

Executive Summary

Name and Location of Project and Project Proponent

Name of Project: *Jangchucholing - Tashidingkha Road*, Wangdue Phodrang, Bhutan

Name and Address of Proponent:

Rural Access Project
Department of Roads
Ministry of Works and Human Settlement
Royal Government of Bhutan
Thimphu, Bhutan
Telephone- 327451

After the encouraging experience of the Rural Access Project I (RAPI) with the financial support of the World Bank, the Department of Roads is planning to undertake the implementation of Rural Access Project II as follow up/next credit of the World Bank. The Environmental Friendly Road Construction (EFRC) technique was adopted under RAP I to minimize the environmental degradation during construction and subsequent operation with the financial and technical support of SNV Bhutan. RAP I project is expected to be completed in June 2006. Prior to the completion of RAP I, the department of Roads (DOR) is making preparatory works of RAP II, which is to be implemented soon after the completion of RAPI. The Jangchucholing-Tashidingkha Feeder Road Project is one of the sub-projects to be implemented under RAP II. The survey, design and cost estimation of this sub-project is currently underway. The total length of this sub-project is 14.3 kilometer. The proposed road starts from Jangchucholing and passes through Ridang Goenpa, Yusangang, Peljorling, and finally ends at Tashidingkha. The estimated populations to be benefited by this road project include 1602 living in 178 households. The proposed road is planned to be developed as feeder road category having 5.1 meter formation width with gravel surface and necessary structures such as retaining wall, culverts, slope protection works, and other water management structures. The construction of the road will also adopt the EFRC technology. Out of total 14.3 kilometer, the construction has already been initiated in initial stretches with the utilization of Royal Government Bhutan's internal funding. Almost all earthwork and partial gravelling has been accomplished up to the length of 8.0 km. However, the structures and bio-engineering works in this initial stretches is still remained. The longitudinal gradient of the proposed road project varies from 0 to 10%.

In accordance with the Environmental Assessment Act 2000, and Regulation for the Environmental Clearance of Project (2002), all the road project of feeder road category must go through Environmental Assessment (EA) level studies to obtain development permits or public financing prior to the implementation of project. The proposed project falls under this category and the Department of Roads is carrying out EA studies through domestic consultants. However, during the course of EA study and project planning, no objection certificates from relevant stakeholders have been obtained and will be submitted together with EA report for necessary approval and clearance by National Environment Commission (NEC).

The alignment of proposed road sub-project has been finalized after rigorous studies of alternative alignment. During this exercise, two alternatives were assessed. Based on the analysis, the proposed alignment has been finalized in terms of social benefits covering large number of households for connectivity, physical environment in terms of slope stability, less possibility of disruption of road services due to snowfall, suitable gradient for alignment, and less impacts on biological environment in terms of removal of less number of trees and less destruction of other forest resources. The comparison of both the alignments is presented in section 3.3.3 of this main report.

The summary of potential environmental adverse impacts due to the implementation of the proposed project is presented in **table E.1**.

