

Government of Nepal  
Ministry of Federal Affairs and Local Development  
Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR)

**DEVELOPING A PARTICIPATORY APPROACH FOR ROADSIDE  
PROTECTION OF RURAL ROADS IN NEPAL  
DRAFT RIGHT OF WAY UTILISATION MANUAL**



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In association with:  
Research for Community Access Partnership (ReCAP)

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*Cover Photo: Local banana on Sukhad-Bhajani road (Photo by Ruth Schaffner, 2016)*

## Acronyms

Amt	Amount
B/C	Benefit Cost Ratio
CBA	Cost Benefit Analysis
CFUG	Community Forestry User Group
COI	Corridor of Impact
DADO	District Agricultural Development Office
DDC	District Development Committee
DFO	District Forest Office
DoLIDAR	Department of Local Development and Agricultural Roads
DoR	Department of Roads
DRCN	District Road Core Network
DSCO	District Soil Conservation Office
DTO	District Technical Office
EA	Electricity Act
EIA	Environmental Impact Assessment
EPR	Environmental Protection Regulation
ER	Electricity Regulation
ESMF	Environmental and Social Management Framework
FA	Forest Act
FECOFUN	Federation of Community Forest Users Nepal
FNCCI	Federation of Nepalese Chambers of Commerce and Industry
FR	Forest Regulation
GoN	Government of Nepal
HH	Household
IGA	Income Generating Activities
IR	Irrigation Regulation
IRR	Internal Rate of Return
LSGA	Local-Self-Governance Act
MoA	Memorandum of Agreement
MoU	Memorandum of Understanding
NGO	Non-Governmental Organisation
NPV	Net Present Value
NRRS	Nepal Rural Road Standards
NRs	Nepalese Rupees
NTFP	Non-Timber Forest Products
PMU	Programme Management Unit
PRA	Public Road Act
ReCAP	Research for Community Access Partnership
RoW	Right of Way
SNRTP	Strengthening for National Rural Transport Programme
SWOT	Strength, Weakness, Opportunities and Threats
UK	United Kingdom
VDC	Village Development Committee
VPD	Vehicles per Day

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## Introduction

With the aim to develop a participatory approach for roadside protection on rural roads in Nepal, an innovative approach is applied: To foster ownership by way of a Memorandum of Understanding (MoU) and agreements between district authorities and local user groups. As a starting point to implement this innovative approach, a pilot project (including a research and a practical/implementation component) was conducted, taking into account the current legal, engineering, bio-engineering and socio-economic conditions in rural Nepal (ReCAP, DoLIDAR, 2016).

The utilisation of Right of Way (RoW) land for poverty alleviation along the roads of the District Road Core Network is a new concept. A clear legal provision for this purpose has not been enacted in Nepal so far. However, various policy and legal provisions have been endorsed in regard to plantation and to maintaining greenery in the RoW through local authorities. From this basis, the research component of the pilot project developed appropriate legal instruments for the use of the RoW. Following investigations on legal, engineering and socio-economic conditions, a list of suitable plants was prepared. Cost benefit analyses (CBA) of the proposed plants indicate that by involving the poorest of the poor in planting the RoW land for productive use, their income can be considerably increased.

The practical component of the pilot project is aimed at testing, i.e. implementing, the developed approach on sections along district roads in the Terai and in the hills. The here presented Draft RoW Utilisation Manual comprises the required legal, engineering, bio-engineering and economic aspects and respective activities to be undertaken. Based on the experiences gained in implementing these pilot activities, this manual will later be adapted and completed. The finalised manual shall then provide the guidelines to be followed for a wider replication of the approach.

## Background

The construction of rural roads, with the objective of providing improved access to the rural population, has been one of the top priorities of the Government of Nepal. As a result, the construction of rural roads of various categories has been progressing at a rapid rate. Of these roads, about 21'500 km are included in the District Road Core Network (DRCN), which falls under the direct responsibility of the Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR).

Despite huge investments in the DRCN, the operation of these roads is not satisfactory. To date, most of them still operate during the dry season only. A key reason for this failure has been the inability to identify and establish a robust mechanism for road maintenance, which includes the proper management of the RoW land. Currently, a major part of the RoW land has been encroached upon and used inappropriately, triggering soil erosion, landslides and road accidents. This situation has increased the liability for the Government of Nepal (GoN) and has accelerated the deterioration of the roads. Against this backdrop, identifying a new approach for sustainable management of the RoW land, linked to prospective income generating activities for poor communities, is a significant initiative.

Legally, DRCN roads require a 20 m wide RoW. The total of this RoW land in Nepal amounts to approximately 30'000 ha. It is estimated that of this RoW land, up to 21'000 ha could be planted for productive use, as Income Generating Activity (IGA) in favour of poor communities. Allowing local poor households (HH) to gain benefit from IGA on RoW land could increase their motivation to manage the RoW land on a sustainable basis.

The concept for the utilisation of the RoW of roads is new in Nepal and there is neither a formal institutional mechanism in place, nor have any specific legal instruments been developed to support this concept. However, there are a handful of experiences in Nepal, where public land has been used by local communities for income generating activities, or generally for the benefit of the locals. Annex A presents the legal matrix on the current utilisation of public land in Nepal. In the research component of the pilot project, the existing practices were analysed and an innovative approach was developed for the

successful management of land within the RoW of the DRCN. Based on these findings, a tentative framework for the implementation of the developed approach was prepared, which is consecutively tested during the practical component of the pilot project.

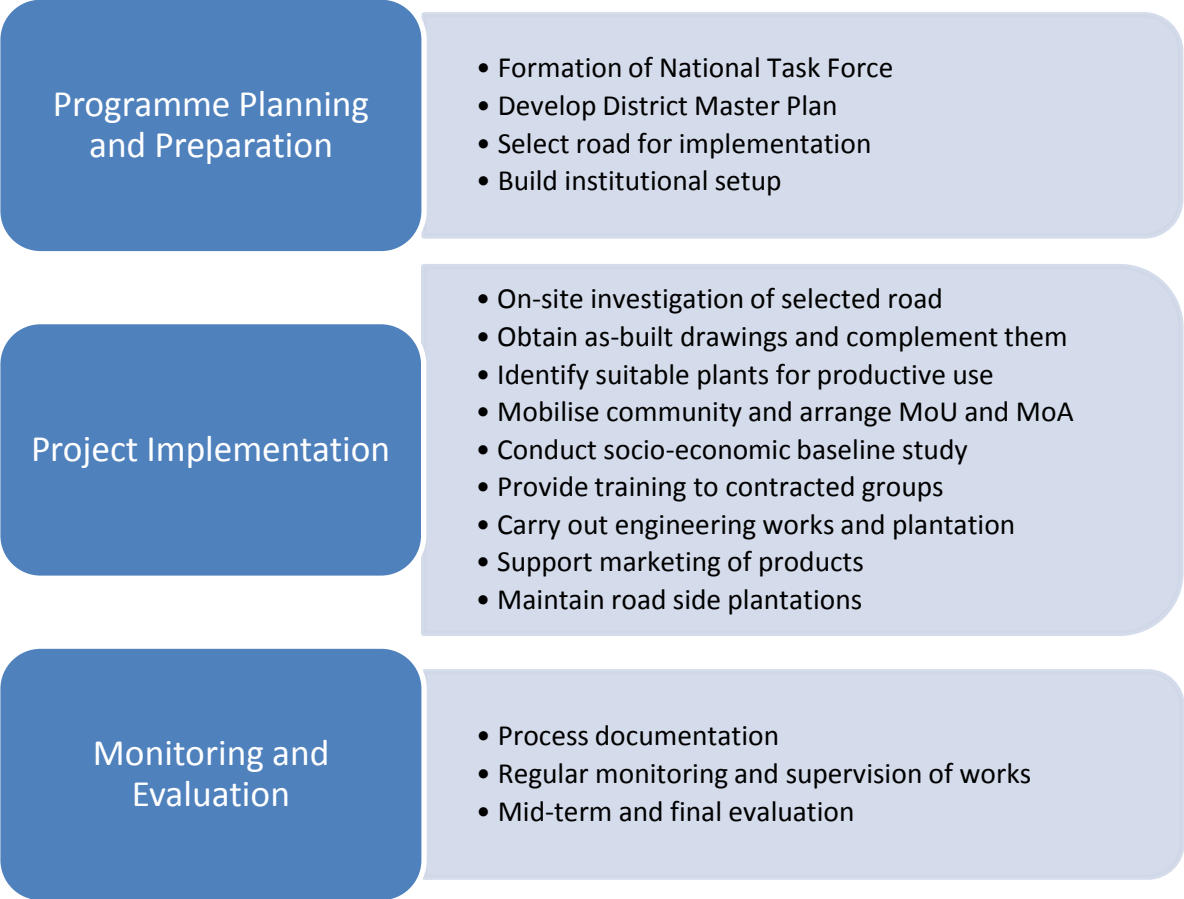
For this pilot implementation, key milestones are recommended for institutional and legal arrangements, for plantation and engineering inputs, and for relevant socioeconomic requirements. The framework for the pilot implementation and the recommended key milestones are compiled in the here presented Draft manual.

The pilot project considered only short road sections, so some of the proposed activities may not be feasible for wider replication. For instance, it was proposed to bring the roadside slopes to the standard as specified in the Nepal Rural Road Standards (NRRS). However due to high costs of such a correction, this measure may not be feasible in a wider replication of the approach. Therefore, it is recommended that the DoLIDAR together with the District Development Committees (DDC) develops a ranking of optional RoW plantation projects to be implemented in a phase-wise approach.

It is also essential to note that before successfully signing a Tripartite MoU between DoLIDAR/DDC/ Municipalities/Village Development Committee (VDC) and local communities for the utilisation of the RoW of a particular road section, a wide consensus will be needed on matters related to benefit sharing mechanisms as well as on the roles and responsibilities of the various government institutions involved.

The Draft RoW Utilisation Manual provides the essential basis for effective project implementation. It comprises three phases (Figure 1): Programme planning and preparation at the head office, project implementation at site, and monitoring and evaluation.

**Figure 1: Main project implementation steps for RoW utilisation**



In the following chapters, the steps required to implement the three phases are described in detail. The phasing of the individual implementation steps is presented in Annex B.

## **1 Programme Planning and Preparation**

Prior to on-site implementation, the following steps have to be undertaken at DoLIDAR head office in Kathmandu.

### **1.1 Formation of Task Force at DoLIDAR for drafting a nationwide programme incorporating concerned stakeholders**

DoLIDAR shall constitute a specific task force, or mandate an existing task force, to carry out consultations and ensure compliance of tasks and activities to be undertaken by the concerned stakeholders. In a first step, it is essential to gain an overview of the DRCN. A ranking must be developed of all roads for phase wise consideration and implementation. For this, the task force, with the help of DoLIDAR and other stakeholders, shall explore the availability of suitable RoW land, and facilitate the process of acquiring the official 20 m RoW on district roads. It shall take the lead in mobilising personal and financial resources both from the private and public sectors.

### **1.2 Interaction with the concerned stakeholders for developing necessary institutional setup at national, district and local level**

The task force shall take the lead in establishing the institutional set up required for the implementation of the concept at national, district and local level. It shall support the DDC/District Technical Office (DTO) in carrying out periodic consultations with government ministries, departments, corporations and non-governmental entities relevant to the program. It shall undertake training needs assessments and other relevant capacity building activities, both at national and district level.

