stakeholder consultation and (ii) public consultation. Stakeholder consultations are performed mainly with selected individuals and organizations with professional national and provincial expertise in the EIA process. The stakeholder consultations were held in Tbilisi and Batumi in March and April 2009. The public consultations are conducted with various stakeholders including representatives of the affected community. The consultation involved a wide range of participants representing affected people, community leaders, civil society, nongovernment organizations, environment professionals, and central and regional government officials. The first public consultation was held in Batumi on 28 April 2009; the second is scheduled for 26 June 2009. The results of the first consultation were positive; participants considered that the bypass roads would bring significant economic benefits to the region and recommended taking cautious measures to preserve the protected nature reserve.

65. Stakeholder consultations conducted in Tbilisi and Batumi at the early stage of the PPTA involved professionals and government officials responsible for reviewing the EIA and taking decisions on construction and environmental impact permits. The objective was to share information about the Project and obtain feedback on important environmental components that would be considered in the EIA process. During the consultations, the consultant presented the scope of the EIA study, discussed potential environmental and social impacts, collected available secondary data and information on environmental parameters, identified the parameters for a baseline environmental monitoring survey, and discussed the regulatory requirements for environmental permits and public consultations.

66. The public consultation organized in Batumi on 28 April 2009 involved about 50 people mostly from project-affected areas. Key representatives of the affected communities discussed the project issues with the relevant specialists and government authorities, expressed their concerns for the environmental and social impacts in their community associated with the bypass roads, and recommended mitigation measures. The specialists obtained a better understanding of the environmental concerns of these communities and established contacts for collecting information relevant to the Project during implementation. The meetings were planned as open meetings and key informal representatives of the communities, nongovernment organizations, and provincial and rayon (district) officials were invited to attend.

67. Recommendations from the consultations are incorporated in the engineering design of the Project (e.g., construction of retaining structures and drainage structures, avoiding construction close to the Kobuleti nature reserve, and development of a proper compensation plan for the affected community). No major concerns were raised during these consultations except the issues for proper drainage, construction quality, proper engineering practices during construction, and transparency in construction work. The first public consultation was widely covered by the electronic and print media. Staff of the Ajara television station and newspaper interviewed the chairman of the Ajara Autonomous Region, Roads Department staff, and the consultant. Project details were broadcast during the day and prime time news schedule.

68. The EIA, in both English and Georgian, documenting the mitigation measures and consultation process will be made available for public review. The SEIA will be published on the ADB website and the full EIA will be available upon request from ADB as well as from the Roads Department. The affected residents and local communities expressed support for the Project during the consultations as they clearly see the benefits to the community as well as the region. Consultations and public disclosure of information should continue during project implementation through (i) preparing and disseminating a brochure in Georgian explaining the entitlements of those affected; and the procedures for obtaining compensation for temporary disturbances, trees, crops, and land for construction sites, and recording grievances; and (ii) setting up a formal grievance redress committee with representation from the affected people. The supervision consultant in association with the contractor will be responsible for managing the effective grievance redress program.

IX. CONCLUSIONS

69. The EIA identifies negative and positive impacts due to construction activities and normal operations of the bypass roads. Recommendations are made to mitigate expected negative environmental impacts with adequate funds provided to cover environmental monitoring and mitigation cost.

70. The major positive impacts of the Project will be less air pollution and dust, less congestion, improved traffic safety along the existing road, and better accessibility. Additional positive impacts are increased economic growth in the region, substantial income and employment opportunities, improved living conditions, reduced poverty, and better access to village produce.

71. Potential negative impacts are road safety, landslides, soil erosion, rockfalls, increased air emission and noise, dumping of construction spoils into the rivers and unauthorized sites, impacts on quarries and borrow sites, impacts on the habitats of the nature reserve, and significant land acquisition.

72. Road safety will be improved by stabilizing unstable batters and installing road safety barriers including proper traffic engineering signs and display boards. Soil erosion and rockfalls will be minimized after project completion. Landslides, critical side slopes, and unstable batters will be protected by retaining structures and rockfall fences. The contractor will prepare a spoil management plan and submit it to the Roads Department for approval. Quarries and borrow materials will be collected from the preapproved sites and be properly restored after the extraction of materials. The bypass road has been realigned to a safe distance from the buffer zone to avoid any potential disturbances to the habitats of the nature reserve. In addition, strict measures are recommended in the EMP to restrict encroachment on the nature reserve. A land acquisition and resettlement framework is being developed to compensate the affected population.