Table E1: Potential Environmental Impacts

Likely Impacts	Environmental Impacts				Significance
	Nature	Magnitude	Extent	Duration	
<i>Construction Phase</i>					
Impact due to Earthwork Excavation and Disposal	Direct	Medium	Site Specific	Short Term	Significant
Impact due to Operation of Quarry Sites	Direct	Medium	Site Specific	Short Term	Insignificant
Impact due to Change in Land Use (Forest land - 3.96 ha, Agricultural Land -1.1 ha, Sokshing- 0.48 ha)	Direct	Low	Site Specific	Long Term	Insignificant
Impact on Water Resources Damage on irrigation System, Water supply System, and river water quality degradation	Direct	High	Local	Long Term	Insignificant
Slope Instability and Erosion	Indirect	Medium	Site Specific	Medium Term	Insignificant
Air and Noise Pollution	Direct	Low	Local	Short Term	Insignificant
Impact due to use of blasting materials	Direct	Medium	Local	Short Term	Insignificant
Water Pollution	Direct	Low	Local	Short Term	Insignificant
Loss of Forest (6,147.79 m3)	Direct	Medium	Local	Long Term	Significant
Pressure on Forest Product	Indirect	Medium	Local	Long Term	Insignificant
Disturbances on Wildlife	Indirect	Low	Local	Short Term	Insignificant
Rare and Endangered Species	Indirect	Low	Local	Short Term	Insignificant
Pressure on Social Service and Facilities	Indirect	Medium	Local	Short Term	Insignificant
Occupational Health and Safety	Direct	High	Site Specific	Short Term	Insignificant
Health and Sanitation	In direct	Medium	Local	Short Term	Insignificant
Impact on Local Culture	Indirect	Low	Local	Short Term	
<i>Operation Stage</i>					
Soil Stability and Management	Direct	Medium	Site Specific	Long Term	Insignificant
Road Accident	Direct	Medium	Local	Long Term	Insignificant
Air and Noise Pollution	Direct	Medium	Local	Long Term	Insignificant
Water Pollution	Indirect	Low	Local	Long Term	Insignificant
Road Safety Measures	Direct	High	Local	Long Term	Insignificant
Development of Ribbon Settlement	Indirect	Medium	Local	Long Term	Insignificant
Depletion of Forest Resources	Indirect	Medium	Local	Long Term	Insignificant
Socio-economic and Other Issues	Indirect	Low	Local	Medium	Insignificant

The mitigation measures suggested to be adopted during the implementation of proposed sub-project is also presented in **table E2**.

Table E2: Suggested Mitigation Measures

Activities/Issues	Mitigation Measures	Location
A. Pre-construction Stage		
Selection of Alignment as per EA Study	Select best among the alternate route in consideration with minimize the adverse impacts and maximize the beneficial impacts (Please refer section 3.3.3 and 3.5 of EA main report)	Project Area
Implementation of EA recommendation in project, planning and design	Incorporation of EA recommendation in project planning and design	Road Corridor
Inclusion of Mitigation Measures in Project Cost, Bid Documents, and contract	Incorporation of EA recommendation in Bid Documents and Contract	Along the Road Corridors
Construction Logistics	Arrangement of logistics in time including necessary precautions for storage,	Construction Camps, sites
Land and Properties Acquisition	Compensation and rehabilitation to 6 affected households suggested in table 6.2 of EA main report	Specific locations (please refer 6.3.1.9 of EA main report)