### **1.3 Develop a ranking of roads for RoW plantation**

The task force will support DoLIDAR/DDC to develop a ranking of the DRCN roads for the phasing of implementation at district level. The roads with a clear RoW, i.e. where the land acquisition process is completed, should rank first. Also, there must be a proven willingness/commitment of the district to carry out a project.

### **1.4 DDC to prepare District-level Master Plan to implement RoW plantation on the DRCN**

The Local-Self-Governance Act 1999, Sect. 189 assigns to the DDC the function, duty and power to prepare a master plan of district-level roads in the district development area. Accordingly, the DDC may include the productive use of the RoW land in their periodic plan or District Transport Master Plan, depending upon the local situation and preconditions.

### **1.5 DDC/DTO to select DRCN road for project implementation**

Based on the district master plan, DDC/DTO shall choose the roads for the RoW plantation projects. The following criteria should be applied:

- RoW in place, land acquisition process is completed
- Socio-economic activities in place (community user groups, survey of population structure)
- Road construction documents available (as-built drawing or detailed project reports)

### **1.6 DDC to assign a project manager**

With regard to the institutional setup at district level, the DTO is the predestined person to take responsibility for the management of the RoW plantation projects.

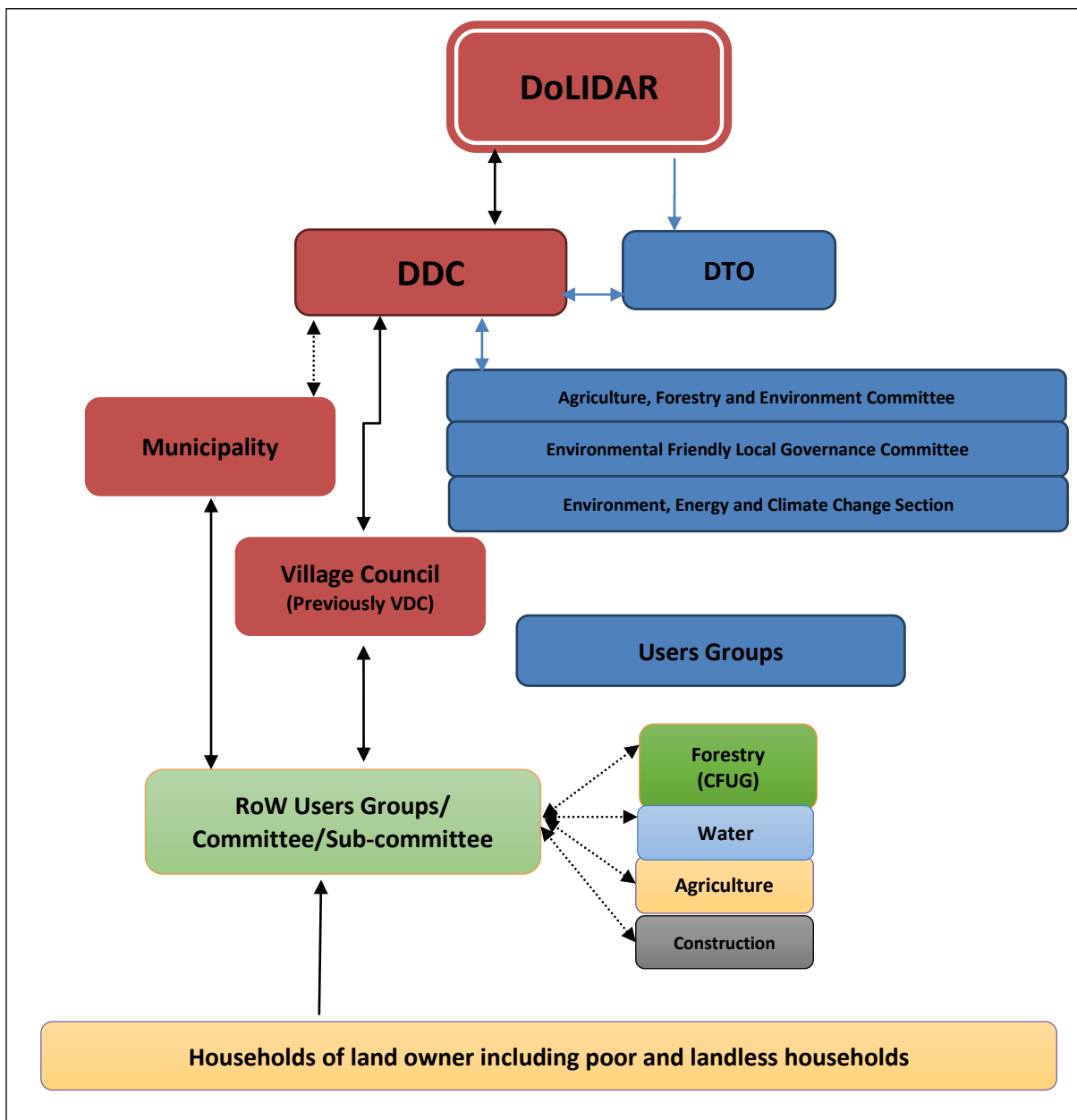
### 1.7 DDC/DTO to form a district committee for implementation

For his support, the DTO can set up a dedicated team with a clear vision, mission, strategy and well-formulated objectives at district and local level. If needed, a separate operational manual can be developed as guidance for this purpose.

### 1.8 Build up institutional setup at district and local level by consulting the concerned agencies

The institutional framework envisioned in the Local Self-Governance Act (LSGA) 1997, the Public Road Act (PRA) 1974 and the Forest Act (FA) 1993 for utilisation of the RoW provide the basis for the institutional setup for coordination, monitoring and implementation of income generation activities in the RoW for poverty alleviation. This knowledge forms the basis for district and local stakeholder consultations, which are instrumental for recommending an appropriate institutional mechanism for the future. Figure 2 indicates a possible institutional mechanism for the implementation of RoW plantation projects.

Figure 2: Proposed institutional mechanism (based on desk review and consultations)



The following agencies may be addressed:

- DDC
- District Agricultural Development Office (DAGO)
- District Forest Office (DFO)
- District Soil Conservation Office (DSCO)
- District Drinking Water Sub-Division Office
- District Irrigation Sub-division office
- District Federation of Community Forest Users Nepal (FECOFUN)
- District network of Irrigation Water Users Association
- Federation of Nepalese Chambers of Commerce and Industry (FNCCI)
- Associations of farmers at district level
- Other relevant Non-Government Organisations (NGOs)

### **1.9 Finalise institutional setup at national, district, local level; deploy respective professionals**

The DTO, in consultation with DoLIDAR/DDC, will finalise the institutional setup. This may include a working group for backstopping during the project implementation phase.

### **1.10 Design and conduct capacity building activities at DoLIDAR/DDC, VDCs/Municipalities**

It is essential to assess the types of capacity development activities that will be needed at national, district and local level. This can be achieved through a questionnaire survey with the key individuals, or by training unit heads or those individuals who are responsible for human resource development. Based on the findings of this assessment, respective training programs should be carried out, either based on existing sources or specifically designed new programs.

## **2 Project Implementation**

### **2.1 On-site investigation of the project road**

The DTO with his team should first conduct a reconnaissance survey along the identified road with the aim to gain an overview of the road, the soil profile, the availability of construction material nearby and of other general information about the road and its alignment:

- Road reconnaissance survey to define suitable road sections for RoW plantation.
- Joint stakeholder (DTO and team/VDC/potential user group) decision about exact location of road sections.

On the basis of this reconnaissance survey, the most suitable sections for RoW plantation can be selected, on which a more detailed survey can then be conducted.

### **2.2 Obtain as-built data of selected road sections**

As-Built Drawings on cross sections and alignment of the respective road sections can be obtained from the DDC. These can then be verified in the field and any discrepancies documented.

### **2.3 Supplement existing as-built data with records of cross sections and small structures**

Cross-sections are an instrumental basis for choosing plant species, designing toe wall and other retaining structures as well as fencing items during the preparation of a project proposal. With a limited timeframe it might not be feasible to obtain cross sections of the roads by conducting detailed topographical surveys of the road using sophisticated equipment, such as a Total Station. Therefore, in cases where As-Built Drawings are not available, the DTO with his team can establish basic cross sections (formation width of the roads, side drains, cut and fill slopes, etc.) during field inspection in 100 m intervals. Considering the topographical features of a road, the established cross-sections, and the types

of plant species proposed for plantation, adequate civil engineering requirements can be designed (for the NRRS see Annex C1; for Sample Cross Sections see Annexes C2, C3; for a Low Cost Fencing Design see Annex C4; for Cost Calculation of Low Cost Fencing see Annex C5).

#### **2.4 Assess site conditions for plantation for productive use incl. bio-engineering requirements**

The site conditions for plantation for productive use shall be assessed, based on factors similar to those used for site assessment in bio-engineering:

- altitude
- climate, e.g. temperature, rainfall
- orientation of slope
- soil type, fertility, moisture

#### **2.5 Identify plants suitable for the plantation in the RoW land, jointly with district agencies, the District Agricultural Development Office (DADO), DFO and DSCO**

During the pilot study, a comprehensive list of optional plants was composed by cross checking lists of plants recommended for bio-engineering with compilations of food and fodder plants of Nepal (Annex D). This list was specified for the local conditions at the pilot sites, through discussions with stakeholders and communities at regional and local level (Annex E).

In general, the **bio-engineering properties** of the optional plants for roadside plantations must be considered. Thus the selected plant should include the ability to catch, armour, reinforce, anchor, support or drain a slope.

With regard to plants for **productive use** in particular, the above plant selection criteria common for bio-engineering are supplemented by socio-economic considerations such as:

- occurrence in the area
- suitability for road stabilisation
- availability of plant material like seedlings, saplings, seeds, cuttings
- availability of nurseries
- suitable crop for roadside planting
- suitability for productive use
- common or known species for productive use in the area
- skills for cultivation developed or on the job assistance available
- marketing chain in place or options to initiate

Plant selection must obviously also consider practical aspects, since the proposal should be applicable by the user groups designated to do the plantings.

#### **2.6 Make an economic/financial analysis of RoW plantations**

For a socio-economic analysis of the plants to be used, a Cost-Benefit-Analysis (CBA) must be carried out, complemented by a SWAT and a Value Chain Analysis. This includes the following steps (for details see Annex F):

##### **Estimation of return**

The return is estimated based on the following parameters:

- Quantity of output (estimated)
- Gestation period
- Total years of output
- Price of the output (farm gate and market price)
- Estimate total return annually or seasonally, depending on the product (quantity x price)
- Estimate return for subsequent years according to the return period of the plants

## **Perform SWOT Analysis and Value Chain Analysis**

The analysis of Strengths, Weaknesses, Opportunities and Threats (SWOT) helps to understand the strengths, weaknesses, opportunities and threats for any business activity. By analysing these factors the positive aspects in the market for the business activity of the product can be reaped, and ways to improve the weaknesses and threats can be devised.

A value chain analysis shows the existing chain of the market value addition by different actors. The analysis allows identifying ways to improve the value of the product by positive interventions or support, and thereby to increase the income of the farmers.

### **2.7 Community mobilisation and socio economic analysis along the selected sections**

Interaction with the local communities is the first step towards successfully implementing plantation projects in the RoW. The DTO with officials from DDC and their counterparts shall visit the communities along the defined road section. The main objective of this visit is to share with the community the project objectives, the planned activities, and the roles and responsibilities of the concerned stakeholders including the local people. The visit will help understand the existing situation and the needs of the community, and to identify challenges that may occur during project implementation.