73. The environmental management and monitoring program developed for both temporary and permanent works covers preconstruction, construction, and operation stages with an estimated cost of \$6,364,875. Implementation of an appropriate EMP and mitigation measures during various phases will minimize the negative impacts of the Project to acceptable levels. To ensure that these plans and mitigation measures are implemented and negative impacts avoided, the EMP will be included in the contract documents of the Project with a separate line item for environmental management in the bills of quantities. The residual impact on the environment will be minor and in some cases positive where erosion has been active along the existing tunnel portal and henceforth will be controlled. The cost of the retaining structure and other protective measures for slope stability is included in the engineering design.

74. Environmental and social management training of Roads Department officials at different stages in the project cycle is required to enable them to carry out environmental, social, and resettlement monitoring and implementation of the EMP. Environmental, social, and resettlement training will require the input of 2 person-months of international and 4 person-months of national specialists with an estimated cost of about \$69,800.

75. The Project will have overall beneficial impact as well as some negative impacts that will be carefully monitored and adequately mitigated. Therefore, the completion of this EIA fully meets ADB requirements and no further environmental study is required for this Project. However, an updated EIA and EMP will be produced based on the detailed engineering design, and cover the impacts of temporary work activities during the detailed design stage in early 2010. An environmental impact permit must be obtained at that time to comply with MOENPR guidelines.

ENVIRONMENTAL MANAGEMENT PLAN DURING PRECONSTRUCTION, CONSTRUCTION, AND OPERATION

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
Preconstruction Phase				
Pedestrian	Exposed to high-speed motorized traffic	<p>Consideration is made in the engineering design to provide paved full-width shoulder (1.5 m on both sides) for pedestrians and roadside lay-bys for marketing local produce. Where space permits, either a part of the roadway or a separate surface from the edge of the roadbed is considered, especially in the region where road is passing through settlements, schools, and markets. Special provisions are made in bridge designs.</p> <p>The bypass roads will attract more traffic after their completion. To help reduce the risk of serious accidents, speed control signs and other visual means will be considered at the entrance and through the urban zones of towns and settlements along the road. Reduced speed will help improve safety and reduce noise, particularly in the evening.</p>		Roads Department, design consultants
Compensation for temporary and mobile stores and plants	Social instability	The social development specialist prepared a compensation policy and guidelines. This is being defined in the land acquisition and resettlement framework, outlining who is entitled to compensation, what will be the compensation mechanisms, how much compensation will be paid according to the type of damage (e.g., a fruit growing tree will be compensated three harvest equivalents). In the approaches to towns and villages and the road through them, mobile vendors who sell items on the ground or from makeshift stands at the edge of the pavement will be encouraged to conduct their business at new strengthened shoulders.		Roads Department, resettlement expert
Construction Phase				
Natural Environment				
Soil and Material				
Topsoil	Loss of fertility of arable land	The first 22 km of the project road passes through highly fertile land suitable for agriculture. Retain the topsoil (about 15 centimeters) and use it to refill after excavation to minimize the impact on productive land.	198,000	Roads Department, contractor
Soil erosion	High suspended solid contents of river,	On hill slopes and other potentially erodible places, from km 23 to 35 along the roadside, plant appropriate vegetation that retards erosion. About 80,000 square meters of slopes will be planted with vegetation to	100,000	Roads Department, contractor

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
	sedimentation, drainage failure, inundation of farmland, and mud flows	<p>deter landslides and soil erosion.</p> <p>On sections with filling and cutting, protect the slopes by ensuring mild slopes and planting with appropriate vegetation.</p> <p>Provide drain channels on both sides of the project road.</p> <p>In the design, consider erosion: slope and pier protection with retaining structures.</p> <p>Undertake construction activities in hilly areas only during the dry season.</p>		
Spoils	Spoil dumping: if improperly designed will result in loss of agricultural land and impaired view	<p>Site preparation activities generate substantial spoils. The contractor will prepare a spoil plan, which should show the location of any borrow pits to be used, fill location for excess cut, and measures to be taken to rehabilitate these pits and cuts upon finalization of the Project. The Roads Department will approve and monitor this plan.</p> <p>A balanced cut and fill will be designed. However, excess cut, if any, will be used to shape the embankment side slopes, strengthening the toe of the high slopes road bench, and filling up the preapproved sites.</p>	Included in civil works	MOEPNR, contractor
Slope Stability	Landslides	Construct 12,250 cubic meters of retaining wall for slope stabilization; 190 m of rockfall protection measures are proposed in the engineering design.	3,675,000	Roads Department, contractor
	Hill cutting	Prevent rockfalls and landslides resulting from improper hill cutting by cutting slopes at only 45° with appropriately spaced branches. Secure any cut and fill that results in slopes steeper than 45° with a protective wall using bioengineering methods.		
	Restoration of slopes	Restore and maintain existing vegetation and slopes in the 20 km hilly section. Remove vegetation and cut trees judiciously; limit to the minimum possible extent. Provide vegetative cover by planting grass and creepers for landslide sections. The long-term solution for landslides will be to maintain uphill vegetation cover, and appropriate agricultural activities in the steep banks with diversification of crops and cropping techniques.	49,000	
Degradation of	Loss of topsoil	No new borrow areas will be developed under this Project. Use existing	Included	Roads Department,

