



Government of Nepal
Ministry of Federal Affairs and General Administration
Department of Local Infrastructure (DoLI)

A PARTICIPATORY APPROACH FOR ROADSIDE PROTECTION OF RURAL ROADS IN NEPAL

RIGHT OF WAY UTILISATION MANUAL



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Cover Photo: Flowering Broom Grass at Site #1, Chhintang, Dhankuta District.

Acronyms

AKC	Agriculture Knowledge Centre- at province level
B/C	Benefit Cost Ratio
CBA	Cost Benefit Analysis
CFUG	Community Forest User Group
COI	Corridor of Impact
CRN	Central Road Network
DADO	District Agricultural Development Office
DCC	District Coordination Committee
DDC	District Development Committee
DFO	Division Forest Office
DoLI	Department of Local Infrastructure
DOLIDAR	Department of Local Infrastructure and Agriculture Roads (now superseded by DOLI)
DoR	Department of Roads
DRCN	District Road Core Network
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 Chamber of Commerce and Industry
FR	Forest Regulation
GoN	Government of Nepal
HH	Household/s
IDO	Infrastructure Development Office – at provincial level
IDS	Infrastructure Development Section – at municipality level
IGA	Income Generating Activities
IR	Irrigation Regulation
IRR	Internal Rate of Return
LGOA	Local Government Operations Act
LRN	Local Road Network
km	kilometre/s
m	metre/s
MoA	Memorandum of Agreement
MOFAGA	Ministry of Feral Affairs and General Administration
MoPIT	Ministry of Physical Infrastructure and Transport
MoU	Memorandum of Understanding
NGO	Non-Governmental Organisation
NPV	Net Present Value
NRRS	Nepal Rural Roads Standard
NRs	Nepalese Rupees
NTFP	Non-Timber Forest Product
Palika	Rural Municipality/Urban Municipality (collectively known as the local level)
PRA	Public Roads Act
PRN	Provincial Road Network
ReCAP	Research for Community Access Partnership
RoW	Right of Way
SCWMO	Soil Conservation and Watershed Management Office -
SNRTP	Strengthening for National Rural Transport Programme
SWOT	Strength, Weakness, Opportunities and Threats
TID	Transport Infrastructure Directorate – at province level
UK	United Kingdom
VHLSC	Veterinary Hospital and Livestock Service Centre – at province level

VPD	Vehicles per Day
VR	Village roads
WSSD	Water Supply and Sanitation Division – at province level
WRIDD	Water Resources and Irrigation Development Division – at province level

Preface

The total length of rural roads in Nepal is about 61,395 km of which 3,950 km are black topped, 13,538 km gravel, and 43,907 km earthen roads. Most of the earthen rural roads in Nepal are built without properly following the basic principles of road construction. Road planning and development in Nepal has, in the past, not fully involved all concerned stakeholders. All aspects of building a sustainable road are key – the social, economic, environmental and technical elements of road design and development are key to ensure sustainability. In addition, slope protection, drainage systems, bio-engineering and the demarcation of the Right of Way (RoW) and its sustainable use are mostly overlooked during the design and construction of rural roads. This has resulted in poor road conditions.

For the purpose of roadside protection, and proper utilisation of the Right of Way, the Department of Local Infrastructure (DoLI) and the Research of Community Access Partnership (ReCAP), with the technical support from HELVETAS Nepal launched a pilot project focusing on research into roadside protection and utilisation of the RoW land. Based on the research project's findings, the Government of Nepal, through the Department of Local Infrastructure (DoLI), regarded it important to develop a manual focusing on roadside protection and utilisation of RoW and improving the livelihood of disadvantaged people who live close to the road. This procedural manual is therefore focused on the utilisation of the RoW and has three main sections - planning and preparation work, implementation, and monitoring and evaluation.

The main intended audience of this manual is the staff at local government level because rural roads have become a major function of the Local Governments. Because of the high demand for roads from citizens, roads have become a major part of development plans at the local level; however, planning and management lack transparency, accountability and the consideration of sustainability in terms of road longevity. This manual thus aims to enhance the capacities of key stakeholders for utilizing the RoW in a sustainable manner, and it is very much expected that the manual will help local level staff responsible for road planning and construction to fully understand the different processes necessary at each stage of roadside protection and the utilisation of the RoW.

Acknowledgments

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PART 1

1 Introduction

The concept of utilising the RoW areas is new in Nepal and there is no formal institutional mechanism in place, or any specific legal instruments developed to support this concept. However, there are some situations in Nepal where public land has been used by local communities for income generating activities, or more generally for the benefit of the local people - the legal matrix in relation to the current utilisation of public land in Nepal is presented in Annex A. 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 (District Road Core Network). Based on these findings and experience, an initial framework for the implementation of the developed approach was prepared, which was tested during the practical component of the pilot project.

The construction of rural roads, with the objective of providing improved access for rural communities, 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 25,000 km were included in the DRCNs, and about 35,000 km in the plan for Village Roads (VR).

Despite a huge investment in the DRCNs, the operation of these roads is not satisfactory, as 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. A major part of the RoW land has not been demarcated clearly and is therefore used inappropriately, triggering damage to roads through soil erosion, landslides, and also causing 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 potential income generating activities for poor communities, is a significant initiative.

Legally, DRCN roads require a 20m 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 an Income Generating Activity (IGA) in favour of poor communities. It is considered that allowing local poor households (HHs) to gain benefit from an IGA on RoW land would increase their motivation to manage the RoW land on a sustainable basis. It is considered that there is great scope to replicate the approach of utilizing the ROW for both generating income and protecting the roadsides.