Activities/Issues	Mitigation Measures	Location
B. Construction Stage		
Site Clearance/removal of vegetation	<ul style="list-style-type: none"> ▪ Removal vegetation within 5.1 m formation width only ▪ Bio-engineering with native plants (<i>Alnus nepalensis</i>, <i>Erythrina arborescens</i> and <i>Salix babylonica</i> or Weeping willow) ▪ Avoid felling matured trees ▪ Compensatory plantation within road corridors to restore lost habitat ▪ Tree felling shall be done parallel to road alignment ▪ Log barrier/Check dams to be installed to prevent debris from rolling down and damaging the vegetation cover 	Along the road alignment/Specific location (8+500 – 13+000 km)
Construction, operation and shifting of camps	<ul style="list-style-type: none"> ▪ Briefing labourers/construction workers on local culture and rules and regulations of kingdom on illegal activities such as felling of trees, fishing and hunting. ▪ Camps to be placed in secure location and be able to protect inhabitants from rain, excessive sunshine and other extreme condition ▪ Providing cooking gas or kerosene to discourage use of scarce firewood ▪ Waste disposal facilities such as dustbins and garbage to be provided ▪ Health screening for labourers ▪ Fire fighting equipment to be provided ▪ Separate clean drinking water to be supplied to reduce water use competition and for proper sanitation ▪ Adequate Pit latrines to be constructed at the campsites ▪ Camp areas to be cleaned and bare surface be revegetated to restore aesthetic value 	Labour camps to be constructed nearby takeoff and at chainage 7+600 and 9+000
Management of Harvested Forest Product	<p>Sell/Auction the harvested forest product (timber/fuel wood) if feasible Local should be given opportunity to buy timber at subsidized rural rate Trees felled in sokshing area could be given to the owner as compensation for their resources lost.</p>	Along Road Corridor where forest is to be cleared (8+000 – 14+300 km)
Compensatory Plantation	Plantation of tree at least 5 times in Nos. of destruction in suitable area in nearby the project area. (Note: RAP could support and fund Dangchu Geog in tree plantation specially on 2 nd June social forestry Day observed every year on HM Coronation Day)	Along chainage 6+500 – 14+300), in consultation with communities
Change in Land Use	<ul style="list-style-type: none"> ▪ Avoid fertile agricultural land, ▪ provide compensation and rehabilitation to 6 households that falls within the ROW as suggested in Table 6.4, Section 6.3.1.9 of the EA main report 	Road Alignment Chainage (4+500 – 14+300 km)
Spoil Disposal	<ul style="list-style-type: none"> ▪ using spoils for reclaiming the degraded land in consultation with local community ▪ No disposal shall allowed in the areas of fragile slopes, floodways, farmland, forest areas, natural drainage path, religious and cultural sites, canal and other infrastructures ▪ Dispose spoils in the designated sites ▪ Build many spoil benches for filling disposal area rather than few larger ones to avoid slope overloading ▪ Compact spoil benches at every 0.5 m thickness ▪ Site shall be rehabilitated with appropriate bioengineering works and provide proper drainage 	All along the road corridor. Spoil should be dumped at specified disposal site between chainage of 6+850 – 7+500 and 13+000 – 13+200 km
Earthwork and Excavation	<ul style="list-style-type: none"> ▪ Selection of proper alignment avoiding unstable and fragile, zone ▪ Slope cutting activities carried out during dry season ▪ Slope cutting to be limited to 1:1 (details provided in table 6.2 of the EA report) ▪ Slope cutting to be done with excavators ▪ Log barriers/ Check dams to be built to avoid damage of vegetation, properties and injuries to passerby ▪ Apply appropriate Bioengineering technique such spreading top soil, broadcasting seeds, grass slips, seedling of local plants such as <i>Alnus nepalensis</i>, <i>Erythrina arborescens</i>, <i>Salix babylonica</i> and other appropriate and natively available species. ▪ Gabion retaining walls with geotextiles at valley side e.g. at chainage 2+630 in already built portion of road (Details provided in Table 6.3 in Section 6.3.1.2 of EA report) 	All along road alignment but specifically at location of unstable zone of chainages: 0+000 – 4+080 6+340 – 14+300
Slope Instability and Erosion	<ul style="list-style-type: none"> ▪ Select an appropriate road alignment as recommended by EA & Geological and Geotechnical studies. In this case, select alignment I of alignment option II. ▪ Cut & fill approach shall be applied as far as possible. The recommended slope gradient for different cut slope height is provided in table 6.2 of EA report. ▪ Revegetate cut & fill slopes or exposed areas as soon as possible by using local plant species such as <i>Alnus nepalensis</i>, <i>Erythrina arborescens</i>, <i>Salix babylonica</i> and other appropriate and natively available species 	All along the chainage. Specifically at Chainages : 0+000 – 4+080 5+020 – 14+300