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
borrow areas	and disfigurement of landscape	borrow areas of Chaqvistskali River (km 26.10) and Chorokhi River (km 48). Redevelop borrow pits and quarries as per standard procedure. In all the borrow pits and quarries, vegetation is sparse. Rehabilitate quarries and borrow sites immediately after excavation to prevent soil erosion. Redevelopment will include <ul style="list-style-type: none"> o focusing on slopes to minimize erosion; o replacing stockpiled soil cover; and o replanting grass, shrubs, and trees. 	in civil works	contractor
Operation of quarry sites on riverbanks	Sedimentation and siltation downstream and riverbank destruction Changing the river pattern will have a beneficial impact on the flow regime of rivers	Do not permit work on sites with fine sediments. Limit the depth of excavation in rivers. Identify riverbeds with excessive sediment, and limit the excavation to ideal section and depth of the river. Secure permit to quarry prior to start of construction. Locate quarry site away from drinking water intakes and tributaries used by the community for domestic purposes. Impose limits on depth and area of extraction to prevent disturbance of loose materials that may trigger siltation. Since one of the major problems in the area is flooding, excavation should be done in such a way that the flow of rivers is improved.	Included in civil works	Roads Department, Contractor
Construction of bridges and/or drainage structures in streams and rivers	Flood, inundation, mudflow, pollution, and adverse effects on runoff flow pattern	Design discharge of 50-year return period is considered for culverts, 100 years for bridges to prevent flooding. Side drainage structures will be incorporated in designs to divert the stream water at construction sites. In sections along rivers and streams, properly dispose of earth and stones so that they do not block rivers and streams, resulting in any adverse impact on water quality and flow regime. Take all necessary measures to prevent earthworks and stone works	Included in civil works	Roads Department, contractor

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
		<p>related to the road from impeding cross-drainage at rivers, streams, canals, or existing irrigation and drainage systems.</p> <p>Side-borrow sites will be used as drainage ditches and designed so that they drain into the nearest watercourse. But at a slope (e.g., <5%) permitting fine suspended materials to settle.</p> <p>Roadside drainage system will be established for the entire length of the project road by paying special attention to integration with any agricultural irrigation system, adjacent to the right-of-way.</p>		
	Obstruction to water flow	<p>Stream crossings that are dry during the work period will be kept unobstructed at all times; the channels will not be altered.</p> <p>Bridge rehabilitation will be scheduled in the dry season to avoid adverse impacts on the river water quality.</p>		
Siltation	Adverse effects on channel stability	<p>Increase coverage of open surface area by planting grass and creepers so that washing away of materials from sloped surfaces is reduced to a significant extent.</p> <p>Store construction materials containing fine particles, e.g. limestone or laterite, in an enclosure so that sediment-laden water does not drain into nearby watercourses, but rather percolates slowly into the soil.</p> <p>Discharge sediment-laden construction water into settling lagoons or tanks prior to final discharge.</p>	100,000	Roads Department, contractor
	Damage to river bank	<p>For river bank protection, install gabion baskets.</p> <p>Include cofferdams, silt fences, sediment barriers, and similar mechanisms in the design to prevent siltation at the bridge construction sites.</p>		
Spills from bitumen plants	Contamination of water table or surface drainage	<p>During road rehabilitation the most severe water quality impact could come from spilled bitumen or petroleum products used to thin the bitumen. Bitumen is stored in drums which may leak or are often punctured during handling after long periods (> 6 months in the elements) of storage. Bitumen will not be allowed to enter either running or dry streambeds and will not be disposed of in ditches or small waste</p>	5,000	Roads Department, contractor