- Get information about the settlement in the village/municipality and near the road on both sides.
- Identify existing institutions in the area e.g. Local Road User Group, Forest User Group, Irrigation Water User Group, Drinking Water User Group, farmers groups etc.
- Identify present users of the RoW.
- Obtain the list of members, their wellbeing-ranking, and the list of office bearers of such organisations.
- Organize meetings with the concerned communities.
- Identify households interested in participating in the program. Give priority to poor and landless households.
- Discuss with VDC/Municipality in order to identify possibility of support for the program.
- Provide support to organise.
- Identify the group/HH which will actively execute the project (ideally the poorest of the poor).
- Assess those skills required for implementing the project which are already available, and identify those fields in which they will have to be further trained.

### **2.8 Final specification of road section in consultation with the community**

The specification of the road section a particular community has been allocated must be finalised, including a clear demarcation of the start/end points and the RoW edge line. This shall be done in consultation with the local people and landowners, political parties and other people relevant as per the local situation, such as representatives from the VDCs, Municipalities, etc. For this decision, it is essential to develop a common consensus and to include provisions given in respective legal obligations.

### **2.9 Negotiation between DoLIDAR/DDC/VDC/potential user group about cost and benefit sharing mechanism**

Since a large number of HHs are being involved on a single section of road, it is most important to establish specific guidelines on how the partaking HHs are to be selected and on how the benefits from the proposed project are to be shared among them. Ideally, the selection of partaking HHs is based on those HHs interested in the utilisation of the RoW, since not all HHs may be interested. Issues such as the duration of the project, types of plants to be planted, roles and responsibilities of each stakeholder including the government counterpart, should be clearly defined and mutually agreed upon, before signing the contractual documents.

### **2.10 Prepare a Tripartite MoU with DoLIDAR/DDC and HHs of selected user group**

First the legal requirements for formal understanding must be identified. According to the existing provision of the Public Road Act, the DoLIDAR/DDC owns the land of the RoW, including the roadside which will be utilised for this pilot project. To some extent, the LSGA also delegates roles and responsibilities to the VDCs/Municipalities, such as the protection of production including trees along the roadside. The local communities must therefore **obtain a formal consent or approval from the local government to utilise the RoW land**, based on a tripartite MoU between DoLIDAR/DDC, the VDC/Municipality and the local community. These parties need to enter into a formal process for arranging a MoU among them before implementing project activities at the local level. The DDC can facilitate the required arrangement process (see Annex G for a model MoU).

### **2.11 Prepare Memorandum of Agreement (MoA) between DDC/other service providers and selected user group**

The LSGA has made a provision for local communities to implement local level development and income generating activities. Accordingly, local bodies can implement this project through local communities. The local bodies can **provide financial, technical and capacity building support** to local communities based on a particular contract or a MoA between local bodies and local communities. Local bodies and local communities need to enter into a formal agreement process in order to receive support (financial, technical and capacity building) from local bodies to implement this pilot project (see Annex H for a sample MoA).

### **2.12 Determine training requirements at local level**

Capacity building and training of the participants of the contracted user groups should be organised before starting the project. The required types of training and capacity building activities must be identified. It is advisable to provide training on plantation, maintenance, harvesting and marketing or processing mechanisms, in order to enable the user groups to produce a high value crop with low costs.

### **2.13 Provide training at local level**

DDC experts shall conduct (or alternatively the DTO shall select and appoint an NGO capable of conducting) the required training courses and capacity building activities for the project participants.

### **2.14 Investigate on local nurseries and set up nursery if required**

Usually, district offices or NGOs are already running nurseries for plants used on local level. If a new project nursery has to be established, it is advised to cooperate with DDC staff or to appoint an experienced NGO to train the representatives of user groups in the required skills.

### **2.15 Conduct Baseline Study**

A socio-economic and environmental baseline study shall be conducted in order to capture pre-project baseline information on the target beneficiaries. The specific objectives of this study are to:

- Investigate the socio-economic status of the appointed user group in order to gain an understanding of the prevailing socio-economic conditions of the project beneficiaries
- Provide a starting point of comparison for final evaluations, covering legal issues, engineering interventions and plantation

A wide range of appropriate tools and methodologies can be used to measure the status of social-economic, physical, environmental and human assets of the targeted communities or HHs.

### **2.16 Walkover survey along the selected road section to identify the locations for physical intervention and plantation**

Before implementing any physical measure, the DTO with his team, in coordination with the contacted user group, should conduct a reconnaissance survey of the whole road section chosen for the project. The purpose of this survey is to identify locations for physical interventions, for example specific sites

where gabion installations, masonry/dry wall constructions, fencing, or other physical interventions may be needed. It is equally important to mark the locations for the plantation and to estimate the required plant quantities.

### **2.17 Order/collect construction material and plant material**

If material is not available locally, the DTO will have to order construction and plant material timely so that it is ready at the start of physical works and plantation. The local people may be able to collect the required amount of construction material on site. The DTO with his team is responsible for ensuring the quality and quantity of the materials to be collected, defining locations for its deposition and storage, etc. The user group will collect the required plant material from defined areas or nurseries.

### **2.18 Develop water management if required**

The amount of water required for the plantation primarily depends on the plant species and the season considered for the plantation. In most cases, a certain volume of water will be required for watering the plants at planting time. Likewise, during the construction of e.g. stone masonry work, water supply might be needed. In such situations, the contracted user group with the help of DTO with his team should be ready to set up water management facilities before starting the construction activities. A temporary water provision may be considered, e.g. by hiring a water pump for the required period, or it may be possible to temporarily tap water from a village pipe.

### **2.19 Completion of physical works on site (before plantation)**

All physical construction activities must be completed before starting any plantation. The surface of the slopes must be trimmed to a smooth profile, with no vertical or overhanging areas. All loose material must be removed from the slope surface. For details on site preparation for plantation, see Roadside Bio-Engineering, Site Handbook (Howell, Department of Roads (DoR) 1999).

### **2.20 Carrying out the plantation**

For planting, cut unwanted weeds and remove debris or fill surface irregularities. Dig pits before planting. Carefully plant the seedlings, slips or saplings in the pit, filling the soil carefully around the roots. If available, mix a handful of compost with the soil. Water the young plants a few of times if there is no rain.

For a visualisation of road sections after project implementation see Annex I.

### **2.21 Regular maintenance**

The local contracted user group is responsible for plant care after plantation: Watering during dry spells in the first season, mulching, weeding of unwanted plants, and protection.

### **2.22 Support for marketing of the products**

The implementing agency (DoLDIAR/DDC) represented by the DTO, should develop a plan to support the local community in marketing their product. The types of support required may be identified during the baseline study or during the training needs assessment. It must include:

- Business analysis
- Production plan with investment costs
- Return from the plantation

An example of a business plan for the implementation of road side plantation is presented in Annex J, based on the pilot project on “Developing a participatory approach for roadside protection of rural roads in Nepal”(2016).

### **3 Monitoring and Evaluation**

Two steps of monitoring and evaluating the achievement of project milestones are proposed. Firstly, an internal evaluation shall measure the implementation of activities and their impacts on an on-going basis (a quarterly basis is proposed). Secondly, a bi-annual evaluation should be carried out by an external expert. Finally it is essential that the implementing bodies, i.e. the DTO and his team, document the project process from the beginning and throughout the project duration.

#### **3.1 Process documentation**

It is essential to observe and assess the changes and impacts achieved by the project, both in the technical and the socio-economic field, as well as to analyse why and how the observed changes have happened and to which extent the project has contributed to these changes. This information is relevant for the implementing agency (DoLIDAR/DDC) to identify key lessons and recommendations for future action.

#### **3.2 Regular monitoring and supervision of works by DDC/DTO; VDC/Municipality**

The DTO and his team will be responsible for conducting the proposed quarterly internal project evaluation. The evaluation format should contain measurement criteria, indicators, activities and the scale of impact created by the project activities. If available, existing formats can be used for this purpose.

#### **3.3 Mid-term and final evaluation**

Based on budget-availability and the importance of the work, DoLIDAR may consider a mid-term and final evaluation of the project. For this, DoLIDAR or the funding agency may hire external experts to conduct these monitoring and evaluation studies. The criteria for the external evaluation should contain at least the number of activities implemented, the number of people trained, extent of awareness raised in the project areas and the number of policy makers included particularly in the utilisation of the RoW. The main aim of the mid-term and final evaluation shall be to systematically compare the concrete results achieved through the project and its underlying working mechanisms against the proposed outcomes.

## References

*For a comprehensive list of references see ReCAP, DoLIDAR 2016*

- BISHT N S and Ahlawat S P, 1998. Broom Grass State Forest Research Institute, Department of Environment and Forests Government of Arunanchal Pradesh, Itanagar, India
- DEVKOTA S, Sudmeier-Rieux K, Penna I, Eberle S, Jaboyedoff M, Adhikari A and Khanal R, 2014. Community-based bio-engineering for eco-safe roadsides in Nepal, University of Lausanne, IUCN, Nepal and DSCWM, GoN, Nepal
- DoLIDAR, MoLD, GoN, 2012. Rural Road Standards, Nepal
- DoLIDAR, MoFALD, GoN, 2013. Environmental and Social Management Framework (Revised), SNRTP, Ministry of Federal Affairs and Local Development, Kathmandu, Nepal
- DoLIDAR, MoFALD, GoN, 2014. Nepal Rural Road Standards, 2055, 2nd revision 2071, Ministry of Federal Affairs and Local Development, Kathmandu, Nepal
- DoR, MoPPW, GoN, 1988. Nepal Road Standards, Nepal
- DoR, MoPPW, GoN, 1995. DoR Strategy, Nepal
- DoR, MoPPW, GoN, 2007. Road Maintenance and Development Project, Institutional Strengthening Component, Nepal
- DoR, MoPPW, GoN, 2003. Reference Manual for Environmental and Social Aspects of Integrated Road Development, Nepal
- GoN, 1971. Local Administration Act, Nepal
- GoN, 1974. Public Roads Act, Nepal
- GoN, 1977. Land Acquisition Act, Nepal
- GoN, 1978. Land Revenue Act, Nepal
- GoN, 1995. Forest Regulation, Nepal
- GoN, 1997. Environment Protection Regulation, Nepal
- GoN, 1998. Town Development Act, Nepal
- GoN, 1999. Local Self Governance Act, Nepal
- GoN, 2008. Rural Road Maintenance Directives
- GoN, 2012. Land Use Policy, Nepal
- GoN, 2015. Constitution of Nepal
- GoN, 2015. Forest Policy, Nepal
- GoN, 2015. Forestry Strategy, Nepal
- GoN, 2015. Community Forestry Development Guideline (Revised 2015), Nepal
- HOWELL J, DoR, MoPPW, GoN, 1999. Roadside Bio-engineering, Reference Manual, Government of Nepal, Department of Roads, Nepal
- HOWELL J, DoR, MoPPW, GoN, 1999. Roadside Bio-engineering, Site Handbook, Nepal
- ReCAP, DoLIDAR, 2016. Developing a participatory approach for roadside protection of rural roads in Nepal, Final Report, Nepal
- PATHAK A, Chapagain S P, Raj J K, 2014. Amriso (Broom grass) widespread cultivation demanding for value addition in processing in Rai and Chapagain (Eds), "Value Chain Analysis of Forest Products in Koshi Hill District of Nepal: Challenges and opportunities for economic growth". Forest Action Nepal and RRN Kathmandu, Chapter VIII PP 153-172