The pilot project considered only short road sections, so some of the proposed activities may not be feasible for wider replication. For example, it was proposed to bring the roadside slopes to the standards as specified in the Nepal Rural Road Standards (NRRS); however, due to high costs of such a correction, this measure may not be economically feasible in a wider replication. It is thus considered that a key responsibility of DoLI together with the Transport Infrastructure Directorate (TID) is to develop a ranking of optional RoW plantation projects that can be implemented in a phase-wise approach.

1.1 Areas of Application of this Manual

The utilisation of the Right of Way (RoW) land to enhance poverty reduction along the roads of the District Road Core Network is a relatively new concept, and a clear legal provision for this purpose has not been enacted in Nepal to date. However, various policy and legal provisions have been endorsed by local authorities in regard to plantation and to maintaining greenery in the RoW.

To encourage this local support, the research component of the pilot project has developed appropriate legal instruments for the use of the RoW.

This RoW Utilisation Manual comprises the required legal, engineering, bio-engineering and economic aspects and related activities to be undertaken, especially for local and provincial roads. It is especially appropriate for local level staff who can use it as a reference while they formulate local road sector policies in aspects of road protection and utilisation of RoW.

1.2 Scope of this Manual

After the promulgation of the Constitution of Nepal in 2015, all three tiers of Government have the mandate for developing, maintaining and managing the road networks – however, there is a need for clear demarcation of responsibility – which road type in the national network is the responsibility of which tier of the Government? According to current legislation, the Department of Roads (DoR) looks after the Central Road Network (CRN), the Provincial Governments will be responsible for the Provincial Road Network (PRN), and local level government for the local roads. However, a) the former DRCN will fall under the jurisdiction of both the provincial as well as the local governments, b) very few of the VRs will fall under the definition of the PRN, and c) most but not all of the VRs are the responsibility of the local governments. Clarification and serious discussion with reference to road maintenance, especially between Provincial and Local level government is clearly required to define the responsibility for road upkeep. Year-round vehicle passability needs to be the focus because:

- many local level governments have yet to define the extent of the RoW for local roads,
- there is a lack of uniformity on classification and definition of local and rural roads, and -
- there are policy gaps at the local level related to potential for utilisation of the RoWs.

This manual will be helpful to address issues of utilisation of RoW at local levels and provides the essential basis for effective programme implementation.

The manual describes three phases (see section 1.4): i) programme planning and preparation ii) programme implementation at the site, and iii) monitoring and evaluation.

1.3 Users of this Manual

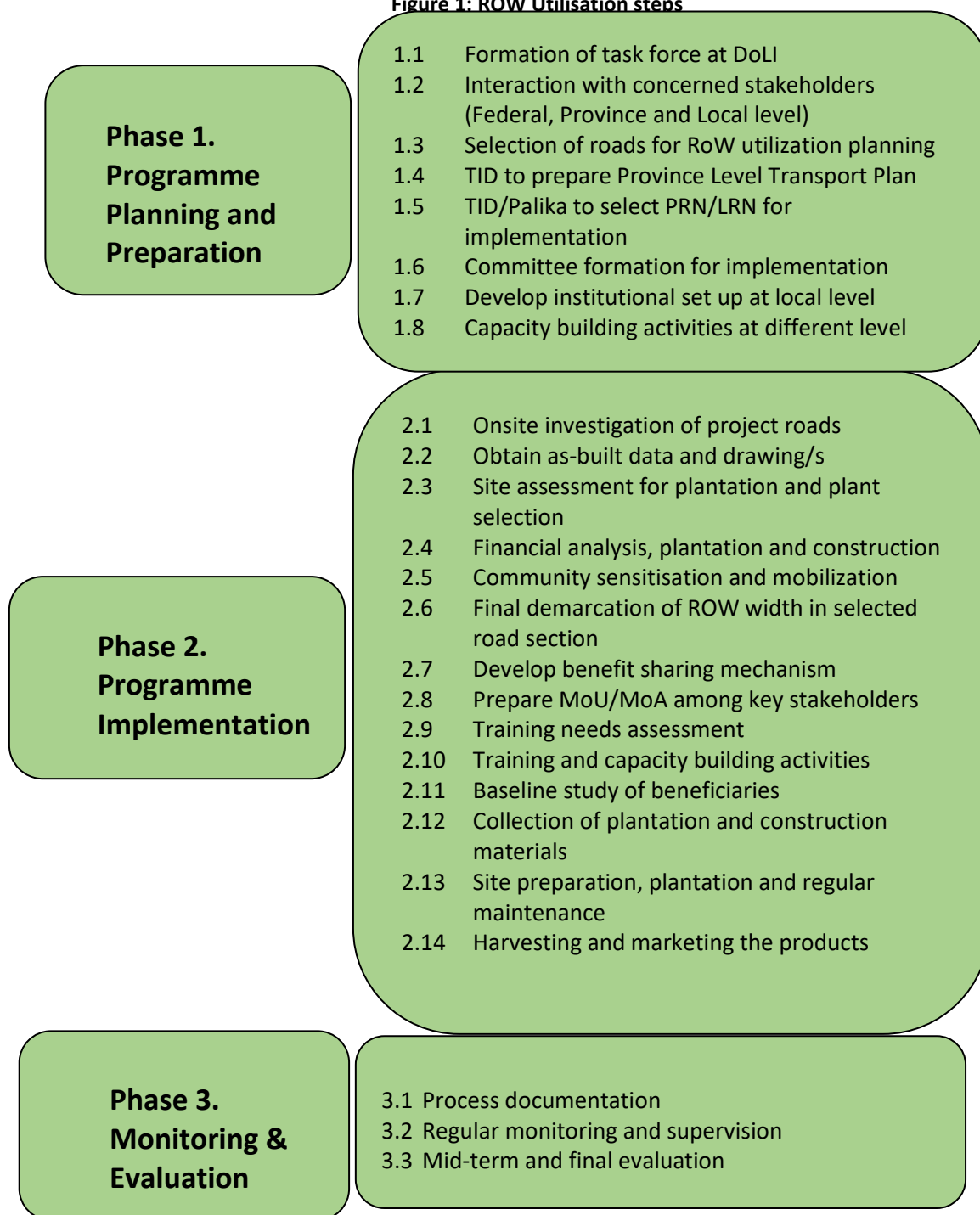
The manual is intended for all those involved in planning, constructing and maintaining rural roads and utilising the Right of Way in Nepal. This includes elected representatives especially of Local Governments (LGs); staff of the Roads Departments/Section of municipalities; service providers and technical consultants; members of Road Users Committees (RUGs), and other local people and staff of projects, companies, INGOs and development agencies concerned with the roads sector in Nepal. Similarly, this manual will also be helpful to the Province Governments (PGs) for outlining the concept in their jurisdiction.