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
Air, Noise, and Vibration				
Emissions from construction vehicles and equipment	Health hazard to workers and residents living close by	<p>disposal sites prepared by the contractor. Bitumen storage and mixing areas must be protected against spills and all contaminated soil must be properly handled according to MOEPNR standards. At a minimum, these areas must be contained, such that any spills can be immediately contained and cleaned up. Prior to initiating the work, the contractor will meet with the Roads Department to determine the proper siting of the mixing areas and the handling and management of such spills. Any petroleum products used in the preparation of the bitumen mixture must also be carefully managed to avoid spills and contamination of the local water table.</p> <p>Regularly maintain vehicles and machinery used for construction. Discourage idling of engines.</p> <p>Ensure that each vehicle related to the construction has a valid "emission permit for motor vehicle" during construction.</p> <p>Avoid vehicular traffic through communities as much as possible. Keep vehicle speeds low if they pass through communities.</p> <p>Ban machinery causing excessive pollution (e.g., visible smoke) from construction sites.</p> <p>Store construction materials away from residential areas and ensure they are properly covered.</p>	Included in civil works	Roads Department, contractor
Asphalt and mixing plant	<p>Noise, dust</p> <p>Harmful impacts on surface and groundwater</p> <p>Impacts on biological environment (plants)</p>	<p>In accordance with Decree number 154 "On the Procedure and Terms for Issuance of the Environmental Impact Permit" as amended on 3 February 2006 (Section 3. "List of activities subject to EIA", paragraph 1-D), the contractor will prepare and submit an EIA for the asphalt plant. The EIA will contain a full scope impact assessment and management planning (including air emissions, wastewater discharge, and full range of an EMP, such as spill contingency management, pollution prevention management, and waste management).</p> <p>The contractor will obtain a valid operating license for the asphalt plant; and submit a layout plan of the site of the mixing plant and a statement</p>	Included in civil works	Roads Department, contractor

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
		on handling bitumen spills, prior to the commencement of works.		
		At the site, the contractor will take appropriate provisions to assure that bitumen may not enter into streambeds, rivers, or lakes; and that it will not be disposed of in ditches or any waste disposal site. The bitumen storage and mixing area must be effectively protected against spills. Contaminated soil will be handled according to MOEPNR requirements or other acceptable standards. As a minimum, these areas must be contained to allow immediate collection and cleanup. All petroleum products will be carefully managed to avoid spills and contamination of local groundwater table.		
Dust/Odor	Air pollution	Water will be sprayed during the construction phase in all mixing areas where dry materials are handled and/or crushed. Temporary access roads to aggregate sites must be included in the dust suppression program. The contractor will prepare a spraying that will serve as the basis of a dust control program. The project authorities will regularly monitor this schedule.	91,250	Roads Department, contractor
		Cover vehicles delivering materials to and from the construction sites to reduce spills. Asphalt application will be heated liquid bitumen sprayed onto an aggregate base. Bitumen preparation sites will be noisy, with some odor and a considerable risk of fire. Therefore, all bitumen preparation and loading sites must be over 1 km downwind from any community development. The contractor must have spill and fire protection equipment available to rapidly deal with any accidents.		
		Equip mixing and crushing plants and operations with dust suppression devices such as water sprays. Operators will wear dust masks and ear protection.		
Dust and noise from borrow pits	Noise, dust	Ensure noise control measures to comply with government standards. Water earth roads close to the settlements; use covered trucks. Secure appropriate environmental permits.	Included in civil works	Roads Department, contractor

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
		Control access to borrow and material dumping sites to prevent unauthorized entry of people, grazing cattle, and any other stray animals.		
		Provide protective gear like ear plugs to operating personnel if they are exposed to noise beyond threshold limits.		
Noise from construction activities	Noise pollution to the settlements	Strictly enforce noise standards at aggregate crushing plants and bitumen preparation sites to prevent noncompliance with Georgian standards for traffic noise control (as controlled by decree of minister for health, labor and social affairs (297n of 16 August 2001) on the approval of environmental quality standards. Enhance maintenance of machinery and vehicles to minimize noise.	Included in civil works	Roads Department, contractor
		To reduce nighttime noise, stop construction from 21:00 to 06:00 when construction is taking place at <500 m from villages along both sides, and the road passes within 15 m of sensitive areas such as health centers.		
Noise Barriers	Noise pollution near settlements	Design and construct noise barriers for 341 m near Ozurgeti and Kobuleti, where the predicted noise exceeds the Georgian national standards.	213,125	Roads Department, contractor
Tunnel				
Illumination	Traffic safety	Design and install tunnel illumination (lighting) along the tunnel side walls at about 10 m intervals.	Included in civil works	Roads Department, contractor
		Illumination is generally required for tunnels longer than 50 m. The detail of lightings required will be determined during the detailed design stage but the magnitude of illumination required in this preliminary design has been estimated from past experience.		
Emergency Facilities	Traffic safety	Design emergency facilities in accordance with the length and gradient of the tunnel and volume of traffic.	Included in civil works	Roads Department, contractor
Quarry and Borrow Sites				
Pollution	Dust and noise	The mitigation plan to be followed by the contractor at the borrow sites includes the following:	Included in civil	Roads Department, contractor

