

Government of Nepal
Ministry of Physical Planning and Works
Department of Roads



Environmental & Social Management Framework

A guide to the environmental and social
issues associated with new road
construction and upgrading



(Final Version) April, 2007

ANNEXES

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Annex 1
The Consultants Terms of Reference
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ANNEX 1

Note: The following text is extracted from the General ToR for the SWRP&PIP provided to the Consultants. Hereunder, only those **sections are printed in bold** which relate to the Environmental and Social Management Framework:

TERMS OF REFERENCE FOR CONSULTING SERVICES FOR STUDY FOR SECTOR WIDE ROAD PROGRAM & PRIORITY INVESTMENT PLAN

1. Background:

Geographically, Nepal comprises a mountainous region, hill districts, and lowland plains. The economy is dominated by agriculture, which represents 44 percent of Gross National Product (GNP) and employs the majority of the population. Apart from trails and air transport, roads are the only means of transport. They are essential to economic development, carrying approximately 90 percent of freight and passenger traffic. Road transport in Nepal is vital to reducing isolation and distributing economic development to remote areas.

Nepal's road network can be broadly divided into two parts: the Strategic Road Network (SRN) and the Rural Roads (RR). The SRN is currently being updated to include approximately 5500 kilometers of completed and proposed national highways and feeder roads. It carries most of the road traffic and provides the national transportation links between main centers and to neighboring countries. Within the SRN is the loosely defined core road network (CRN). It comprises approximately 1,500 km of national highways with the highest traffic volumes (greater than 1,000 vehicles per day). The CRN carries the bulk of longer distance commercial traffic movements, linking all major commercial centers, economic centers and main border crossings. The RR comprises approximately 4,600 km of district roads, plus trails, tracks and suspension bridges.

His Majesty's Government of Nepal (HMG/N) has prepared a Priority Investment Plan (PIP) for the Road Sector as part of the Road Maintenance and Rehabilitation Project (RMRP) funded by the World Bank. In addition to it Department of Roads (DoR) has recently carried out a North-South Road Corridor study and prepared a 20-year Road Master Plan for the Road Sector covering the 10th, 11th, 12th and 13th Five-year plans of His Majesty's Government of Nepal. Based on these Plans and Study along with the aims and objectives set in the current 10th Five Year Plan and National Transport Policy (2058) HMG/N plans to carry out a Study for Sector Wide Road Program & Priority Investment Plan. Part of the proceeds from Road Maintenance and Development Project (RMDP) under the loan assistance from the World Bank (IDA Cr. 3293-NEP) will be utilized to carry out proposed Study.

The key object of the Study is to prepare a sector wide investment plan for the road sub-sector in order to provide all weather motor able access within four hours walk from remote settlements.

The study consists of two parts:

Part I - Sector Wide Road Program & Priority Investment Plan for The Strategic Road Network

To generate the total length of all weather national grid of road networks comprising both strategic and rural roads to allow accessibility to the populace not farther than four (4) hours walk in the hills and two (2) hours walk in the Terai. The consultant shall estimate an optimum investment need based on expected traffic volume and other economic activities in the area.

To Review the present Priority Investment Plan (PIP) and update it for the period of ten years (2007-2016) covering about 5000 km of existing strategic road network out of which 2800 km of upgrading and improvement (rehabilitation). The updated plan shall include additional 2200 km for new construction including optimum maintenance costs forecasts for all the strategic road networks required for that period.

Part II - Detailed Technical and Economic Feasibility Study of Selected 600 km of Roads

To carry out detailed technical and economic feasibility studies for new construction, upgrading and improvement (rehabilitation) of about selected 600 Km of the Strategic Road Network. The roads for the study will be screened from the updated plan. Out of the 600 km of roads about 200 km will be studied for new construction and the rest about 400 km for upgrading and improvement excluding the roads whose feasibility studies have already been carried out.

Part I Sector Wide Road Program & Priority Investment Plan for The Strategic Road Network

2. Objectives

The main objectives of **Part I** are:

- a. to develop and suggest a futuristic national grid of road networks including both the strategic and rural roads based in the twenty year road master plan, district road transport plan and the north-south road corridor study.
- b. to prepare an appropriate Priority Investment Plan (PIP) of strategic road network covering about 7200 km roads for the period from 2007 to 2016 and a review process under the policy objectives set by the twenty year road master plan identifying potential programs and projects for the strategic road network.
- c. to determine the optimal balance among construction of new roads (national highways, feeder roads and bridges) and improvement, rehabilitation and maintenance of the existing strategic road network**
- d. to determine an appropriate level of expenditure on investments for construction and maintenance given local resources and absorptive capacity constraints (financial, technical and human resource related) and the probable level of foreign assistance in the sub-sector during the period of ten years starting from the year 2007.**
- e. to forecast the optimum maintenance costs of the strategic road networks required for the period from 2007 - 2016.
- f. to review the present Priority Investment Plan (PIP) prepared under the policy objectives set by the Eighth Five Year Plan (EFYP) and assess the achievements set forth in that PIP regarding the construction and improvement, rehabilitation and maintenance of the existing strategic road network only.
- g. to compare different budget scenarios from 2007 to 2016 for the strategic road network and present the consequences of budget constraints to the society (network net

present value), road users (network road users) and road agency (short term and long term agency investment and maintenance expenditures).

- h. to characterize the current network average condition and forecast the average network condition over time for the different evaluated budget scenarios.
- i. to determine the optimal investment plan with allocation of resources between geographic regions, surface types, road work types and functional classification of roads.
- j. to present a list of strategic road network links, for the defined proper level of road agency expenditures, containing for each link the corresponding basic characteristics (length, width, roughness, traffic etc.), recommend road work, road work cost, road work timing, net present value, rate of return and net present value per road cost ratio.
- k. to present the result of the network evaluation on a map produced preferably with a GIS system.
- l. to train about six DOR engineers and assist DOR to establish HDM-4 system within Department of Roads to improve the technical capacity of DOR in network planning using HDM-4 model.

3. Scope of the Services

The Consultants shall carry out all engineering, economic and socio-environmental studies, including topographical surveys and pavement strength tests, needed to prepare the Priority Investment Plan of strategic road network. Sectoral investment studies on development, upgrading and improvement of the strategic road network, will be conducted and overall maintenance strategies would be developed based on the World Bank's Highway Development and Management Model (HDM-4), which the consultants will calibrate to suit the Nepalese conditions. While preparing the PIP regional balance shall be taken into consideration. The followings are the detailed description of the main tasks to be undertaken by the Consultants:

(I). Review of Technical Studies and Detailed Work Program

The Consultant will review all relevant studies carried out in the past and extract any information that may be used in the present study. The present existing PIP along with the twenty-year road master plan, district roads transport plan and north-south road corridor study would be the guiding reference for the future PIP. Based on such information and their initial findings, the consultants will update and revise the original work plan submitted with their proposal and provide a detailed schedule of work including the timing of key events and present it as part of Inception Report.

(II). Traffic Forecasts and Network Analysis

- (a) Traffic Studies:** The Consultants will review the existing traffic data from the Highway Management and Information System (HMIS) publications, Traffic Engineering and Safety Unit (TESU), Road Network Development Project (RNDP) and other consultants working for Road Maintenance and Development Project (RMDP). They shall prepare a program of additional data collection and assess present strategic road traffic demand. The program will include, to the extent required, additional classified traffic survey for both passenger and goods traffic showing the origin and destination along the roads of study. The consultant shall also carry out the axle load survey in all major roads along which instances of overloading persists.

- (b) **Traffic Forecasts:** The Consultants will prepare traffic volume and mix forecasts for strategic highways and feeder roads. The choice of appropriate forecasting model will be preceded and determined by an assessment and analysis of (i) overall economic development prospects and the resulting total transport demand, (ii) the likely future modal distribution of traffic between strategic road network and the other transport network in Nepal. Different scenarios could be developed and evaluated as appropriate.
- (c) Wherever predominantly stable growth conditions and only gradual changes in socio-economic conditions are expected to prevail, the Consultants will extrapolate from past trends, making adjustment that may be necessary to account for changes that are likely to modify these trends. Where major rapid changes in socio-economic conditions are expected, the consultants will prepare traffic forecast in three stages: (i) estimation of volume and location of future tourism, agricultural, industrial and mining input and consumption, including imports and exports; analogous estimates of population and personal income growth and of the income elasticity of demand for transport will be necessary; (ii) translation of population and output/consumption forecast into traffic-both by volume and by origin and destination and (iii) distribution of traffic to the various transport modes, taking into account both perceived and total distribution costs and any major planned transport projects (such as under construction Banepa - Sindhuli - Bardibas Road, and under study Kathmandu-Terai Fast Track, and the Kathmandu Outer Ring Road). The resulting transport growth rates will be applied to be base year traffic estimates to produce road traffic forecasts for the strategic road network.
- (d) The Consultants should consider the almost uni-modal set-up to Nepal's transport system. Use of a traffic assignment and forecasting model shall be supported by the rationale for the Consultant's choice and present it as part of their proposal.
- (e) On the basis of the traffic forecasts and taking into account the limited existing network, the consultants will assess whether the segments additional to the existing grid of roads (including upgrading of existing roads) are necessary to meet future traffic demand and sustainable taking into account environmental considerations. The Consultants will prepare a simple model of traffic forecast based on the above analysis for the strategic road network. The demand for roads would be e.g. a function of productive potential, social service delivery needs, accessibility, aggregate transport costs and resource mobilization capacities.

(III). Technical Data Collection

Strategic Road Network: The consultants will review and update the following technical data in the format required by the HDM-4 model. An important component of the services will be to involve DOR personnel with activities related to use of HDM-4 for preparing the investment plan including on the job and specific training to introduce capability within DOR in operation of HDM-4 software for Highway Development and Management.

- (a) **Vehicle Operating Costs (VOC):** The Consultant will review the VOC model developed for the Road Maintenance Project in the past and update it for use in the future.

The consultant will define current vehicle operating costs and travel time costs for Nepal by performing a Level 1 and Level 2 calibration of the HDM-4 model, following the guidelines presented on the Volume 5 of the HDM-4 documentation. Priority should be given to establish economic vehicle fleet costs, fleet utilization and physical and power characteristics and calibrating the desired speed and fuel consumption.

- (b) **Construction and Maintenance Costs:** The Consultants will review and update estimates of unit costs for construction and maintenance works to be used in the modeling phase (HDM and transport model), based on existing data from construction, upgrading and improvement works carried out in the recent past. Costs should be considered both in financial as well as economic terms.
- (c) **Road Data:** The Consultant will review the present PIP and adopt the same system for road data for both paved and unpaved roads. As adopted in the present existing PIP the Road data for unpaved roads will be limited to roughness, CBR of the natural sub-grade, thickness and characteristics of the pavement materials, road geometry and the carriageway and formation widths. It shall be collected on sample basis for typical sections and estimated elsewhere. The sampling rate will depend on the economic importance of the roads considered.
- (d) **Bridges:** The Consultants will review and if necessary update the existing inventory of bridges recently prepared by the local consultant for the Road Maintenance and Development Project. The inventory includes a summary description, classification based on types and sizes and conditions of all bridges and ferries on the strategic road network. A review of unit maintenance costs for bridges will also be included in the study.
- (e) **Air Transport Network:** The Consultants will review and update the basic data of air transport network in order to estimate basic unit costs to compare with other modes of transport affecting rural accessibility.

(IV). Road Inventory and Database

The consultants will produce the road data described above primarily for the network modeling. The Consultant will review the existing formats, in which information has been gathered and presented, and suggest changes in the formats if necessary. As of this effort, the consultants will review inventory procedures established by DOR/MRCU. In addition to reviewing the DOR/MRCU inventory procedures, they will also develop nodes and links for the new roads added to the strategic road networks.

(V). Analysis and Evaluation

Strategic Road Network: The analysis would consist of a prioritization of construction, upgrading and maintenance investments based on the network modeling, ranked according to economic criteria considering most likely sectoral budget ceiling limitations.

For analysis of the maintenance options of the existing roads of the Strategic road network, consultants will group the referenced roads into categories or groups of homogenous sections with similar characteristic such as traffic range, pavement type and condition (roughness level), structural strength and so on.

Sections requiring special attention should be analyzed separately. For all groups of sections defined above, the consultants will define the investments and the corresponding maintenance needs that will be technically justified to match the capacity of the segment to future road transportation demand. The consultants will use HDM-4 to compare the options and select the economically viable option for the full network. The options to be considered shall include construction of new sections and realignments including by pass to the major settlements; widening of existing pavements reconstruction on existing alignment improved road standards (upgrading); provision of full strength pavement overlays (including widely leveling course where needed); periodic maintenance operations such as thin premix overlays, single or double surface dressing courses; improvement of sub-grade strength through better compaction methods and/or stabilization; improvement of embankments and addition of drainage structures to prevent damages from flooding; and so on. The consultant shall study the roads and road sections under the performance based maintenance system and critically examine its suitability in the Nepalese conditions.

(VI). Priority Investment Plan

The consultants will prepare a national grid of road network consisting both strategic and rural roads to provide road accessibility at a distance of not more than 4 hours walk. Based on the national grid and the above data and analysis the consultant will prepare a priority investment plan for about **5000 km** of existing strategic road networks and about **2200 km** of additional new roads.

The consultant should prepare the plan based on the optimum phasing of investments and maintenance over a 10-year period, indicating the optimum balance among: (i) construction and upgrading of the strategic road network; (ii) rehabilitation and maintenance of existing roads and bridges of the strategic network. It is expected that the consultants during the course of their work will compare several strategies for the development of the strategic transport networks and its maintenance taking into account the specific physical and economic conditions, likely environmental impacts and necessary mitigation measures and natural constraints of Nepal relevant for road development such as inter alia, the country's difficult topography, limited absorptive capacity, scarcity of human resources in the road sector, land use predominantly for agriculture, ecologically/environmentally sensitive areas, and relatively uneven distribution of population centers.

The consultant will compare different budget scenarios and present the consequences of budget constraints to the economy (society net present value), to road users (network road users costs), road network (network average road roughness and percent of the network in good and fair condition) and to road agency. The budget scenario to be evaluated could be for example: a) optimal expenditures, b) 75% of optimal expenditures, c) 50% of optimal expenditures, d) expected level of expenditures.

The consultant will present a table with the results of the network evaluation by road link, for the expected level of expenditures and other budget scenarios. The table will present at least for each road link the basic characteristics (length, width, surface type traffic, roughness, etc.), the proposed road work, the year of the proposed road work, the road work cost, the road work cost per kilometer, the net present value, the rate of return, and the net present value per road work cost ratio. The structure of the table should be suited to present the main results in a map preferably with GIS system.

The consultants will review the availability of local (HMGN and Road Board Funds) and foreign financing for the road sub-sector in Nepal, make reasonable assumptions of future levels consistent with the lending programs of the major

donors in the sub-sector (ADB, IDA, Japan, SDC, DFID etc) and match these against the optimized programs in the 10 year plan to be reviewed periodically.

Part II Detailed Technical and Economic Feasibility Study of Selected 600 km of Roads

2. Objectives

The primary objectives of the consulting services are:

- a. to conduct detailed technical and economical feasibility study of selected 600 km roads which does not have detailed study carried out earlier, for upgrading, improvement and new construction. The roads for the study shall be chosen during the preparation of Interim Report of the Priority Investment Plan in month 6-7 of the services in close consultations with DOR. Out of the total 600 km of roads for the feasibility study, about 400 km of the roads shall be studied for upgrading and improvement including bridges and the rest 200 km for new construction.
- b. to review and update the existing detailed feasibility studies of roads carried earlier under the Road Maintenance and Development Project, for the present economic and socio-environmental parameters provided these roads rank high in the PIP list.

3. Scope of the Services

The following sections outline the anticipated tasks required to bring the proposed extensions and improvements to the Strategic Road Network for possible appraisal by the Bank in 2006. The services include:

a. Technical Economical Feasibility Studies of the prioritized roads:

The consultant will carry out the technical and economical feasibility study of the prioritized roads for new construction of approximately **200 km** of roads and for upgrading (rehabilitation and improvement) of approximately **400 km** of the strategic road network including bridges.

The consultant will evaluate, using an economic evaluation model (HDM-4 or Road Economic Decision Model, RED) for each road, a series of project-alternatives considering different investment levels, which will be compared with a without project alternative that will represent a do-minimum scenario and not do-nothing scenario.

b. Initial Environmental Examinations and Environmental Impact Assessments:

The study also includes Environmental Impact Assessments for New Construction and Initial Environmental Examinations for roads proposed for Upgrading as specified in the DoR Reference Manual for Environmental and Social Aspects of Integrated Road Development and Public Works Directives, Part II Procedural Directives Ch 2 and 3, HMG/N acts and regulations and applicable Bank Guidelines.

Detailed Scope of Works

The consultants will carry out the following tasks:

- (i) **Review studies and documents pertaining to the proposed feasibility study, including DOR planning documents; previous feasibility studies and**

analysis; road traffic data and available forecasts (vehicle, cargo, and passenger); relevant environmental and social impact studies; and available survey data (including maps, aerial photographs, etc.).

- (ii) Carry out desk study of the investment plan to refine and select the roads for detailed feasibility for new construction and upgrading. The desk study will include preliminary cost estimates and a preliminary economic assessment based on available traffic data and also possible environmental and social impacts.
- (iii) Conduct a meeting with DOR to consider the results of above tasks to reach a decision on the roads to be studied in more detail. It is expected that about 200 kilometers of roads linking the district headquarters and about 400 kilometers of roads for upgrading, (rehabilitation), will be included for further study.
- (iv) Undertake a field survey of the selected routes for both upgrading and new construction. This field review will include only those routes identified following the initial desk analysis and review of overall feasibility.

The fieldwork will include reconnaissance (drive along at existing dirt roads and walk over along the suggested alignment for proposed construction) surveys, socio-economic data collection, data on passenger and freight movements, an initial review of the environmental factors pertinent in the selected road corridor and mapping of affected socio-environmental assets. The Consultants should attempt to identify at this stage any particularly vulnerable groups whose social, economic or environmental capability could be threatened by the proposed road construction or land acquisition.

- (v) For project components proposed for upgrading (rehabilitation) work, conduct a field survey to ascertain existing condition of road (including drainage, bridges, and other physical structures); prepare an inventory of required works (including bridges), carry out geological/geo-technical/material survey; and assess pavement design. Based on typical contracting arrangements and unit-based pricing, prepare a cost estimate of each project component including projected cost of bridges.
- (vi) For project components of new construction providing access to district headquarters, conduct a field survey and establish alternative alignments, identify features affecting design (man-made and geographical), and conduct a geological/geo-technical/material survey. Establish typical cross sections in sufficient number and detail to develop cost estimates for the construction. Identify issues pertaining to land acquisition and recommend approaches to be taken.
- (vii) Prepare a preliminary design of proposed project components. For upgrading (improvement/rehabilitation) works this will include adjustments to alignments, improvements or new construction of drainage, bridges, etc. For new roads provide alignment, profile, and cross section on an appropriate scale and details for the terrain and conditions. The scale for the drawings will be not less than 1:25000.
- (viii) It is intended that the construction and upgrading activities would be undertaken using Labor-based methods to the extend possible, with contracts let to local contractors supervised by HMG/N appointed construction management consultants Accordingly, the Consultants are required to specify simple work specifications, flexible road geometric, simple and community managed bioengineering measures, cost effective road structures in their design.
- (ix) Develop methodology to forecast passenger and freight traffic movements on the proposed roads to be used in the economic analysis. These should be based on

the populations served and anticipated trip production and freight generation rates. Forecasts of traffic levels on the sections of road to be upgraded will be based on surveys of existing demands and future growth estimates.

- (x) In consultation with the DoR, develop a comprehensive list of unit item rates to form the basis of the project cost estimates. In order to develop the Rates and Cost Estimates Consultants are required to apply appropriate HMG/N Norms and Specifications with proper and timely interactions with concerned Branches/Sections of DoR.
- (xi) The consultants will prepare detailed economic feasibility and sensitivity analyses for each new proposed hill road to fair weather standard (as per DoR guidelines) road based on estimates of transport benefits and costs (construction and maintenance) for each project. The economic analyses will include Internal Rates of Return, Net Present Value calculations, first year Benefit-Cost ratio, and sensitivity analyses to one-year delays in construction, increases in construction costs, decreases in benefits, and staged approach possibilities. The benefit calculation will estimate transport cost savings resulting from the replacement of foot paths, tracks and air transport with truck and bust transport, and agricultural producer surplus (using methodologies acceptable to the World Bank) resulting from road construction and improved level of access. The above work will entail basic surveys of traffic on footpaths, tracks and roads by mode (including estimation of local seasonality factors), and basic surveys of agriculture data (areas, products and average yields from District Development Committee data).
- (xii) The Consultants will also prepare the detailed economic feasibility analysis for the upgrading to sealed gravel or bituminous standards (as per DoR Guidelines) of the existing sections of earthen or gravel roads. These analyses will be based on vehicle operating cost savings attributable to existing traffic movements. The work will entail traffic surveys and traffic forecast based on seasonality factors and calculation of the current number of closure days per year. As in the case of new roads, the Consultants should prepare detailed feasibility and sensitivity analyses.

To evaluate the economic evaluation of improving unpaved roads, the consultant could use the Roads Economic Decision Model (RED) developed by the World Bank to evaluate the investments in unpaved roads.

- (xiii) **Prepare a social impact analysis in accordance with Bank guidelines and requirements of the Government. Include consultation with local communities affected by the project, possibly through community meetings, local leaders, and non-government and other community organizations. Mitigate adverse social impacts to the extent possible through the project design with costs incorporate in the economic evaluation. Identify positive benefits to, for example, human resource development. If resettlement is required, advise the Government on the requirements for a resettlement plan and assist with defining the basis for the plan.**
- (xiv) **Throughout the study, involve the local communities and residents within the areas of influence of the proposed roads in a program of consultations and community involvement. This will require liaison with local community leaders, local NGOs and local officials, as well as interviews and dialogue with the local populations particularly disadvantaged and vulnerable groups in the effected areas.**

The objectives of the community involvement activities should be to maximize the potential benefits, minimize the adverse impacts, and to gain the acceptance, commitment and participation of the individuals and groups affected by the road. The voluntary participation of local communities is also desirable as a means to increase their commitment with future maintenance requirements.