Activities/Issues	Mitigation Measures	Location
	<ul style="list-style-type: none"> ▪ Slope cutting to be carried out only during dry season ▪ Proper drainage as recommended by Geological and Geotechnical Studies shall be adopted ▪ Adoption of appropriate bioengineering technique along with civil structures such as breast and retaining wall for slope stabilization. (For detail refer 6.3) 	
<p>Quarries, borrow pits and stock pile (Note: As per geological & geotechnical study, RAP II, March 2006, there are no suitable quarry sites within 14.3 km stretch of Jangchucholing - Tashidingkha road. However, boulder could be quarried from streambeds of Chubachhu).</p>	<ul style="list-style-type: none"> ▪ Selection of quarry site away from critical habitat, settlements, cultivated area as far as possible ▪ Separate clearance from DGM is necessary for Quarrying activities ▪ Quarrying operation to be done from crown of the slope and gradually moving down-slope in a phased manner ▪ Provision of appropriate safety gadgets such as gloves, helmets, face masks, ear plugs, goggles, safety ropes to be tied around the waist, etc., to workers ▪ Quarrying activities to be carried out during daytime only ▪ Sprinkle water over quarry and stockpiles twice a day to reduce excessive dust generation ▪ Restoration of quarry site and access road using appropriate bioengineering measures (Planting <i>Alnus nepalensis</i> which grows in plenty around Chubachhu). ▪ Top soil shall be scrapped and stored in safe place for future reuse in bioengineering application 	<p>Specific location of quarrying and stock piling</p> <p>Chubachhu Stream</p>
<p>Wild life and its habitat</p>	<ul style="list-style-type: none"> ▪ Road shall be designed as per following criteria: <ul style="list-style-type: none"> ○ With minimum road width of 5.1m for easier wildlife movement and to discourage unwanted vehicular parking which discourages unnecessary interference to surrounding forest. ○ Cut slope shall be limited to 1:1 ○ Slope shall be cut in benches and flattened to allow easy wildlife crossing ○ Design and constructing speed breaker to reduce vehicle speed to avoid wildlife mortality by accidental or intentionally ○ Animal crossing signage shall be provided (refer figure 6.2, 6.3, 6.4, & 6.5) ○ Application of appropriate bioengineering technique to improve or recreate lost habitat ▪ Installation of strong log barrier/check dams to prevent debris from rolling downhill and damaging the vegetation cover. ▪ No tree felling, collection of firewood or disturbance of vegetation shall be allowed outside road reserve ▪ Felling of Oak trees shall be strictly prohibited as it is one of the main sources of food for Himalayan Black Bear. ▪ No labour/construction camps, crushing/batching plants siting shall be allowed within the habitat area between Peljorling – Tashidingkha village ▪ Only Acconex shall be used along the sensitive or critical habitat area to reduce disturbance to wildlife ▪ No spoil shall be dumped in the habitat area except at designated site provided (refer table 6.1 of EA report) ▪ No fire shall be permitted and fire break shall be implemented to prevent fire outbreak. Fire fighting equipment shall be made available to prevent any accidental fire hazard. ▪ Contractor/Construction Supervisor will ensure the maintenance of permissible noise to reduce disturbances to wildlife ▪ Contractor/Construction Supervisor will be responsible for controlling illegal activities by the construction workers ▪ Contractor shall install check point to prevent illegal logging during construction period in the name of the project ▪ Awareness campaign on forest rules and regulations will be conducted for labourers and project officials by the project in coordination with DFO along with Local Forest Beat Office to discourage & prevent unlawful act. ▪ Forest Beat Officer will make a surprise visit to the camp sites and other work areas to discourage the workers and others from illegal hunting and indiscriminate tree fellings. 	<p>Generally all sites, from Chainage 0+000 – 14+300 km</p> <p>Check dams needed at chainage 8+000 – 13+500,</p> <p>Compensation plantation as part of bioengineering work will be along Road corridor especially from 8+300 – 13+500</p>
<p>Handling and Use of Blasting Materials</p>	<ul style="list-style-type: none"> ▪ Transportation, handling and storage of explosive should follow the prevailing rules (Explosive rules of the Ministry of Home & Cultural Affairs), ▪ Store explosive in steel container, which are fire and theft proof, ▪ Do not store gelatin, detonators, and cortex, together, ▪ Dispose waste safely by burying them in 5-8 feet deep pits, ▪ Adopt controlled blasting practice with limited charge where possible, ▪ Use Acconex near habitation and protected areas, ▪ Make provision of well equipped first aid kits, health facilities, and fire fighting equipment on construction site, 	<p>Road Chainage 10+100 and 11+900 km where rock cutting by blasting materials is required.</p>