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$) works	Responsible Institute
		<ul style="list-style-type: none"> • Only existing borrow areas approved by the environmental authority will be used for the Project. • Pit management, (including restoration if it will follow the completion of certain works) will be in full compliance with all applicable environmental standards and specifications. • The excavation and restoration of borrow areas and their surroundings, will be conducted in an environmentally sound manner to the satisfaction of MOEPNR and the Roads Department. • Borrow pit areas will be graded to ensure drainage and visual uniformity or to create permanent tanks/dams. Additional borrow pits, if necessary, will not be opened without the restoration of those areas no longer in use, and without the approval of MOEPNR. • Topsoil from the opening of borrow pits will be saved and reused to revegetate the pits to the satisfaction of MOEPNR. 		
Gravel extraction		<p>At the gravel extraction sites, the proposed mitigation plan includes the following:</p> <ul style="list-style-type: none"> • Use resources already being exploited to prevent proliferation of extraction sites, and make control and reinstatement more manageable. • If new gravel extraction sites must be opened, investigations must be conducted to identify possible fossil deposits at a distance from active riverbeds. • Extraction within these areas should first ensure that all reusable surface materials are stockpiled for subsequent restoration purposes. 	Included in civil works	Roads Department, contractor

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
		<ul style="list-style-type: none"> The boundary of the extraction area should be clearly defined and, on the river side, a reserve bank should be maintained. When extraction is approved from gravel bars within the existing riverbanks on the inside margins of meander curves, no gravel should be removed from within 2 meters of the upper water level at the time of extraction in order to protect the currently active river channel. When extraction is in areas with less sensitive, shallower river flows, removing gravel to the level of the existing riverbed may be permitted. The existing valley grade would be maintained and the operations area should be protected by a low 1 to 2 meter-wide gravel bank. Crushing plants are to be installed with scrubbers and filters to cleanse the dust in crushing plant. 		
Flora	Minor vegetation loss	Prepare a tree-cutting and replanting scheme within the first 4 months of the start of civil works. Provide appropriate training to the workers and include penalties for the contractor for cutting firewood that is not in compliance with the provision for heating and cooking fuel in work camps.	100,000	Roads Department, contractor and nongovernment organization
	Loss of trees	<p>Ensure construction vehicles operate within the corridor of impact, i.e., approximately 10 m to either side of the carriageway centerline, to avoid damaging soil and vegetation. Avoiding soil compaction around trees is very important. Generally the rule will be to avoid driving heavy equipment or trucks anywhere into the drip-line of a tree (defined as an imaginary line around a tree where rainwater falls freely to the ground unimpeded by the tree's foliage).</p> <p>Do not remove any trees without prior approval of the Roads Department.</p> <p>The contractor will not use or permit the use of wood as a fuel for the execution of any part of the works, including the heating of bitumen and</p>	Included in civil works	Roads Department, contractor's environmental, health, and safety manager (EHSM)

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
		bitumen mixtures, and to the extent practicable will ensure that fuels other than wood are used for cooking, and space and water heating in all camps and living accommodations.		
Roadside Fence	Disturbances to nature reserve habitats	Recommend roadside fencing along the 8 km stretch of the Kabuleti Nature Reserve. Implement strict solid waste management during construction.	16,000	Roads Department, contractor, Kobuleti Protected Area management
Fauna	Impact on fauna	<p>Do not locate any work camps near Ispani Mire.</p> <p>Provide adequate knowledge to workers on the protection of fauna.</p> <p>Retain vegetative cover stripped from the construction locations for landslide and slope protection.</p> <p>Perform compaction around trees carefully to avoid damage of tree drip-lines.</p>	Included in civil works	Roads Department, contractor
Fish, Fisheries, and Aquatic Biology	Impact on fauna	<p>Schedule bridge construction to avoid adverse impacts on fishery and aquatic biology.</p> <p>Do not allow construction of bridge substructures (foundations) during the spawning period in the Black Sea. Officers of these construction vessels should exercise the utmost care in avoiding collisions and other accidents that could lead to accidental spills and cause water pollution.</p> <p>The Roads Department will prepare a spill contingency plan to avoid clogging drainage systems with grass, shrubs, and earth due to storm-water flow.</p>	Included in civil works	
Protected Areas and Sensitive Receptors	Impact on nature reserve	<p>Do not locate any construction camps from km 6 to 14 in the protected area section of the bypass road.</p> <p>Set up asphalt and mixing plants outside the protected area section and transport the material to lay the pavement in the protected section.</p> <p>Implement strict solid waste management close to the nature reserve.</p>	Included in civil works	