## Annex A: Legal matrix on the utilisation of RoW and public land

Public land	Legal instruments	Operating instruments	Contracting entities	Responsible government agencies	Implementing communities	Activities	Benefit sharing
<b>Public land (owned by local bodies and other institutions)</b>	FR, 1995 (Rule 26.2)	Bylaws of CFUGs and Forest Operational Plan	Owner of public land and CFUG	Owner of public land and DFO	CFUGS	Plantation, conservation and utilisation of products	Based on contract and operational plan
<b>Riversides land</b>	FA, 1993, 1995 (Sect. 31)	Operational plan approved by DFO	DFO and poor community based leasehold forest group	DFO	leasehold forest group	Plantation, river flood control, bio-engineering, cash crops	Based on approved lease certificate
<b>Irrigation channels</b>	IR, 2000 (Rule 12)	Community Forestry Work-Plan	Irrigation Water User Association, DFO and Irrigation Office	DFO and Irrigation Office	Irrigation Water User Association	Plantation of tree or NTFPs, use, marketing and income generation	Based on approved work-plan
<b>RoW under high-tension lines</b>	EA, 1992 (Sect. 24), ER, 1993 (Rule 50) and EPR, 1997	EIA report, Environmental Management Plan and Forest Management Plan	Local community (CFUG), DFO, project developers and contractor	DFO, project developers and contractor	Local community (CFUG), DFO	Harvesting of medicinal & aromatic plants in RoW of electricity line	100% income for poor communities (households)
<b>Row of public road (land acquired for public interest)</b>	PRA, 1974 (Sect. 16.4)	Plans of local bodies, agreement paper, operational plan	Local institution (communities), local bodies and DoLIDAR/DDC	Local bodies, DoR, DoLIDAR, DDC, DFO, Agricultural Offices	Poor groups, groups of landless people, local communities	Plantation, agro-forestry, agriculture (cash crops), bio-engineering	Based on agreement between communities and DoLIDAR





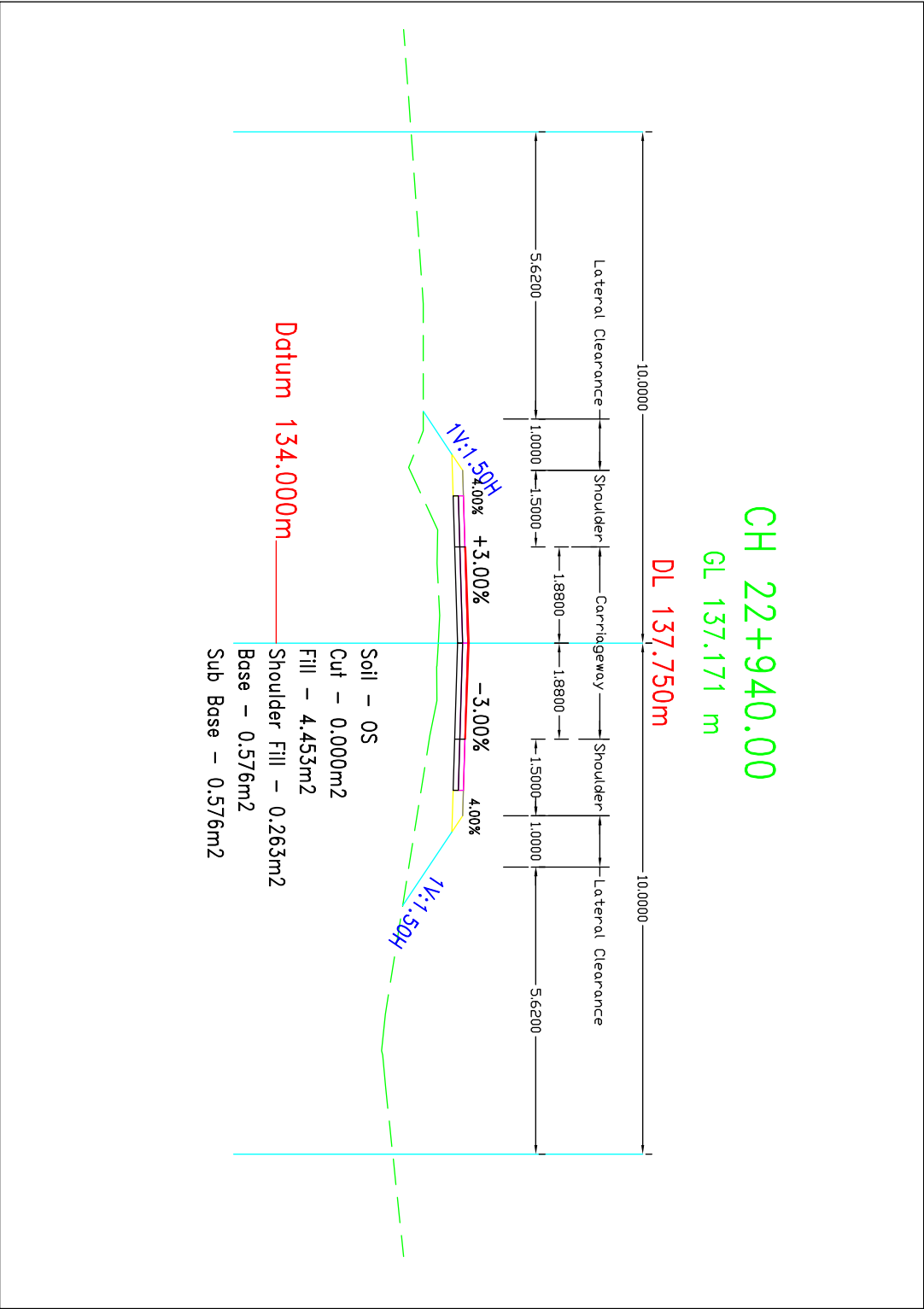
## Annex C1: National road geometrics design standards

The detailed Road Geometrics Design Standards and Surfacing Options for Rural Roads Project of DoLIDAR are given in the following table:

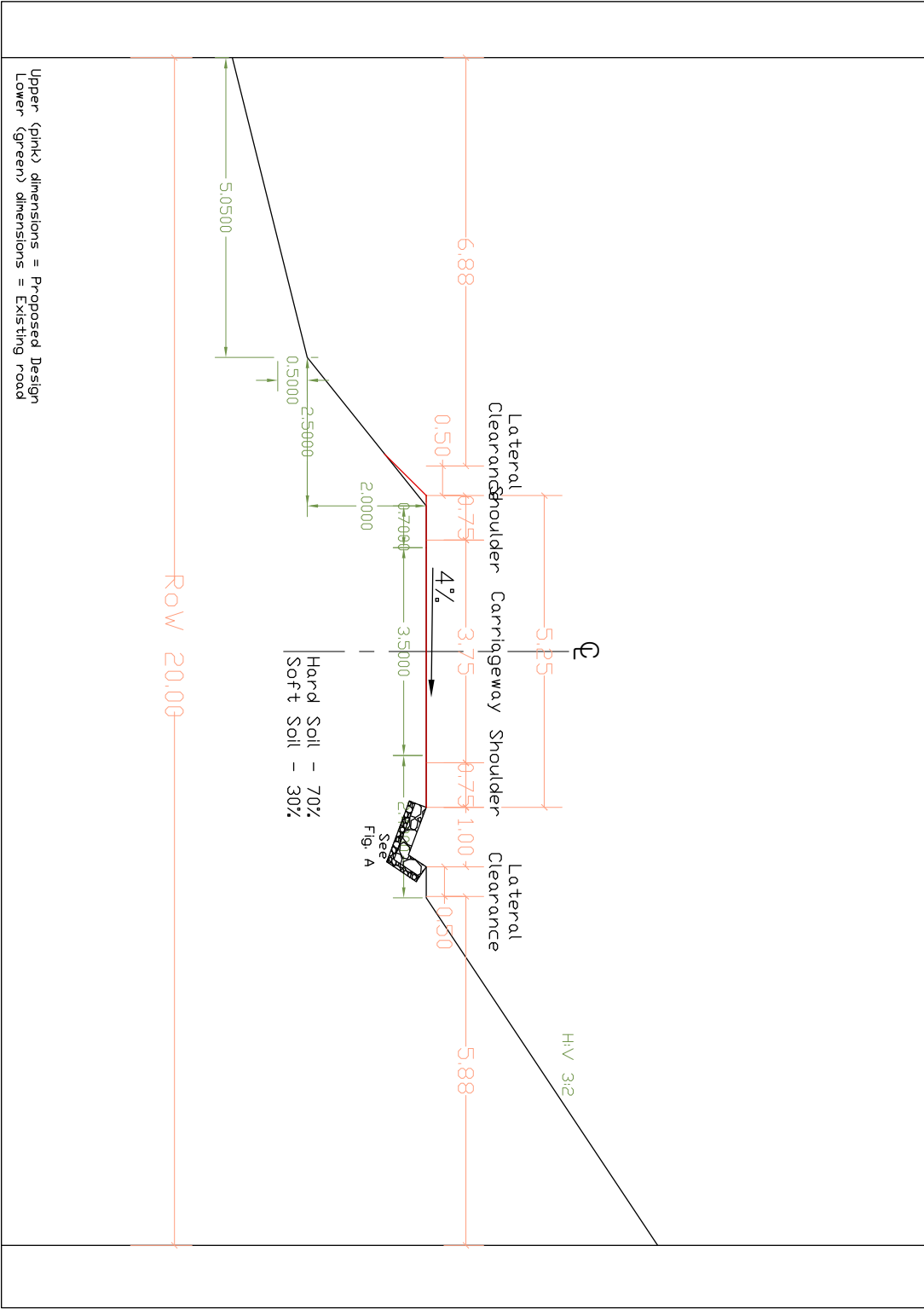
Road Geometrics Design Standards				
Sr. No	Road components	Design Standards		Remarks
		Terai	Hills	
1.	<b>Carriageway Width (m)</b> <ul style="list-style-type: none"> <li>Traffic &lt; 100 VPD</li> <li>Traffic &gt; 100VPD &lt; 400VPD</li> </ul>	3.00 3.75	3.00 3.75	
2.	<b>Shoulder Width (m)</b>	1.50	0.75	On both sides
3.	<b>Roadway Width (m)</b> <ul style="list-style-type: none"> <li>Traffic &lt;100 VPD (see notes below)</li> <li>Traffic &gt; 100 VPD &lt; 400 VPD</li> </ul>	6.00 6.75	4.50 5.25	Excludes width of drain, parapet & retaining wall top
4.	<b>Right of Way (m)</b>	20.00	20.00	10 m RoW on either side from the road centreline
5.	<b>Corridor of impact or COI (see notes below)</b>	As specified in as per the provision of the ESMF of SNRTP		COI will be the minimum width to cover the actual road construction boundary plus 1.00 m on each side of the construction line
6.	<b>Design Speed (km/h)</b> <ul style="list-style-type: none"> <li>Ruling</li> <li>Minimum</li> </ul>	50 40	25 20	
7.	<b>Stopping Sight Distance (m)</b>	45.00	20.00	
8.	<b>Lateral Clearance (m)</b> <ul style="list-style-type: none"> <li>Normal</li> <li>Minimum</li> </ul>	1.50 1.00	1.00 0.50	
9.	<b>Vertical Clearance (m)</b>	5.00	5.00	
10.	<b>Radius of Horizontal Curves (m)</b> <ul style="list-style-type: none"> <li>Ruling</li> <li>Minimum</li> </ul>	>=90.00 60.00	>=20.00 12.50	Exceptional case: 10 m
11.	<b>Hairpin bends</b>			
	Desirable Spacing (m)	NA	100.00	Distance between two bends
	Minimum Radius (m)	NA	12.50	Exceptional case: 8.5 m
	Minimum Roadway width at apex(m)	NA	5.50	For curves with radius <12.5 m provide 7.00 m width
12.	<b>Gradient (%)</b>			
	Ruling	5	7	
	Limiting	6	10	
	Exceptional	7	12	Up to 15% in hill roads for short stretch of 50 m in unavoidable situation except in hairpin bends
	Maximum for Bridge approach	5	6	
	Minimum in hill roads	NA	0.50	
13.	<b>Extra Widening (m)</b>			