Activities/Issues	Mitigation Measures	Location
	<ul style="list-style-type: none"> ▪ Allow only trained or certified blasters to carry out all blasting activities, ▪ Maintain coordination with Wangdue Dzongkhag administration, police, and Gup of Dangchu Geog on schedule of blasting to ensure that nearby community people are informed, ▪ Use appropriate warning signals by using whistles, flags, megaphone to ensure safety of traveling vehicle and people, ▪ Adopt OHS (provision of helmets, gloves, masks, etc), ▪ Conduct blasting exercise during day time 	
Disruption of Drainage System	<ul style="list-style-type: none"> ▪ provide adequate numbers of drainage structures in order to have minimum interference with and impact on natural drainage pattern of the area, ▪ Construct side drains, lined drain to tap excessive water and dispose of to natural drain, ▪ Planting of fast growing plant species <i>Alnus nepalensis</i>, with high water absorptive capacity in marshy area to lower the water table and reduce surface drain, avoid surface water discharge into farmland or risky locations, 	Along the road alignment 0+000 – 14+300
Disruption of Community Infrastructures	<ul style="list-style-type: none"> ▪ Adapt side drain as irrigation channel and provide four hume piped crossing along the road crossing ▪ Avoid indigenous spring water source of community and provide retaining wall to protect it ▪ Provide temporary/alternative arrangement foot and mule tracks ▪ Restore all disturbed infrastructures to the condition before disturbance or improve where appropriate, 	Chainage (Irrigation at 4+200, Spring at 9+024km, foot trails 6+380, 10+820 and others)
Road Surfacing/gravelling work	Sprinkle water twice a day particularly nearby settlements to control dust pollution, maintain equipment and vehicles	Along the road corridors near Ridhang Goenpa, Peljorling & Tashidingkha
Air Pollution	Adopt mitigation measures as suggested in earthwork excavation, spoil disposal, quarrying and stock piling	Along the road corridors
Water Quality	Adopt mitigation measures as suggested in earthwork excavation, spoil disposal, quarrying and stock piling	Along the road corridors, specifically at Chubachhu & Samochhu
Noise Pollution	Adopt mitigation measures as suggested in earthwork excavation, spoil disposal, quarrying and stock piling	Along the road corridors
Pressure on Community Infrastructures	Make separate water supply arrangement if required	Construction Camp site, etc
Adoption of Occupational Health and Safety	Adoption of OHS	Construction site
Disruption of Religious and Cultural Resources	<ul style="list-style-type: none"> ▪ Road hitting directly holy tree has been realigned but needs protection wall to avoid slope failure ▪ Realigned the road section to avoid hitting the ruin stupa and provide retaining wall to protect the stupa. 	Construction Site (Ruin stupa at 8+040 km and religious tree at 7+840 km)
C. Operation Stage		
Slope Instability	correct maintenance of the slope protection measures and drainage works should be adopted, minor landslides, erosion, and mass wasting should be immediately cleared and slope restored with appropriate technology (preferably bioengineering), promote and support soil conservation activities in the right of way and beyond, organize environmental awareness programmes for local communities, road users, and decision makers.	Landslide prone area
Road Accident	Adoption of Road safety measures, road signals to be places,	Along the road
Development of Ribbon Settlement	Restriction of development of ribbon settlement through Implementation of Road Act 2004	Along the road corridors
Depletion of Forest Area	Protection of forest resources by imposing strict rules	Along the road corridors
Maintenance of Road	Adoption of regular maintenance practices	Along the road

In order to implement the mitigation measures, comprehensive Environmental Management Plan covering mitigation measures, responsible person for adoption of mitigation measures, monitoring indicators, monitoring agencies, and frequency of monitoring has been prepared and presented in chapter 7 and Appendix 2.