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
		<p>Place improved road sign and awareness display boards including existing laws for violation in the protected area section to alert road users.</p> <p>Consider providing improved roadside fencing for the protected areas when developing the environmental mitigation cost.</p>		
Socioeconomic Environment				
Local Road	Loss of access and damage to local road	Maintain all existing roads in traffic-worthy condition and ensure uninterrupted movement of traffic.	Included in civil works	Roads Department, contractor
	Loss of access to the main road	<p>Divert traffic to ensure safe and smooth traffic movement.</p> <p>Properly maintain access to all roadside properties.</p> <p>Construct and maintain temporary bypasses (including dust control) during construction, particularly at bridge crossings.</p>		
		Form a grievance redress committee in association with the affected population before starting the civil works and give the community advance notice of the construction schedule.		
		Repair damaged local roads to their original condition after project completion.		
	Construction of access roads	If new access roads to the project alignment are necessary, place these through agricultural land. Route these temporary roads along existing farm tracks to avoid losses to agricultural lands. Require contractors to present the proposed construction and hauling schedule for approval before construction commences. In unavoidable circumstances, pay suitable compensation to people whose land will be temporarily acquired for the duration of the operations. The compensation will cover loss of income for the duration of acquisition and land restoration.		
Road Safety	Road accidents	Provide traffic control facilities, such as, roadside concrete barriers, sidewalks, road signs, and street lights.	Included in civil works	Roads Department, contractor

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
		<p>Provide safe pedestrian facilities, e.g., shoulders, foot paths, and bus bays.</p> <p>During construction, the contractor is responsible for ensuring that all construction vehicles observe speed limits for construction sites and public roads; and for providing adequate signage, barriers, and flag persons for traffic control.</p> <p>Fit all vehicles with audible warning devices when reversing.</p>		
Compensation for Land Use and Trees	Social instability and deforestation	The Roads Department is preparing a policy guideline and compensation plan based on the outcome of the project preparatory technical assistance. This is being defined in the compensation and resettlement framework outlining who is entitled to compensation, what will be the compensation mechanisms, and how much compensation will be paid according to the type of damages. In the approaches to villages and settlements, road side vendors will be advised in advance of the construction schedule.		Roads Department, contractor
Construction Camps	Contamination from solid waste	<p>Reuse, recycle, and properly dispose of all construction materials. Remove all worn-out parts, equipment, and empty containers from the site to a proper storage location designated by the Roads Department.</p> <p>Collect solid waste and garbage in bins; dispose of it daily, according to a brief and basic waste management plan prepared by the contractor and approved by the Roads Department, prior to commencement of civil works.</p>		Roads Department, contractor's EHSM
	Sewerage in contractor's yard and construction camps	<p>The contractors will not establish site-specific landfills. All solid waste will be collected and removed from the work camps and disposed of in local waste disposal sites.</p> <p>Carry out primary treatment of sewage if needed by larger camps.</p> <p>Prior to initiating work, the contractor will present a simple sewage management plan to the Roads Department for approval.</p> <p>Discharge sewage into soak pits or municipal sewers when possible;</p>		Roads Department, contractor's EHSM