- (xv) Prepare an environmental impact assessment (EIA) and Initial Environmental Examination (IEE) in accordance with Bank guidelines and requirements of the Government, and report results of the social analysis (SA) appropriate for project appraisal. Mitigate adverse impacts to the extent possible through the project design (inclusive of such measures as supporting DOR's Geo Environmental Unit), with costs incorporated in the economic evaluation. In addition to negative impacts (such as blasting construction techniques) assessments, explore the opportunities to support environmental enhancement measures, such as forest and other natural resource conservation along the road corridor.
- (xvi) Following the completion of the feasibility study, cost estimates, and environmental studies and revised economic appraisals, the Consultants will develop and present their recommendations in regard to the timing, phasing and implementation of the proposed project components. Specifically, this will include recommendations in regard to the most appropriate contracting procedures and packaging of the project components. The Consultants will also develop, in conjunction with Department, the necessary organizational requirements both within the Department and also in regard to the contractors and supervision consultants.
- (xvii) Prepare a Project Appraisal Document at the end of study period, which will bring together all the main findings in respect of the various components in such a form as to assist with possible project appraisal by the World Bank. The document would include details of each project sub-component, economic and financial costing, Initial Environmental Examination and EIA statements (including land acquisition and resettlement issues), social assessment, estimated benefits, and overall economic and technical justification as well as project implementation schedule and implementation arrangements.

4. Training

The consultants will be required to conduct on the job and training to about six DOR Engineers in HDM-4, GIS Applications and Project Planning and prioritisation during execution of their services including: a) collecting road network data; b) storing, managing, and evaluating road network data; c) calibrating HDM-4 for road user costs and unit road agency costs; d) using HDM-4 for project evaluation, programming, and planning of road works; and e) presenting the results of their work efficiently to decision makers with proper tables, graphs and maps to be created in GIS system.

5. Report and Time Schedule

Item	SWRP & PIP		Feasibility Study	
	No. of Copies	Timing (in months) from start date	No. of Copies	Timing (in months) from start date
Inception Reports	15	2.5	15	7
Progress Reports and Technical Reports	15	Every Month (month 4 onwards)	15	Every Month (month 8 onwards)
Interim Reports	15	7	15	11
Draft Final Reports	30	13	30	14

Appraisal Document	NA	NA	15	14
Final Reports	30	15	30	15

(a) Sector Wide Road Program & Priority Investment Plan

The Inception Report shall summarize the consultant's initial findings and mobilization of staff, a first assessment of available data and of site conditions, and a detailed revised work program and schedule of activities. **Progress Reports** shall contain a brief summary of the work accomplished in the preceding months, an outline of work expected to be completed during the next progress reporting period, and consultants' comments or recommendations on any unforeseen conditions that may affect the progress or quality of their work. **The Interim Report** shall contain a summary of the findings and recommendations of the consultants on review of studies, calibration of network models, GIS application, network data traffic studies and forecasts, capacity of existing strategic network models, HDM-4 and GIS application, network data traffic studies and forecasts and capacity of existing strategic network. **The Draft Final Report** shall include the result of analysis of the scope of works outlined above for PIP including review process. **The Final Report** shall be reflecting all revisions required after receipt of comments from HMG and IDA on the Draft Final Report.

(b) Feasibility Study

The Inception Report will include the initial mobilization activities and will specifically present the suggested route alignments in previous studies and changes made in that alignment if any, recommended by the Consultant. The report will contain, among others, the proposed economic analyses methodology for the new road construction and road upgrading components for approval. The report will also contain the results of the initial screening exercise, which will select the final **600 km** (approximately **200 km** new construction and approximately **400 km** for rehabilitation and upgrading) from the investment plan as agreed during the inception. **Interim Report** will include the results and findings from the walk over and/or drive along survey and on the changes recommended on route alignments for further study. The findings in terms of the Initial Environmental Examination on local people by the road construction and analyses for each project sub-component will also be presented together with recommendations for further study, as required. This report will also present the initial results of the project costing, including unit rates, draft quantities and draft of the study including IEE and EIA as applicable. **Project Appraisal Report** will incorporate all Components of the proposed Project in accordance with the requirements set down in **3 (xvi)** of **Detailed Scope of Works**. **Final Report** will document all aspects of the study and provide details of the program and strategy for implementation incorporating the revisions required after receipt of comments from HMG and IDA on the **Draft Final Report**. **Progress Reports** will include a brief summary of work completed, work proposed, staffing arrangements and any other contractual matters.

All data collected during the course of the study will be documented, collated, and presented as annexes. All data, reports and relevant documents will be provided on electronic disk in a readily usable format.

6. Data and Facilities to be provided by the Client

Data on Pavement Condition, Road Roughness, and Traffic Studies available in the Department of Roads will be made available to the Consultants. In addition the client will make available previous documents and reports, which are in its possession.

7. Obligation of the Consultants

The consultant shall provide all the technical and support staff required to carry out their services. The Consultant shall also be responsible for providing all other necessary facilities and logistic support for its staff, including accommodation, transportation, office and survey equipment, material testing, communication, utilities, office etc.

The consultants will carry out confirmatory surveys on information available with DOR and collect additional necessary data for the execution of their services from field surveys. Some of the necessary data for the execution of the services are:

(i) Pavement:

Width: The consultants will measure pavement and shoulder widths as needed but at least once in every kilometer.

Curvature and Gradient: Using suitable instruments, the consultants will determine the average curvature in degrees per km and the average gradient in m/km for each road section referenced in the network.

Structures and CBRs: The Consultants will open test pits in the existing pavements and shoulders every 25 km or less, if required in order to determine the existing pavement structure, measure thickness of each individual layers, determine bearing capacity and measure CBR and moisture content of the natural sub-grades and shoulders. Between two test pits, the dynamic cone penetration (DCP) test will be carried out on the shoulders to assess the variability of CBRs of the sub-grades and on the pavement layers (if driving the DCP through the macadam layers is not found possible, then the consultants will bore a pre-hole through it) to assess the pavement thickness and bearing capacity profile and to determine the structural strength of the pavements. DCP on pavements should be at 2 km intervals for national paved highways and roads with more than 500 vehicles per day and at 5 km intervals on other paved roads. The consultant will ensure that deflection data (Section (iii) below) is available for some of the sites selected for the DCP.

(ii) Roughness:

The consultants will review the existing roughness data from the reports of the consultants who have carried out similar tests for DOR in different projects in the recent past and if required use a vehicle mounted response-type road roughness measuring system to collect additional data. The system will be calibrated and periodically checked in accordance with the International Roughness Index (IRI) standard. Consultants may limit the number of runs per section to one in each direction unless the existing conditions warrant otherwise.

(iii) Deflection:

The consultants will review the data collected by different consultants who have carried out such tests for different DOR projects in the recent past, and if required, measure additional existing pavement deflections under a standard 8 Ton axle. All measurements will be carried out when the pavements are soaked, preferably about the end of the monsoon, or else the values should be adjusted suitably to represent soaked conditions. The deflection values will be correlated to the structural numbers determined from the Dynamic Cone Penetrometer (DCP) measurements.

(iv) Pavement Condition:

The consultants will review the Pavement Condition survey of strategic road networks carried out by consultants employed by DoR in the recent past, and if required carry out additional surveys using the same methodology, at a sampling rate of 5 percent (50 meters in every one kilometer), to determine the surface distress (measured by the Surface Distress Index) and the dominant mode(s) of distress (e.g., cracking, potholing, raveling and rutting) in each of the referenced road section.

Addendum to Social Aspects of the ToRs

Part I Priority Investment Plan for the Strategic Road Network

Part I: Objectives

To prepare a sector wide social impact management framework, including recommendations for strengthening institutional capacity and arrangements.

Part I Section 3. Scope of Services

The consultant's service will include but not limited to the following:

- A detailed review of DOR's past or recent relevant experience on similar works in Nepal and assess lessons learned. Field discussions with people impacted by RMDP would serve as a good source for identifying what worked, what did not, and what key lessons can be identified from this experience used to strengthen future operations in the sector.
- An assessment of the capacity of DOR (or lower level agencies) to identify and ensure implementation of effective social mitigation measures, preferably incorporated as part of standard project preparation practice.
- An assessment of HMGN and Bank policies on involuntary resettlement settlement, identification of any gaps, and recommendations to bridge these gaps.
- On the basis of the analysis defined above, prepare a sector wide social impact management framework, including recommendations for strengthening institutional capacity and arrangements. Prepare the appropriate mitigation instruments - as a minimum a Resettlement Policy Framework, Vulnerable Communities Development Framework and sub-project RAPs and VCDPs prepared as necessary.

Addendum to Environmental Aspects of the TORs

1. Priority Investment Plan for the Strategic Road Network

Part I: Objective

- Assess the current standards of environment and social assessments being carried out in DOR;
- Assess the policies and operational procedures to address, mitigate and manage the environment and social issues in DOR; test for compliance in practice on a sample basis and identify areas that need modification/strengthening; and
- Recommend how the preparation (planning and design), implementation and supervision arrangements might be enhanced, and how any identified environmental issues might be mitigated.

Part I: Scope of Work

(1) Environmental regulations

- (a) Review of existing Nepali regulations, policies, guidelines, frameworks pertaining to EA, EIA and road construction and compare with World Bank safeguard policies and identify any gaps; and

- (b) Review of Nepali regulations concerning forestry, natural habitat, national parks a, conservation areas, pest management, cultural and archaeological property, and disclosure policies and compare with the World Bank policies and identify gaps. Determine which aspect of each regulation/policy is pertinent to DOR.
- (2) Assessment of DOR capacity to implement environment regulations and management and an analysis of the quality of implementation
- (a) Analysis of the current practices and institutional mechanism for application of the above mentioned policies and guidelines. Identify the gaps between the practice and the regulations;
- (b) Assess the current standards and quality of environmental assessments being carried out in DOR;
- (c) Assess the capacity of the DOR to carry out environmental management implementation in projects. Namely, capacity to: (i) develop TOR for IEE, EIA and environmental assessments; (ii) review EIA; (iii) develop environmental management plans; (iv) undertake all the clearance requirements for IEE, EIA etc. through the concerned Ministry and Ministry of Population and Environment; (v) conduct public consultations; (vi) incorporate all the recommendations of the IEE, EIA, and EMP in the contractual documents; (vii) supervise/monitor the environmental requirements; and (viii) ensure quality control of all environmental management activities.
- (d) Assess the existing policies and operational procedures and implementation mechanism to address, mitigate and manage the environmental issues in DOR. Test for compliance in practice on a sample basis and identify areas that need modification/strengthening. The sampling will analyze the following:
- (e) **Procedures:** The Consultant will review the processes undertaken to analyse, predict and manage the identified environment and social issues in design of these selected projects. The Consultant will establish whether the proposed remedial (prevention, mitigation and compensation) measures are commensurate with the nature and scale of the environment and social impacts of the projects. This will include, but not be limited to, reviewing (i) the engineering codes of practice followed for project design, with particular relevance to environment management; (ii) the construction management practices and environment management specifications being followed at site; (iii) implementation of tree plantation and roadside vegetation strategies; (iv) implementation of environmental enhancement measures, such as enhancement of roadside water bodies or public property resources; and (v) overall compliance with adequate environmental, social and health safeguards, during construction.
- (f) **Supervision and monitoring:** The Consultant will review the mechanisms for supervision and monitoring environmental and social issues in both the implementation and operation periods of the sample projects.
- (g) **Policies:** The Consultant will establish whether all the applicable environment, forestry and social policies and legal requirements have been met by the projects. The Consultant will also review the existing

DOR policies with respect to the management of the environment and social issues at all levels and all stages of project preparation and implementation;

- (h) **Discussion of alternatives:** The Consultant will verify whether all reasonable alternatives were considered during preparation of the current projects; and will critically review the final choice of road (alignment, pavement, road cross-section and construction material) with respect to the environmental and social setting of the projects, and program objectives such as connectivity and accessibility to physical, economic and social services and infrastructure.
- **Consultation process:** The Consultant shall establish whether concerns from all stakeholders including the local governments and the vulnerable groups (such as women, agriculture laborers etc.) were addressed in planning and designing the sample projects. This will include verifying the consultation process at DDC, VDC and Ward levels and how the public concerns have been addressed or not addressed by the project.
- (i) Based on the analysis conducted in (a) to (e) recommend concrete measures to be included in Study for Sector wide Road Program and Priority Investment Plan to bridge the gaps identified.
- (3) Institutional strengthening of the DOR for environmental management
- (a) Based on the analysis above, summarize the potential environmental requirement under the Study for Sector wide road program and Priority Investment Plan.
- (b) Prepare or revise if already existing, a compendium of mitigation measures differentiated by ecosystem types and environmental impacts and an environmental code of practice (suggested outline in Annex 1);
- (c) Determine the institutional mechanism for environmental management;
- (d) Prepare training plan;
- (e) Prepare legal framework necessary to ensure environmental management within DOR; and
- (f) Determine consultation and disclosure mechanism (See Annex 2 for suggested framework).
- (4) Methodology
- The Consultant will develop sampling criteria and select an adequate sample of districts for this study, so as to be representative of the entire programme in the identified districts. The selection criteria will be such that a variety of geographical terrain such as undulating, hilly regions, and Terai regions are covered in the study. The Consultant will select the districts in close consultation with the DOR.
 - The Consultant will carry out a desk review of the relevant documented guidelines to address environment and social issues, standards, procedures and processes that are being applied in the program.
 - The Consultant will carry out detailed field surveys for physical verification of actual contracts on a large and credible number of ongoing projects (in various stages of completion) representing the diverse social

and environmental variations. The field surveys are expected to (i) determine the extent to which these guidelines, standards, procedures and processes are actually being applied in practice; (ii) identify and assess environmental and social impacts arising from the planning/design, construction and operation of the projects in their particular setting; and (iii) identify all other relevant issues including those described in the scope of work.

2. Technical and Economic Feasibility of selected 600 km of roads

The current TOR is for specific roads identified under the priority investment plan. Since these are highways under category A, individual EIA and EMPs are required for each road under the Environmental Assessment safeguard policy. The following is suggested to be included in addition to the existing scope of services.

- (a) **Environmental overview:** The consultant will appraise the environment of the proposed roads and issues arising from the planning/design, construction and operation of the projects in their specific setting. Typically this will include aspects such as: climate, topography, geology, soil characteristics; ambient air quality, ambient noise levels; quality and availability of water; flood drainage, alteration of the natural drainage patterns (surface and ground water flows); flora & fauna - their ecological value; agricultural practices, grazing and land utilization; availability of construction material, handling of earthwork, conservation of topsoil and reuse; use of quarries and borrow areas and their rehabilitation; public and workers' safety, etc.
- (b) **Impacts on land use:** The Consultant will carry out an assessment of the land use/utilization pattern within the influence area, and direct, cumulative and induced impacts thereon from the projects. This will typically include potential impacts such as exploitation of natural resources; land use transformation - particularly the loss of grazing/pasture land and common property resources; urban-industrial development and ribbon development, etc.
- (c) **The consultants will review and update environment management plans (EMPs) Frame Work to be adopted by DOR in line with HMGN and Bank policies.** The IEE of the sub-projects for the first year program shall include EMP to mitigate the environmental impacts. These plans will be developed based on actual field investigations for the respective projects (separate from the surveys undertaken for the current/ongoing projects). The EMP will also assign to appropriate agencies the recommended actions necessary to mitigate identified risks and enhance the overall preparation, design and supervision arrangements for the project.

Environmental Codes of Practice

The environmental codes of practice shall include typical designs of mitigation/enhancement measures, complete with technical specifications for material and workmanship.

- (1) **Environmental Impact Screening Process**
- (2) **How to Apply the Environmental Codes and Specifications**

- (3) General Principles of Environmentally Sustainable Planning, Design and Construction**
- (4) Construction Camps and Site Operations (includes Haul Roads, Material Stockpiling, Facilities for Workers, etc.)**
- (5) Tree Plantation and Roadside Vegetation (includes Planting Operations, Maintenance, Selection of Species, Community Participation, Aesthetic Effects, etc.)**
- (6) Erosion Control**
- (7) Slope Stability**
- (8) Temporary Sediment and Pollution Control Devices**
- (9) Quarry Development, Operation and Reinstatements (includes Blasting, Pre-splitting, and other Safety Concerns)**
- (10) Gravel Extraction and Borrow Areas – Development, Operation and Reinstatements/Redevelopment**
- (11) Drainage and Flood Prevention**
- (12) Bridge Works (includes Scour and bank Protection)**
- (13) Traffic Control During Construction**
- (14) Protection of Chance Found Cultural Property; Removal of Burial Sites or Graves**
- (15) Public and Workers' Safety during Construction (includes Transport and Storage of Explosives)**
- (16) Waste Management and Site Redevelopment (including Spoil Disposal, Balancing Cut and Fill, etc.)**
- (17) Additional Measures for Roads through Forest Areas, Wildlife and Natural Habitats (includes Swamps, Temporary Wetland such as Paddy Fields, other Habitats and Breeding Grounds)**
- (18) Additional Measures for Roads in Hills and Undulated Terrain**
- (19) Other Site Specific Mitigation/Management measures (such as for Rivers, Lakes, etc.)**
- (20) Supervision, Monitoring and Compliance.**

Screening and Consultation Framework

- (1) Key Environment Management, Social Development and Participation Issues**
- (2) Analysis of Institutional and Organizational Issues**
- (3) Overall Screening and Consultation Framework**
- (4) An information strategy (objectives of road programme/project for local communities, relevance to the felt need of the communities).**

- (5) Collaborative and participatory mechanisms between communities and local/project authorities (enabling communities to participate in identifying and selecting road improvements, as well as in monitoring the implementation and operation).**
- (6) Mechanism for ensuring continued consultation (communities to be consulted about their needs, constraints and priorities, and discuss access/mobility needs as well as the levels and kinds of services needed).**
- (7) Local employment opportunities (from road improvement/maintenance works).**
- (8) Gender Strategy for the project (includes women's equitable access to employment opportunities).**
- (9) Empowerment and local control (includes decision-making by community representatives)**
- (10) Mechanisms for monitoring and evaluation.**

Annex 2

Environmental Code of Practice

ANNEX 2

Environmental Code of Practice for Road Construction

1. General Principles Guiding Environmentally Sustainable Planning, Design and Construction of Roads

1.1 General

This Guideline aims to assist road planners, site engineers and supervisors with a set of technically specified solutions, tailored to Nepalese conditions, to illustrate the general principles of environmentally sound and sustainable planning, design and construction of road structures. It also refers to drainage and flood prevention, roadside planting, work safety and health concerns, and protection of wildlife and cultural assets.

This Annex makes references to a number of documents in use by the former GEU. Major reference documents are the 'Environmental Codes of Practice, Study on Environmental and Social Aspects of Pradhan Mantri Gram Sadak Yojana, New Delhi, India, Feb, 2004', and the 'Roadside Bio-Engineering Manual of ODA, ORN #16, 1999'.

The Guidelines for the Code of Practice in road construction activities relates particularly to the project preparation stage to avoid/address environmental concerns through modifications in project design and the due incorporation of mitigation measures. It needs to be observed, however, that in addition to these guidelines and project planner needs also to consult and follow the construction guidelines as outlined by the DoR.

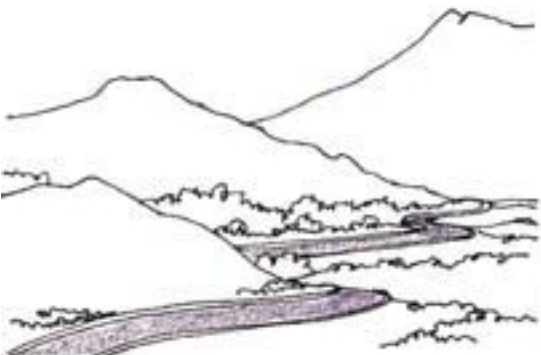
1.2 Finalization of the Road Alignment

All requirements of latest publication of Nepal Roads Standard (NRS), and Design Standards for Feeder Roads of DoR, GON in selection of alignment should be met with. In addition, adequate public consultations with the communities for information disclosure and to identify the concerns and preferences need to be taken up during selection of the alignment (see 'Chapter 8 - Public Consultation Framework' of this document). Finalization of alignment shall be carried out in accordance with the provisions presented below.

The alignment should be...

- Short
- Easy and safe to construct and maintain
- Economical
- Laid on firm ground
- Aesthetic and
- Having least adverse environmental impacts
- Ensure good drainage
- Adequate view of possible hazards ahead

A good road alignment shall conform to the natural topography as far as possible to avoid excessive cut and fill:

High Impact Road	Low Impact Road
	
High standard roads • Good geometrics • Moves large volume of traffic rapidly and safely • Huge cuts and fills, stability of slopes • Damage to vegetation, and • Disruption to natural drainage patterns	Low standard roads • Conforms to the natural topography • Suitable for low volume rural roads and low travel speeds • Reduced environmental impacts - o Reduces the cut and fill, - o Reduces damage to vegetation - o Minimize changes to natural drainage patterns.

An inventory of all environmental features along the proposed road is to be prepared and marked on topographic / thematic map (of scale 1:10,000). This would be conducted by the Project (may be assisted by consultant), and also in co-ordination with the local community through site walk-through survey. Consultations with the local communities are to be conducted during walk-through to obtain their suggestions and incorporate their concerns to address the potential environmental impacts. Suggestions of the community during the walk-through are to be incorporated, to the extent possible, while finalizing the alignment. A simple checklist to be filled up while carrying out the walk- through survey is given in **Table A2-1**.