Users of the manual are recommended to find the process in which they are interested and then follow the described steps. The **process** will help to understand how different steps are connected.

1.4 The Steps for RoW Utilisation

This manual aims to specifically cover procedures for the utilisation of the RoW and each part of the manual has been developed as a series of processes, which are further divided into steps, some of which are illustrated by figures. Details of some of the activities are documented in the Annexes.

Figure 1: ROW Utilisation steps



PART 2

2 Programme Planning and Preparation

The following activities need to be performed during the planning and preparation stages concerning the utilisation of the RoW.

2.1 Formation of a Task Force

DoLI may lead 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. As a first step, it is essential to gain an overview of the DRCN, and how each road is presently classified under the PRN or the LRN. A ranking for each road must then be developed defining priorities, and then a phased plan prepared for the implementation of maintenance or construction activities. The task force, with the help of DoLI and other stakeholders, shall then explore the availability of suitable RoW land in the high priority roads, and facilitate the process of officially acquiring the RoW for each road. The task force will take the lead in mobilising financial resources both from the private/RUGs and public sectors.



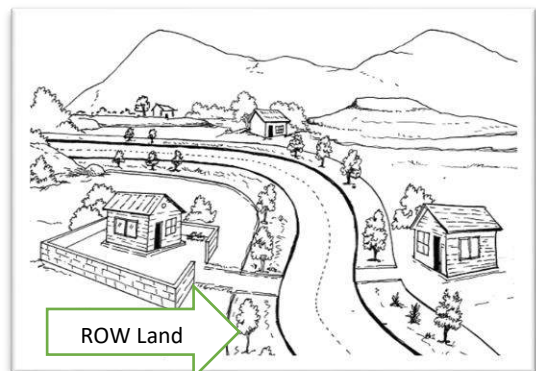
2.2 Interaction with the Concerned Stakeholders

The task force shall take the lead in establishing the institutional set up required for the implementation of the RoW concept at national, provincial and local levels. It shall support the TID/IDO in carrying out periodic consultations with government ministries, departments, corporations and non-governmental entities relevant to the programme. It shall undertake a training needs assessment and other relevant capacity building activities, both at national and provincial level.



2.3 Selection of Roads for RoW Planning

The task force will support DoLI/TID to develop a mechanism for selection of the priority PRN/LRN roads to assist in the phasing of implementation at provincial level and local levels. The roads with a clear RoW - i.e. where the land acquisition process is completed – will be selected as first priority. A proven willingness and commitment of the TID/Palikas to carry out the project is an essential requisite for these priority roads.



The following criteria will be applied at both provincial and local level roads:

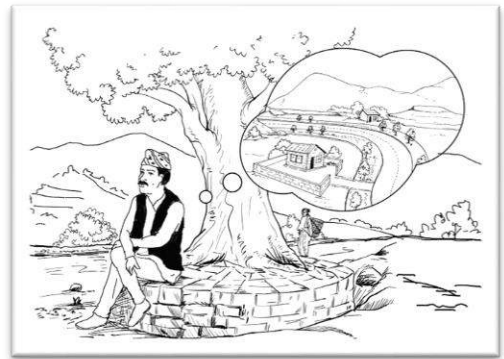
- the RoW is defined, and the land acquisition process is completed;

- socio-economic activities are completed or near completion – e.g. community user groups are formed, and a structural survey of the population is completed;
- road construction documents are available – for example, as-built drawings, or detailed project design reports.

2.4 Preparation of the Province/Local-level Transport Plan

The Constitution of Nepal has assigned the function, duty and power to prepare a master plan of province-level roads to the Provincial Administrations. As a result, the TID may include the productive use of the RoW land in their periodic plan or the Provincial Transport Master Plan, depending upon the local situation and preconditions.

The Local Government Operations Act, 2074, Section 11. (2) assigns the function, duty and power to prepare a master plan of local-level roads in the municipal areas to the local level. Accordingly, the municipalities may include the productive use of the RoW land in their periodic plan or the Municipal Transport Master Plan, depending upon the local situation.



2.5 TID/IDO to Select PRN Roads - for project implementation

Based on the Provincial Transport Master Plan, the TID/IDO shall choose the roads for the RoW plantation projects, based on the selection criteria mentioned in section 2.3.

At local level, the municipalities will select the LRN roads where RoW plantation project implementation will take place, based on the existing or revised municipal transport master plan, and the above criteria.

2.6 TID/Municipality to Assign Staff with Particular Responsibility

At the Provincial Level:

In the institutional setup at the Provincial level, the IDO is the authorised office to take responsibility for the management of the RoW plantation projects.

At the Municipality Level:

The Head of the Infrastructure Development Section (IDS) in each municipality is the assigned staff member to take overall responsibility for the management of the RoW plantation projects. The Head will assign a senior staff member to take on the day to day responsibilities.

2.7 TID/Municipality to Form a Committee for Implementation

At Provincial level, the IDO Chief shall set up a dedicated team with a clear vision, mission, strategy and well-formulated objectives. If needed, a separate operational manual can be developed as guidance for this purpose.