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
		locate construction camps away from rivers.		
		Provide a septic tank at each construction campsite and construction field.		
		Do not stock construction materials, including chemicals such as oils and paintings, near streams and wells for drinking water. Cover construction materials with enough tarpaulin and assign a specific individual to ensure this. Protect these materials so that they do not enter water bodies with rainwater.		
		During construction near rivers, build a temporary retaining wall along the river to prevent river, water canal, or irrigation and drainage systems from being blocked by soil and stones.		
		The formation of standing water on construction sites often leads to the spread of insect-borne diseases such as malaria. Therefore the contractor must develop a vigorous program to avoid such standing water; including removing old materials such as used tires and storage drums.		
	Contamination from harmful and toxic chemicals (paints, fuel and lubricants, oils, and explosives).	Store hydrocarbons, toxic materials, and explosives in designated sites. Confine vehicle maintenance and refueling to areas in construction sites designed to contain spilled lubricants and fuels. Dispose of spill waste to approved disposal sites, according to MOEPNR requirements.	5,000	Roads Department, contractor's EHSM
		Take adequate precautions to prevent oil, lubricant, and hydrocarbon contamination of channel beds. Clear any spillage immediately with utmost caution to leave no traces.		
		Quarantine all areas intended for storage of hazardous materials; provide adequate facilities to combat emergency situations complying all the applicable statutory stipulations.		
		Ensure the personnel in-charge of these sites are properly trained and control access to these areas, allowing entry only with authorization.		
Community	Stresses in the	Construction worksites may place stresses on resources and		Roads Department,

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
Involvement	community	<p>infrastructure of nearby communities. The contractor will provide temporary worksite facilities such as health care, eating space, and praying places.</p> <p>Establish a grievances redress committee.</p>		contractor
Worker's Health, Safety, and Hygiene	Health impact	<p>Recommend labor intensive construction and the use of local labor.</p> <p>The contractor will hire an EHSM to monitor workers' health, safety, and hygiene for entire construction period of 3 years.</p> <p>Ensure good drainage at all construction areas, to avoid creation of stagnant water bodies, including water in old tires especially in urban areas.</p> <p>Provide adequate sanitation and waste disposal at construction sites.</p> <p>Provide adequate health care for workers and locate worksites away from sensitive areas.</p> <p>Do not hire children and pregnant women.</p> <p>Provide education to construction personnel on preventing contraction of disease, protective measures, and disease control.</p> <p>Provide construction personnel with necessary self-protection devices, such as safety helmet, earplugs, and other safety protection devices.</p> <p>Set up enclosures at construction sites and other dangerous places to prevent the public from trespassing.</p> <p>Take special vigilance when transporting and storing explosives. Ensure careful and strict management of explosive work and sites.</p> <p>In blasting operations, confirm that the quantity of explosives is rational and set safe warning distances as per quantity of explosives. Ensure good work to ensure safety of residents and buildings.</p>	108,000	Roads Department, contractor's EHSM

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
	Contamination and odor from sanitary waste	Equip all work sites with latrines. All toilet facilities will be at least 300 m from water sources or existing residences. Disposal of sanitary waste will depend on the size of the work camps: (i) small treatment facilities (for large work camps), (ii) on-site storage and disposal to municipal disposal systems (when camps are located close to municipalities), or (iii) septic tanks with ground seepage (smaller work camps not located adjacent to watercourses). Prohibit any untreated discharge to local watercourses.		
	Drinking water quality	Ensure drinking water meets national and World Health Organization potable water quality standards; treated if it exceeds the standards. Ensure construction camps have rationing facilities particularly for kerosene and LPG so that dependence on firewood for cooking is avoided to the extent possible.		
	Entertainment	Provide in-house community and common entertainment facilities for construction camps. Discourage and/or prohibit dependence on local entertainment outlets by the construction camps to the extent possible.		
HIV/AIDS and sexually transmitted disease	Spread to the community along the corridors	Adequately train all construction workers in basic sanitation and health care issues (e.g., how to avoid transmission of sexually transmitted diseases such as HIV/AIDS). Conduct group consultations to create awareness among the community about these diseases.	108,000	Roads Department, Contractor's EHSM
Cemetery and Graveyard	Social grievances	Protect and respect graveyards and holy places. Recommend that contractors consult with local residents during civil works close to these sites.		Roads Department, Contractor
Archaeological Chance Finds		In the event of the unexpected discovery of archaeological objects during construction operations, the contractor will immediately inform the Roads Department, which will notify the Ministry of Culture to obtain instructions. Construction work may have to be stopped until the ministry gives clearance for the continuation of operations.		Roads Department, Ministry of Culture, Contractor
Resume works only after appropriate measures have been taken as				