Table A2-1 : Environmental Assessment and Screening Matrix

	Project Activity Resources	Pre-construction			Construction												Operation & Maintenance			Remarks
		Land acquisition	Delineation	Survey	Site Clearance	Workforce Camp	Water Source	River Training	Excavation	Embankment	Spoil Disposal	Blasting	Bridge Culvert	Road side drain & outlets	Bio-Engineering	Canal	Vehicular Operation	Porters	Maintenance work	
Physical	Topography																			
	Climate																			
	Hydrology																			
	Geology/Soil																			
	Water Quality/Water Source																			
	Air and Noise																			
Biological	Forest																			
	Wildlife																			
	Aquatic Life																			
	Biodiversity																			
	Conservation Area																			
	Wet Land																			
Soci-economic	Education																			
	Economy																			
	Gender Issues																			
	Institutions																			
	Culture																			
	Population/Ethnicity																			
	Health																			
	Land use																			
	Food Sufficiency																			
	Agriculture/Farming																			
	Industry																			
	Aesthetic																			

Elements to investigate and, to qualify and quantify to the degree possible are:

Inventorize the following ... • Unstable slopes, landslides and erosion prone area. • Land use (productive agricultural land, forest, grazing areas etc.) • Scale of resettlement • Trees • Forests, if any (Dense forest area with more than 40% grown cover and thin or open forest area with less than 40% grown cover); conservation areas, national parks • Drainage lines, rivers and water crossings • Irrigation water courses • Water bodies • Cultural properties • Utilities • Community facilities • Schools • Hospitals • Major settlements, and • Seasonal markets or cultural congregations	 Route Alignment to avoid felling trees
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In hill and mountain areas, non-irrigated dry *bari* lands are generally suitable for locating a road alignment without major technical problems. Forest areas on the other hand, particularly in the vicinity of streams are generally steep, difficult and unstable, and should be avoided where possible. Irrigated *khet* lands are unsuitable on account of fertility and associated high agricultural production and technology because of drainage related maintenance problems during road operation.

In case of flood-prone areas and/or areas with very flat slopes, particularly in the *Terai*, hydrological surveys have to be conducted before alignment finalization. Inputs derived from these surveys such as the need for provision of culverts/bridges or other cross/roadside drainage structures should be considered in the alignment finalization. Routes involving higher costs on drainage compared to alternative routes should be avoided. In case of hill areas, geological studies have to be conducted to determine locations of loose rock, soil or potential sites for land slides, which may need to be avoided.

Recommended Practices for Alignment Finalization ...

- Follow existing main trails, as far as possible
- Follow natural topography
- Conform alignment to within property boundaries
- Adopt geometrics that do not compromise on safety requirements
- Avoid crossing power transmission lines, water mains, etc
- Avoid alignments affecting vegetation and felling of trees
- Avoid alignments passing through very unstable slopes.
- Avoid alignments close to streams
- Avoid encroachment of water bodies, and
- Avoid passing through natural designated forests, sanctuaries, national parks and wetlands.
- The road should cross the ridges at their lowest elevation. Relative economics are to be worked out before deciding upon the alignment.
- Hairpin bends are to be kept to a minimum. If unavoidable the alignment should be such that a flat hill slope is obtained for its location.
- Provide adequate cross-drainage structures to ensure that natural drainage patterns are not altered

1.3 Design considerations

All the road designs should conform to the specifications prescribed by Nepal Road Standard and design standard for feeder roads, as appropriate

Drainage: For large catchment areas with low ground slopes, the accumulation of water may cause flooding on the up-stream of the road. The increased velocity of water passing through the culverts causes scour on the down-stream and alters natural ground levels and scouring of land. Hydrological studies are to be conducted in large catchment areas to limit the afflux and provide adequate waterway for cross-drainage structures.

Enhancements:

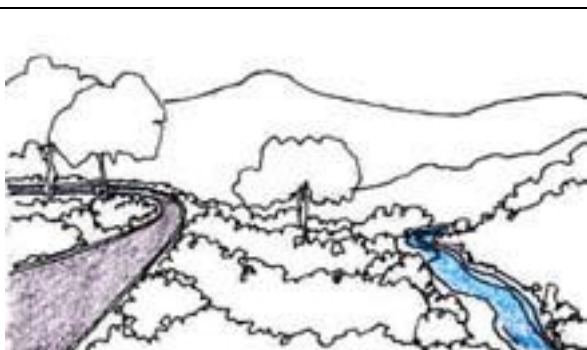
- i. Cattle crossings to be provided at normal crossing routes for safety of both cattle and road user.
- ii. Ramps for access to and from agriculture lands for cross traffic are to be provided to avoid damage to embankment and roadside drains.
- iii. Shoulders should be paved at destination/roadside villages and provide bus bays to avoid traffic obstruction.
- iv. Where possible, the embankment should be widened to provide a platform for stacking materials for maintenance and to ensure that the shoulders are kept free for movement of traffic.

Reduce roadway width when...

- Land is not available
 - o Through built up areas
 - o Through irrigated lands
- Voluntary land donation is resisted
- Land holdings are small and land take affects livelihood and
- The project road is "link route"

Low embankment height reduces...

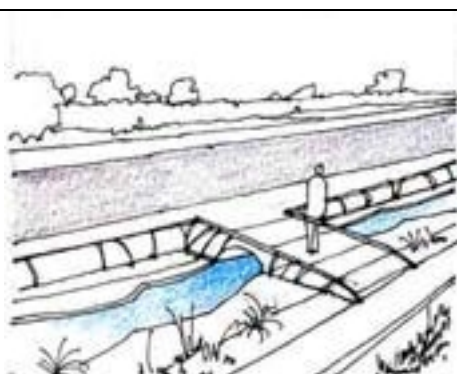
- Quantity of earth work
- Redevelopment costs of borrow areas
- Dune sand accumulation in desert areas and
- Requirement of land for construction of road



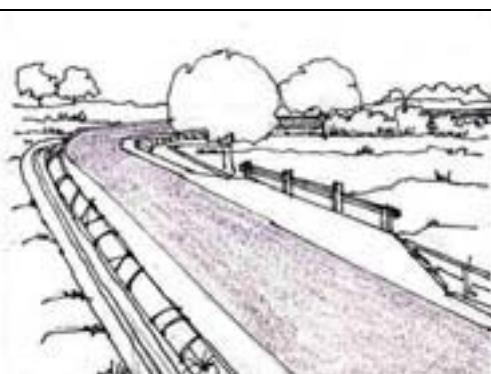
Align Road Away from Drainage Channels



Provide Adequate Openings



Ramp for Lateral Traffic



Widening of Shoulders for Storing Maintenance Materials

Community Concerns: Community concerns, expressed during consultations are to be addressed to the extent possible in the design of the road. The concerns need to be documented and checked for addressal. In case any of the measures are not incorporated, the same needs to be intimated to the community with adequate explanation after design finalization.

Road Signages: Adequate informatory, cautionary and warning road signs should be provided to ensure traffic safety, especially in the event of adoption of lower standards. The signboards should be placed such that they do not block the line of sight.

1.4 Environmental Considerations

Environmental considerations for various activities and sub-activities in road construction projects are presented in **Table A2-2** and **A2-3**. Measures for the same are to be incorporated in the project preparation stage to offset environmental impacts in the subsequent stages.

Corridors prioritized as per the core network shall be subjected to screening – whilst utilizing the screening checklist described in sub-section 4 of this Annex.

The Feasibility Study then has the task to identify the magnitude of the issues / impacts for finding adequate technical mitigation solutions and safeguard measures.

Some of the key environmental concerns to be mitigated...

- Land, including loss of productive topsoil
- Drainage
- Land use and livelihood the issue/s
- Vegetation, cutting of trees
- Forests, wild life, fisheries and aquatic habitat
- Water bodies and water quality
- Slope stability
- Wetlands
- Structures, and
- Common property resources

1.5 Integrating Environmental and Social Provisions in Bid Documents

The environmental and social considerations discussed above have to be incorporated suitably in the Detailed Design and the bid document to ensure implementation. Towards this end, the following steps should be taken by the Project Office.

- Detailed Drawings for the environmental provisions as per the environmental codes of practice are to be included in the Design. The drawings are to include specifications of the materials used and also the detailed bill of project area as quantities in the bid document.
- Cost implications of environmental measures suggested by the environmental codes of practice have to be included in the estimates for the project.
- Monitoring arrangements towards the implementation of the environmental provisions are to be specified.

Construction scheduling –factors to consider...

- Overall scheduling to incorporate climatic factors, snow fall, harsh weather conditions
- Agricultural practices and harvesting seasons
- Timing of specific activities to avoid special weather conditions
- Events of importance in the project area as festive seasons etc.
- Availability of local labour during harvest seasons

- As per the directives of the MoPPW/DoR, the contractor is expected to submit for approval of the engineer, the general methods, arrangements, orders and timing for all the activities in the works along with monthly cash flow. In scheduling the construction works, it is expected that the contractor considers all the risks and schedule the activities, which are likely to be impacted by weather phenomenon in a period in which these phenomenon are unlikely to occur. This would also need review and final approval of the engineer.

Timing of activities-factors to consider...

- If there is a time lag (more than a fortnight) between WBM and black-topping, the surface needs to be suitably blinded and may have to be re-rolled as per the instructions of the 'Engineer'.
- The time lag between the prime coat and the final black-topping shall be minimum and in any event be not more than 3 days.
- Sealed coat shall immediately follow the 20 mm carpet on the same day.

Table A2-2: Environmental concerns in Detailed Design Preparation

Activity	Items to consider	Measures to address	Detailed in Chapter
Survey walk	Topography	Inventories of environmental features avoidance, design modification to minimize adverse environmental impacts Incorporating community concerns in to finalizing alignment.	
	Geology		
	Forests		
	Drainage lines/rivers/water crossing		
	Irrigation water courses		
	Water bodies		
	Grazing lands		
	Cultural properties		
	Utilities		
	Community facilities		
Detailed Survey	Major functions		
	Geological, geotechnical studies in hill areas	Stability analysis and measures to address slope instability in hill slopes and high banks	
	Topographical surveys	Work out requirement of cut and fill	
Identification of Material Sources	Hydrological surveys in flood prone areas (particularly in Terai)	Identification of flood prone areas and measures to avoid afflux Identification of agricultural use of land	
	Borrow Material	Material extraction from existing quarries	3
	Quarry Material	Location Criteria	4
	Water availability	Material extraction from existing quarries minimized	5
		Identification of perennial/community/private sources Utilizing community water sources without conflict of uses	
Assessment of environmental impacts	Climate factors	Scheduling construction considering the special weather phenomena	
	Water bodies	Provision of silt fencing	
		Rehabilitation of water bodies	
	Stability of slopes	Measures for slope stabilization	7
	Soil Erosion	Erosion control measures	8
	Land use changes	Land use control measures adjacent to the road	18
		Empowering a VDCs/DDC/Municipalities to regulate development	
	Agriculture lands	Avoidance from setting up construction camps, borrow areas	2
		Conservation of top soil and reuse	3
		Site restoration after construction	6
	Cultural properties	Avoidance through design modifications	18
		Planning for relocation & rehabilitation	
	Common Property Resources	Avoidance through design modification	1
		Planning for relocation in consultation with community	
	Drainage	Provision of adequate number of CD structures	10
Precautionary measures during	Trees	Compensatory plantation & roadside plantation	9
	Forest areas	Avoidance through design modifications Environment Management measures during construction	1
	Natural Habitats	Avoidance through design modification or formulating additional measures for avoiding impacts	1
	Top soil	Stockpile top soil and preservation	6
	Construction sites	Provision of pollution control measures	14

Activity	Items to consider	Measures to address	Detailed in Chapter
construction to avoid environmental impacts		All measures to ensure public and worker's health/safely, standby emergency facilities	15
		Waste management	12
	Borrow areas	Arrangement with land owners to include redevelopment	3
	Quarry areas	Rehabilitation of quarry areas if new quarries are opened	4
	Public workers health & safety	Personal Protective Equipment to be provided	14
		Public safety at construction site to be under taken	
		Measure for workers health & hygiene at construction camp	2, 14
Consultations with community	Land for borrowing	Agreement to include borrow area rehabilitation	3
	Water for construction	Agreements with owners/community for utilizing water	5
	Site for construction camps	Rehabilitation of the land after construction	2
	Removal of trees	Compensation for the trees cut	9
	Cultural properties	Avoidance through modification of alignment	17
		Relocation costs to be covered in the project, if needs relocation	17
	Common property resources	Avoidance through modification of alignments	2
		Relocation costs to be covered in the project, if needs relocation	2
Finalization of alignment	Traffic during construction	Provision of alternate routes or prior notice to the users	1
	Concerns of community	Community concerns to be incorporated	1
	Environmental impacts identified	Impacts identified are to be mitigated by incorporation of provisions as per these Codes	1
	Design aspects	Impacts that can be mitigated through design modifications should be incorporated	1
Preparation of detailed drawings	All concerns/impacts identified	Designs for enhancements and mitigation measures including cost provisions	All

Table A2-3: Environmental Concerns during Project Implementation - to be identified in the EMP

Activity and Sub Activity	Impact/s	Measures	Detailed in Chapter
Pre-Construction Activities			
Alignment Marking	-Nil-	i) Co-ordination with DoR	1 2
Relocation of Utilities	Impact on current usage	i) identification of relocation site in advance	2
		ii) Scheduling the activity in consonance with the community usage pattern	2
Tree Felling	Compliance with Forest Act in case trees are on forest land	i) Prior clearance from Department of Forest; coordinate with district forest officer	1, 9 15
	Loss of canopy	ii) Compensatory plantations & landscape designs	9
Clearance of Land	Affect on livelihood	i) As per project provisions for compensation and resettlement	2
	Affects on standing crops	ii) Scheduling of activity and coordination; compensation	1
	Affects on cultural properties	iii) Modification of alignments for avoidance or relocation of the cultural properties	17
	Affect on natural habitats	iv) No clearance of vegetation beyond existing RoW.	15
Diversion of Forest Land	Compliance with Forest Act	i) Activity scheduling to avoid delays, confirmation to legal requirement	15
	Affect on flora	ii) Precautionary measures during construction in forests	15
	Pollution from construction activities	iii) Precautions while operating equipment machinery	13
Transfer of Land Ownership	Grievances from community	i) Addressal through Grievance Redressal Mechanism & Consultations	1
	Affect on livelihood	ii) Provision to entitlement as per resettlement framework	1
Location of Storage Yards, Labor Camps, & Construction Sites	Pollution from construction camps, storage yards and labor camps	i) Location criteria to be adopted	3
	Pressure on location infrastructure	ii) Infrastructure arrangements to be as per guidelines	3
Procurement of Equipments and Machinery	Machinery likely to cause pollution at settlement and natural habitats	i) Machinery to be procured shall be in conformance with approved specifications	13
	Safety concerns in machinery operation	ii) Safety equipment for workers; safety awareness and practice	14
Identification and	Conflict of users in case of	i) Consultations and arrangements at	6

Activity and Sub Activity	Impact/s	Measures	Detailed in Chapter
Selection of Material Sources	water	contractor-individual levels, documentation of agreement	
	Borrowing causes depressed land	ii) Consultations and arrangements at contractor-individual levels, documentation of agreement	4
	Pollution due to material extraction from borrow and quarry areas to surrounding environment	iii) Precautionary measures during siting of borrow areas and quarry areas	4 5
	Disturbance to Natural Habitats	iv) Avoidance to location of material source in Natural Habitats	15
Identification of designated locations of waste disposal	Pollution due to location close to settlements, water bodies & other sensitive areas	i) Site selection in conformance to criteria provided	13
Construction Activities			
Site Clearance			
Clearing and grubbing	Effects on road side vegetation	i) Restricted movement of machinery/equipment	2 13
	Debris generation creating unsightly conditions	ii) Disposal/storage of grubbing waste and possible reuse	12
Dismantling of existing culverts and structures, if any	Generation of debris creating unsightly conditions	i) Disposal of waste and likely reuse	12
	Flooding due to interception to drainage paths	ii) Provision of diversion channels and/or scheduling construction of culverts in dry months	10
Planning Traffic Diversions and Detours	Trampling of vegetation along traffic diversions	i) Activity scheduling, identification of alternative track	15 9
Material Procurement	Loss of topsoil	i) Stripping and storing topsoil	7
	Formation of stagnant water pools due to borrowing/quarrying	ii) Rehabilitation plan for borrow areas and quarry areas	4 5
	Illegal quarrying/sand mining	iii) Conformance of quarries selected to the EMP requirements including quarry rehabilitation plans	5
	Uncontrolled blasting at quarries	iv) Controlled blasting to the extent required.	5
		v) Conformance to blasting rules as per the Explosive Act of GoN	1
Transport of materials to site	Fugitive emission from transport trucks	i) Covering of material with tarpaulin or use of covered box trucks during transport	12
	Dust emission from haul roads	ii) Haul road management	13
Storage of materials	Contamination of water sources, leaching into ground water	i) Provision of impervious base to storage areas	3
Handling of earth	Dust rising and increase in particulate concentration in ambient air	ii) Use of dust suppressants like water sprinkling	13
Handling of Soil and Dust	Increase of particulate concentration and contamination of nearby areas	iii) Use of dust suppressants like water sprinkling	13
Handling of granular material	Risk of injury to workers	iv) Use of Personal Protective Equipment	14
Handling of bituminous materials	Leaching of materials, contamination of water sources	v) Provision of impervious base at bitumen storage areas	13
	Air pollution	vi) Control of emission from mixing	13
Handling of oil/diesel	Contamination of accidental spills	vii) Prevention of accidental spills, affecting cleaning immediately after spill	15
	Pollution due to incomplete burning	viii) Ensure complete combustion of fuel through regular maintenance of equipment	12
Waste management	Littering of debris at construction site	ix) Waste to be disposed at disposal locations only	12
	Contamination of surroundings due to runoff from construction site	x) Preventing of runoff from entering water bodies	12 10
Operation of construction equipments and	Air and Noise pollution	xi) Conformance to Emission Standards and Norms	13 14

Activity and Sub Activity	Impact/s	Measures	Detailed in Chapter
machinery			15
	Operational safety of workers	xii) Conformance to Safety concerns of the road users and workers in operation, first aid provision and mandatory provision of Personal Protective Equipment	14
Movement of Machinery	Trampling of vegetation	xiii) Restriction of movement within ROW	15
	Damage of Flora and natural habitats	xiv) Minimizing impact on vegetation	15
	Damage to roadside properties	xv) Minimizing impacts on private and common properties, including religious structures	17
Earthworks			
Cutting	Uncontrolled blasting in case of rock cutting	i) Controlled blasting to be made mandatory	5
	Loss of topsoil	ii) Preservation of topsoil for reuse	7
	Waste generation	iii) Safe disposal of waste and possible reuses	12
Embankment construction	Interruption of drainage	i) Drainage channels to be provided with culverts in advance to embankment construction	10
	Dust Rising	ii) Dust suppression with water	13
	Excess water/material usage	iii) Minimizing height of embankment	1
		iv) Scheduling embankment construction in wet months, if possible	1
		v) Compaction with vibratory rollers is suggested	1
	Erosion causing impact on embankment/slope stability	vi) Slope stabilization measures as seeding, mulching and bio-engineering techniques	8.
	Formation of rills/gullies	vii) Construction of temporary erosion control structure as per requirements	8
	Contamination of water	viii) Control measures as silt fencing, vegetative barriers etc.	8
		ix) Avoiding disposal of liquid waste into natural water courses	10 11
Maintenance at construction camp	Collection of rainwater in construction camps	x) Temporary drains during construction	3
	Waste water from labor camps	xi) Disposal of waste water into soak pits	3
	Contamination of soil	xii) Removal of oil/other chemical spills & wastes	3
Cutting embankments of surface water bodies	Impact on the drainage flows in and out of the water body	xiii) Restoration of drainage channels	10 11
	Embankment stability	xiv) Design of slopes of the water bodies, slope protection	8
Sub-Base and Base courses			
Granular sub-base	Extensive extraction of quarry materials	i) Use of locally available materials	5
Wet mix macadam	Extensive water requirement	ii) Scheduling the activity in wet months	1
		iii) Avoiding conflict to use due to water extraction from construction	6
Shoulders treatment	Movement of machinery for compaction	iv) Restricting movement on adjacent land	13
Culverts and Minor Bridge Works	Interruption of water flow	i) Provision of diversion channels	11
	Pollution of water channels during construction	ii) Control of sediment runoff	11
	Safety of workers	iii) Mandatory use of personal protective equipment	14
Surfacing			
Bituminous surface	Workers safety during handling of hot mix	i) Mandatory use of personal protective equipment	14
	Damage to vegetation (burning/cutting)	ii) Avoiding use of wood as fuel for heating bitumen	14
		iii) Hot mix plant location on waste lands	14
	Contamination due to bituminous wastes	iv) Reuse of land filling of bituminous wastes	12
	Impacts on air quality	v) Ensuring compliance of hot mix plants with the standard emission standards	13
Concrete surfacing for roads crossing built up areas	Contamination of surroundings due to concrete mixing	vi) Mixing concrete at designated locations away from habitation and agricultural land	3
Road furniture/Signage	positive	To be provided as per design	

Activity and Sub Activity	Impact/s	Measures	Detailed in Chapter
Shoulder protection	Requires material extraction from quarries	i) Use locally available material	5
		ii) Ensure that all shoulders are clear of debris or construction materials	7
Enhancements	positive	i) To be included in Detailed Design Report	1
Post construction activities			
Clearing of construction camps			
Camp site restoration	Change of land use due to setting up of construction camp	i) Camp site to be restored to its original condition as per the rehabilitation plan	3
		ii) Restoration of top soil	7
Dismantling of campsite	Waste generation at the construction site	iii) Disposal at waste at designated locations	12
Clearing of water Channels, side drains and culverts	Generation of debris and silt	i) Removal of debris and disposal	12 13
Rehabilitation of borrow areas	positive	i) Top soil restoration, re-vegetation	7

2. Site Preparation

The preparation of site for construction involves: (i) Marking and clearance of the required RoW of all encroachments by the Project Management prior to mobilization of Contractor; and, (ii) Site preparation by the Contractor prior to commencement of construction. The land acquisition and resettlement issues involved are to be addressed as per the provisions of the Resettlement Framework for the project.

2.1 Site Preparation Activities by the Project Management

After finalization of the alignment, the Project Management (PM) shall be responsible to stake out the alignment by establishing working benchmarks on ground. It shall be the responsibility of the PM to take over the possession of the proposed RoW and hand over the land width required clear of all encumbrances to the Contractor.

The addressal of social and resettlement issues shall be carried out by the PM as per the provisions of the Resettlement Framework (See Chapter 6 of ESMF) and the Screening and Consultation Framework (See Chapter 3 of ESMF). Activities pertaining to the clearance of land and relocation of utilities need to be initiated by the PM well in advance to avoid any delays in handing over of site to the Contractor.