At Municipality level, the IDS will form a dedicated team for implementation with a clear vision, mission, strategy and well-formulated objectives.



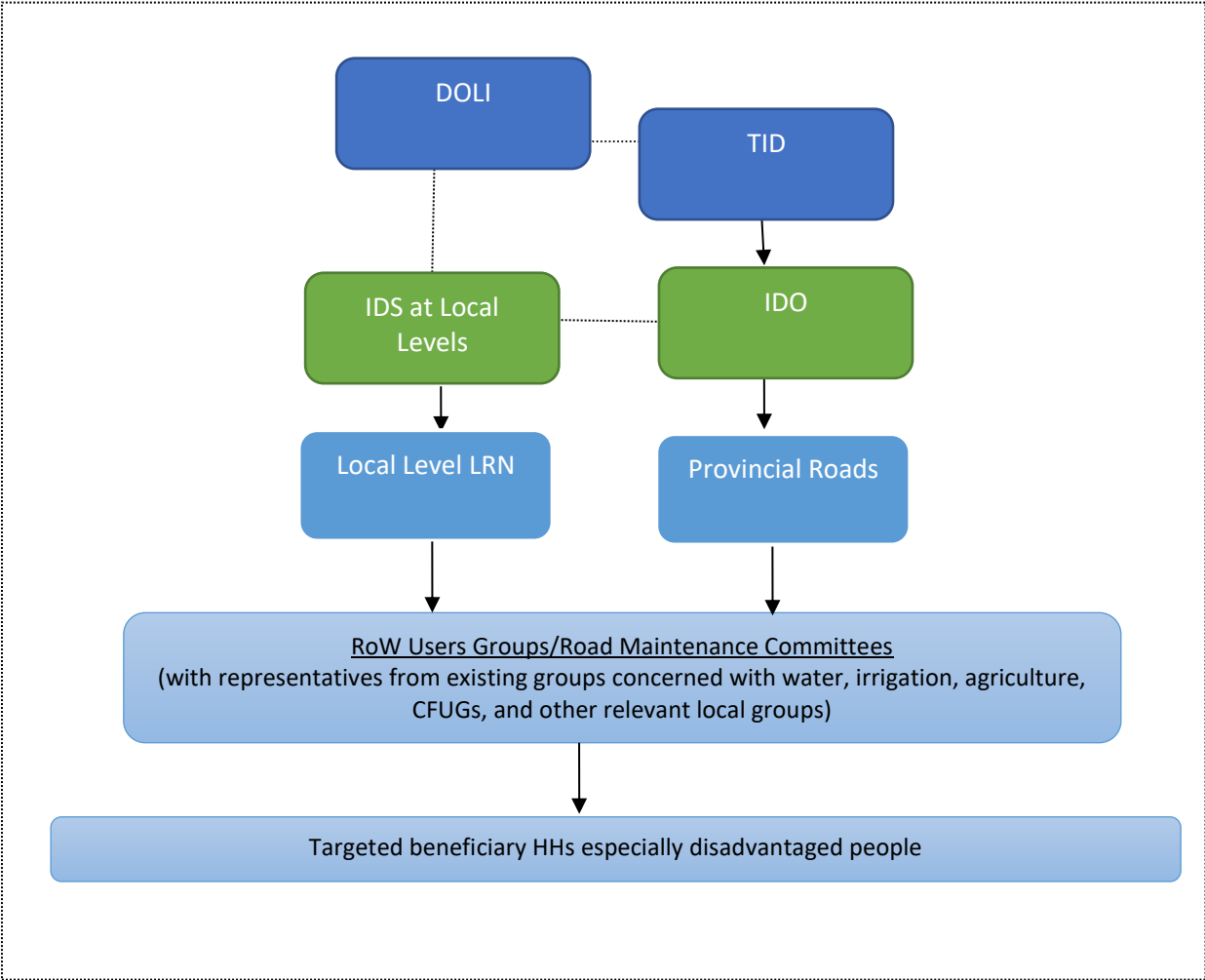
2.8 Establishment of the Institutional Setup at Local Level

Local Government Operations Act (LoGOA) 2016 the Public Roads Act (PRA) 1974 and the Forest Act (FA) 2019 provide the basis for the institutional setup for coordination, monitoring and implementation of income generation activities in the RoW for poverty reduction.

These acts form the basis for the crucial province and local stakeholder consultations – and are instrumental for recommending an appropriate institutional mechanism for the future. Figure 2 below indicates a possible institutional mechanism for the implementation of the RoW plantation projects.

The final institutional set-up may include a working group for backstopping during the project implementation phase.

Figure 2: Proposed Institutional Mechanism (based on desk review and consultations)



The following agencies will be consulted during the different line of activities for right of way utilisation:

- The District Coordination Committee (DCC) and Province Government
- The Agriculture Knowledge Centre (AKC).
- The Divisional Forest Office (DFO).
- The Soil Conservation and Watershed Management Office (SCWMO).
- The Water Supply and Sanitation Division (WSSD).
- The Water Resources and Irrigation Development Division (WRIDD).
- The Federation of Community Forest Users Nepal (FECOFUN).

- The District Network of Irrigation Water Users Association.
- The Federation of Nepalese Chamber of Commerce and Industry (FNCCI).
- The Association of farmers at district level.
- Other relevant Non-Government Organisations (NGOs).

The IDO, in consultation with DoLI/TID, will finalise the modus operandi of the institutional setup.

2.9 Capacity Building Activities at DoLI/TID, IDO, Municipality and Users Groups

It is essential to assess the types of capacity development activities that will be needed at National, Provincial and Local level. This can be achieved through a questionnaire survey with the key individuals involved in both planning and implementation, with support and information from training unit heads and/or those individuals who are responsible for human resource development. Based on the findings of this assessment, respective training programmes will be designed and carried out, based on existing courses and materials or specifically designed new curricula and programmes.