Road Geometrics Design Standards				
Sr. No	Road components	Design Standards		Remarks
		Terai	Hills	
	For curve radius $\leq 20$	1.50	1.50	
	For curve radius 20-60	0.60	0.60	
	For curves radius $> 60$	Nil	Nil	
14.	<b>Camber minimum (%)</b>			
	Earthen Roads	5	5	Hills: Unidirectional camber sloping either towards hill side or valley side Terai: both side camber from centre line
	Gravel Roads	4	4	Hills: Unilateral camber in carriageway sloping towards hill side Terai: both side camber from centre line
	Bituminous Roads	3	3	Hill: Unilateral camber in carriageway sloping towards hill side Terai: both side camber from centreline
15.	<b>Passing Zone/ Bus lay Byes</b>	Width 2.5 m in addition to carriageway width and length 30 m along the edge of carriageway tapered to 20 m along the outer edge or at least of dimensions as specified in NRRS- 2013		
16.	<b>Traffic Signs and Road Safety</b>	As detailed in the NRRS 2013		
17.	<b>Carriageway Width (cross-drainage structures)</b>			
	Culvert	6.00	4.50	Distance between parapet walls
	Bridge	4.25	4.25	Distance between kerb on one side and footpath (min 1.00 m width) on the other side (see notes below)
18.	<b>Road side Drains</b>	<b>Hill road:</b> tick drain with masonry (1:4) back wall and 10 cm thick M-15 grade concrete sloped bed throughout the road length as required <b>Built up areas:</b> Type G drain specified in DoLIDAR Technical Guideline with adequate cover slabs for crossings		

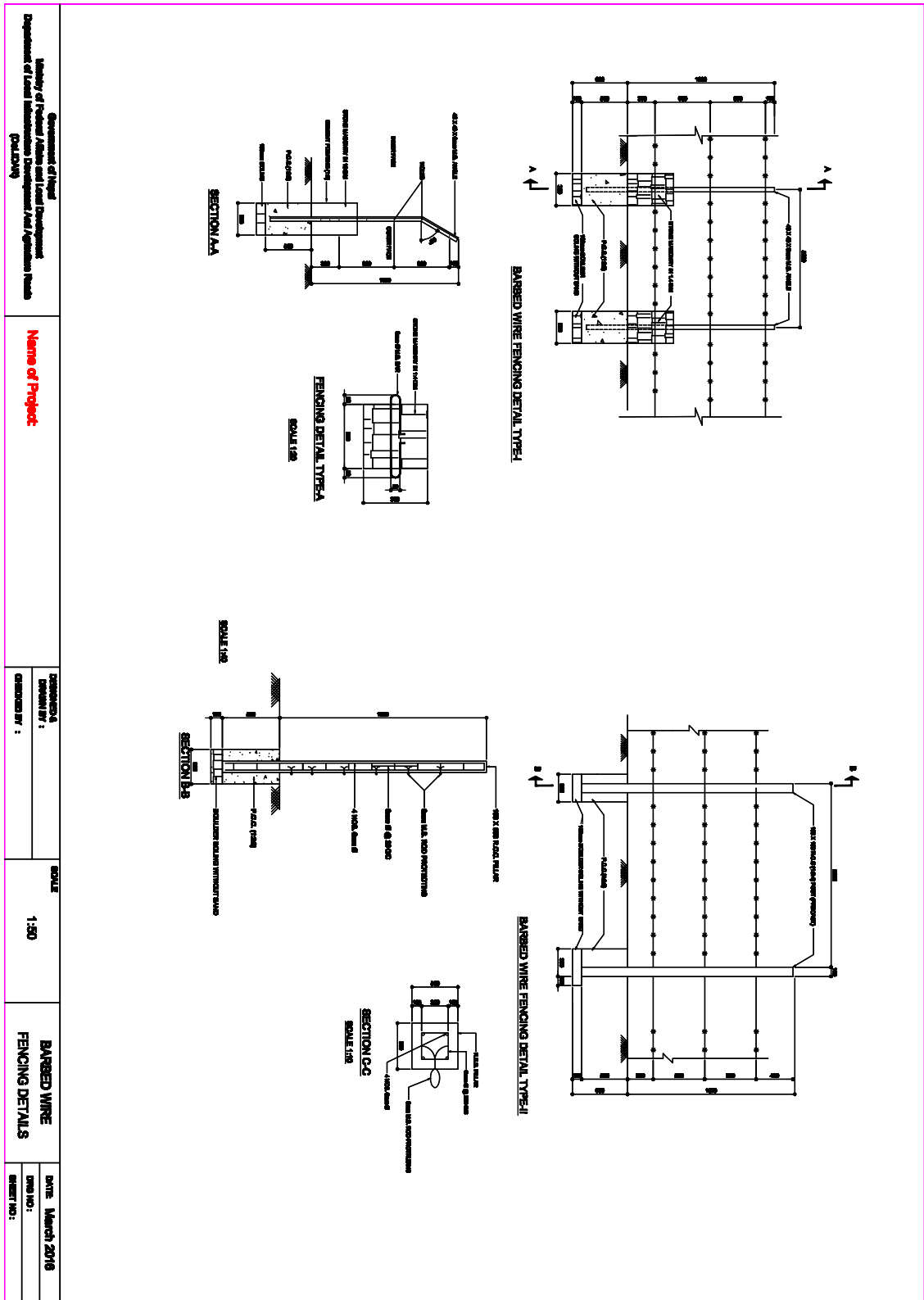
**Annex C2: Typical cross section of a district road, Terai**



**Annex C3: Typical cross section of a district road, hilly area**



# Annex C4: Low Cost Fencing Design



Government of Punjab  
 Ministry of Food and Rural Development  
 Department of Land Reclamation, Development and Agrarian Issues  
 (Punjab)

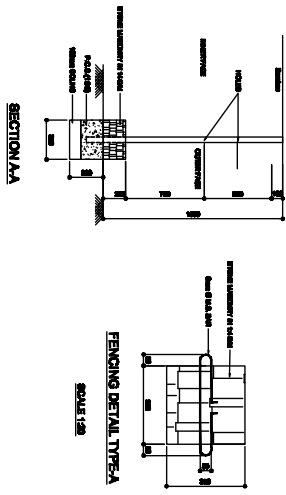
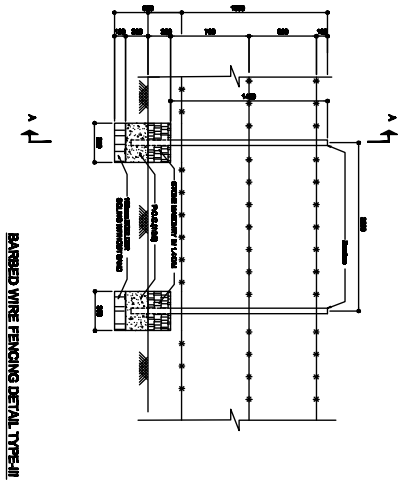
**Name of Project:**

DESIGNED &  
 DRAWN BY :  
 CHECKED BY :

SCALE  
 1:50

**BARBED WIRE  
 FENCING DETAILS**

DATE: March 2016  
 DRAWN NO.:  
 SHEET NO.:



## Annex C5: Example of Cost Calculation for Low Cost Fencing

Ministry of Federal Affairs and Local Development  
Department of Local Infrastructure Development And Agriculture Roads  
(DoLIDAR)

### ABSTRACT

Sn	Fence Type	Cost per meter			
		Labour	Material	Overhead 15%	Total
1	MS ANGLE POLES	143.12	331.20	49.10	523.42
2	RCC POLES	139.29	232.11	55.71	427.12
3	BAMBOO	104.66	150.01	32.95	287.62

Government of Nepal  
Ministry of Federal Affairs and Local Development  
Department of Local Infrastructure Development And Agriculture Roads  
(DoLIDAR)

### COST ESTIMATES OF BARBED FENCING WITH MS ANGLE POLES (TYPE-1)

Fencing length (m) : 100 Spacing of Poles (m): 5

S	DESCRIPTION	No	L (m)	B (m)	H (m)	QUANTT	Unit	Rate Rs	Amount Rs	Labour Amount	Material & Equipment Amount	Overhead 15%	norms no.
1	Site Clearance	21	0.35	0.35	0.60	1.54	m <sup>3</sup>	290.20	500.00	391.30	43.48	65.22	LS
2	E/W in excavation	21	0.35	0.35	0.10	0.26	m <sup>3</sup>	2798.56	447.92	378.16	11.34	58.43	2.14
3	Boulder soling without sand packing	21	0.35	0.35	0.10	0.26	m <sup>3</sup>	2798.56	719.93	291.34	334.69	93.90	6.5a
4	PCC (1:3:6) for anchor blocks	21	0.35	0.35	0.50	1.29	m <sup>3</sup>	7463.50	9599.93	2508.19	5839.58	1252.16	7.2c
5	Stone masonry in 1:4 c/s mortar	21	0.35	0.35	0.50	1.29	m <sup>3</sup>	7243.68	9317.18	3312.09	4789.81	1215.28	6.1C
6	MS Angle poles (ISA 40x40x6)	21	2.50	@ 3.5 kg/m		183.75	kg	80.00	14700.00		14700.00		isa406
7	Barbed wire fencing to Angle poles horizontals	60	5.00			300.00	m	56.86	17058.00	7431.00	7401.00	2224.80	24.7
Total Basic Cost of Fencing									52342.96	14312.08	33119.89	4909.80	
Basic Rate/metre of fencing									523.43	143.12	331.20	49.10	

### COST ESTIMATES OF BARBED FENCING WITH RCC POLES (TYPE-2)

Fencing length (m) : 100 Spacing of Poles (m): 5

S	DESCRIPTION	No	L (m)	B (m)	H (m)	QUANTT	Unit	Rate Rs	Amount Rs	Labour Amount	Material & Equipment Amount	Overhead 15%	norms no.
1	Site Clearance	21	0.35	0.35	0.60	1.54	m <sup>3</sup>	290.20	500.00	391.30	43.48	65.22	LS
2	Excavation work	21	0.35	0.35	0.60	1.54	m <sup>3</sup>	290.20	447.92	378.16	11.34	58.43	2.12
3	Boulder soling without sand packing	21	0.35	0.35	0.10	0.26	m <sup>3</sup>	2798.56	719.93	291.34	334.69	93.90	6.5a
4	PCC (1:3:6) for anchor blocks	21	0.35	0.35	0.50	1.29	m <sup>3</sup>	7463.50	9599.93	2508.19	5839.58	1252.16	7.2c
5	PCC (1:2:4) for RCC poles	21	0.10	0.10	2.00	0.42	m <sup>3</sup>	9121.51	3831.03	819.00	2512.34	499.70	7.4a
6	6mm dia MS rods for hooks, 20 cm long	147	0.20	@ 22 kg/m		6.47						0.00	
	long bars	84	2.00			36.96							
	stirrups	189	0.40			16.63							
7	Formwork for RCC works in poles	21	0.40		2.00	7.92	m <sup>2</sup>	470.70	3727.94	1461.64	1780.02	486.25	8.2a
8	Barbed wire fencing to RCC poles horizontals	60	5.00			300.00	m	56.86	17058.00	7431.00	7401.00	2224.80	24.7
Total Basic Cost of Fencing									42712.98	13929.27	23211.33	5571.09	
Basic Rate/metre of fencing									427.13	139.29	232.11	55.71	