PM's responsibilities before handing over site ...

- Clearance of encroachments within proposed RoW
- Initiation of process for legal transfer of land title
- Alignment modification or relocation/removal of utilities in consultation with the various government departments, and
- Obtain clearances required from government agencies for
 - o Felling trees, and
 - o Diversion of stretches of forestlands etc.

2.2 Site Preparation Activities by the Contractor

The Contractor shall verify the benchmarks soon after taking possession of the site. The Contractor, prior to initiation of site preparation activities, shall highlight any

deviations/discrepancies in these benchmarks to the PM/Engineer¹ in writing. The contractor shall submit the schedules and methods of operations for various items during the construction operations to the PM/Engineer for approval. The Contractor shall commence operations at site only after the approval of the schedules by the PM/Engineer.

The activities to be undertaken by the contractor during the clearing and grubbing of the site are as follows:

- The clearance of site shall involve the removal of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, part of topsoil and rubbish. Towards this end, the Contractor shall adopt the following measures: (i) Limiting the surface area of erodible earth material exposed by clearing and grubbing; (ii) Conservation of top soil and stockpiling as per the provisions stated in the contract clauses and (iii) Carry out necessary backfilling of pits resulting from uprooting of trees and stumps with excavated or approved materials to the required compaction conforming to the surrounding area.
- To minimize the adverse impact on flora and vegetation, only ground cover/shrubs that impinge directly on the permanent works shall be removed. Cutting of trees and vegetation outside the working area including RoW shall be avoided under all circumstances. In case the alignment passes through forest areas, official from District Forest Office shall be consulted for identification of presence of any rare/endangered species with in the proposed road way. Protection of such species, if found, shall be as per the directions of the Forest Department of forest and as suggested by the Environmental Management Plan in the IEE/EIA study Report.
- The locations for disposal of grubbing waste shall be finalized prior to the start of the works on any particular section of the road. The selection of the site shall be approved by the PM/ The 'Engineer'. The criteria for disposal of wastes shall be in accordance with the provisions given in Chapter 12 of this Annex, i.e., "Waste Management" and Site Redevelopment.
- In locations where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion and sedimentation control features can follow immediately, if the project conditions permit.
- Dismantling of (Cross Drainage) structures and culverts shall be carried out in a manner not to damage the remaining required portion of structures and other surrounding properties. The disposal of wastes shall be in accordance with the provisions in Ch.12, "Waste Management" and Site Redevelopment. The following precautions shall be adopted: (i) The waste generated shall not be disposed off in watercourses, to avoid hindrance to the flow; and (ii) All necessary measures shall be taken while working close to cross drainage channels to prevent earthwork, stonework as well as the method of operation from impeding cross drainage at rivers, streams, water canals and existing irrigation and drainage systems.
- The designated sites duly approved by PM or The Engineers shall be cleared of its existing cover for setting up of the construction sites, camps and related infrastructure facilities, borrow areas and other locations identified for temporary use during construction. The contractor shall comply with all safety requirements in consideration

¹ The Engineer – the engineer according to FIDIC

as specified in Ch.14 – “Occupational Health and Safety”. Before initiation of site preparation activities along these lands to be used temporarily during construction, it shall be the responsibility of the Contractor to submit and obtain approval of the site redevelopment plan from the PM/ The Engineers. The letter/contract agreement between the owner(s) of the land parcel for temporary usage shall include site redevelopment to its original status. The guidelines for the same are furnished in Ch. 13 - Construction Plants & Equipment Management; Ch.3 - Construction Camps and Site Operation; and Ch. 4 - Borrow Areas.

- Site preparation shall involve formation of the road base wherein it is ready for construction of protective/drainage works, carriageway, shoulders, parapets and other road furniture. In hilly terrain, trace cut are already undertaken by the PM during surveys for alignment marking and design preparation. The PM shall transfer the land for civil works to the Contractor after peg marking of the alignment.

3. Construction Camps and Site Operation

The terms and conditions of this Code of Practice pertain to the silting, development, management and restoration of construction camps to avoid or mitigate impacts on the environment. The area requirement for the construction camp shall depend upon the size of contract, number of laborers employed and the extent of machinery deployed. The key activities requiring addressal during the project stages are presented in **Table A2-4**.

Table A2-4: Key Activities of Different Stages

Stages	Activities
Pre-construction	Proper Site Selection
	Development
Construction	Maintenance and Management
Post-construction	Closure and Restoration to original condition

3.1 Pre-Construction Stage

The Contractor shall identify the site for construction camp in consultation with the individual owners in case of private lands and the VDC/Municipality in case of public lands. The suitable sites shall be selected and finalized in consultation with the Project Management (PM) or the Engineer². Take site photos for settling later disputes.

The contractor will work out arrangements for setting up his facilities during the duration of construction with the land owner/local bodies. The arrangements will include the restoration of the site after completion of construction. The arrangements will be verified by the PM/local bodies to enable redressal of grievances at a later stage of the project.

After finalization of the site, the contractor shall submit to the PM/Engineer a detailed layout plan for development of the construction camp, indicating the various structures to be constructed including the temporary structures to be put up, site roads, drainage, lighting, waste management and other facilities. The plan will include the redevelopment of sites to

² ‘Engineer’ as per FIDIC/Consultant

pre-construction stage. As a reference, the campsite should cover a minimum area of 3,000 m² for 60 workers (=Thumbs Rule).

Selection of construction camp/site locations ...	
<i>Avoid the following ...</i> • Lands within 500m of habitations, markets, schools, health posts etc. • Irrigated agricultural lands, productive land • Lands belonging to small farmers, vulnerable groups • Lands under village forests/community forest • Lands within 100m of community water bodies and water sources as rivers • Lands within 100m of watercourses • Low lying lands • Lands supporting dense vegetation • Grazing lands and lands with tenure rights • Lands where there is no willingness of the landowner to permit its use	<i>Prefer the following ...</i> • Waste lands • Lands belonging to owners who look upon the temporary use as a source of income • Community lands or government land not in use for beneficial purposes • Private non-irrigated lands where the owner is willing, and • Lands with an existing access road

Towards the provision and storage of drinking water at the construction camp, the contractor shall ensure the following provisions:

- The contractor shall provide for a sufficient supply of cool potable water in the construction camps. The contractor shall identify suitable community water and agreement sources as hand pumps, spring and ponds for procuring drinking water, in consultation with the VDC/Municipality or local beneficiary communities.
- Only in the event of non-availability of other sources of potable water, the Contractor shall obtain water from an existing open well, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with dust and waterproof trap door.
- Every water supply or storage shall be at a distance of not less than 15m from any wastewater / sewage drain or other source of pollution. Water sources within 15m proximity of toilet, drain or any source of pollution will not be used as a source of drinking water in the project.
- A pump shall be fitted to each covered well, the trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once a month.
- When possible, contractor can procure drinking water in their water tankers or from private/government water supply tankers after ensuring drinkable quality of water. In every site, adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labor employed therein. Separate and adequate bathing facilities shall be provided for the use of male and female workers.

Arrangement with landowners...

The contractor shall submit to PM/ The 'Engineer' the following:

- Written No-objection certificate of the owner/cultivator
- Extent of land required and duration of the agreement
- Photograph of the site in original condition
- Details of site redevelopment after completion

Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions.

Sanitary arrangements, latrines and urinals shall be provided in every work place on the following scale:

- Where female workers are employed, there shall be at least one latrine for every 25 females or part thereof.
- Where males are employed, there shall be at least one latrine for every 25 males or part thereof.
- Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings.
- Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men Only" or "For Women Only" as the case may be.
- The latrines and urinals shall be adequately lighted and shall be maintained in a clean sanitary condition at all times, and
- Water shall be provided in/near latrines and urinals by storage in drums or piped supply.

Arrangements for Waste Disposal

- Disposal of sanitary wastes and excreta shall be into septic tanks.
- Kitchen wastes shall be disposed into soak pits. Wastewater from campsites will be discharged and disposed in a kitchen sump located at least 15 meters from any body of water. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit.
- Solid wastes generated in the construction site shall be reused if recyclable, inert materials shall be disposed off in landfill sites and combustible materials shall be buried if it is not hazardous.

First Aid Facilities

- First Aid Box will be provided at every construction campsite and under the charge of a responsible person who shall always be readily available during working hours of the work places. He shall be adequately trained in administering first aid-treatment. Formal arrangement shall be prescribed to make motor transport or ambulance available to carry injured person or person suddenly taken ill to the nearest hospital. If hospital is far away, proper medical clinic facility should be made available at camp where emergency treatment is available. Thereafter, the injured shall be taken to hospital.

Fire fighting arrangement

- The construction camps shall be equipped with fire fighting equipment and facilities. The staff residing there shall be regularly trained to use such facility during fire outbreak. Proper pictorial posters should be used to indicate to everyone the location of fire fighting equipment.

Interactions with host communities

- To ensure that there is no conflict of the migrant labor with the host communities, the contractor shall issue identity cards to laborers and residents of construction camps.

- He equally should conduct regular awareness campaigns to maintain good social relationship with local communities.
- Of paramount importance are regular awareness/training programmes for all laborers to address and avoid prostitution and spread of sexually transmissible diseases (HIV/AIDS)

3.2 Construction Stage

Construction camps shall be maintained free from litter and in hygienic condition. It should be kept free from spillage of oil, grease or bitumen. Any spillage should be cleaned immediately to avoid pollution of soil, water stored or adjacent water bodies. Following precautions need to be taken in construction camps.

- Measures to ensure that no leaching of oil and grease into water bodies or underground water takes place;
- Wastewater should not be disposed into water bodies;
- Regular collection of solid wastes should be undertaken and should be disposed off safely;
- All consumables as the first aid equipment, cleaning equipment for maintaining hygiene and sanitation should be recouped immediately;
- PM/ The Engineer will monitor the cleanliness and appropriate management of construction campsites and ensure that the sites are properly maintained throughout the period of the contract to the satisfaction of the PM and as envisaged by contract agreement.

Site Restoration: At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Therefore, photographic documentation is recommended to verify and settle possible disputes. Various activities to be carried out for site restoration are:

- Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas;
- Construction campsite shall be grassed and trees cut replaced with saplings of similar tree species;
- Saplings planted shall be handed over to the community or the land owner with due arrangements meeting the cost for further maintenance and watering for at least five years; and
- Soak pits and septic tanks shall be covered and effectively sealed off.

3.3 Storage Site

- Storage of general materials: brick on edge flooring or sand flooring will be provided at the storage places of construction materials to avoid soil and water contamination due to oil spillage;
- Storage of cement: damp-proof flooring, as per standard codes;
- Storage of blasting materials: shall be as per the specific provisions of law (Explosive Act of GoN).

4. Borrow Areas

Embankment fill material is to be procured from borrow areas designated and approved for the purpose. The properties of the borrow material shall be tested and recorded on standard format. Precautionary measures need to be incorporated during borrow area location, material extraction and rehabilitation. Table A2-5 presents key activities involved in borrowing material acquisition:

Table A2-5: Key Activities during Different Stages

Stage	Activities
Pre-construction	Siting
	Development
Construction	Operation
Post-construction	Restoration

4.1 Project Planning and Design Stage

Design measures for reduction in quantity of earth work will have to be undertaken to reduce the quantity of material extracted and consequently decrease the borrow area requirement.

Borrow area siting should be in compliance with standard EMP recommendations provided in the IEE/EIA. The Detailed Design shall contain (i) Guidelines for locating /excluding sites of borrow material; (ii) The arrangements to be worked out with the land owner/community for the site; and (iii) Sample designs for re-development and/or rehabilitation of borrow areas to remain in environmentally friendly condition (e.g. avoidance of establishing mosquito breeding grounds or garbage dump sites)

4.2 Pre-construction Stage

The contractor shall identify the borrow area locations in consultation with the individual owners in case of private lands and the local bodies in case of public lands, after assessing the suitability of the material. The suitable sites shall be selected and finalized in consultation with the PM/ The Engineer.

Borrowing to be avoided on...
• Lands close to toe line, but in no case less than 1.5m • Irrigation agricultural lands • Grazing land • Lands within 0.8 km of settlements • Environmentally sensitive areas - o Designated protected areas/forests - o Unstable site-hills - o Water-bodies - o Wetlands - o Caves and karstic landforms - o Streams and seepage areas - o Areas supporting rare plant/animal species

Planners and designers shall duly investigate if roadside borrow pits would be allowable,

as such structures pose additional accident risks, may weaken or soak the embankment, and serve as public garbage dumpsites.

The Contractor will work out arrangements for borrowing with the land owner/local bodies. The arrangements will include the redevelopment after completion of borrowing. The arrangements will be verified by the PM/local bodies to enable redressal of grievances at a later stage of the project. 'The Engineer' of PM shall approve the borrow area after inspection of the site to verify the reclamation plan and its suitability with the contractor and landowner. The contractor shall commence borrowing soil only after the approval by the PM.

Arrangements with landowners...	Redevelopment plan to address...
• Contractor shall submit to PM • Written No-objection certificate of the owner/cultivator • Extent of land required and duration of the agreement • Photograph of the site in original condition • Details of site redevelopment after completion	• Land use objectives and agreed post-borrowing activities • Physical aspects (landform stability, erosion, re-establishment of drainage) • Biological aspects (species richness, plant density,) for areas of native re-vegetation • Water quality and soil standards • Public safety issues

4.3 Construction Stage

No borrow area shall be operated without permission of the Engineer. The procurement of borrow material should be in conformity to the guidelines laid down in standard code of practice adopted for the project. In addition, the contractor should adopt the following precautionary measures to minimize any adverse impacts on the environment:

- i). The unpaved surfaces used for haulage of borrow materials will be maintained dust free by the Contractor through sprinkling of water twice a day during the period of use.
- ii). To avoid any embankment slippage, the borrow areas will not be dug continuously, and the size and shape of borrow pits will be decided by the Engineer.
- iii). Borrow pits situated less than 0.8 km (if unavoidable) from villages and settlements should not be dug for more than 30 cm after removing 15 cm of topsoil and should be drained.
- iv). The Contractor shall maintain erosion and drainage control in the vicinity of all borrow pits and make sure that surface drains do not affect the adjacent land or future reclamation. This needs to be rechecked by the engineer responsible.
- v). In case the borrow pit is on agricultural land, the depth of borrow pits shall not exceed 45 cm and may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside. Incase of stripping and stockpiling of topsoil, provisions of Ch. 7, "Topsoil Salvage, Storage and Replacement" need to be followed.
- vi). To prevent damages to adjacent properties, the Contractor shall ensure that an undisturbed buffer zone exists between the distributed borrow areas and adjacent land. Buffer zone shall be 3 m wide or equal to the depth of excavation, whichever is greater.
- vii). Incase of riverside, borrow pit should be located not less than 15 m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood.

viii). In no case shall the borrow pit be within 1.5 m from the toe line of the proposed embankment.

4.4 Post Construction Stage

All reclamation shall begin within one month of abandonment of borrow area, in activities and land accordance with the redevelopment plan. The site shall be inspected by the PM/The Engineer after density achieved in implementation of the reclamation plan.

A viable option to explore is the re-shaping of borrow pits for aquaculture purposes, as long as soil and water supply conditions would be conducive to develop fishponds out of the borrow pits. In such cases, the Contractor shall be obliged (as per clauses) to use his machinery in re-shaping/inserting dividing bunds in the pit so the entire site will be readily usable as fish culture enterprise.

Certificate of Completion of Reclamation is inflow and outflows in to be obtained by the Contractor from the landowner stating that "the land is restored to his/her satisfaction". The same is to be submitted to the PM/The Engineer.

Checklist of items for inspection by PM/The Engineer
• Compliance of post-borrowing activities and land use with the reclamation plan • Vegetation density targeted, density achieved in case of re-vegetation, species planted as per reclamation plan • Drainage measures taken for inflow and outflows in case borrow pit is developed as a detention pond • Decrease of risk to public due to reclamation • Condition of the reclaimed area in comparison with the pre-borrowing conditions

5. Quarry Management

The general practice adopted is to procure materials from existing quarries operating with the requisite permits. Notwithstanding, specific environmental safeguard to be included in the Works Contracts need to be observed with respect to exploiting new quarries. **Table A2-6** presents the activities to be carried out whilst engaging in quarry operations.

Table A2-6: Key Activities during Various Stages

Stage	Key Activities
Pre-construction	Plan, Design and Establish new quarry
Construction	Precautions during quarry operations
Post-construction	Implementation of quarry site closure and landscape Redevelopment Plan

5.1 Project Planning and Design Stage

The PM shall provide in the Detailed Design Report and the bid document, a list of licensed quarries operating within the district and adjoining districts. In addition, these shall contain the following: (i) Sustainable quantity of materials available in quarries; (ii) Alternative /existing quarries and distances; and (iii) Adequacy of materials for the project in these quarries.

Only in the event of non-availability of existing quarries, shall the Contractor open a new quarry. The bid document shall include the exhaust quarry redevelopment as per needs of the landowner / community.

5.2 Pre-construction Stage

The Contractor shall select an existing licensed quarry identified in Detailed Design Report for procuring materials. The Contractor shall establish a new quarry with the prior consent of the PM\The Engineer only in cases when: (i) Distance from existing quarries is uneconomical; and (ii) Alternative material sources are not available. The Contractor shall prepare a Redevelopment Plan for the quarry site and get it approved by the PM\The Engineer.

Operations & redevelopment plan for new quarries to contain....
• Photograph of the quarry site prior to commencement. • The quarry boundaries as well as location of the materials deposits, working equipments, stockpiling, access roads and final shape of the pit. • Drainage and erosion control measures at site. • Safety Measures during quarry operation. • Design for redevelopment of exhaust site. <u>Option A:</u> Re-vegetating the quarry to merge with surrounding landscape: This is done by conserving and reapplying the topsoil for the vegetative growth <u>Option B:</u> Developing exhausted quarries as water bodies: The pit shall be reshaped and developed into pond, for harvesting rainwater. This option shall only be considered where the location of quarry is at the lowest point, i.e. surrounding areas / natural drainage slopes towards it.

The construction schedule and operation plans should be submitted to the PM\The Engineer prior to commencement of work. The plan shall contain a detailed work plan for procuring materials that includes procurement, transportation and storage of quarry materials.

5.3 Construction Stage

Development of site: To minimize the adverse impact during excavation of material following measures needs to be undertaken:

- i) Adequate drainage system shall be provided to prevent the flooding of the excavated area
- ii) At the stockpiling locations, the Contractor shall construct sediment barriers to prevent the erosion of excavated material due to runoff.
- iii) Construction of offices, laboratory, workshop and rest places shall be done in the up-wind of the plant to minimize the adverse impact due to dust and noise.
- iv) The access road to the plant shall be constructed taking into consideration location of units and also slope of the ground to regulate the vehicle movement within the

- plant.
- v) In case of storage of blasting material, all precautions shall be taken as per The Explosive Act of GoN.
- Quarry operations including safety:
- i) Overburden shall be removed and disposed as per Ch. 13 "Waste Management and Site Redevelopment".
 - ii) During excavation slopes shall be flatter than 20 degrees to prevent their sliding
 - iii) In case of blasting, the procedure and safety measures shall be taken as per The Explosive Act of GoN.
 - iv) The Contractor shall ensure that all workers related safety measures shall be done as per Ch. 15, "Occupational Health & Safety".
 - v) The Contractor shall ensure maintenance of crushers regularly as per manufacturer's recommendation.

Stockpiling of the excavated material shall be done as per stockpiling of topsoil explained in Ch 7, "Topsoil Salvage, Storage & Replacement."

During transportation of the material, measures shall be taken as per Ch. 14, "Construction Plants and Equipment Management" to minimize the generation of dust and to prevent accidents

The PM/The Engineer shall review the quarry site for the management measures during quarry operation, including the compliance to pollution norms.

5.4 Post Construction Stage

The Contractor shall restore all haul roads constructed for transporting the material from the quarries to construction site to their original state.

The PM/The Engineer shall be entrusted the responsibility of reviewing the quarry site for the progress of implementation of Redevelopment Plan.

The Contractor shall be responsible for the Redevelopment Plan prior to completion, during the defect liability period. The PM/The Engineer shall be responsible for reviewing this case of redevelopment prior to issuing the defect liability certificate.

6. Water for Construction

This Code of Practice pertains to the procurement of water required for construction, except for bituminous works. Water is required during all stages of road construction such as embankment, sub-grade, granular sub-base (GSB) and water-bound macadam (WBM) as well as construction of structures. Relevant activities as per stage are:

Table A2-7: Key Activities at Various Stages

Stage	Key Activities
Project Planning & Design Stage	Scheduling construction to suit water availability
	Identification of alternate water sources
Pre-construction Stage	Arrangements for procuring water
Construction	Extraction of water

6.1 Project Planning & Design Stage

The Detailed Project Report shall contain the following information:

- Estimate of water requirement during different seasons based on construction schedule of various stages of the project,
- Identification of potential sources of water for construction,
- Arrangements to be worked out by the contractor with individual owners, when water is obtained from private sources,
- Permits required for tapping new sources, as per the requirements of the local bodies, and
- Whether scarcity of water would have any impact on schedule of construction.

In water-scarce regions, provide additional information in the Detailed Design Report and IEE/EIA
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- | |
|--|
| <ul style="list-style-type: none"> • Exploring possibilities for use of existing perennial sources, through interactions with water user groups as the villagers, relevant local bodies and the Government Department, keeping in view that the water extraction does not infringe upon the usufruct rights of the existing water users. • Identification of potable water source for domestic use of workers and for use in cement - based construction such as cement concrete roads, culverts and other cross drainage works. • Identification of alternate water sources, water-harvesting techniques may be explored for use in hilly areas to avoid water extraction from the existing community sources. |
|--|

In water scarce regions, if water-harvesting structures are to be constructed, suitable locations and mechanism for sitting these structures shall be identified. These are envisaged to be permanent water tanks for collection of stream water. Detailed drawings of water harvesting structures based on site conditions will need to be worked out and presented in the Detailed Design Report.