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
Traffic Safety	Road accidents	<p>requested by the ministry and confirmation is received that works may continue.</p> <p>Control speed of construction vehicles through road safety education and fines.</p> <p>Allow adequate traffic flow around construction areas.</p>		Roads Department, Police, and Contractor
Traffic Jams and Congestion	Social havoc	<p>Provide adequate signage, barriers, and flag persons for traffic control.</p> <p>Communicate with the public through community consultation and newspaper announcements regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restrictions.</p> <p>Implement appropriate traffic diversion schemes to avoid inconvenience due to project operations to present road users, particularly during nighttime.</p> <p>Implement diversion schemes to ensure smooth traffic flow and minimize accidents, traffic delays, and congestion.</p>		Roads Department, Contractor
Contract Procedures and Specifications	Faulty construction	<p>Ensure diversion signs are bold and clearly visible particularly at night.</p> <p>Carefully monitor contractors' conformity with contract procedures and specifications during construction.</p> <p>The main contractors are responsible for ensuring that subcontractors conform to general construction guidelines (good engineering practices and standard good working practices). Otherwise, the quality of works subcontracted will be poor.</p> <p>Contractors will be made to follow standard construction practices, monitored and supervised by the construction supervision consultants.</p>	367,000	Roads Department, Contractor, construction supervision consultant
Location of Camp Sites and Storage Depots	Loss of productive land	<p>Coordinate with local government for identification of construction camps.</p> <p>Locate campsites and storage depots preferably on unproductive or</p>		Roads Department, contractor

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
		barren land. Discourage use of agricultural and cultivable lands. Do not establish camp sites and material storage sites from km 7.2 to 8.5 (near the Ispani protected areas).		
Roadside Service Stations	Fuel and nourishment	Provide service stations with vehicle and food services for tourists and travelers, thus increasing income opportunities especially for poor families. These establishments will be at sites in which villagers can sell their produce and handicrafts without having to transport the goods to distant markets.		Roads Department, contractor
		A typical service station should have the following facilities in its initial stage: (i) parking facilities; (ii) market facilities (including a free market); (iii) locally made materials to introduce local industries; (iv) restaurant facilities; (v) health center, primarily for maternity, HIV/AIDS; (vi) meeting place (training facility); (vii) information facilities; (viii) toilet facilities; and (ix) water supply area.		
Operations Phase Natural Environment				
Dust and Air Pollution	Air pollution	Maintain and clean roads properly. Conduct emission testing of vehicles and enforce servicing of ill maintained vehicles.		Roads Department/MOE
Noise	Noise pollution	Based on monitoring results, at places with noise violation, consider mitigation measures such as earth berms, dense layered plantation to block noise, or other measures like noise barriers.		Roads Department/MOE
Road Safety Campaign	Road accidents	Upgrade skills and knowledge of drivers and school students by introducing safety courses in drivers' training and school curriculum. Study road accidents properly and identify the causes.	40,000	Nongovernment organization in coordination with the Roads Department and police
Tourism	Pollution	The Project will improve the tourism industry in the area and provide easier access to tourist sites. Increased tourism may also be beneficial by encouraging local officials to preserve the aesthetic value of the entire region (e.g., to promote the	Roads Department maintenance	Regional government

Activity	Potential Environmental Impact	Proposed Mitigation Measures	Cost Estimate (\$)	Responsible Institute
		collection of rubbish and debris and to construct wastewater collection and treatment systems). However, increased tourism has the potential to overcommercialize and negatively impact natural tourist locations. Local officials should carefully monitor this aspect.	budget	
Water Resources				
Spills of Toxic Chemicals, Petroleum Products	Accidental spills of hazardous and toxic chemicals and loss of life	Prepare contingency plans for cleanup of spills of oil, fuel, and toxic chemicals, based on a spill contingency plan to be prepared by the consultant for the government, within 1 week of commencing the Project.	Roads Department maintenance budget	Roads Department, police, MOEPNR
Storm Water Drainage System	Localized flooding	Clean the drainage system periodically to ensure adequate storm-water flow. Local community groups under contract with the Roads Department will be responsible for cleaning the drainage facilities, especially clearing the clogging of drains, cutting of grass, and clearing the shrubs.	Roads Department maintenance budget	Roads Department, community group
Ecological Resources				
Planting and Landscaping	Afforestation along the roads	<p>Replace roadside tree plantations lost to construction and encourage new afforestation and landscaping projects.</p> <p>Recommend designating areas for greening and landscaping by local community along the road on a token payment basis. A portion of the profits raised from the trees and plants (e.g., from the sale of timber) can be given to the community. The Roads Department will assess this option at the later stage of implementation and develop a plan.</p>	200,000	Roads Department, local groups of women or landless people

EHSM = environmental, health, and safety manager, MOEPNR = Ministry of Environmental Protection and Natural Resources.