PART 3

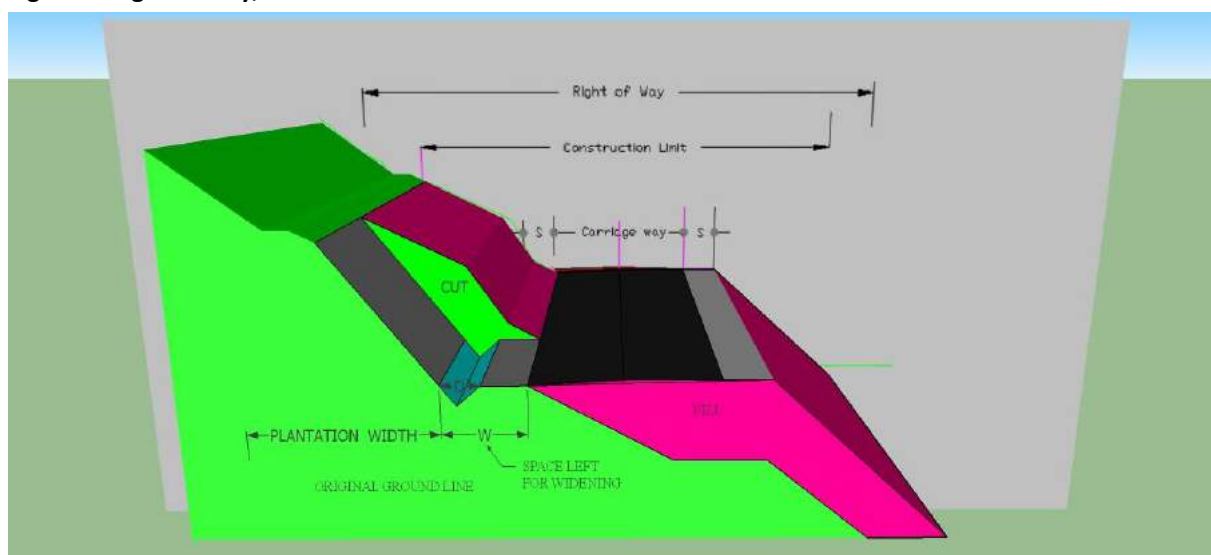
3 Programme Implementation

3.1 On-site Investigation of the Project Road

The IDO Chief (or at Municipality¹ level, the IDS Chief) with her/his team should first conduct a reconnaissance survey along the identified road to gain an overview of the road, the soil profile, the availability of construction materials and of other general information about the road and its alignment.

On the ground, the RoW is rarely a uniform area of land, as most roads, especially in the hills of Nepal are on sloping ground – in addition, as a result of road classification and/or whether it falls in the provincial or local level, or any local sub-category based on its perceived importance. The effective width available for plantation varies based on the road classification (or importance), and terrain aspects such as the cross slope of the roadsides. The higher the importance of the road, the greater width it will occupy thus reducing the width for any planned plantation; likewise, steeper terrain generally results in steeper cuts which will occupy more width thus decreasing the availability of land suitable for plantations.

Figure 3: Right of Way, Setback and Plantation Areas



As a result of this road reconnaissance survey, a very important step in the implementation phase, suitable road sections for RoW plantations can be defined and shared to the joint stakeholders meeting (e.g. - the IDO and implementation team, the Municipality, and the identified user group/s).

On the basis of this reconnaissance survey and subsequent discussions with the joint stakeholders, a decision can be taken on the exact sections suitable for RoW plantations; a more detailed survey can then be conducted. The factors on which to base site selection for a RoW plantation will be as follows:

Land acquired for RoW: Due to the right to property of the people, plantation schemes cannot be commenced before the land acquisition is settled. However, the plantation scheme can proceed where the roadside landowners are ready to contribute voluntarily. In such a situation, it is crucial to include these landowners as members of the RoW plantation user group. Since the land ownership of these private lands has not been transferred to the public utility, it is not possible to engage the poorest of the poor for RoW plantation activities.

¹ Municipality means both rural municipality and municipality.

(Reference can be taken from: Pilot study of Hile - Chhintang road where RoW land is already acquired. The pilot project sites were selected considering that met one of the most important criteria)

Finalization of road width: Road width should be finalised before RoW plantation activity commences. Not having finalised road width will cause damage to plants later on when there is road maintenance activities or construction undertakings, such as further cutting and filling, or further widening. Generally, the road width is determined on the basis of traffic volume, which would be specified in the appropriate road standards of the particular level (the Province or the municipality).

Maintenance of roadside slopes: Roadside slopes must be maintained based on the soil type so as not to cause erosion and landslides. Normally, the safety ranges for cut and fill slopes of roads, based on soil type, are as follows.

For Cut Slopes:

For hard rock:	1V:0.3H to 1V:0.8H
For soft rock:	1V:0.5H to 1V:1.2H
Dense sandy soil:	1V:1H to 1V:1.2H
Loose sandy soil:	1V:1.2H to 1V:1.5H
Clayey soil:	1V:0.8H to 1V:1.2H
Boulder mixed soil:	1V:1H to 1V:1.2H

For Fill Slopes:

For boulder mixed soil:	1V:1.5H to 1V:1.8H
For sandy soil:	1V:1.8H to 1V:2H
Rock fragments:	1V:1.8H to 1V: 2H
Sandy and hard clay:	1V:1.5H to 1V: 1.8H
Soft clay:	1V:1.8H to 1V: 2H

There should be provision for a berm for each rise of 5m height, in case of cutting as well as in filling slopes.

Road Maintenance in RoW plantation area

The following aspects need to be considered in the selection of sites and extent of RoW plantations.