Scheduling Construction in Water Scarce Areas: As part of the project preparation, the PM shall conduct an assessment of water requirement and availability in water scarce regions as: arid regions. As possible, the schedule for construction in these water scarce areas shall be prepared such that earthwork for embankment is carried out just before monsoon, so that water requirement for subsequent construction works like granular sub-base and water-bound macadam are met in monsoon and post monsoon season. Carrying out these activities even during the monsoon is possible as the rainfall may not be high enough to disrupt construction.

6.2 Pre-construction stage

Prior to commencement of extraction of water for construction, the Contractor shall work out arrangements as specified in the Detailed Design Report.

Arrangements for procuring water by contractor...
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- | |
|---|
| <ul style="list-style-type: none"> • In case of community water sources, the Contractor shall carry out consultations and obtain written consent of VDC/Wards for extraction of water through written arrangements • In case of private water sources, the Contractor shall not commence procurement of water from a source unless and until the written consent of all current registered owners of the parcel or parcels on which the source is located has been obtained. • In case of new tube-wells, the Contractor shall obtain clearances required from the local bodies, as required. The sitting of such tube-wells shall be at a distance of not less than 20m from any septic tank/soak pit or other source of pollution. |
|---|

- In case of water harvesting structures (if required), the Contractor shall in consultation with the residents, identify suitable locations for sitting the structure and construct the same.
- In case of perennial sources, the Contractor shall adhere to all administrative procedures pertaining to procurement of water from such sources.

6.3 Construction Stage

During construction, the Contractor shall be responsible to monitor the following:

- The arrangements worked out with the local bodies/individual land owners for water extraction is adhered to;
- Extraction of water is restricted to construction requirement and domestic use of construction workers only;
- Water requirement for curing of concrete shall be minimized by pooling of water over the concrete or by covering with wet gunny bags;
- Water used for mixing of mortar/concrete and subsequent curing is free from injurious amount of oil, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel; and
- The potable water used for drinking purposes of construction workers shall be of approved standard.

Prior to issuing project completion certificate to the contractor, the PM shall verify the following:

- Payment of all dues to the local bodies or the individual owners of the wells against the water extracted, and
- Restoration of the premises of water extraction points to their original status after construction.

7. Topsoil Salvage, Spoil Management, Storage and Replacement

Loss of topsoil creates commonly long-term impacts along roads due to (i) site clearance and widening for road formation; (ii) development of borrow areas; (iii) temporary construction activities as construction camps, material storage locations, diversion routes etc. This subsection of the Environmental Code of Practice includes environmentally sound removal, conservation and replacement of topsoil. Table A2-8 lists the key activities that need to be addressed during the different project stages.

Table A2-8: Key Activities during Various Stages

Stages	Key Activities
Pre-construction	Siting up construction activities
Construction	Stripping & Stockpiling
	Erosion Control measures
Post-construction	Reuse Topsoil

7.1 Project Planning & Design Stage

The alignment finalization shall be done to minimize uptake of productive land, as laid down in Section 1 of this Annex (General Principles of Environmentally Sustainable Planning, Designs and Construction). At the project preparation stage, the following shall be investigated: (i) Extent of loss of top soil due to widening and siting of construction activities; (ii) Estimates of borrow area requirements; and (iii) Area requirement for topsoil conservation. The bid document and the Works Contracts shall include all due provisions that necessitate the removal and conservation of topsoil at all locations opened up for construction by the Contractor.

7.2 Pre-construction Stage

The arrangements for temporary usage of land, borrowing of earth and materials by the Contractor with the land owner/local bodies shall include all necessary precautionary measures for conservation / preservation of topsoil. The key principle of good planning practice is to minimize the use and the disturbance of topsoil.

7.3 Construction Stage

It shall be the responsibility of the Contractor to strip the topsoil at all locations opened up for construction. The stripped topsoil should be carefully stockpiled at suitable accessible locations approved by the PM/The Engineer. At least 10% of the temporarily acquired area shall be earmarked for storing topsoil. In case of hilly areas, topsoil with humus, wherever encountered while opening up the site for construction shall be stripped and stockpiled.

The **stockpiles for storing the topsoil** shall be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile is restricted to 2 m. A minimum distance of 1 m is required between stockpiles containing different materials.

In cases where the topsoil has to be preserved for more than a month, the stockpile is to be stabilized within 7 days of forming. The stabilization shall be carried out through temporary seeding. It consists of planting rapid-growing annual grasses or small grains, to provide initial, temporary cover for erosion control.

Locate stockpiles in...

- A secure area away from
 - o Grade, Subsoil & Overburden materials;
 - o Pit activities; and
 - o Day-to-day operations.
- Areas that do not interfere with future pit expansion;
- Areas away from drainage paths and uphill of sediment barriers.
- Areas away from settlement, school, health posts,
- Areas safe from flooding

Vegetative material for stockpile stabilization:

- Use local grasses (e.g. *Vetiver*), legumes, herbaceous, or woody plants or a mixture thereof
- Selection & use of vegetative cover to take into account soil and site characteristics such as drainage, pH, nutrient availability, and climate to ensure permanent growth

After spreading the topsoil on disturbed areas, it must be ensured that topsoil is seeded, and mulched within 30 days of final grading.

During construction, if erosion occurs from stockpiles due to their location in small drainage paths, the sediment-laden runoff should be prevented from entering nearby watercourses. The Contractor shall preserve the stockpiled material for later use on slopes or shoulders as instructed by the Engineer and specified in the Environmental Management Plan.

Preserving stockpiles – Precautions:

- Stockpiles will not be surcharged or otherwise loaded
- Multiple handling will be kept to a minimum to ensure that no compaction will occur.
- Divert runoff around stockpiles unavoidably located in drainage paths using a perimeter bank uphill.
- The stockpiles shall be covered with gunny bags or tarpaulin immediately in case they are not stored for periods longer than 1 month

7.4 Post Construction Stage

The topsoil shall be re-laid on the former extraction area, using the borrow earth to maintain/ameliorate the fertility of crop lands. The finishing of re-layering the topsoil shall be done in ways being satisfactory to the respective farmer.

The area to be covered with vegetation shall be prepared to the required levels and slope as detailed in the Detail Design Report and/or in the EMP. The stockpiled material shall be spread evenly to a depth of 5-15 cm to the designed slopes and watering the same as required. The growth of the vegetation shall be monitored at frequent intervals and, as necessary, compensatory or corrective plantation/seeding be carried out up to the required level of vegetation re-growth.

All temporary arrangements made for stockpile preservation and erosion control are to be removed after reusing the stockpile material.

8. Slope Stability and Erosion Control

Stability of slopes is a major concern in hill areas, in locations with high rainfall and elevated seismicity. In cases of high embankment, water retention at the embankment base initially causes toe failure and subsequently failure of the whole embankment. Soil erosion is consequent to high runoff on hill slopes. High wind velocities cause erosion of embankments made up of cohesion-less sandy soils. Embankments made up of silty and sandy soils get eroded in the absence of vegetative cover, particularly when the slopes are steeper than 2°.

The scope of good practices to minimize adverse effects due to slope instability and soil erosion needs to address the following potential negative environmental impacts: (i) damage to adjacent land and land-uses; (ii) erosion of fertile topsoil layers; (iii) silting of ponds and lakes disturbing aquatic habitats and fisheries; (iv) contamination of surface water bodies, and; (v) reduction in road formation width due to erosion of shoulders/berms.

Table A2-9 highlights the key activities that need to be addressed during the project stage.

Table A2-9: Key Activities during Various Project Stages

Stages	Key Activities
Project Planning & Design Stage	Slope Consideration
	Erosion Consideration
During Construction	Erosion Control Measures
Post Construction	Slope Stabilization

8.1 Project Planning and Design Stage

During the detailed project preparation phase, the following investigations shall be carried out prior to finalization of alignment.

- (a) Topographical;
- (b) Hydrological;
- (c) Geo-technical; and
- (d) Geological Investigation (in case of hill roads).

The alignment selection should be such that (i) steep as well as heavy cuts are avoided; (ii) flora and fauna of the area are not disturbed, and; (iii) the natural drainage pattern is not obstructed.

For high embankments, geo-technical investigations (determination of C, density etc.) of the available material need to be done to check its suitability as fill material. In case of cross drainage structures, measures for preventing siltation and scouring shall be undertaken as outlined in Ch. 11 of this Annex, "Drainage and Flood Prevention"

The following guidelines shall be followed while using cohesion-less soils for embankment construction.

- The alignment should follow the natural ground level to the extent possible and the embankment shall be restricted to minimum to achieve ruling grades.
- Slope of the embankment should be 3 (H : 1(V) or flatter.
- The corners of the embankment should be rounded for the better aerodynamic performance

Bally Benching: To control the erosion on slopes as well as for arresting the shallow movement of top mantle slide mass at the construction location, the Contractor should provide Bally Benching. This method is also very effective in preventing gully erosion. Typical arrangements with detailed specifications are shown in **Figure A2-9**.

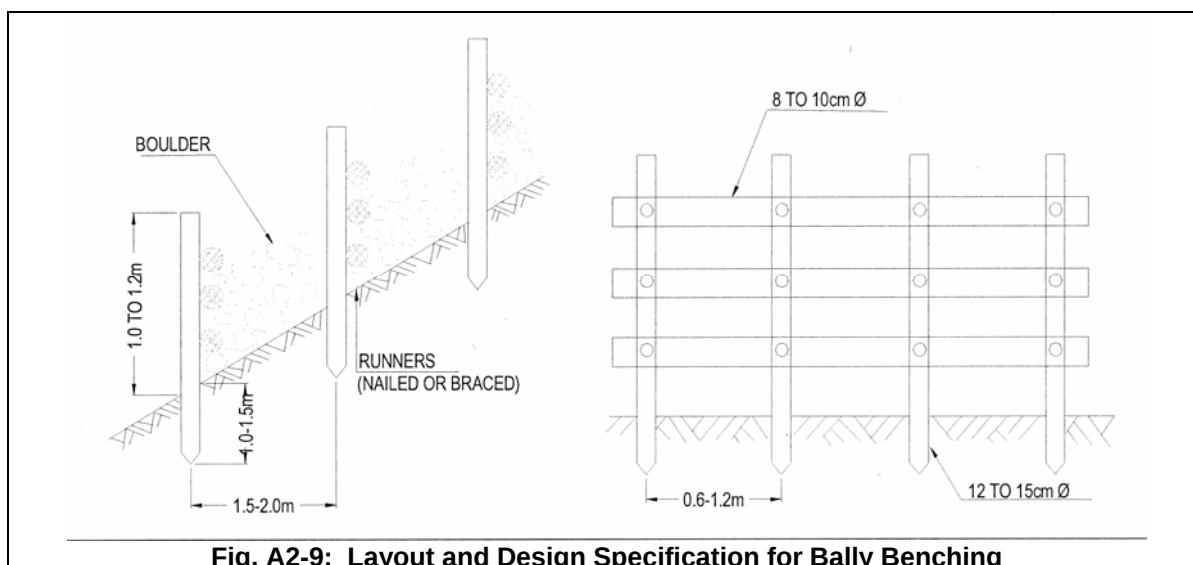


Fig. A2-9: Layout and Design Specification for Bally Benching

Check dams: Sheet and channel erosion on hill slopes gentler than 1(V):12(H) can be prevented effectively through construction of check dams. Details are provided in **Box 8-2**.

Box 8-2: Check Dams

A check dam is a small dam constructed in a drainage way to mitigate sheet and channel erosion by restricting the flow velocity. On steeper slopes $> 1:12$ (H:V), check dams are ineffective. Basic design criteria for check dams are:

- Check dams are usually constructed of riprap, logs, sandbags, and/or straw bales.
- The maximum check dam height should be 0.6 m.
- The centre of the check dam should be a minimum of 25 cm lower than the ends to act as a spillway for runoff, as illustrated in Figure 8.3
- Overflow areas should be stabilized to resist erosion.
- Stone check dams should use 7.5 cm or larger stone with side slopes of 2:1 (H:V) or flatter and should be keyed into the sides and bottom of the channel for a minimum depth of 0.6 m. The drainage area for a stone check dam should not exceed 0.2 km².
- Multiple check dams should be spaced so that the bottom elevation of the upper dam is the same as the top elevation of the next dam downstream, as illustrated below.

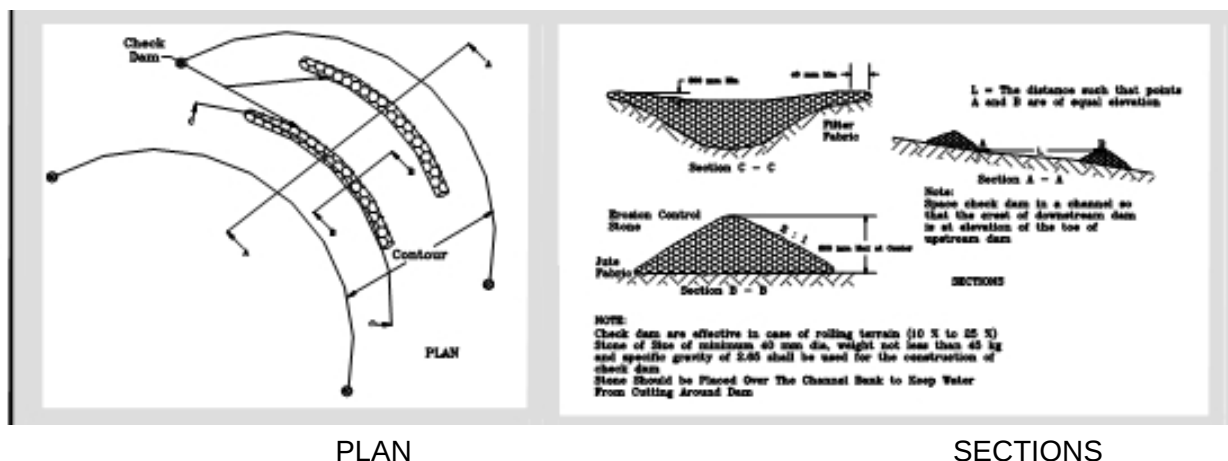


Fig. A2-10: Check Dam Specification

Soil erosion shall be controlled on high embankments by the following techniques:

- **Brush Barrier** (for details refer Ch. 7, "Topsoil Salvage, storage and replacement" and Section 3 of Road Side Bio-engineering Site Handbook, DoR, 1999)
- **Silt Fencing** (detailed specifications and drawings are provided in **Box 8-3**)

Box 8-3: Detailed Specifications For Silt Fencing

Description:

Silt fencing is as temporary sediment barrier made of woven, synthetic filtration fabric supported by steel or wood post. The purpose of the silt fence is to prevent sediment carried by sheet flow from leaving the site and entering to natural drainage or any other water body located near the construction site. Silt fencing encourages the sheet flow and reduces the potential for development of rills and gullies. Care should be taken that silt fences are not installed across streams, ditches, waterways or other concentrated flow areas. All silt fencing should be installed along the contour, never up or down a slope. Where all the sheet flow run off is to be stored behind the silt fence, maximum slope length should not exceed as shown in **Table A2-10**

Table A2-10: Criteria For Silt Fence Placement

Land Slope (%)	Maximum Slope Length (Above the fence in m)
<2	30.0
2 to 5	22.5
5 to 10	15.0
10 to 20	7.5
>20*	4.5
* In areas where slope is greater than 20%, a flat area length of 3.0 m between the toe of the slope and the fence should be provided.	

Construction Specification:

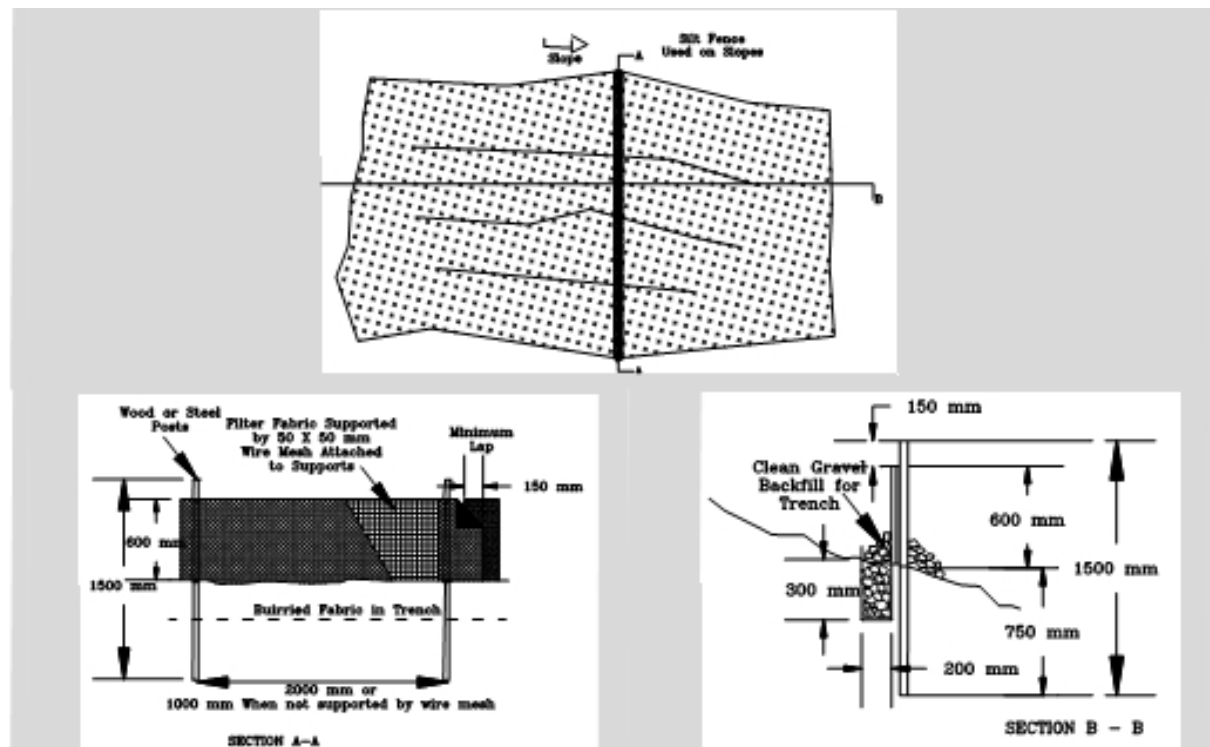
Silt fencing (Refer **Figure A2-11** for Cross-section) consists of 1.0 m wide filter fabric and should be placed on the contour. Incase runoff flow or velocities are very high or where slope exceed vertical height of 3.0 m, silt fencing should be wire reinforced. The contractor should purchase silt fencing in a continuous roll to the length of the barrier to avoid the use of joint. Incase of joints, filter cloth should be spliced together only at supporting post, with minimum 15 cm overlap and securely sealed. The pile is driven to the depth of 300 mm into the ground by pressing from the top. The frame will be installed at the edge of stockpiles and at the water bodies along which construction is in progress.

Inspection:

The Project Management/The Engineer will inspect location as well as efficiency of silt fencing. The inspection should be done after every 15 days and incase of storm water, within 24 hours after the end of rain.

Maintenance:

- The contractor should remove sediments, once they have accumulated to about half the original height of the fence.
- Filter fabric should be replaced whenever it has deteriorated to such an extent that the efficacy of the fabric is reduced.
- The silt fence should remain in place until disturbed areas have been permanently stabilized. All the sediments accumulated should be properly disposed of before the fence is removed.
- The operation of removing and disposing have to be monitored by the Project Management or Engineer.



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Figure A2-11: Cross-section of Silt Fencing

(For detail, refer to 'Roadside Bio-Engineering Reference Manual, 2056, MPPW/DoR; and 'Roadside Bio-Engineering Site Handbook, 2056, MPPW/DoR, 1999 and other Bio-Engineering related documents published by DoR

- In regions of intensive rainfall, locations of steep slopes, regions of high soil erosion potential and regions of short growing seasons, erosion control matting should be provided. Detailed specifications and drawings are provided in **Box 8-4**.

BOX 8-4: Erosion Control Matting

Description:

The design specifications as well as location should be finalized during the Project Preparation Phase. During the execution period in post-construction stage, Project management must ensure that all the guidelines are to be followed as per specification during the site preparation and installation of erosion control matting. Following are the steps need to be followed for placing erosion control matting:

Site Preparation:

- The areas should be fertilized and seeded.
- A smooth surface free of depression that allows water to collect or flow under matting is required.
- The soil should be left with loose surface after seeding.
- The material should be steel wire formed into "U" shape and should be 15 cm to 25 cm long.

Installation:

- Filter fabric made of biodegradable material (e.g. Jute) should be placed approximately horizontally on the slope less than 2:1
- Prior to netting, a 10 cm anchor trench should be dug at the top and toe of the slope with the top trench placed 30 cm back from the crown, or a berm over which the fabric can be carried.
- For horizontal application, work must proceed from the bottom towards the top of the slope with a 10 cm overlap. After cutting material should be folded less than 7.5 cm to 10 cm at the end, stapled and covered.
- Staples should be placed at a spacing of 22.5 cm to 30 cm apart in the trenches along the horizontal lap joints.

(For detail, refer 'Roadside Bio-Engineering Reference Manual, 2056, MPPW/DoR; and 'Roadside Bio-Engineering Site Handbook, 2056, MPPW/DoR, 1999 and other Bio-Engineering related documents published by DoR.)

8.4 Post Construction Stage

All the exposed slopes shall preferably be covered with vegetation using suitable and endemic grasses, brushes etc. Meticulous care needs to be employed to select exclusively locally available species possessing the properties of (i) good growth; (ii) dense ground cover; and (iii) deep rooting system to facilitate slope stabilization (e.g. *Vetiver* grasses).

In case of steep and barren slope, in order to retain the seedling to the ground, asphalt mulch treatment, shall be given. Seedling are covered with asphalt emulsion and spread into a thin layer. The asphalt film gradually disintegrates and a carpet of green vegetation and deep-rooted species of grass and clovers, takes its place.³

Anchoring shall be carried out (as per IRC: SP: 48-1998, Chapter 11) in case of rocks.

Regular inspection of check dams and repositioning/replacement of dislodged or stolen stones need to be carried out.

Repair and maintenance of eroded side drain inverts is to be done in order to arrest retrogression of levels in side drains. Slopes of high embankment can give a fertile base for growth of vegetative cover / sodding.