### COST ESTIMATES OF BARBED FENCING WITH BAMBOO POLES (TYPE-3)

Fencing length (m) : 100 Spacing of Poles (m): 3

S	DESCRIPTION	No	L (m)	B (m)	H (m)	QUANTT	Unit	Rate Rs	Amount Rs	Labour Amount	Material & Equipment Amount	Overhead 15%	norms no.
1	Site Clearance	35	0.25	0.25	0.50	1.09	m <sup>3</sup>	290.20	500.00	391.30	43.48	65.22	LS
2	E/W in excavation	35	0.25	0.25	0.10	0.22	m <sup>3</sup>	2798.56	317.41	267.97	8.04	41.40	2.14
3	Boulder soling without sand packing	35	0.25	0.25	0.10	0.22	m <sup>3</sup>	2798.56	612.19	247.73	284.60	79.85	6.5a
4	PCC (1:3:6) for anchor blocks	35	0.25	0.25	0.20	0.44	m <sup>3</sup>	7463.50	3265.28	853.13	1986.25	425.91	7.2c
5	Stone masonry in 1:4 c/s mortar	35	0.25	0.25	0.20	0.44	m <sup>3</sup>	7243.68	3169.11	1126.56	1629.19	413.36	6.1C
6	Bamboo	35				35.00	pcs	100.00	3500.00		3500.00		isa406
7	Barbed wire fencing to Angle poles horizontals	102	3.00			306.00	m	56.86	17399.16	7579.62	7549.02	2269.30	24.7
Total Basic Cost of Fencing									28763.14	10466.31	15000.57	3295.03	
Basic Rate/metre of fencing									287.63	104.66	150.01	32.95	

Government of Nepal  
Ministry of Federal Affairs and Local Development  
Department of Local Infrastructure Development And Agriculture Roads  
(DoLIDAR)  
RATE ANALYSIS for Kailali 72-73

4. Description of items : Excavation of soft clay and silty soils including disposal (upto 10m lead and 1.5m lift)

Norms No.	LABOUR (A)					MATERIAL (B)					EQUIPMENT (C)				
	Type	unit	Qty	Rate	Amount	Type	unit	Qty	Rate	Amount	Type	Unit.	Qty	Rate	Amount
2.1	Unskilled	MD	0.7	350.00	245						Tools(3% of labour charge)				7.35
			Total of A		245			Total of B					Total of C		7.35

- a) Total A+B+C= Rs. 252.35  
b) Overhead Expenditure 15% of (a) = Rs. 37.85  
c) Total a+b= Rs. 290.20  
Unit Rate =Rs. 290.20 per cu.m.

12. Description of items : Wooden form work.

Norms No.	LABOUR (A)					MATERIAL (B)					EQUIPMENT (C)				
	Type	unit	Qty	Rate	Amount	Type	unit	Qty	Rate	Amount	Type	Unit.	Qty	Rate	Amount
8.2a	Skilled	md.	1.72	550.00	946.00	Local Wood	m <sup>3</sup>	0.526	30000	15780.00					
	Unskilled	md.	2.57	350.00	899.50					deduct selvage value 25%					3945.00
										material should be use 6 times.					11835.00
						Nail	kg	2.50	110.00	275.00					1972.50
			Total of A		1845.50			Total of B		2247.50			Total of C		

- a) Total A+B+C= Rs. 4093.00  
b) Overhead Expenditure 15% of (a) = 613.95  
c) Total a+b= Rs. 4706.95  
Unit Rate =Rs. 470.70 per m<sup>2</sup>

13. Description of items : Supplying and laying dry stone (30cm thick avg) pitching on filter aggregates including haulage upto 100m and lift upto 1.5m

Norms No.	LABOUR (A)					MATERIAL (B)					EQUIPMENT (C)				
	Type	unit	Qty	Rate	Amount	Type	unit	Qty	Rate	Amount	Type	Unit.	Qty	Rate	Amount
23.5a	Skilled	MD	0.71	550.00	390.5	Boulder	m <sup>3</sup>	1	1301.03	1301.03					
	Unskilled	MD	2.12	350.00	742										
			Total of A		1132.5			Total of B		1301.03			Total of C		

- a) Total A+B+C= Rs. 2433.53  
b) Overhead Expenditure 15% of (a) = Rs. 365.03  
c) Total a+b= Rs. 2798.56  
Unit Rate =Rs. 2798.56 per cu.m.

15. Description of items : R.R. masonry work in 1:4 c/s mortar.

Norms No.	LABOUR (A)					MATERIAL (B)					EQUIPMENT (C)				
	Type	unit	Qty	Rate	Amount	Type	unit	Qty	Rate	Amount	Type	Unit.	Qty	Rate	Amount
6.1b	Skilled	md.	1.50	550.00	825.00	cement	bag	3.18	750.00	2385.00					
	Unskilled	md.	5.00	350.00	1750.00	sand	m <sup>3</sup>	0.45	650.00	292.50					
						stone	m <sup>3</sup>	1.10	951.23	1046.35					
			Total of A		2575.00			Total of B		3723.85			Total of C		

- a) Total A+B+C= Rs. 6298.85  
b) Overhead Expenditure 15% of (a) = 944.83  
c) Total a+b= Rs. 7243.68  
Unit Rate =Rs. 7243.68 per m<sup>3</sup>

## Annex D: Optional plants for productive use of RoW for wider replication

Nepali name	Scientific name	Altitude (m asl)	Site conditions	Growth height (m)	Productive use	Propagation	Comments
<b>Trees, shrubs</b>							
Ainselu	<i>Rubus ellipticus</i>	1'000-2'500	varied	1-3	berry	seeds, root cutting	
Alainchi	<i>Elettaria cordomomum</i>	1'000-2'000	moist	1-2	spice	seed, polypot	highly priced spice crop
Amala	<i>Phyllanthus emblica</i>	Terai-1'500	hot and dry, harsh	1-2	fruit, medicinal	seed, polypot	
Amba/Ambak	<i>Psidium guajava</i>	Terai-2'000	Varied and dry	2-4	fruit	seed, polypot	
Bainsh	<i>Salix tetrasperma</i>	Terai-2'700	moist	5-8	fencing	hardwood cutting	
Ban chutro	<i>Berberis aristata</i>	1'500-3'000	Varied and dry	2	berry	seed, polypots	
Ban silam	<i>Elsholtzia blanda</i>	Terai-1'500	varied	2	oil seed	seed	
Bayer	<i>Zizyphus mauritiana</i>	Terai-1'200	hot and dry, harsh	3	fruit, fodder	seed, polypot	
Bhui katahar	<i>Ananas comosus</i>	Terai-1600	hot and dry, harsh	1	fruit	stem cutting	processing industry in place
Cafi	<i>Coffea spp.</i>	Terai-2'000	varied	2	beverage	seed, polypot	processing industry in place
Chiya	<i>Camelia sinensis, C spp.</i>	Terai-2'000	varied and moist	2	beverage	hardwood cutting	processing industry in place
Chutro	<i>Berberis asiatica</i>	1000-2'500	varied and dry	1-2	berry	seed, polypot	
Dhanyero	<i>Woodfordia fruticosa</i>	Terai-1'500	hot and dry, harsh	1-3	fodder	seed, polypot	
Ghangaru	<i>Pyracantha crenulata</i>	1'500-2'500	varied	1	for fencing	hardwood cutting	
Ghurmiso	<i>Leucosceptrum canun</i>	1'000-2'500	varied	2-3	fodder, hardwood cuttings for fencing	hardwood cutting, seed	
Kanda phul	<i>Lantana camara</i>	Terai-1'750	hot and dry	2	flower	hardwood	ornamental use

Nepali name	Scientific name	Altitude (m asl)	Site conditions	Growth height (m)	Productive use	Propagation	Comments
						cutting	
Kera	<i>Musa paradisiaca</i>	Terai-1'500	varied, well drained	3-4	food, fibre	Seed, sapling, nursery	processing industry in place
Kettuke	<i>Agave americana</i>	Terai-2'400	hot and dry	1	bio-engineering	root sucker	
Kimbu	<i>Morus alba, Morus spp.</i>	Terai-2'000	varied, and dry	3	fruit, leaves, fodder	hardwood cutting, seed	silk production?
Lalupate	<i>Poinsettia pulcherrima</i>	Terai-1'500	varied	2	flower	hardwood cutting, seed	ornamental use
Neem	<i>Azadirachta indica</i>	Terai-2'000	varied, dry	2	medical, cosmetics	cutting	
Pate Siuli	<i>Opuntia ficus Indica</i>	Terai 1'800	hot, dry, harsh	1	fruit, fencing	offshoot, cutting	
Rahar	<i>Cajanus cajan</i>	Terai-1'500	varied and dry	2	vegetable	seed	as border crop
Kadam/Sajiwan	<i>Jatropha curcas</i>	Terai-1'000		1.5	bio-diesel, fencing	hardwood cutting	processing not fully in place
Sahijan	<i>Moringa oleifera</i>	Terai-1000	sandy soil, dry lands	5-8	food, medicinal, cosmetic	cutting	often in hedges
Simali	<i>Vitex negundo</i>	Terai-1'750	hot and dry, varied	2	fencing	cutting	often in hedges
Siuli/Sihundi, Siyuri, Siurdi	<i>Euphorbia royleana</i>	900-1'800	varied	1-2	medicinal, fencing	cutting	often in hedges
Rudraksha	<i>Elaeocarpus ganitrus</i>	Terai-2'000	varied	15-60	medicinal, religious	seed	very valuable crop
Utis	<i>Alnus nepalensis</i>	900-2'700	stony, poor, rather damp	5-10	firewood, timber, fodder	polypot	timber industry
<b>Grasses, herbs, legumes</b>							
Amriso	<i>Thysanolaena maxima</i>	Terai-2'000	stony, poor, rather damp	1.5	brooms, fodder	rhizome cutting	Marketing in place
Bablyo	<i>Eulaliopsis binata</i>	Terai-1'500	hot and dry		rope, paper, fodder	slip cutting, seed	
Napier grass	<i>Pennisetum purpureum</i>	Terai-1'500	varied	1.5	bio-engineering		
Kagati ghans	<i>Cymbopogon citratus</i>	Terai-1'500	stony, poor,	1	medicinal, cosmetics	slip cutting, seed	Increasing

Nepali name	Scientific name	Altitude (m asl)	Site conditions	Growth height (m)	Productive use	Propagation	Comments
			rather dry				demand
Phurke	<i>Arundinella nepalensis</i>	700-2'000	stony, poor, rather dry	1	thatch, fodder	seed, slip cutting	
<b>Bamboo species</b>							
Choya/ Tama bans	<i>Dendrocalamus hamitoni</i>	300-2'000			various	culm cutting	thin culm, heavy branching
Dhanu bans	<i>Bambusa balcooa</i>	Terai-1'600			various	culm cutting	thick culm, heavy branching
Kalo bans	<i>Dendrocalamus hookeri</i>	1'200-2'500			various	culm cutting	heavy branching, brown hairs
Mal bans	<i>Bambusa nutans</i>	Terai-1'500			various	traditional method	strong, straight culms
Nobha/Ghopi/Lyas bans	<i>Ampelocamus patellaris</i>	1'200-2'000			various	traditional method	smaller, bluish culms
Tharu bans	<i>Bambusa nutans</i>	Terai -1'500			various	traditional method	strong, straight culms