- a) **Clearance of road:** Debris from slides and falling materials from the hillsides must be cleared and disposed of properly.
- b) **Maintenance of drainage:** Water is the most damaging factor to the road so all channels or seepage lines carrying water onto the road should be properly and safely diverted. All side and cross drains need to be repaired and maintained otherwise water will run on to and over the road, which will damage both road surfaces and sides.
- c) **Maintenance of structural components:** Retaining walls may be constructed dry or a cemented masonry wall installed. It is important to check that stones laid on dry walls should be intact. For cemented walls, it is important to check that the quality of filter materials behind the wall is appropriate, that the filter materials are cleaned, and that weep holes have not been blocked, by weed growth for example, which will increase water pressure and is prone to damage. Gabion walls may have some bulgings, but rusty wire and general wear and tear due to age and exposure may need earlier attention and repair.
- d) **Rill and gully erosion control:** The occurrence of rill and gully erosion needs to be recorded and monitored. This type of erosion is caused by poor design and/or maintenance of the roadside drainage systems. If such thing is observed, the drainage system needs to be improved primarily by removing the source of water from endangering the road or by stone ripraps, turfing of

embankments, construction of catch drains, or by application of an appropriate bioengineering measure.

The use of bio-engineering measures, such as live check dams, brush layers, fascines, and planting grasses and shrubs, are strongly encouraged to maintain the road slopes properly and protect all potential RoW plantation areas.

3.2 Obtain As-built Data and Drawings - of the selected road sections

As-Built Drawings of the road sections, with cross section details and alignments, selected for RoW plantations can be obtained from the IDO (or from the IDS in case of municipalities). These can then be verified in the field and any discrepancies documented.

Figure 4: Sample format for roadside condition survey

Roadside Condition Survey Format
.....Road
STRIP MAP

From _____ Km Date _____
To _____ Km Sheet No: _____
Photo No: _____ 25m Field _____

									25m					Field				
									20									
									15									
									10									
									5									
									0 m									
Soil/Rock Type	Fencing Need	Site Clearance/ Slope trimming need	Side Drain/Type /Status	Current Land Use/Cover	Civil Structure need	Demarcation /Adjacent Landowner/Kita no.	Land Acquisition status	Pavement Type /Road width	Land Acquisition status	Demarcation /Adjacent Landowner/Kita no.	Civil Structure need	Current Land Use/Cover	Side Drain/Type/Status	Site Clearance/ Slope trimming need	Fencing Need	Soil/Rock Type		
9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9		

The existing as-built data/drawings can be supplemented with records of cross sections and small structures. Cross-sectional drawings are an instrumental basis for designing the toe wall and other retaining structures, for choosing an appropriate plant species, and designing any fencing structures required during the preparation of a project proposal.

Within 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. In this situation, where time is short and as-built drawings are not available, the IDO/IDS Chief with her/his team can establish basic cross sections (formation width of the roads, side drains, cut and fill slopes, etc.) during field inspection at 100m intervals. Considering the topographical features of a road, the established cross-sections, and the types of plant species proposed for the plantation, adequate civil engineering

requirements can be designed on the basis of the information in the Annexes: for the Road Standards, see Annex C1; for Sample Cross Sections, see Annexes C2 and C3; for a Low Cost Fencing Design, see Annex C4; and for Cost Calculation of Low Cost Fencing, see Annex C5.

3.3 Site Assessment for Plantation for Productive Use - including bio-engineering requirements

The site conditions for plantation for productive use will be assessed based on factors similar to those used for site assessment for bio-engineering suitability. These factors include altitude, climate, (primarily seasonal temperatures and rainfall), slope orientation (aspect), and soil type (essentially texture, fertility, and moisture holding capacity).

As in the hilly landscapes of Nepal, and especially in roadside location, aspect and soils change rapidly over a small area of land, it is difficult to base plant choice on these factors. For new project sites, the chosen plant type will be dependent upon the following.