The conclusions of the present EA study mainly include:

- The Environmental Clearance (EC) for the construction of initial 8 km of the 14.3km long Jangchucholing – Tashidingkha road was issued by NEC on 10th November 2004. To date the construction of 8 km road has been partially completed with the internal funding of DOR/RGOB. The remaining 6.3 km road from Peljorling to Tashidingkha along with the completion of initial 8.0 Km stretch will be constructed under the RAP II, which is to be financed by World Bank. This EA report has been prepared for the construction of entire Road length (completion of initial stretch and new construction between chainage 6+300 to 14+300 Km), which requires formal approval from NEC in accordance with RECOP.
- Based on the exercise during the course of EA studies, the proposed road sub-project will have no detrimental impacts to physical, biological and socio-economic and cultural resources as the predicted negative impacts could be mitigated through the adoption of an appropriate mitigation measures.
- Of the two alignment alternatives, the alternative alignment I is better option as it passes through gentle to moderately inclined slopes and occupying less forest and cultivated areas. Furthermore, the alignment I reduces the travel distance from Geog headquarter to the Wangdue Dzongkhag by almost 20km.
- The bridge site at Chubachhu is highly susceptible from flood erosion as it could be completely damaged during monsoon as a result of likely occurrence of flood of large magnitude. This requires careful attention while planning and adopting design parameters.
- The proposed road falls within Biological Corridor connecting Jigme Dorji Wangchuk and Jigme Singye Wangchuk National Park (previously known as Black Mountain National Park). About 0.05 km² of the total area of 876 km² will be converted to road use. The area required to convert into Road is quite small and it will have insignificant adverse impacts on movement of wildlife. As per the Biodiversity Action Plan of Bhutan 2002, Biological corridors are not strictly protected areas and hence are not included with the Protected Area Network.
- The proposed road sub-project does not encounter any historical and cultural heritage sites along its corridor.
- About 178 households of 12 villages of Dangchu Geog with an estimated population of 1602 people would directly or indirectly benefit from this sub-project by increasing access to market, education, health facility and other service centers. The construction of this road would reduce the travel time from Geog head quarter to the road head (near Jangchucholing) by almost 4 hours.

The proposed project is recommended for implementation by following the specific recommendations:

- Considering the emergence of integration of environmental conservation into development process, the proposed project should be designed and implemented in line with the Environmental Friendly Road Construction Technique being adopted in Bhutan,
- The mitigation measures suggested should be integrated in planning and design stage of the project in terms of selection or appropriate alignment, incorporation of mitigation measures in detailed engineering design, cost estimate, bid document including technical specification as preventive measures.
- As the bridge site at Chubachu need careful planning and adopt suitable design parameter to avoid likely damages from the flood events.
- The John Howell's Bio-engineering in Bhutan for Road Sector 1999 should be consulted and used while designing a slope stabilization structures. This guide provides a detail bioengineering methods and techniques including the altitude-wise bioengineering plant species particularly for Bhutanese terrains.

As a way forward, the RAP shall carryout the following activities once the detail road design is completed:

- During the detailed design, the project will incorporate recommendation made by EA study
- The mitigation measures proposed in the EMP shall be included in contract conditions, technical specifications and cost estimations, and Bill of Quantity (BOQ).
- The Contractor/Bidder shall prepare site specific EMP as per EFRC/DOR's "Guidelines for Bid Preparation, July 2005" which has to be submitted with the bidding document.
- During construction, the contractor, Project officials (RAP at center as well as in Project level) will ensure the implementation of mitigation measures, monitoring activities in specified time as recommended by EMP. In addition, the project officials will facilitate the monitoring process to be carried out by other stakeholders such as communities, MOWHS, NEC.