Source: Howell, DoR, 1999; Devkota et al, 2014; Field research, 2016

## Annex E: Plants for productive use in RoW in Terai and in the hills

Local Name	Latin	English	Suitable for road side	Parts used	Known species	Available	Skills developed	Processing in place	Market chain
<b>Kailali</b>									
Kera	<i>Musa paradisiaca</i>	Banana	+++	fruit for food fibre for paper, for cloth	+++	nursery	+++ +	+++ +	+++ ++
Ukhu	<i>Saccharum officinarum</i>	Sugarcane	++	stem	+++	nursery	+++	+++	+++
Kagati ghans	<i>Cymbopogon citratus</i>	Lemon grass	+++	leave for medical, cosmetics	++	+	+		++
Beshar	<i>Curcuma sp.</i>	Turmeric	+	rhizome for spice leave for oil	+++	+	+++ +	+++ +	+++ +
	<i>Mentha</i>	Peppermint	+	leave for medical, cosmetics	+	+	+	+	+
Kadam	<i>Jatropha curcas</i>		+++	stem for fencing seed for biodiesel	+++	++	+++ +	+++ -	- -
<b>Dhankuta</b>									
Amliso	<i>Thysanolaena maxima</i>	Broom grass	+++	panicle for broom leave for fodder	+++	+++	+++ +	+++ +	+++ -
Chiya	<i>Camelia sinensis/ asamica</i>	Tea	+++	leave	+++	nursery	+++	+++	+++
Utis	<i>Alnus nepalensis</i>	Alder	+++	tree trunk for timber, fire wood leave for fodder	+++	nursery	+++	+++	+++
Chilaune	<i>Schima wallichii</i>		+	timber	+++	nursery	++	++	++
Alainchi	<i>Amomum aromaticum</i>	Cardamom	+++	seed	+++	++	+++	+++	+++

Rating: +++ = high; ++ = medium; + = low

Source: Field research, 2016

## **Annex F Details on socio-economic analysis and plant selection for RoW utilisation**

### **1. Socio economic analysis of the area**

- Get information about the settlement in the village/municipality and near the road on both sides.
- Identify existing institutions in the area e.g. Local Road User Group, Forest User Group, Irrigation Water User Group, Drinking Water User Group, farmers groups etc.
- Identify present users of the RoW.
- Obtain the list of members, their wellbeing-ranking, and the list of office bearers of such organisations.
- Organize meetings with the concerned communities.
- Identify households interested in participating in the program. Give priority to poor and landless households.
- Discuss with VDC/Municipality in order to identify possibility of support for the programme.
- Provide support to organise legal matters.
- Identify the group/HH which will actively execute the project (ideally the poorest of the poor).
- Assess those skills required for implementing the project which are already available, and identify those fields in which they will have to be further trained.

### **2. Identify plants suitable for plantation for productive use in the RoW**

The criteria for the selection of plants will be

- occurrence in the area
- suitability for road stabilisation
- availability of plant material like seedlings, saplings, seeds, cuttings
- availability of nurseries
- suitable crop for roadside planting
- suitability for productive use
- common or known species for productive use in the area
- skills for cultivation developed or on the job assistance available
- marketing chain in place or options to initiate.

### **3. Make the economic/financial analysis of the plants**

a. Estimate costs for the following items:

- Cost of fixed inputs if any
- Seedling
- Labor cost (for activities like land preparation, plantation, weeding, irrigation, fertilizer application, harvesting, and other activities)
- Fertilizer (compost and others)
- Insecticides and pesticides
- Transportation cost
- Processing cost
- Cost in the first year and cost in subsequent years

b. Estimate return

- Quantity of output (estimated)
- Gestation period
- Total years of output
- Price of the output (farm get and market price)
- Estimate total return annually or seasonally, depending on the product (quantity x price)
- Estimate return for subsequent years according to the return period of the plants.

#### 4. Estimate Net Present Value (NPV)

The NPV is the difference between the present value of cash inflows and the present value of cash outflows. NPV is used to analyse the profitability of a projected investment or project.

$$NPV = \sum_{t=1}^T \frac{R_t}{(1+r)^t} - C_0$$

Where,

$R_t$  = Net cash inflows during period t

$C_0$  = total initial investment costs

r = discount rate

t = number of time periods

A positive net present value indicates that the projected earnings generated by a project or investment (in present price) exceed the anticipated costs (in present price). An investment with a positive NPV will be profitable one and with a negative NPV will result in a net loss.

The formula in excel is

=NPV(discount rate, series of nominal cash flows i.e. B-C) + initial investment at time  $t_0$

#### 5. Estimate Benefit Cost ratio (B/C)

Estimation of B/C is another criterion to decide a business investment. A benefit cost ratio shows the monetary benefits of project relative to its monetary costs. All benefits and costs should be expressed in discounted present values.

B/C takes into account the amount of monetary gain realized by performing a project versus the amount it costs to execute the project. General rule of thumb is that if the benefit is higher than the cost the project is a good for investment. Higher benefit cost ration indicates more beneficial project for investment. The formula for the estimation of B/C is:

$$B/C = \frac{\sum_{t=1}^n \frac{B_t}{(1+i)^t}}{\sum_{t=1}^n \frac{C_t}{(1+i)^t}}$$

Where,

$B_t$  = Benefit at time period t

$C_t$  = Cost at time period t

i = discount rate

t = time period

In excel it can be calculated by dividing the discounted benefit by discounted cost.

#### 6. Estimation of Internal Rate of Return (IRR)

IRR is the internal rate of return for a series of cash flows represented by the numbers in values. IRR is also defined as the interest rate received for an investment consisting payments and income that occur at regular periods.

If there is only one period investment the IRR represents expected return from the initial investment after 5 years if the return comes for five years.

The formula for the estimation of IRR is:

$$IRR = \sum_{t=1}^n \frac{B_t}{(1+i)^t} - \sum_{t=1}^n \frac{C_t}{(1+i)^t} = 0$$

Where,

$B_t$  = Benefit at time period t

$C_t$  = Cost at time period t

i = discount rate

t = time period

Criteria for the decision-making are:

If  $IRR > i$  ; meaning investment is feasible

If  $IRR = i$  ; meaning investment is on a break-even point

If  $IRR < i$  ; meaning investment is not feasible

## **7. Perform SWOT analysis and Value Chain Analysis**

The analysis of Strengths, Weaknesses, Opportunities and Threats (SWOT) helps to understand the strengths, weaknesses, opportunities and threats for any business activity. By analysing these factors the positive aspects in the market for the business activity of the product can be reaped, and ways to improve the weaknesses and threats can be devised.

A value chain analysis shows the existing chain of the market value addition by different actors. The analysis allows identifying ways to improve the value of the product by positive interventions or support, and thereby to increase the income of the farmers.

**Annex G Sample format for MoU**

**Tripartite Memorandum of Understanding**

Between  
Office of ..... (DoLIDAR/DDC)  
Office of ..... (Municipality/VDC)  
and  
..... RoW users group/committee/sub-committee

This Tripartite Memorandum of Understanding (MoU) sets for the following terms and understanding between the office of .....(DoLIDAR/local bodies) and the ..... RoW user groups/committee.

**Background**

The utilisation of RoW in .....(name of road) is highly important for the maintenance of this road and mobilisation of road side households, poor family and landless people for their poverty alleviation through the utilisation of RoW for poverty alleviation. Therefore, based on the legal provision of PRA 1974 and LSGA 1999, this MoU has made between .....DDC, .....Municipality/VDC and .....users group/committee/sub-committee.

**Purpose**

This MoU has made to maintain long term partnership between local bodies and local communities to achieve poverty alleviation related goal of local bodies and local communities through utilisation of RoW from local communities.

The above goals will be accomplished by undertaking the following activities: (List and describe the activities that are planned for the partnership and who will do what)

1. Consent for the utilisation of road side land under RoW
2. Maintenance of road and fencing: .....
3. Plantation: .....
4. Finance and income generation: .....
5. Capacity building: .....

**Funding**

The local bodies will provide some non-research funding resources to implement the pilot projects in this .....road for the utilisation of RoW through local communities in order to poverty alleviation. Though, the local bodies are not compelled to provide any support to local communities without other specific contract between local bodies and concern local communities. Therefore, this MoU is only a window of opportunity for local community to request funding support.

**Other source of support**

The .....RoW user group/sub-committee may also explore other sources of funding and necessary support from different government agencies, local bodies, NGOs and private sector for the implementation of approved programme and activities during the utilisation of RoW. The RoW user group/sub-committee will inform to the parties of this MoU about such contract and other sources of funding during the submission of any relevant progress report.

**Duration**

This MoU will and may be modified by mutual understanding between contracting parties and consent of authorised officials from .....(DDC/municipality/VDC). This MoU shall become effective upon signature by the authorised officials/representatives from both parties and will remain in effect until modified or terminated by any one of the partners by mutual consent. In the absence of mutual agreement by the authorised officials/representative from both parties this MoU shall end on ..... (end date of partnership).

**Monitoring and reporting**

The local bodies and their respective committees will be responsible for monitoring and evaluation of the effectiveness of the projects implemented based on this MoU. The technical support during the monitoring and evaluation will be provided from the staffs of local bodies. The local communities will prepare and provide progress report considering the requirements of any specific agreement between local bodies and local communities.

**Contact Information**

Name of local bodies:	Name of local communities:
Name of authorities:	Name of representative:
Position:	Position:
Address:	Address:
Telephone:	Telephone:
Fax:	Fax:
E-mail:	E-mail:
(Partner signature)	(Partner signature)
Date:	Date:

Name of local bodies:

Name of authorities:

Position:

Address:

Telephone:

Fax:

E-mail:

(Partner signature)

Date:

**Annex H: Sample format of MoA between the Local Bodies and RoW Users Groups/ committee/sub-committee**

**Memorandum of Agreement**

Office of..... (Local Body/government agencies/NGOs)

**1. Parties and representative to Agreement and Project**

(a) Particulars of the Local Body/government agencies/NGOs:

- 1. Name
- 2. Designation
- 3. Address

(b) Particulars of the Users Groups/committee/sub-committee:

- 1. Name
- 2. Designation
- 3. Address

(c) Particulars of the project:

- 1. Name
- 2. Address
- 3. Objectives
- 4. Project approving body
- 5. Beneficiaries (Households) of the programme
- 6. Date of beginning of the project
- 7. Date of completion of the project

**2. Particulars relating to the cost of the project**

(a) Estimated cost: Rs.....

(b) Sources to bear the cost:

- 1. From Government of Nepal Rs.....
  - 2. From the concerned local body Rs.....
  - 3. From non-governmental organisation Rs.....
  - 4. From community-based organisations (CFUGs etc.) Rs.....
  - 5. From development partners Rs.....
  - 6. From users groups/sub-committee Rs.....
  - 7. From others Rs.....
- Total Rs.....

(c) Particulars of construction or any other materials:

	Name of materials	Quantity	Unit
1. From sectoral section			
2. From concerned local body			
3. From non-governmental organisations			
4. From community-based organisations			

5. From development partners
6. From users groups/committee
7. From others

(d) Beneficiary of the Project:

1. Number of household families
2. Population
3. Community
4. Others: poor households.

### 3. Particulars relating to the users groups/committee

1. Chairperson
2. Vice-chairperson
3. Secretary
4. Treasurer
5. Member
6. Member
7. Member
8. Member
9. Member

### 4. Experience in operation of projects

### 5. Details of the instalment to be received by users groups/committee

Instalment	Date	Amount of instalment	Quantity of construction materials or other materials	Remarks
First				
Second				
Third				
Total				

### 6. Provisions for the maintenance of project and continuation of programme (monthly or quarterly or annual resource)

(a) Name of the users groups/committee responsible for maintenance of the project:

(b) Contribution from households (number of human resource) Rs....