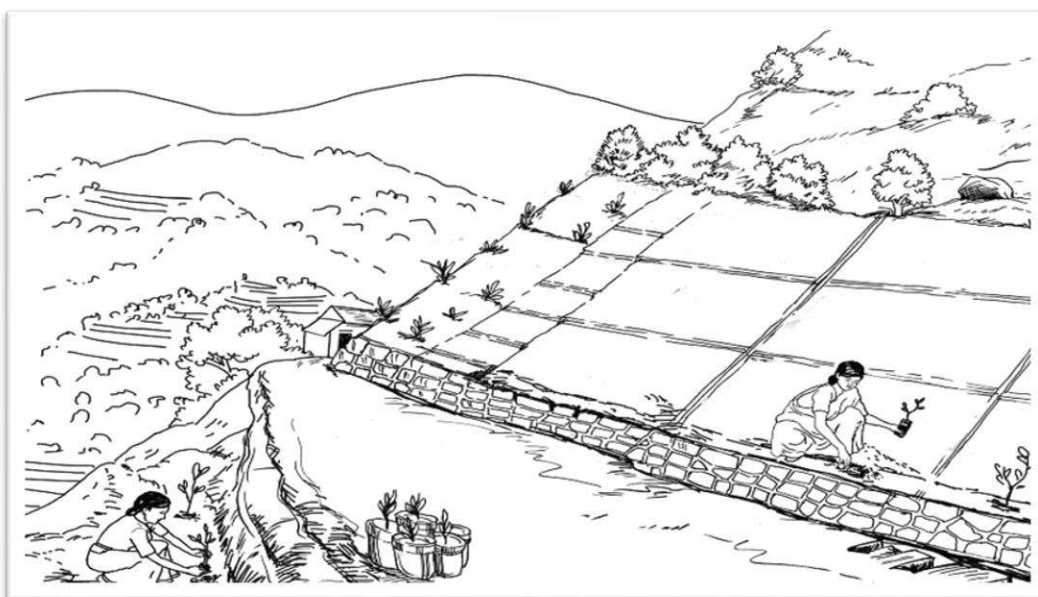
- **Engineering function of the plant species**
Plants have various engineering functions which need to be considered for these changeable, vulnerable and difficult environments – one of these characteristics is the ability of the selected plant to anchor, reinforce, and support the soil on the slope, another is the ability to assist in good drainage of the site. Those plant species with good reinforcing properties are effective in preventing the dislodging of surface soil particles and erosion, and the formation of gullies in the cutting and filling slopes. The selection of the plant species must take special reference to the site condition including slope angle, the length of slope, the moisture condition, and other aspects.
- **Cultivation technique**
Due to sensitivity to slope erosion and failure, plant species that require less tillage and watering are preferred for their bioengineering characteristics, thus the selected plant should be able to survive and prosper in adverse situations.
- **Altitude and temperature**
The selected plant must be able to grow and flourish at the altitude of the planned site, and within the seasonal temperature variations range of the particular site.
- **User's choice**
A major consideration is the choice of the RoW users who must fully support the final species selection and thus will be fully engaged in the plantation of the RoW and its productive use.
- **Market led product**
In order to maximise profit for the local community, it is important to take into account the potential for commercialization of the product from the RoW plantations – this should be based on the return on investment. Priority should be given to those species that yield products having a high market demand and value.
- **RoW land type and landscape position**
The steepness of the RoW, and the risk of future landslides, for example, are also factors that need to be taken into account when choosing the plant type. On steep and fragile slopes, large tree types of plant are not recommended – in these locations, light but deeply rooted plant species should be selected, for example peach, Broom grass, or Napier grass. In lower lying or valley bottom sites, the risk of flooding may also have to be taken into account. The broom grass has high level of soil holding capacity because of its strong and long fibrous roots. It specially helps against surface erosion from runoff and rain splash due to its dense surface cover, small leaves and small height (about two meter), which has to be trimmed annually to get more yield.

Suitable plant species for the plantation on the RoW land will be jointly determined with different agencies such as the AKC, the local Veterinary Hospital and Livestock Service Centre (VHLSC), the DFO,

and other relevant local organisations and individuals such as NGOs active in the area, as well as skilled and specialist farmers and nurseries.

During the pilot study, a comprehensive list of optional plants is described by cross checking a list of plants recommended for bio-engineering with compilations of food and fodder plants of Nepal suitable for that particular agro-ecological zone (**See Annex D. *Optional Plants for Productive Use of RoW for Wider Replication***). And, the **Annex E** list, *Plants for Productive Use in the RoWs in the Terai and in the Hills*, has been drawn up for the local conditions at the pilot sites, through discussions with stakeholders and communities at provincial and local level. These two annexes are very important for assessing the suitable plants considering the terrain.

The bio-engineering properties of the plants for roadside plantations also must be considered in order to ensure that the selected species also has site protection characteristics; the selected plant should include the ability to catch soil particulates, and anchor and reinforce the soil with deep roots, and enhance slope support and good drainage.



In terms of other requirements, the following characteristics of the selected species must also be taken into account to ensure maximisation of production and return on capital:

- occurrence of the species in the area,
- its suitability for roadside stabilisation,
- the availability of planting materials, such as seedlings, saplings, seeds, and cuttings,
- the availability of local nurseries,
- the agro-ecological suitability of the crop for roadside planting,
- its suitability for productive use,
- whether it is a common or known species by the community for productive use in the area,
- the skills available for cultivation or the potential for simple skill development within the target communities,
- whether a market chain is in place for the product, or there are clear options to initiate such a chain.

Plant selection must be based on practical aspects, since the plantations are to be established and managed by the designated user groups.

3.4 Financial Analysis of RoW Plantations and Construction

To support a socio-economic analysis of the plantations to be established, a Cost-Benefit-Analysis (CBA) must be carried out, complemented by a SWOT and a Value Chain Analysis. This includes the steps listed below, which are detailed in Annex F.

After visiting the site to undertake a detailed roadside condition survey, it is necessary to quantify the costs through an assessment of all works to be done along the RoW plantation section. The major work components to include in the budget estimation are as follows.

a) **Civil Works Costs:**

After the survey, there may be a need to improve or maintain the structures that comprise the road and roadside. Quantities and cost estimations of particular structures is carried out based on the survey and design of the road, and the establishment of the new plantation. Some changes in horizontal and vertical alignment may also be incorporated at this stage so that the road should be properly engineered in a sustainable manner. Improvement to the basic components of the road – such as the side drains and cross drains for safe disposal of water, as well as the retaining and breast structures, and maintaining the non-erodible nature of slopes through cutting and filling - should be incorporated where these are necessary.

Assessment of the costs of civil works should include any costs incurred through road widening if this is planned for the near future.