In arid areas, in order to avoid the deposition of sand over or near the road surface, shrubs are to be planted at an appropriate distance from the formation. The shrubs should not be abutting the road and the distance for carrying out plantation shall be determined based on prevalent wind speeds as well as quantity of sand being carried amongst various other factors. There should be a clear gap between the roadway and shrubs to allow the wind to pickup its velocity and carry along with it any sand that is deposited.

9. Roadside Plantation

Apart from improving aesthetics and the ecological properties of the area, additional roadside trees potentially provide fuel wood, act as noise barriers, provide visual screen for sensitive areas and also generate revenue by sale of its produce. However certain precaution must be taken in design of avenue or cluster plantation so that the trees do not have an adverse impact on road maintenance and/or on safety of the road users. This code of practice elaborates on the approach towards planting trees along roads. Emphasis has been laid on a greater involvement of communities in planting and maintenance of roadside trees. The activities requiring addressal during the project stages are:

Table A2-11: Key Roadside Planting Activities during different Project Stages

Stages	Activities
Project Planning & Design Stage	Minimizing tree felling
	Plantation Strategies
	Tree Plantation
Post Construction Stage	Maintenance of trees

³ For details, reference should be made to 'Roadside Bio-Engineering Reference Manual, 2056, MPPW/DoR; and 'Roadside Bio-Engineering Site Handbook, 2056, MPPW/DoR, 1999 and other Bio-Engineering related documents published by DoR.

9.1 Project Planning and Design Stage

During alignment finalization, due consideration shall be given to minimize the loss of existing tree cover, encroachment of forest areas and protected areas (see Ch. 1, "Project Preparation"). Tree felling, if unavoidable, shall be done only after compensatory plantation of at least twenty five saplings of determined size for every tree cut is done as per policy and site-specific prescriptions of the Department of Forest. This shall be carried out by the Project Management.

Pant trees along roads where there is ...

- Availability of land for planting
- Availability of water
- Willingness of local beneficiaries to nurture the saplings

A roadside landscape plan shall be prepared by the Project Management as part of the Detailed Design Report in its environmental management plan, and finalized in consultation with the Department of Forest, if needed. It should be ensured that plantation is carried out only in areas where water can be made available during dry seasons and the plant can be protected during the initial stages of their growth. The species shall be identified in consultation with officials of forest department, giving due importance to local flora. It is recommended to plant mixed species in case of both avenue or cluster plantation. The saplings for plantation can be supplied by the Forest Department or managed by Project Management from local nurseries or nurseries of the District Road Office. Costs for providing saplings shall be borne by the road construction funds.

It is highly recommended to carry out public consultations that will identify opportunities and roles of local communities (particularly disadvantaged persons, low castes, women) or local bodies in maintaining and managing the trees to be planted in the project. A MoU can be signed between the VDCs, affected communities and Forest Department with respect to maintenance schedules and replacement of withered or damaged trees, and empowering the affected communities to be entitled to any revenue generated out of these trees. It shall be the responsibility of the VDC through the affected communities or, as applicable, through Community Forest User Groups (CFUGs) to work out institutional mechanisms for managing and maintenance of the roadside plantation schemes.

Normally, the EMP of the EIA or IEE suggests a plantation strategy relating to species selection, planting time, tending and monitoring survival. Development of cluster plantations might be encouraged in the public barren lands, at locations desired by the community. The location for plantation can be in RoW, which will also act as noise and dust barrier. If desired by local communities, arrangements shall be made in which local people can use fruit and fodder from the trees.

Do not plant trees...

- Within the line of sight around junctions
- On the inside of curves
- Within 5 m of the proposed centre line

The choice of species will be based on the preferences of the community and the technical advice of the forestry extension service. Fruit bearing or fodder indigenous species requiring less maintenance shall be chosen to ensure a higher survival rate. Exotic species bearing the risk of becoming invasive shall not be considered. The species of trees to be planted should be decided in consultation with the Forest Department for the particular region. Reference should also be made to the "Road Side Bio-engineering Site Manual" and Reference Manuals published by DoR. Should a Contractor utilize non-approved plant

species he shall made responsible for immediate and complete destroying of such species, under supervision of a local forestry representative.

The Project Management shall identify suitable nursery locations in consultation with the District Forest Office.

9.2 Post-Construction Stage

Planting of saplings from the nurseries as per landscape plan and the subsequent maintenance of the trees planted shall be carried out by the contractor or committee of local communities formed and funded by the project for the first five years. Planting shall be undertaken immediately after rainy season or initial weeks of spring. The activities to be taken up as part of maintenance shall include (i) cutting/lopping branches up to a height of 2.5 m above ground level to ensure visibility (ii) Removal of dead wood from the roadway and storing away from roads, and (iii) Weed cutting from shoulders and keeping the shoulders free from any growth of vegetation. In addition, the committee is to ensure a healthy survival rate by planting replacement saplings in cases where the survival rate is less than 80%.

Watering of trees during the initial period of two to three years shall be the responsibility of the committee or the agency designated by it. Final payment, if any, shall be on the basis of the number of trees surviving at the end of five years of initial plantation. The shoulders of the road shall be kept clear of weeds or any undesirable undergrowth, which may hinder free flow of traffic.

It needs to be ensured that the branches of the trees do not obstruct clear view of the informatory and caution signs.

Deciduous trees shed leaves every season. It is necessary to keep the roadway clear of such debris. Some gaps should be left even in avenue plantation to ensure that the carriageway dries up early after an occasional shower.

10. Drainage and Flood Prevention

Good drainage is of paramount importance for a functional road. Inadequate and faulty drainage arrangements result in obstruction to natural drainage pattern. The problem is further aggravated in the low-lying areas and flood plains receiving high intensity rainfall, which can lead to the instability of embankment, damage to pavement, sinking of foundation, soil erosion, safety hazards and disruption in traffic. Provision of cross-drainage and longitudinal drainage increases the life of the road and consequently reduces water logging and related environmental impacts.

On the other side construction or upgrading of CD structures and longitudinal drains is likely to increase sediments, scour the banks, change water level and flow, and also affect the ecology of the surrounding area in many ways.

This code shall address the environmental concerns related to drainage aspects during different stages of the project execution:

Table A2-12: Key Activities regarding Drainage during different Project Stages

Stages	Activities
Project Planning & Design Stage	Hydrological Investigation
	Geometric Design
	Consultations with downstream and upstream users
Construction Stage	Sediment control measures
Post Construction Stage	Inspection and Maintenance

10.1 Project Planning and Design

Drainage shall be broadly taken up as (i) Cross-Drainage, and (ii) Longitudinal Drainage both surface & sub-surface drainage. The alignment shall be routed such that minimum drainage crossings are encountered. Also the geometric design criteria as per Nepal Road Standard 2027 BS (first revision 2045 BS), and Design Standards for Feeder Road, 1997 published by DoR, for effective surface drainage should be ensured.

All drains crossing along the alignment shall be identified on site and marked on map while undertaking transect walk. Basic information on the width of channel, frequency of traffic holdup and flow would provide inputs into screening of alternate alignments as well as fixing the alignment. Consultations with the community shall provide information on the Highest Flood Level (HFL) in the area.

In areas of high and medium intensity rainfall (>400 mm/year), flood prone areas and hilly areas detailed hydrological studies will need to be conducted. Some reference materials for this could be Guideline Manual for Design of Bridges, DoR 2006. Similarly, other reference material may include;

IRC: SP-13: 1973 "Guidelines for the Design of Small Bridges & Culverts" and IRC: SP33:1989 "Guidelines on Supplemental Measures for Design, Detailing & Durability of Important Bridge Structures".

The design of cross-drainage structures shall be based on the inputs from the hydrological studies.

Design of Cross Drainage (CD) structure shall observe, among others:

- Normal alignment of the road is followed even if it results in a skew construction of culverts and stream bank protection are incorporated;
- Afflux generated is limited to 30 cm in plains with flat land slopes;
- Designs to ensure that fish passage is not interrupted either in upstream or downstream direction;
- Adequate scour protection measures for stream bank, roadway fill as head walls, wing walls and aprons are in most circumstances indispensable;
- Reinforced road bed (of concrete or rock) for protection against overflow in case of low water crossing (fords/causeways);
- The design of CD structure should have stairs leading to the bed of the drainage channel, for regular inspection of the sub-structure.
- Longitudinal drains are to be designed to drain runoff from highest anticipated rainfall as per rainfall data for the past 20 years or 50 years as per hydrological analysis in high rainfall areas (annual rainfall > 1000 mm) and hill areas.

- Outfall of the roadside drains shall be into the nearby stream or culvert. The outfall should be at such a level that there would be no backflow into the roadside drain. Wherein pond/low lying areas exist in the vicinity, the flow may be diverted into them after removal of sediment for possible ground water recharge.
- In case no natural stream is found appropriate for roadside drain outfall, water-harvesting structures shall be constructed to collect the runoff. The location shall be determined based on the size of the structure (which in turn depends on the discharge anticipated) and willingness of the landowner who would be utilizing the collected water. These shall be determined by the Project Management in consultation with the landowner during project preparation stage.
- Roadside ditches in high rainfall areas (annual rainfall > 1000mm) and hill areas, shall be lined to protect from runoff of high velocities.

The schedule of construction of CD structures should be confined to dry months to avoid contamination of water bodies and disturbance of aquatic life.

In case of high embankment (>1.0m) or bridge approaches, lined channels shall be provided to drain the surface runoff, prevent erosion from the slopes and avoid damage to shoulders and berms. Detailed specifications can be referred to Guideline Manual for Design of Bridges, DoR, 2006. Additional reference material can also include IRC:SP-20:2002.

11.1 Pre-Construction Stage

Following measures are to be undertaken by the contractor prior to the commencement of CD/Bridge construction:

- The contractor should inform the concerned departments about the scheduling of work. This shall form part of the overall scheduling of the civil works to be approved by Project Management.
- The downstream as well as upstream users (e.g. irrigation farmers, fisher folk) shall be informed one month in advance, and alerted for potential impacts;
- The contractor shall schedule the activities based on the nature of flow in the stream;
- Erosion and sediment control devices are to be installed prior to the start of the civil works.
- Interceptor drains to be dug prior to slope cutting to avoid high runoff from slopes entering construction sites in case of hill roads
- Runoff from temporary drains and interceptor drains need to be carefully directed into natural drains in hill roads
- In case of upgrading existing CD Structures, temporary route / traffic control shall be made for the safe passage of the traffic, depending upon the nature of the stream
- All the safety/warning signs are to be installed by the contractor before start of construction

In case of utilization of water from the stream, for the construction of the CD structures, the contractor has to take the consent from the concerned department (refer also to the previous Chapter "Water for Construction")

10.2 Construction Phase

Drainage structures at construction site shall be provided at the earliest to ensure proper compaction at the bridge approach and at the junction of bridge span and bridge approach.

In hill areas sub-surface drains, if required, shall be provided immediately after cutting the slopes.

Velocity of runoff to be controlled to avoid formation of rills/gullies as per the code guidelines provided in Ch. 8 "Slope Stability & Erosion Control."

While working on drainage channels, sediment control measures shall be provided. Silt fencing (as per the detailed specifications given in Ch. 8, "Slope Stability & Erosion Control") shall be provided across the stream that carries sediment.

The sediments collected behind the bunds shall be removed and after drying, can either be reused or disposed off as per Ch. 12, "Waste Management and Site Redevelopment."

Safety devices and flood warning signs to be erected while working over streams and canals.

The HFL should be marked as per hydrological data on all drainage structures.

10.3 Post Construction

Inspection and cleaning of drain shall be done regularly to remove any debris or vegetative growth that may interrupt the flow.

The HFL should be, as necessary, re-marked as per hydrological data on all drainage structures.

Temporary structure constructed during construction shall be removed before handing over to ensure free flow through the channels.

The piers and abutments should be examined for excessive scour and make good the same if required.

In case of causeways, the following aspects shall be taken into consideration:

- Dislocation of stones in stone set pavements, scouring of filler material due to eddy currents.
- Floating debris block the vents. In case of large amount of floating material, debris arrestor shall be provided in upstream side.
- Damage to guide stones, information board shall be inspected and replaced accordingly.

The schedule of Inspection shall be drawn up for checking cracks, settlements and unusual backpressures. It must be ensured that all the rectification shall be undertaken as and when required. Following are broadly the items to be checked:

- Settlement of piers/abutments & settlement of approach slabs have to be checked
- Cracks in CD structures or RCC slabs;
- Drainage from shoulders to be ensured;
- Ditches & drains to be kept clean of debris or vegetation growth;
- Repairs to parapet of culverts whenever required are to be undertaken.

11. Protection of Aquatic Resources

Water bodies may be impacted when the road construction is adjacent to it or the water body is affected by change of drainage pattern due to construction of embankment. The following activities are likely to have an adverse impact on the aquatic ecology of the area:

- Earth moving
- Removal of vegetation
- Vehicle/Machine operation and maintenance
- Handling and laying of asphalt and
- Waste disposal from construction camps

Impacts on water bodies impairs ...

- Catchment area of the water body
- Drainage system
- Flood level and water logging
- Flora and fauna dependant on the water body
- Ground water recharging
- Animal husbandry as water bodies are used by animals
- Water quality &
- Runoff (increase/decrease)

To give adequate protection for aquatic resources, including safeguarding the interests of stakeholders using these resources, there are a number of measures that need to be explored during different stages of a road construction project (**Tab. A2-13**).

Table A2-13: Key Aspects for Protecting Water Bodies in Road Construction Activities

Stages	Activities
Project Planning Design	Proper Road Alignment
	Mitigation design in consultation with communities
Construction Stage	Erosion control and embankment protection measures

11.1 Project Planning and Design Stage

All efforts are to be taken to avoid the alignments passing adjacent or close to water bodies. Where possible, it should be realigned away from the water-body without cutting its embankment, decreasing the storage area or impairing the catchment area. Adequate drainage arrangements should be provided. Stream bank characteristics and hydrology of the area are to be studied before finalizing the alignment, the profile and cross drainage structures.

Complete filling of water body with soil should not be contemplated in the project. The Detail Design Report and its cost estimates have to accommodate costs of rehabilitation (to be estimated as lump sum at Detail Design Report stage) of water-bodies impacted by the project. Water-body rehabilitation shall be as per the Rehabilitation Plan prepared by the Contractor which should have approval of the Project Management/The Engineer*.

Details of the tasks to be performed as per the sequence of activities during the project planning and design are as follows:

- Transect walk should indicate the location of ponds in relation to the existing alignment if it is not already marked on the topographic map. The details to be captured during transect walk are:

* per definition: Engineer according to FIDIC

- Approximate size and depth of the water body in meters 'm'
 - Designated use of the water body (domestic, drinking, irrigation, fisheries, industry)
 - Visual inspection of the quality of the pond water, occurrence of natural impacts (e.g. algae blooms, seaweed proliferation, fish mortalities, foul smell, mosquitoes, garbage).
- ii) Consultations with the people regarding alternate routes that were devised to avoid the fishponds. If alternate routes are not available, consent of the villagers is to be sought for properly compensating for the pond losses.
 - iii) Final design is to be prepared indicating the pond location in the alignment drawings
 - iv) If impacting the pond, the extent of impact is to be clearly indicated on a separate detailed drawing of the pond. The drawing should aid the contractor in setting up exact lines for cutting the pond.
 - v) All necessary measures for mitigation of impacts and precautionary measures while working close to the water body are to be incorporated into the Detail Design Report and cost estimates. The measures to be incorporated shall be as per this code guideline.

11.2 Pre-Construction Stage

The IEE/EIA must assess the likely impacts on the water body and make mitigation provisions that need to be followed meticulously by the Contractor. These measures must also clearly be explained and illustrated in the detailed work plan. In accord to these provisions, the Contractor shall prepare a Rehabilitation Plan for rectifying the likely impact to be caused and approval of Project Management shall be sought prior to commencement of work. The Rehabilitation Plan should include:

Working near Water Bodies - Precautions
• Avoid locating roads on pond embankment • Collect road runoff before entering the water bodies • Runoff to be filtered of sediments before letting into water bodies • Avoid debris disposal into water bodies • Avoid disposal of oil/grease/other contaminants into water bodies

- Locations of erosion protection works and silt fencing (as per Ch. 8, "Slope Stability & Erosion Control", Box 8.3) to prevent sediment laden runoff entering the water body;
- Location of side drains (temporary or otherwise) to collect runoff from the embankment before entering the water body;
- Work program in relation to the anticipated season of flooding/overflowing of the water body, Obstructions likely to cause temporary flooding and information to seek clearance to remove the obstruction;
- Drawings in Rehabilitation Plan should indicate the landscape details along with species to be planted in the surrounding environs of the water body.

The rehabilitation of water body should be with the objective of restoring it to its original state or to a better state with necessary enhancement of its environs. Rehabilitation Plan shall include:

- Reconstruction and stabilization of embankment in case it is impacted
- If storage area is lost, then the water body is to be deepened to regain an equivalent volume

- As applicable and desired by the community, provide for landscape enhancement of the water body (e.g. resting /picnic places along shores of ponds/lakes).
- Cost of rehabilitation

Concurrence of the community has to be sought on the Rehabilitation Plan prepared by the Contractor. Concerns of the community have to be incorporated into the plan before submitting it for approval of the Project Management.

The Project Management shall scrutinize the Rehabilitation Plan, verify the implementation on site and finally approve the plan. The Rehabilitation Plan should be implemented by the Contractor immediately after completion of construction at the stretch near the water body.

When there is interruption to regular activities of villagers near water body due to construction or rehabilitation work, following are the Contractor's responsibilities:

- Restriction on use of water, if any, should be intimated to the community in advance
- Alternate access to the water body is to be provided in case there is interruption to use of existing access. The access provided should be convenient for use of all the existing users whether community or cattle:
- If the water body affected is a drinking water source for a habitation, alternate sources of water are to be provided to the users during the period for which its use is affected.

11.3 Construction Stage

- It should be ensured by the contractor that the runoff entering the water body is free from sediments.
- Silt fencing and/or brush barrier shall be installed in the drainage channels for collecting the sediments before letting them into the water body (see Ch. 8, "Slope Stability and Erosion Control", Box 8.3).
- Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated.

Cutting of embankment reduces the water retention capacity and also weakens it, hence:

- The contractor should ensure that the decrease in water retention should not lead to flooding of the construction site and surroundings causing submergence and interruption to construction activities.
- Any perceived risks of embankment failure and consequent loss/damage to the property shall be assessed and the contractor should undertake necessary precautions as provision of toe protection, erosion protection, sealing of cracks in embankments. Failure to do so and consequences arising out of embankment failure shall be the responsibility of the contractor. The Project Management shall monitor regularly whether safe construction practices near water bodies are being followed.
- Alternate drain inlets and outlets shall be provided in the event of closure of existing drainage channels of the water body.
- Movement of machinery and workforce shall be restricted around the water body, and no waste from construction camps or sites shall be disposed in or adjacent (as rule of thumbs, <200 m) to the aquatic system.

11.4 Post - Construction Stage

With the completion of construction, the Project Management has to ensure implementation of rehabilitation plan for the water body, as indicated by the Contractor.

The boundaries of the water body – particularly wetland habitats - have to be left undisturbed and tidy with the completion of construction.

If unavoidable, drainage channels of adequate capacity shall be provided for the water body being impacted by storm waters.

12. Waste Management and Rehabilitation of Construction Sites

This Code of Practice describes procedures for handling, reuse and disposal of waste materials during road construction activities. The waste materials generated can be classified into construction Waste; and domestic waste. The key activities during project stages where management of wastes is required are presented in **Table A2-14**:

Table A2-14: Key Aspects for Proper Waste Management in Road Construction Activities

Stages	Activities
Project Planning & Design	Identification of type/source of waste
Pre-construction	Identification of disposal sites
Construction Stage	Re-use of wastes, as applicable
Post-Construction Stage	Decommissioning

12.1 Project Planning and Design Stage

As part of Detailed Design Report preparation, Project Management shall carry out the following actions:

- Finalize the road design and alignment to minimize waste generation through balancing of cut and fill operations and minimizing excess cuts requiring disposal.
- Identify the type of wastes as well as sources of waste during construction and suggest options for possible re-use.
- Provide guidelines to the contractor for locating waste disposal sites for non-toxic wastes. Incorporate supervision and approval mechanisms to ensure that no illicit dumping of hazardous materials will occur, with potential deleterious environmental consequences.
- Identify existing and environmentally safe landfill sites for approved disposal of toxic materials.
- In case no existing landfill sites are available, identify landfill sites as well as decommissioning of these sites should be undertaken. Towards this, identify the clearance requirements.
- Include in the bid document, a clause stating that all provisions of Environmental Codes

Practices to avoid - waste disposal ...

- Tipping of waste into stream channels, water bodies, forests and vegetated slopes
- Non-cleaning of wastes after day's work
- Leaching of wastes
- Littering in construction camps / sites
- Storing wastes on private land

of Practice shall be applicable to the locations of disposal of wastes. These shall include all provisions outlined in Ch. 7 “Topsoil Salvage, Storage and Replacement”, Ch. 8, “Slope Stability and Erosion Control” and Ch. 11, “Drainage and Flood Prevention”.

12.2 Pre-construction Stage

During construction, the contractor shall identify all activities that have the potential to generate waste (type, quantities and environmental harmfulness) and work out measures for the same in the construction schedule to be submitted to the Project Management. A sequential listing of the activities during road construction and the nature of wastes together with the possible options for re-use are specified in **Table A2-15**.

For the disposal of excess cut and unsuitable (non-toxic) materials, the contractor shall identify the location for disposal in consultation with the community / VDC/ Municipality as appropriate. Any toxic material shall be disposed in existing landfill sites that comply with legislative requirements. Prior to disposal of wastes onto private/community land, it shall be the responsibility of the Contractor to obtain a **No-objection Certificate (NOC)** from the land owner/community. The format for NOC shall be included in the bid documents and in the works contracts. The NOC shall be submitted to the Project Management prior to commencement of disposal.