(c) From household fees, donation Rs....

(d) From cost involvement or grants Rs....

(e) Interest or other savings Rs....

### 7. Other (technical and managerial) details

(a) (b) (c)

### Terms of Agreement:

1. The amount, materials and any other goods shall be used or shall be caused to be used only for the project and the purpose for which those materials have been received.
2. Upon completion of the project, approval and clearance shall be taken from the local bodies.

- 3. Next instalment shall be requested after informing the particulars of income/expenditure and work progress to the users group/committee and having discussed with them.
- 4. Receipt of cash, kind, expenditure and remaining and the record of the details of progress of the project shall be maintained.
- 5. In cases where a project has been completed in less cost than the total estimate of the project, it is agreed to take/give the payment accordingly having fixed the percentage of the grant and labour/household contribution.
- 6. The users groups/committee launching the project shall have to make arrangement for regular maintenance of the project.
- 7. All the works of the project shall be done as per the decision of the users group/committee.
- 8. Project shall begin from.....and be completed by.....
- 9. The physical particulars and expenditure statement of the project shall be sent to the local bodies.
- 10. Progress report to be submitted by the users group/committee while requesting for instalment.
- 11. Other terms
  - (1)
  - (2)
  - (3)

We are agreed to do as mentioned above.

On behalf of the Local Body/government:

On behalf of users group/committee

Name:

Chairperson:

Designation:

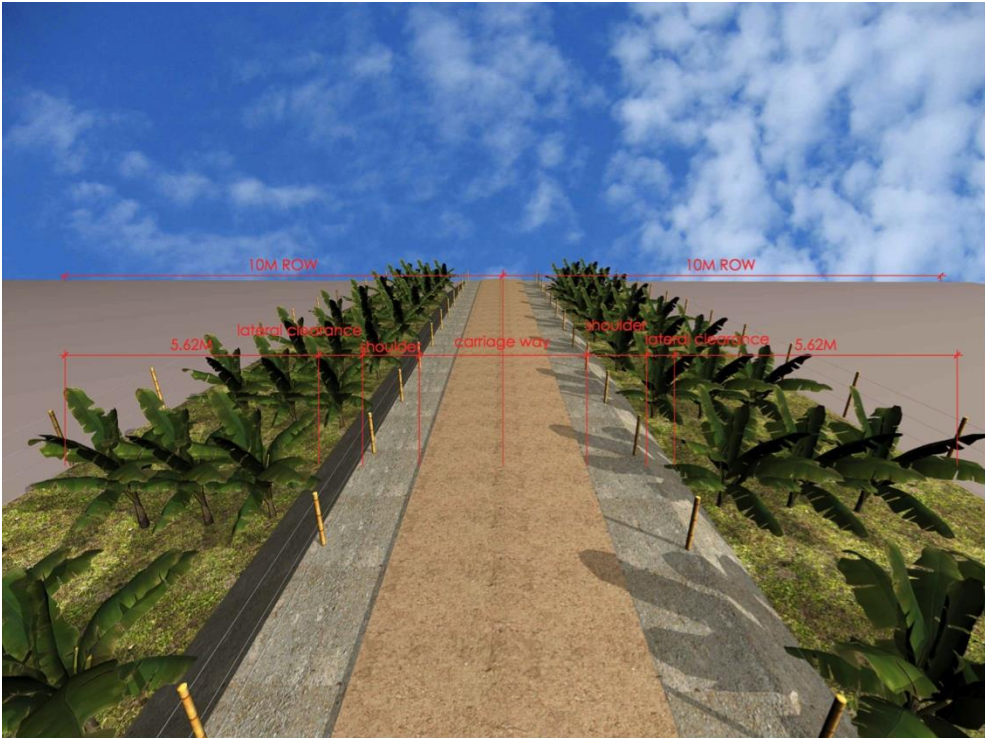
Signature:

Signature:

Date:

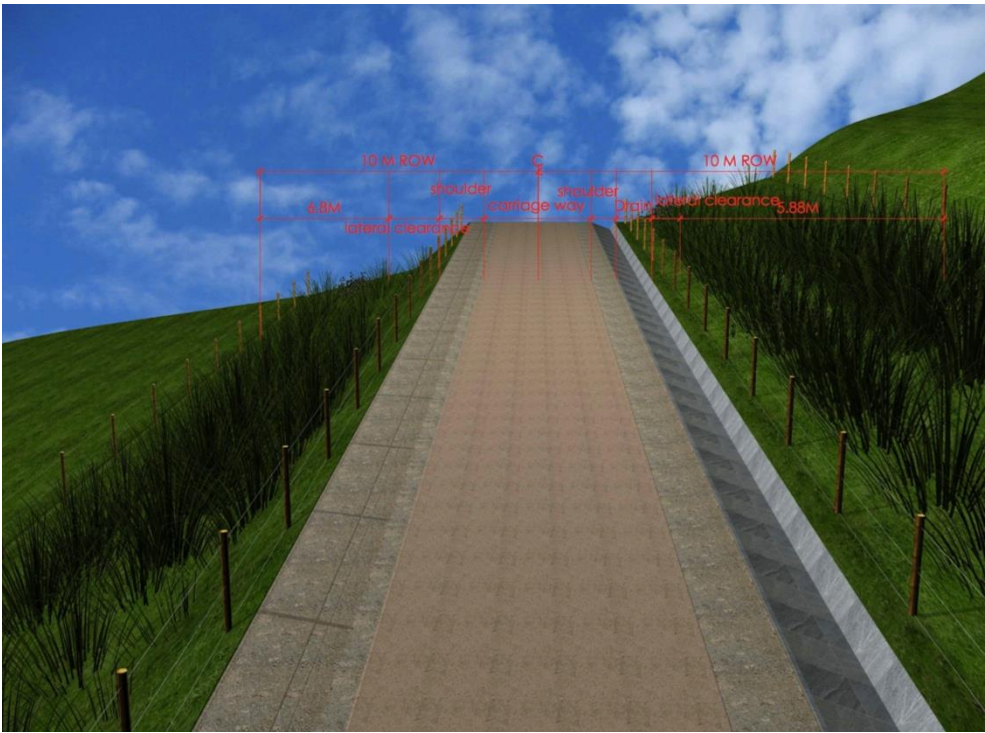
# Annex I: Visualisation of road sections after project implementation

## Visualisation of road section after implementation in the Terai



Designed by Binod Dangol and Laxman KC, 2016

## Visualisation of road section after implementation in the hills



Designed by Binod Dangol and Laxman KC, 2016

## Annex J: Example of business plan for RoW plantation – Field study 2016

A simple business plan is presented in the subsequent section, based on the pilot project on “Developing a participatory approach for roadside protection of rural roads in Nepal”, 2016. The total area in the selected road section for the pilot is 1.275 ha in Dhankuta and about 1.265 ha in Kailali. Broom grass and banana are selected for the plantation in Dhankuta and Kailali respectively.

- Table 1 shows the business analysis of the selected plants.
- Table 2 shows the production plan with different activities and related costs for the plantation of selected plants in the road section. 3 scenarios are presented: Scenario 1 includes only the cost for the cultivation of the selected plants. Scenario 2 includes the cost of fencing considering bamboo poles for fencing. In Scenario 3, only labour costs required for the fencing are included.
- Table 3 shows the return from the RoW plantation on the selected road sections for both districts.

It is assumed that amriso and banana plants need to be replaced in the 6th year for better return. Instruments required for banana plantations are power sprayer, sucker extraction instrument, hasiya and kodalo.

The analysis indicates that the plantation of amriso in Dhankuta and banana in Kailali is profitable and suitable for poverty reduction of the poorest of the poor in the selected area. However, the plantation of amriso in Dhankuta will not be viable, if all costs of fencing are included. Usually, forest user groups do not apply fences at their amriso plantations in Dhankuta.

**Table 1: Business analysis**

S.No	Items	Dhankuta	Kailali
1	Type of the product selected	amriso (1.275 ha)	banana (1.265 ha)
2	Targeted market (for detail see the value chain analysis)	Local collector, middleman, Hile traders, Birtamod wholesalers, Itahari wholesalers, Indian importers	Local consumers, retailers, wholesalers, middle man, processing industries, export to India
3	Production and sale target	More than 10'000 t of broom grass exported in 2012/13 to India (Pathak, et al, 2014). Huge demand of broom grass as it needs to be replaced at least in 4-6 months for each household in Nepal and India.	Huge amount is going out to import banana from India. 27'878 t of bananas were imported in Nepal during 2011/12 from India (ICIMOD, 2015). This shows that there is a gap of demand and supply in the country. So there is a high prospect of market for sale of the product.

**Table 2: Production plan**

Items	Dhankuta			Kailali		
Area	1.275 ha			1.265 ha		
Plants	Broom grass (amriso)			Banana		
Costs	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
Cost for fixed inputs (in NRs)	no inputs required	1'369'010	54'5244	67'593	1'361'879	538'577
Fertilizer	13'000	13'000	13'000	134'430	134'430	134'430

Items	Dhankuta			Kailali		
Land prepar. and pit digging	20'000	20'000	20'000	30'209	30'209	30'209
Seedling	12'752	12'752	12'752	120'836	120'836	120'836
Insecticides and Pesticides	0	0	0	28'321	28'321	28'321
Irrigation	0	0	0	28'321	28'321	28'321
Rental cost for tractor	0	0	0	6'042	6'042	6'042
Other labor cost	39,963	39'963	39'963	42'953	42'953	42'953
Support material	0	0	0	30'209	30'209	30'209
Transportation	0	0	0	18'881	18'881	18'881
Total cost in Year 1	85'715	1'454'725	630'959	507'794	1802081	978'779
Additional cost in Year 2	39'888	39'888	39'888	252'906	252'906	252'906
Additional Cost in Year 3	39'888	39'888	39'888	252'906	252'906	252'906
Additional cost in Year 4	39'888	39'888	39'888	252'906	252'906	252'906
Additional cost in Year 5	39'888	39'888	39'888	252'906	252'906	252'906
Total cost	245'267	1'614'277	790'511	1'519'418	2'813'705	1'990'403

Sources: Pathak et al 2014, Bisht et al, 1998, DDC Dhankuta, DADO office Kailali, DDC Kailali, Field study, 2016

**Table 3: Return from the plantation**

Item	Amriso (Amt in NRs)	Banana (Amt in NRs)
Price	NRs 35/broom	NRs 250/ghari
1	57'384	755'224
2	191'280	755'224
3	717'300	755'224
4	573'840	755'224
5	573'840	755'224
Total	2'113'644	3'776'120
NPV in Scenario 1	1'304'551	1'666'320
NPV in Scenario 2	-55'368	372'034
NPV in Scenario 3	698'543	1'195'336
IRR scenario 1	746%	456%
IRR scenario 2	9%	9%
IRR scenario 3	40%	57%
B/C scenario 1	8	2.39
B/C scenario 2	0.96	1.15
B/C scenario 3	2.05	1.72

Sources: Pathak et al 2014; Bisht et al, 1998, DDC Dhankuta; DADO office Kailali; DDC Kailali, Field study, 2016