12.3 Construction Stage

The contractor shall either reuse or dispose the waste generated during construction depending upon the nature of waste, as specified in **Table A2-15**. The reuse of waste shall be carried out by the contractor only after carrying out the specific tests and ascertaining the quality of the waste materials used, and getting the same approved by the Project Management/The Engineer. Wastes that were not reused shall be disposed off safely by the contractor. The contractor shall adopt the following precautions while reusing wastes for construction:

- In case of bituminous wastes, dumping will be carried out over a 60 mm thick layer of rammed clay so as to eliminate any chances of leaching.
- In case of filling of low-lying areas with wastes, it needs to be ensured that the level matches with the surrounding areas. In this case, care should be taken that these low lying areas are not used for rainwater storage
- In case oil and grease are trapped for reuse in a lined pit, care shall be taken to ensure that the pit should be located at the lowest end of the site.
- The Contractor shall regularly educate his workforce location of disposal site as well as the specific requirement for the management of these sites.

The waste management practices adopted by the Contractor, including the management of wastes at construction camps etc shall be controlled on a regular schedule by the Project Management /The Engineer during the progress of construction. Mechanisms must be in place to ensure due and immediate corrective measures once the existing waste management practices are not up to the satisfaction of the supervising engineer.

12.3 Post-Construction Stage

After decommissioning of construction sites, the Contractor shall hand over the site after clearing the site of all debris/wastes to the Project Management who is obliged to verify. In case of disposal of wastes on private land, certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that “the land is restored to his satisfaction”. The same is to be submitted to the Project Management before final payment is claimed.

13. Construction Plants and Equipment Management

During execution of the project, construction equipments, machinery and plants potentially have various adverse impacts on the environment. The impact can be due to emissions, dust, noise and oil spills that concern the safety and health of the workers, surrounding settlements and environment as a whole. This code of practice describes the activities during the project stages where pollution control measures are required. **Table A2-16** highlights the key activities that need to be addressed during the project and also the significance of impacts in the project region.

Table A2-16: Key Aspects for Plants and Machinery Management

Stages	Activities
Project Planning & Design	Equipment Selection
Construction Stage	Development of Work Safety and Health Regulations
	Awareness of Safety-Health among Workers, emphasis on risk perception and accident prevention, and First Aid
	Safety Device & Cautionary Signs
	Waste Disposal Management
Post-Construction Stage	Restoration of Plant Site/Haul Roads Decommissioning

13.1 Project Planning and Design Stage

Selection criteria for setting up a plant area and parking lot for equipment and vehicles shall be done as per siting criteria for construction camp specified in Ch.3, “Construction Camps and Site Operation”. Apart from these guidelines, the ‘Public Workers Directives’ and forthcoming ‘Procurement Act’ of Government of Nepal shall be adhered to during the preparation of bidding document.

13.2 Pre-construction Stage

The Contractor must **educate the workers** to undertake safety precaution while working at the plant / site as well as in the around heavy equipments as per the Ch.14, “Occupational Health & Safety”.

Before setting up the crusher, hot-mix plant and generator, the Contractor shall acquire “No Objection Certificate (NOC)” from the Project Management/The Engineer. The EMP shall give sufficient indications as where the **siting of such equipment** is allowable or not permissive, depending on parameters like settlement vicinity, ecological sensitive areas,

water bodies, cultural assets and others identified during the public consultation process.

The Contractor shall ensure all vehicles must possess a **Pollution Under Control (PUC) Certificate**, from designated authority by the DoR, which and shall be renewed regularly. The Contractor must also ensure that all machinery, equipments, and vehicles shall comply with the existing HMGN noise and emission norms of Government of Nepal.

The Project Management must ensure that the Contractor shall submit a copy of the NOC and PUC Certificates before the start of work.

13.3 Construction Stage

The Contractor shall undertake measures as per **Table A2-17** to minimize the dust generation, emissions, noise, oil spills, residual waste and accidents at the plant site as well as during transportation of material to construction site.

Table A2-17: Precautionary Measures at Plant Sites

Concern	Causes	Measures
Dust Generation	Vehicle Movement	- Water sprinkling - Fine Materials shall be Transported in Bags or Covered by Tarpaulin during Transportation - Tail board shall be properly closed and sealed
	Crushes	Water sprinkling
	Concrete-Mix Plant	Educate the workers for following good practices while material handling
Emissions	Hot-Mix Plant	- Site selection as pre-identified in the IEE/EIA - Site selection as per Clause 6.5.2, Section 6.5, IRC's Manual for Construction & Supervision of Bitumen Work - Regular maintenance of dust Collector as per manufacture's recommendation
	Vehicles	Regular maintenance as per manufacturer's recommendation
	Generators	Exhaust vent of long length
Noise	Heavy Load Vehicles	Exhaust silencer, Regular maintenance as per manufacture schedule
	Crushers	- Site selection as pre-identified in the IEE/EIA - Siting as per guideline Ch. 12, "Construction Camps and Site Redevelopment"
	Generators	Shall be kept in closed room and regular maintenance as per manufacture's recommendation
Oil spills	Storage and Handling	- Good practice and fire fighting equipment/training - Prepare a contingency Plan for emergency situations - In accord with guideline Ch. 12,, "Waste Management and Site Redevelopment"
Residual waste	Dust Collector / Pits	In accord with guideline Ch. 12, "Waste Management and Site Redevelopment"
Batteries	Acids Burning	Safe / locked storage rooms to prevent accidents and misuse
Concrete waste	Concrete-Mix Plant	In accord with guideline Ch. 12,, "Waste Management and Site Redevelopment"

Bitumen and bitumen mix	Hot-Mix plant	• - do -
Stone chips	Crushers	• - do -
Safety	Range of Equipment	• No worker shall be present in the vicinity of the equipments
	Movable Parts of Equipments	• Caution Signs, • Regular awareness training among workers
	Plan Area/Site	• Caution Sign, Safety Equipments, Regulations
	Accidents/Health	• First Aid Box, Periodic Medical Check up, Insurances
	Break down of vehicles	• Arrangement for towing equipment to the workshop

During site clearance, all cut and grubbed materials shall be kept at a secured location so that it does not raise any safety concerns. During excavation, water sprinkling shall be done to minimize dust generation.

Frequent water sprinkling shall be done on the haul roads to minimize dust generation. Incase of loose soils, compaction shall be done prior to water sprinkling.

Safety Measures during Bitumen Works...

- The Contractor shall ensure that bitumen storing, handling as well as mixing shall be done at hot-mix plant or designated areas³ to prevent contamination of soil and ground water.
- Use of fuel wood for heating bitumen shall be discouraged. When heating is required, bitumen heaters shall be used, fueled by either kerosene, diesel or gas.
- No bituminous materials shall be discharged into side drains.
- Nearby tree, vegetation and private property shall be protected during bitumen spraying work.
- Skilled labor shall be used while hand placing the pre-mixed bitumen material. The hand placing of pre-mixed bituminous material shall be done only in following circumstances:
 - o For laying profile corrective courses of irregular shape and varying thickness
 - o In confined spaces where it is impracticable for a paver to operate, and
 - o For filling potholes
- The Contractor shall provide safety equipments i.e. gumboots and gloves to the workers while handling bitumen.
- While applying Tack Coat, spraying of bitumen shall be done in the wind direction. The labor shall wear jacket while spraying the bitumen.
- Bitumen shall not be applied during strong winds and rainy periods, or if rain is likely.
- All the bituminous work shall be done as per IRC's Manual for Construction and Supervision of Bituminous Works.

Cautionary and informatory sign shall be provided at all locations and times, specifying the type of operation in progress.

The contractor must ensure that there is minimum generation of dust and waste while unloading the materials from trucks.

Batteries and battery acids need to be stored in locked compounds and storerooms to prevent theft and misuse.

Bitumen drums shall be stored in designated locations and not scattered along the road.

The construction waste generated shall be disposed as per guideline Ch.12, "Waste Management and Site Redevelopment".

Table A2-15: Types of Construction-Generated Wastes and Scope of Re-uses

Activity	Types of waste	Scope for possible reuse	Disposal of Waste
Construction Wastes			
Site Clearance and Grubbing	Vegetative cover and top soil	Vegetating Embankment Slopes	
	Unsuitable material in embankment foundation	Embankment Fill	Low lying areas Land fill sites
Earthworks			
Overburden of borrow areas	Vegetative cover and soil	Vegetating Embankment Slopes	
Overburden of Quarries	Vegetative cover and soil	Vegetating Embankment Slopes	
	Granular material	Embankment Fill, Pitching	
Embankment construction	Soil and Granular material	Embankment Fill	
Construction of earthen drains	Soil	Embankment Fill	
Concrete Structures			
Storage of materials	Dust, cement, sand,	Constructing temporary structures, embankment Fill	
	Metal scrap	Re-sale	Scrap yard
Residual wastes	Organic matter	Manure, Re-vegetation	
	Cement, sand	Constructing temporary structure, embankment fill	
	Metal scrap	Diversion sign, Guard rail	
Oil and Hazardous Fluids			
Construction machinery-maintenance and refueling	Oil and Grease	Incineration, Cooking, Illumination	
Bituminous works			
Storage	Bitumen	Low Grade Bitumen Mix	
Mixing and handling	Bitumen	Low Grade Bitumen Mix	
	Bitumen Mix	Sub-base, Paving access ,cross roads	
Rejected bituminous mix	Bitumen Mix	Sub-base, Paving access, cross roads	
Domestic Wastes			
Construction camps	Organic waste,	Bio-decomposition, Manure	
	Plastic and metal scrap	Re-sale, as applicable	Scrap yard
	Domestic effluent	Irrigation, fertilizing fields	
Reconstruction works			
Dismantling of existing pavement	Bitumen mix, granular material	Sub-base	
	Concrete	Road sub-base, reuse in concrete, fill material and as rip rap on roads	
	Guard rail sign post, guard stones	Reuse for same	
Dismantling of cross drainage structure	Granular material and bricks	Constructing temporary structure, embankment fill	
	Metal scrap	Diversion sign, Guard Rail	
	Pipes	Culvert	
Decommissioning of sites			
Dismantling of temporary structures	Granular material and bricks	Constructing temporary structure, embankment fill	
Hill Roads			
Hill cutting	Vegetative cover	Vegetating embankment slopes	
	Soil and granular material	Embankment Fill	
Clearance of slides	Vegetative cover	Vegetating embankment slopes	
	Soil and granular material	Embankment Fill	
Maintenance Operations			
De-silting of side drains	Organic matter and soil	Re-vegetation	

All equipments, which are required to move forward and backward, shall be equipped with alarm for backward movement. It shall be ensured that the workers shall remain away from such working areas at active times.

The Project Management shall carry out periodic inspections to ensure that all the pollution control systems are appropriately installed and comply with existing emission and noise norms.

13.4 Post-construction Stage

The Project Management shall ensure that all haul roads are restored to their original state.

In case any inner village road is damaged while transporting the procured material the contractor must restore the road(s) to the original condition.

The Project Management must ensure that the decommissioning of plant shall be done in environmentally sound fashion and the workshop area closed and brought to its original state.

14. Occupational Health and Work Safety

The health and safety of both the general public and the workers must be of prime concern for all parties involved in with road construction activities as there are major hazards associated with this type of

In specific, **health concerns** include

(a) for the General Public:

- Improper scheduling of construction activities especially near settlements and cultural areas, where local customs would cause temporary gatherings of the public
- Undesired interactions between workers and host community has the potential to spread and increase communicable diseases, if no stringent public awareness and health campaigns are carried out (at both ends, i.e. among the labor forces and the local communities). This problem has particularly to be addressed by all project-responsible staff when there are vulnerable groups (women, children, low casts) at stake, and where outside/migrant laborers constitute a tangible portion of the work forces. Community awareness programs, such as HIV/AIDS prevention, are best undertaken by (contracted) NGOs and health organizations with proven experience in the subject and familiar with the local conditions.
- Unhygienic conditions due to water logging, either by improper decommissioning of Construction Camps and parking lots, or improper disposal of construction wastes, leading to the breeding of vectors that are likely to impact the health of the general public
- Creation of stagnant water ponds / waterlogged areas near construction sites and labor camps have the potential to increase public health risks, as such locations will serve as breeding ground for water-borne disease vectors (e.g. malaria, dengue, intestinal worms).
- Unauthorized use of local natural resources by work forces on items like medicinal plants, non-timber forest products, fire wood, hunting species, fish etc. may lead to

resource depletion, inducing secondary side-effects like malnutrition that may harm public health.

- Over-use of drinking water resources by work forces may equally have negative implications on the public health.
- Migrant workers, especially when under drug and alcohol influence, may cause social conflicts which can result in physical clashes with the general public and the workers, putting local health facilities under constraints.

(b) for the Work Staff:

- Absence of proper sanitary facility likely to act as a breeding ground for vectors raising health concerns among workers.
- Low quality drinking water as well as inappropriate storage of drinking water likely to cause water borne diseases among workers.
- Migrant workers may act as vectors for sexually transmitted diseases such as HIV/AIDS.
- Migrant workers may become vectors for other endemic diseases.

In specific, **safety concerns** include

(a) for the General Public:

- Improper scheduling of construction activities especially near the settlements and sensitive areas
- Parking of equipments and vehicles at the end of the day likely to cause accidents to the general public especially during night hours.
- Transportation of uncovered loose material or spillage of material increases the chances of accidents to road users and surrounding settlements.
- Notice prior to blasting
- Children hanging on trucks and vehicles being at particular risks for fatal accidents.

(b) for the Work Staff:

- Improper handling of materials like bitumen, oil and other flammable/hazardous material at construction sites, likely to cause safety concerns to the workers.
- Lack of safety measures such as fences, adequate lockers, alarm, awareness and safety equipment may result in accidents,
- Lack of specific precautionary measures, especially at work sites with or around heavy machinery / equipments near rivers, steep slopes, equally bears many accident risks, partly with fatal consequences.

This code of practice describes how to address the above mentioned risks into account and offers practicable and proven measures to mitigate the potential impacts. **Table A2-18** highlights the key health & safety activities that need to be addressed during the different project stages.

Table A2-18: Key aspects for health and safety measures to be observed during different project stages

Stages	Activities
Project Planning & Design	Collection / elaboration of Health & Safety Regulations
Pre-construction Stage	Safety & traffic control measures in construction schedule to be included in the Works Contracts
Construction Stage	Regular training of work forces in Work Safety and Health Regulations
	Awareness of safety & health aspects among workers, with emphasis on control of HIV/AIDS and related issues
	Safety Device & Cautionary Signs
	Training of workers on public safety issues
Post-Construction Stage	Provision of proper signagees

14.1 Project Planning and Design Stage

To address health and safety concerns, the Detailed Design Report shall contain selection criteria for setting up:

- Construction Camps (see Ch.3, "Construction Camps and Site Operation")
- Borrow Areas (see Ch.4, "Gravel Extraction and Borrow Area") and
- In case of opening new quarry areas (see Ch. 5, "Quarry Development, Operation and Rehabilitation")

To address the safety concerns to road user during operational phase, the Detailed Design Report shall contain the following:

- Selection and location of regulatory as well as informatory signs, depending upon the geometry of the road
- In case of hill roads, provision of passing places and parapet wall shall be included in road design.

The planning exercise and identification of potential impacts (screening process during IEE/EIA) shall also identify potential risks for vulnerable groups and/or occurrence of social conflicts and incidence/risks of HIV/AIDS. In such cases, it is mandatory to make at this early stage all provisions to put an environmental and health awareness campaign in place before the influx of labor camps may bring about an aggravation of the already existing social and public health problems. An essential step to address such risks is the identification of adequate NGOs who can then conduct awareness programs for conscientization of the affected communities and groups.

14.2 Pre-construction Stage

In order to incorporate public health and safety concerns, the Project Management and the Contractor shall disseminate the following information to the community:

- Location of construction camps, borrow areas and new quarry areas.
- Extent of work
- Time of construction
- Diversions, if any

- Precaution measures in sensitive areas
- Involvement of local and foreign labors in the road construction
- Health issues - water stagnation, exposure to dust, communicable disease, drugs, alcohol, potential sources of social and public health conflicts
- Mechanism for grievance resolution.

The Contractor must educate the workers to undertake the health and safety precautions. The contractor shall educate the workers regarding:

- Personal safety measures and location of safety devices.
- Friendly and cooperative interaction with the host community
- Protection of environment with respect to:
 - o Trampling of vegetation and cutting of trees for cooking
 - o Restriction of activities in forest areas and also on hunting
 - o Water bodies and catch fisheries/aquaculture protection
 - o Storage and handling of materials
 - o Disposal of construction waste

14.3 Construction Stage

During the progress of work, following are the safety requirements that need to be undertaken by the contractor at the construction site:

- Personal safety equipments (such as footwear and gloves)
- All measures as per bidding document shall be strictly followed
- Additional provisions need to be undertaken for safety at site:
 - o Adequate lighting arrangement
 - o Adequate drainage system to avoid any stagnation of water
 - o Lined surface with slope 1:40 (V:H) and provision of lined pit at the bottom, at the storage and handling area of bitumen and oil, incl. the location of generator (grease trap).
 - o Facilities for administering first aid, including training rooms

Minimum Requirements for First Aid (example)

- First Aid Kit, distinctly marked with Red Cross on white back ground and shall contain minimum of the following or similar items:
 - o 6 small-sterilized dressings
 - o 3 medium and large sterilized dressings
 - o 1 (30 ml.) bottles containing 2% alcoholic solution of iodine
 - o 1(30 ml) bottle containing salvolatile
 - o 1 snakebite lancet
 - o 1 pair sterilized scissors
 - o 1 copy of first-aid leaflet
 - o 100 tablets of aspirin
 - o Ointment for burns
 - o A suitable surgical antiseptic solution
- Adequate arrangement shall be made for immediate recoupment of the equipments, whenever necessary.
- A trained personnel in charge of first aid treatment to be readily available during working hours at construction site
- Suitable transport to the nearest approachable hospital should be made available.

The following measures need to be adopted by the contractor to address public safety concerns:

- The contractor shall schedule the construction activities taking into consideration factors such as:
 - o Sowing of crops
 - o Harvesting
 - o Local constraints such as festivals etc.

- o Availability of local labor (should be preference, as per specifications) during particular periods
- All precautionary signs as per DoR standard and traffic control devices (such as barricades, etc) shall be placed as soon as construction activity get started and shall remain in place till the activities get completed.
- As necessary, traffic deviations and accident-prone spots need to be manned by all times during construction activities with control personnel that take particular care to prevent children from accessing dangerous construction sites.
- Following case specific measures need to be followed during the progress of the activity:
 - o In case of blasting, the Contractor must follow The Explosives Act of GoN. In case of construction activity adjoining the water bodies, measures shall be taken as per guidelines in Ch. 11, "Water Bodies". If construction of road is within a settlement, the contractor must ensure there shall not be any unauthorized parking as well as storage of material, adjacent to road. Approved chemicals should be sprayed to prevent breeding of mosquitoes and other disease-causing organisms, at all existing or likely water logging areas.

The Project management shall carry out periodic inspections in order to ensure that all the measures are being undertaken as per this specific set of Code of Practice.

The contractor must give utmost precautionary care to exclude and control the spread of sexually transmitted diseases, by imposing strict rules and providing regular awareness training among all work staff.

14.4 Post-construction Stage

During this stage a major concern is on road user safety. Following are the measures that need to be undertaken by the DoR divisional Office/District Office to ensure safer roads:

- Inspection and maintenance of installed regulatory and informatory signs.
- Ensure that the location of signage does not obstruct the visibility
- In case of hill roads, maintenance of parapet wall as well as of overtaking zones.

The DoR Divisional office/District Office must ensure that during the maintenance operation of road, road materials are stored at a location such that they shall not create any risk to road users.

The construction site shall be cleaned of all debris, scrap materials and machinery on completion of construction for the safety of public and road users, as per Ch.3, "Construction Camps and Site Operation" and Ch.13, "Waste Management and Site Rehabilitation".

The environmental and social audit needs also to determine whether the preventive campaigns to control sexually transmitted diseases, alcohol / drug abuse and trafficking are under proper control, or if further corrective measures are needed covering a given road section.

15. Roads Crossing Forests and Sensitive Wildlife Habitats

This code of practice envisages measures to be undertaken during planning, design, construction and operation and maintenance stages of the Road passing through natural habitats. These measures shall be undertaken in addition to the measures laid down in the other guideline sections of this Annex.

As per the World Bank OP 4.04 and similar directives provided by other donor agencies like ADB, DFID and JICA, the conservation and enhancement of natural habitats is essential for long-term sustainable development.

Natural Habitats refers to...

- National Park
- Reserve Forest
- Sanctuaries
- Notified Wetlands
- Fisheries and Aquatic Habitats
- Karst landforms, including caves

15.1 Project Planning and Design

To minimize the adverse impact on the ecology of the natural habitats, selection of alignment should be as per the principal guideline outlined in Ch. 1, "Project Planning & Design".

An officer of at least the rank of a forest ranger shall be deputed for detailed inventory of ecological features along the Road. The inventory shall be carried out after the ranger travels along the proposed alignment during the transect walk while the nature and type of impacts on natural habitats due to road construction are identified.

Ecological Features...	Adverse Impacts...
• Area and integer function of natural habitat • Habitat requirements for territorial species • Type and number of endangered species of flora and fauna • Water bodies and aquatic life • Breeding ground and seasons • Seasonal and spatial requirements of migratory bird species • Terrestrial animal crossing pathways	• Fragmentation of forest land and habitats • Cutting of trees vital for certain species and populations • Disturbance, withering, trampling of vegetation • Contamination of water due to various forms of water uses and/or influx of pollutants from adjacent surface and groundwater sources • Loss or disturbance of breeding grounds • Interruption of animal crossings due to construction and operation of a road

Impacts on natural habitats shall be minimized to the extent required. Minimization shall be through precautionary measures or through appropriate mitigation measures. Recommended measures and good practices for constructing roads passing through forests and other sensitive natural habitats include:

- Constricting the road width to minimize the extent of diversion of forest land and cutting of trees.
- Drainage Structures shall be designed in accordance with guidelines given in Ch.10.
- Rumble strips shall be provided at every kilometer along the length of the natural habitat and invariably at the start and end of the natural habitat.

- Signage (viz. speed limit, animal crossing, switch of headlight etc) shall be provided as per DoR Standard for road sign.
- If signage proves to be insufficient, physical speed breakers have to be included in the road design in sections with high incidents of traffic accidents with wildlife (e.g. in dense forest sections).
- In case of sensitive ecological road sections the EMP of the IEE/EIA Study shall identify specific measures for the stretch passing through such habitats.

In addition to the above measures, specific impacts identified on site shall be mitigated as per the recommendation of the forest department / officer in charge of the identified natural habitat. In case the proposed alignment falls within a certain surface water flow, a flush causeway shall be constructed without impacting the natural drainage system. The length of the causeway shall be as per the existing water spread. In no circumstances a water body within the natural habitat shall be cut across or filled for the purpose of laying the road.

15.2 Pre-construction Stage

No Construction Camps, Stockyards, Concrete Batching or Hot Mix Plants shall be located within the natural habitat or within 500m from its boundary.

Contractor in consultation with forest ranger or any other concerned authority shall prepare a schedule of construction within the natural habitat. Due consideration shall be given to the time of migration, time of crossing, breeding habits and any other special phenomena taking place in the area for the concerned flora or fauna.

15.3 Construction Stage

Procurement of any kind of construction material (as quarry or borrow material) from within the natural habitat shall be strictly prohibited. No water resources within the natural habitat shall be tapped for road construction.

Use of mechanized equipment shall be kept at minimum while working in forests and/or ecological sensitive habitats. The Contractor must ensure that there will be no parking of vehicles, machine and equipment within such ecological zones.

The disposal of construction waste and spoil within the natural habitat shall be strictly prohibited and as far as possible re-use shall be undertaken as per **Table A2-15** presented in Ch. 12, "Waste Management and Site Redevelopment".

15.4 Post Construction Stage

The road passing through the natural habitat shall be declared as a silence zone.

Compensatory tree plantation in the ratio of 1:25 within the available Right of Way shall be done in accordance with Ch.9 "Tree Plantation".

The Project Management must ensure maintenance of drainage structure undertaken as per Ch. 10, "Drainage and Flood Prevention."

16. Protection of Cultural Properties

Cultural properties located close to the road are likely to be impacted by road construction, therefore these assets should be duly avoided while determining and finalizing a road alignment. **Table A2-19** highlights the key activities that need to be addressed in this regard during different stages of the project and also the significance of the impacts in the project regions.

Table A2-19: Key Activities to protect cultural properties

Stage	Activities
Project Planning & Design	Identification of cultural properties and their significance while consulting local stakeholders and, as applicable, the Dept. of Archaeology
	Avoidance/mitigation measures
Construction	Precautionary measures
Post-construction	Restoration of impacted cultural properties

16.1 Project Planning and Design Stage

Measures for mitigation of impacts on cultural properties during project preparation should observe the following steps:

- Identification of locally significant cultural properties, in close consultation with local communities and religious leaders;
- Assessment of likely impacts on each cultural property due to project implementation, taking into due account the perception of the consulted stakeholders;
- Develop, together with the local representatives, possible measures for avoidance or mitigation of the anticipated impacts.

In case the impact is not avoidable, identification of alternative routes or possibility of relocation of the culture property shall be assessed in consultation with the local public, based on the economic feasibility.

In case of world heritage sites or place of high socio-cultural importance, no relocation would be taken up and alignment shall be shifted away from the cultural property to avoid any impacts. Re-alignment for avoiding impacts on such site is mandatory.

In case of (agreed/feasible) relocation, relocated site should be suggested by the local people and the size of

Information to be collected on cultural properties...

- Location
- Direction (North/ South/East/West) with respect to the planned road
- Distance of the structure from existing centerline of the road
- Type of property: temple/mosque/shrine/palace, religious pond, stone water spout etc
- Plan of the structure
- Importance of the structure - historical/social/archeological
- Ownership of the property
- Probable loss to the property
- Specific periods/durations in which large congregations as festivals/mela take place causing hindrance to vehicular movement
- Choice of community, issue of relocation

relocated structure should at least be equal to the original structure. The original architecture and structure setting should be maintained to the extent possible.

A detailed design of the relocated structure and its site plan along with the necessary BoQ are to be presented in the Detail Design Report.

The relocation and other avoidance measures should be carried out before the start of the road work.

It must be ensured by the Project Management that the BoQ and rates for the relocation works are incorporated into the contract document.

16.2 Construction Stage

Major impacts on the properties during this stage are mainly due to movement of construction machinery as well as due to construction activity in the vicinity of the cultural property. The following precautionary measures are recommendable:

- Provision of temporary barricades to isolate the boundaries of the cultural property from the construction site as approved by the Engineer to avoid impacts;
- Restrict movement of heavy machinery near the structure;
- Avoid disposal or tipping of earth near the structure;
- Access to these properties shall be kept clear from dirt and grit.

During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archeological significance, the same shall immediately be intimated to the Engineer. Work shall be suspended until further orders from Project Management. The Department of Archeology shall then be informed without delay of the chance find and the Engineer shall carry out a joint inspection with officials from the Department who shall suggest appropriate actions the Contractor has to comply with. This will also include information on the probable date for resuming works.

The Project Management must ensure that the contractor implements all precautionary measures as suggested in the Contract Specifications relating to preservation of cultural assets.

16.3 Post Construction Stage

Immediately after completion of construction, the Contractor will affect clearance of the precincts of cultural properties.

In case access to any of the cultural properties is severed during construction it needs to be restored at the Contractor's cost. Restoring is subject to approval of either the VDC or the Department of Archaeology. The Project Management shall certify the approved restoration actions before final payment is made.

17. Remedial Measures against Rural Road Accidents

In 1997, the DoR prepared a series of guidelines that address practical recommendations for identifying and treating road accident sites. It is suggested that road engineers, planners and contractors will explore the following technical solutions and good practices to diminish the toll of road accidents in the country's rural roads.

None of the remedial measures suggested below from **Table A2-20** should be implemented without in-depth analysis. When considering remedial measures it must be emphasized that it is important to study the accident data, identifying the dominant accident types, identifying the causal factors, and selecting remedial measures which are likely to be effective in remedying the deficiencies that have been found. While doing so, planners need also to assess beforehand the following questions:

- (i) *Is the remedy likely to be long-lasting?* – for example, some speed-reduction measures have an immediate effect but this wears off as drivers get used to them;
- (ii) *Is the specific remedy cost-effective?* - some measures may be effective without being cost-effective;
- (iii) *Will the proposed measure result in an excessive increase in other types of accidents?* - for example, in some circumstances the introduction of traffic signals can result in an increase in nose -to -tail accidents;
- (iv) *Will it have unacceptable environmental or social effects?* - -road humps for example can cause traffic noise nuisance as vehicles brake, and may result in traffic diverting onto other less suitable roads
- (v) *Will the measure be unpopular with road users?* - if so, the engineer might come under strong pressure to remove it, unless there is prove to the local community that it is effective in preventing accidents
- (vi) *Will the corrective provision need to be heavily enforced by the Road Police or will it require considerable publicity and education?* -if so, consider whether this is really achievable.

Table A2-20: Remedial Measures for Rural Accident Situations

Accident Type	Possible Remedy
Single vehicle loss of control (usually recorded as overturn)	• improved delineation (centre and edge line markings, delineator posts, chevron signs, reflective studs if a night -time problem) • safety barrier (especially if there is a big drop) –containment parapet on bridges • bar markings on the road (especially on the approach to a very sharp bend) • warning signs (if they already exist, consider increasing their size, or making them reflective, or positioning them better) • seal the shoulder (if unsealed) • impose speed limit • improve skid resistance • re-align bend and/or improve super-elevation
Head on collisions	• Improved delineation (as above) • if collisions happen while overtaking consider prohibiting this using a continuous centre line and possibly "No Overtaking" regulatory sign • if collisions happen at narrow sections (e.g. bridges, culverts) ensure that these are clearly signed (warning signs, hazard markers, bar markings, rumble strips, etc) • if collisions frequently happen while a parked vehicle is being overtaken consider banning parking and/or providing a parking area or lay- by
Pedestrian Accidents	• traffic calming measures within villages and at the entrances (place name signs, gateways, rumble strips, build-outs) (make it very clear to drivers that they are going through a village) • impose speed limits • warning signs ("Children", or "Pedestrians in Road") • provide footways (on bridges and elsewhere) • provide pedestrian crossings (but only if they will be well-used)
Collision with roadside object	• Remove object if possible • Install hazard marker in front of object • use safety barrier to protect vehicle from object (e.g. in front of the end of a bridge parapet)
Collision with stopped or parked vehicle	• consider banning parking in this accident-prone zone • provide bus lay-by or off-road parking area
Accidents at junctions and access points	• better signing and marking (make the priorities clear) • channelization (splitter islands in minor road approach and protected lanes for vehicles turning right out of the major road) using paint ("ghost islands") or physical islands • remove any obstructions to visibility (e.g. trees, bushes, poles, walls etc) • provide service roads for frontage development thereby making it possible to greatly reduce the number of access points.
Accidents on gradients	• Safety barrier (if vehicles frequently run out of control) • Provide crawler (overtaking) lanes or shorter passing places

Accident Type	Possible Remedy
Junction Accidents	<i>There is a great variety of junction situations and not all the remedies listed below will apply to every one -moreover all remedial measures will need to be carefully designed to suit the specific circumstances -it is advisable to consult design manuals before making major alterations to junction layout</i>
Conflicts between traffic streams -at priority (T or cross-roads) junctions	• if traffic is very heavy -such as at many junctions in larger towns - consider installing a roundabout (if there is space) or traffic signals traffic signal installation needs to be done as part of a project covering a number of junctions) • improve the signing and marking (make the priorities clear) • channeling -show drivers the correct path to take by means of road markings (e.g. "ghost islands", lane markings, right-turn bays, lane arrows, etc) and physical islands • control and channel pedestrian crossing movements • modify the layout to encourage slower approach speeds (e.g. by reducing corner radii and providing splitter islands) • prohibit and discourage parking and stopping near the junction (e.g. by signs and pedestrian guardrail) -move bus stops away from the junction • improve traffic lighting • remove any obstructions to visibility on traffic lights • ban difficult turning movements (but only if the ban can be easily enforced and the alternative route is not too long or awkward) • consider reducing the number of conflicts by converting one or more roads to one-way traffic (but consider the area-wide implications) • improve skid resistance
Conflicts between traffic streams at roundabouts	• improve the signing and marking (make the priorities clear) • install splitter islands on the approaches • increase deflection {e.g. by increasing the diameter of the centre island or changing the approach geometry) • control and channel pedestrian crossing movements • prohibit and discourage parking and stopping near the junction (e.g. by signs and pedestrian guardrail) • move bus stops away • improve lighting • remove any obstructions to visibility • improve skid resistance
Pedestrian accidents at all types of junctions	• control and channel pedestrian crossing movements • provide pedestrian crossings • provide pedestrian refuges • prohibit and discourage parking and stopping near the junction (e.g. by signs and pedestrian guardrail) -move bus stops away • improve lighting • at signalized junctions consider introducing a pedestrian stage

Accident Type	Possible Remedy
Conflicts between traffic streams -at signalized junctions	• upgrade the signal equipment (brighter lights, stronger colors) • improve signal visibility (extra signals, better positioning, backing boards, etc) • improve the signing and marking (STOP lines, lanes and lane markings, turn arrows, advance warning signs) • check the timing (additional inter-green time may be need for clearance) • consider changes to the staging' (if there is a right-turning problem consider giving this traffic a separate stage or a priority overlap) • control and channel pedestrian crossing movements • prohibit and discourage parking and stopping near the junction (e.g. by signs and pedestrian guardrail) -move bus stops away improve lighting • remove any obstructions to visibility • improve skid resistance
Accidents not at Junctions	
Pedestrian accidents	• Provide pedestrian footways • provide pedestrian crossings (busy crossings may need to be signal-controlled) • provide pedestrian refuges • control and channel pedestrian crossing movements • install speed reducing road humps (residential areas) • install other traffic calming measures (gateways, build-outs. , chicanes, rumble areas, etc. , designed to encourage low speeds, and careful disciplined driving
Single vehicle – loss of control	• largely as for rural accident situations
Head-on collisions	• largely as for rural accident situations
Accidents involving two-wheelers and non-motorized vehicles	• consider increasing width of nearside lane or providing a special lane

Annex 3
Glossary of Technical Terms used in
the ESMF

ANNEX 3

GLOSSARY - Common Terms used in the ESMF

Baseline Study is the work done to collect and interpret information on the status and trends of the environment likely to be affected by the proposed development action.

Biodiversity is the common description for biological diversity at different levels of life (e.g. habitat, populations, species, individual biota, organisms and micro-biological/cellular structures. In EIAs, biodiversity refers mainly to the wealth of ecosystems in the biosphere, of species within ecosystems, and of genetic information within populations.

Biosphere describes that part of the earth-atmosphere system which supports and is characterized by life, encompassing all terrestrial and aquatic ecosystems.

Biota is a collective term that denotes all the living organisms in a particular space.

Chain Impacts are impacts which are themselves a result of other impacts, as opposed to being caused directly by any particular event. Chain impacts are usually considered as part of a series of related impacts having a cascade an/or accumulating effects on the environment.

Compensation is the provision for enhancement, replacement, restoration, and restitution to recipients of unavoidable negative residual impacts. Often there is payment in funds or replacement. Funds may also be used to recreate lost habitat or other valued resources.

Compensation Plan is the portion of the Environmental Management plan that describes the compensation measures that will be undertaken and committed to if a project proceeds. It includes how much compensation will be paid to whom, by whom, and under what conditions.

Conservation is the preservation of natural resources so as to maintain supplies and quality levels sufficient to meet all present and anticipated needs.

Critical habitat is an area of land and/or water required for the survival of a plant or animal population. Critical habitats are also referred to as **ecologically sensitive areas**.

Cumulative Impact. refers to environmental impact(s) that result from actions being added to others of the past, present, and foreseeable future, caused by construction or related activities or natural events that are either repeated or occur in combination.

Direct or Indirect Impacts: Whereas most physical and hydrological impacts are direct; ecological and social impacts are commonly indirect or secondary in nature.

Ecosystem is an aquatic or terrestrial system or combination of systems that include some or all of the living and non-living components. Boundaries of an ecosystem are often specified for a particular application.

Encroachment relating to road projects refers to the temporary or permanent occupation of Government land (mostly RoW) by private individuals. It includes erection of buildings or other structures and the intrusion with crops and livestock.

Endemism refers to a condition in which species occur only in a single spatially-limited and distinct location, such as isolated islands, mountain valleys, caves, lakes and isolated forest lands (e.g. Sundarban). Endemic species are often highly specialized to the limited

environmental conditions in which they exist, and are thus vulnerable to changes introduced from outside.

Environment is the totality of the natural and human environments on which the project will exhibit influence, and includes

- (i) all biophysical components of the natural environment of land, water and air including all layers of the atmosphere, biological resources, and all inorganic and organic matter both living and dead;
- (ii) all socio-economic components of the human environment including, but not limited to, social, economic development, human resources, quality of life, administrative, cultural, historical, archeological, architectural, structures, sites and things, land and resource usage, and human health, nutrition and safety.

Environmental Assessment (EA) is the process for making environmentally sound decisions in to ensure that the concept of sustainable development is achieved in respect to projects and the plans leading to projects. It has four components:

- (i) early planning to avoid environmental impacts,
- (ii) identification of existing and expected environmental impacts → **EIA or IEE**
- (iii) Environmental Management Plan to determine residual environmental impacts and their management,
- (iv) Public participation.

Environmental Auditing is a systematic, documented and verifiable process designed to ascertain whether the → **EMS** helps the organization to meet the required standards of environmental performance, fulfill its legal obligations and achieve what has been planned for. Compliance performance techniques are important audit tools.

Environmental Enhancement is an intentional change which amplifies the anticipated positive impact of the project on one more environmental components.

Environmental Impact is, from the project's point of view, either

- (i) any change that the project may cause to an environmental component, or
- (ii) any change to the project that may be caused by the environment, which then may lead to altered environmental conditions

Environmental Impact caused by the actions of a project or interventions should be distinguished from the impact to resources or components caused by natural events such as floods, cyclones and earthquakes.

Environmental Impact Assessment (EIA) is the systematic study, assessment and reporting of the impacts of a proposed program, plan or project, including a plan for dealing with and control of negative impacts. The EIA Report provides quantified and qualified information on the expected impacts due to project interventions, and makes provision for mitigating these effects.

Environmental Management Action Plan (EMAP) is a plan to undertaken an array of follow-up activities which provide for the sound environmental management of a project so that adverse environmental impacts are minimized and mitigated; beneficial environmental effects are maximized and sustainable development is ensured. EMAPs are sometimes called **Environmental Protection Plan** and describes specific mitigation actions that will be undertaken during project pre-construction, construction, operation, rehabilitation and abandonment to lessen the effects of the project on the environment usually with specific instructions for personnel involved in project activities. The EMAP integrates existing legislation, codes of good engineering measures and makes provision for respective clauses to be incorporated in the contracts for executing the (road) project.

Environmental Management System (EMS) provides a structured and systematic approach to overall environmental management. It covers policy, procedures, stakeholders, responsibilities and audit mechanisms.

Environmental Standards (ES). An environmental standard is defined here as an environmental threshold establishing maximum or minimum limits for the criteria by which key parameters are measured.

Follow-up Activities constitute the set of specific actions described in the Environmental Management Plan for project implementation and compliance with contractual responsibilities.

GIS is the abbreviation for **Geographic Information System**, a computer-based tool for mapping and analyzing conditions that occur on earth. This system offers a query and statistical analysis used for planning purposes and predicting outcomes from development projects.

GPS is the **Global Position System** using satellite-transmitted signals for exact positioning and reference of any location on a global coordinate grid.

Habitat is the descriptive division of the environment having a functional combination of physical (drainage, soil type, slope) and biological factors necessary for sustained animal, plant or human use and survival.

Impact Matrix is a cross-referencing square or rectangular array of rows (project activities) and columns (important environmental components) used for organizing and visualizing positive and negative environmental impacts of a project.

Indicator is an organism or a quantifiable physical or bio-chemical feature that, by its presence, absence or abundance, indicates a particular property of the surrounding environment.

Indigenous People describes collectively the members of those cultures that have historic, ancestral, spiritual and functional connection to the land on which and from which they live. In popular usage, indigenous peoples are distinguished from members of those cultures whose connection to the land on which they live is limited to the historical period. They often are highly vulnerable against cultural influences from outside.

Initial Environmental Examination (IEE) is the initial report for a proposed project prepared at pre-feasibility level for identifying and addressing the nature and scope of possible impacts.

Interested Parties (also called '**Stakeholders**') are all persons, groups and institutions having a justifiable concern and interest in the project and its impacts. It includes local people as well as elected representatives of the government, NGO's and project donors.

Intervention is the specific action caused by a project that creates an environmental impact.

Landscape refers the spatial organization of an environment on a broad scale, and how that organization shapes, and is shaped by, the activities which take place within it. In Environmental Assessment Studies, the term 'landscape' often refers to aesthetical values.

Magnitude is the degree of change in an important environmental component that results from a project activity.

Mitigation is any action taken to reduce unacceptable negative impacts, e.g. the elimination, reduction or control of the adverse environmental impacts resulting from the proposed project. It includes both design changes to the project and operational strategies (i.e. compensation). Mitigation measures are specified in the EMP.

Project is defined as;

- (i) a physical work such as construction, operation and rehabilitation works, abandonment or other programs in relation to that physical work, and
- (ii) a regional, pre-feasibility, feasibility, design or conceptual plan or study undertaken to ascertain the desirability of proceeding with physical works and associated activities such as road network development, transport sector development, etc.

Project Phase refers to the main categories of project activities expressed sequentially including: pre-construction, construction, operation and abandonment.

(Project) Proponent in respect to a project means the person, body, authority, government or donor that proposes the project, or who is responsible for the environmental assessment or implementation of the project.

Project Stage refers to the main stage of project planning including: pre-feasibility (regional study) and feasibility.

Public Involvement refers to the dialogue, encompassing consultation and communication, between a project proponent and the →stakeholders, ideally at all →stages of a project . It includes dissemination, solicitation, and presentation of information.

Residual Impacts. Residual impacts are those impacts that remain after application of mitigation measures and that cannot be overcome.

Resettlement Action Plan (RAP) is the action plan prepared as part of an EA to address the issues of involuntary resettlement, compensation and rehabilitation of people and communities affected by a road project.

Resilience describes how quickly a system or environmental variable returns to its natural state following cessation of a disturbance, in relation to the proposed → mitigation measure.

Screening is to determine beforehand the nature and extent of the EIA, i.e. to match the level of effort in the EIA to the expected magnitude of the anticipated impacts. In this process, project are classified into impact categories (A, B, C) following certain criteria set commonly by project funding institutions (e.g. *Operational Directives of World Bank*) and the legal framework (e.g. Environmental Conservation Act, Environmental Guidelines)

Scoping is a process whereby the important environmental components, project development issues, project alternatives and concerns of local communities are identified.

Significant Environmental Impact is an adverse residential environmental impact that is not justified in the circumstances.

Socio-economic refers to the human environment which includes social and economic components that are not termed biophysical.

Stakeholders includes all persons and groups having a justifiable concern and interest in the project and its impacts. Stakeholders include local people of different professions, representatives of the Government, overseas donor agencies, NGOs and local industries and small enterprises.

Sustainable Development is development is development that ensures preservation and enhancement of environmental quality, and sound sustainable use of natural resources thereby providing for economic growth which meets the needs of the present without compromising the ability of future generations to meet their own needs (adapted from the Brundtland Commission, 1987).

Synergistic Effects describe those effects which result from the combination and interaction of individual impacts. The effects are often greater than the sum of the individual contributing impacts.

Topography. A detailed description or representation of the features, both natural and artificial, of an area.

Trophic is an ecological term referring to the positioning of organisms in the **food chains** of their respective biological communities. The lowest level is commonly associated with the primary producers, which transform the sun' s energy into tissue that becomes food for higher trophic levels, and the highest level with large carnivores which normally have no predators.

Valuation is the assignment of monetary, importance, priority or other values to the estimated impacts. Monetary or economic valuation in EAs is often termed **evaluation**.

Annex 4

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¹ Not quoted herein are all legislation and policy documents of both the GoN and International Donors quoted in Chapter 3

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