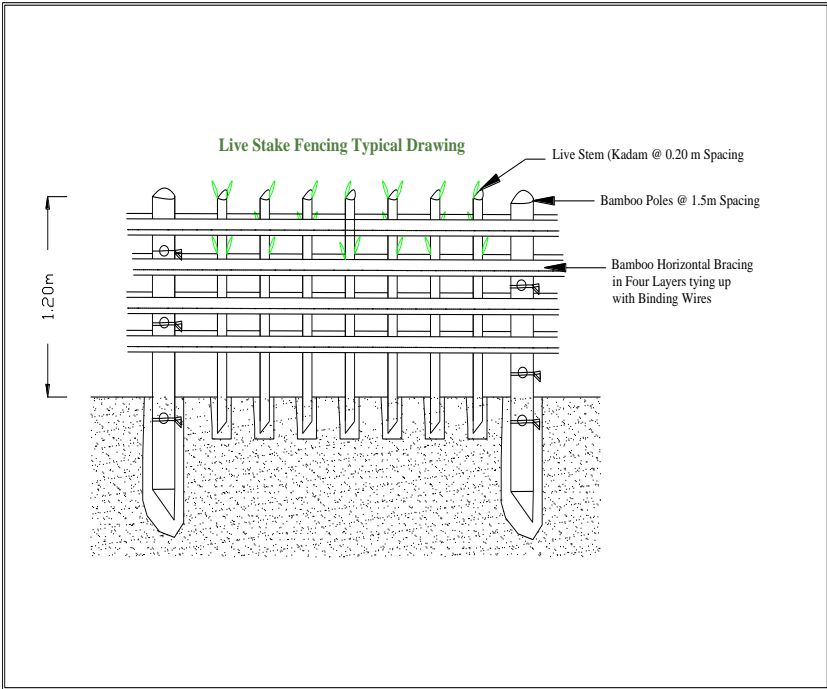
b) **Site Clearance**

Unwanted bushes and other vegetation need to be cleared before plantation, so it is possible to mark out the boundary and extent of the RoW on both sides of the road and measure the total area.

c) **Fencing**

It is crucial to protect the plantation, especially the young plants, from grazing by roaming livestock. In general terms, the valley side of the road is more prone to grazing than the hill side area due to its accessibility. If it is deemed that fencing is required, it should ideally be constructed of locally available materials. Live vertical sticks are most likely to provide a long lasting solution which can be interwoven between the 1.5m spaced bamboo poles as illustrated in the drawing below.

Figure 5: low-cost fencing



Further details on the work items and the cost calculations of low-cost fencing is given in Annex C5.

d) Plantation Costs

The costs of plantation include digging of the planting pits, the purchase cost of the plant seedlings, transportation to the site, and planting the seedling properly in the prepared pit with manuring. The size of the pit and spacing between pits is based on the type of plant species.

e) Irrigation

During periods of drought, irrigation may be required, and it is necessary to calculate costs for this. In most cases, the most economical method for this is a hosepipe (HDPE pipe) to connect to a nearby community tap or to a nearby spring, stream or canal. In the Terai, existing tube wells might be used if there is community nearby – the cost of a new boring is likely to be prohibitive. All estimates need to include all capital and installation costs such as water pumps, storage tanks, pipes and fittings.

f) Provision of daily wages

A provision for a realistic number of person-days work (Heralu in Nepali) should be included in the estimate in order to properly establish and maintain the RoW plantation area and to provide irrigation to the plants when required.

Estimation of return

The return is estimated based on the following parameters.

- The estimated quantity of output.
- The gestation period while the plantation is maturing.
- The total number of years of expected output.
- The sale price of the product, both farm gate and market price.
- The estimated total return annually or seasonally, depending on the product (quantity x price).
- The estimated return for subsequent years according to the returns of the plants.

Perform a SWOT/C Analysis and Value Chain Analysis

The SWOT/C analysis (strengths, weaknesses, opportunities and threats/challenges – as shown below) assists in understanding the different characteristics of the proposed plant and product line. By analysing these factors, the positive aspects of the proposed plantation can be measured against the risks; this must include the stability of the market for the product. Ways to remove or limit the weaknesses and threats can be discussed and devised within the project implementation team.

Figure 6: The SWOT Analysis Matrix

Strength	Weakness
Opportunities	Threats/challenges

A value chain analysis is equally important as this will highlight the existing players in the market chain and place focus on the market value of the product at the end of the chain. The analysis allows the identification of ways to improve the value of the product by positive interventions or simple support (e.g. packaging), and thereby to increase the income generated for the farmers. The following aspects need to be included in the assessment of the value chain.

- Mapping of the main actors - all those who are involved in the value chain.
- An analysis of the market demand and supply of particular product/s at different market hubs.
- The opportunity of value addition and the subsequent market for the product.
- Any potential upscaling of production and products.

3.5 Community Sensitisation and Mobilisation

Interaction with the local communities is the first step towards successfully implementing plantation projects in the RoW. The IDO (or the IDS), with officials from the municipalities and their counterparts, need to first 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, and will include:

- obtaining information about the settlement in the village/municipality and on both sides of the road;
- identifying existing institutions in the area - e.g. Local Road User Groups, Forest User Groups, Irrigation Water User Groups, Drinking Water User Groups, farmer groups, cooperatives, etc.;
- identifying present users of the RoW;
- obtaining the list of members, their wellbeing-ranking, and the list of office bearers of such organisations;
- organizing meetings with the concerned organisations and communities;
- identifying households interested in participating in the programme, giving priority to poor and landless households;
- discussions with village/municipality leaders in order to identify the possibility of local support for the programme;
- identifying the groups or HHs which will actively execute the project – this ideally would be the poorest of the poor if appropriate;
- assessment of the available and present skills required for implementing the project and identify those areas in which further training will be required.

3.6 Final Demarcation of the Right of Way - in consultation with the community

The final demarcation of the ROW area on which a particular community will establish a plantation needs to be mapped and clearly demarcated on the ground with the start and end points and the RoW edge line. This shall be done in consultation with the local people and landowners, the local political parties and other relevant people in the local situation - such as, for example, representatives from the municipalities. It is clear that for this final demarcation to be concluded, it is essential to develop a common consensus between all directly involved stake holders, and to take into account all relevant provisions documented in the respective legal obligations.

3.7 Develop 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. The selection of partaking HHs is initially based on those HHs interested in the utilisation of the RoW, as there will be little commitment from those HHs which are not 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 organisation/s, should be clearly defined and mutually agreed upon, before signing the contractual documents. It is most important at the outset that a cost and benefit sharing mechanism between TID/IDO/Municipality/and the User Group is agreed and documented in the MoU.



3.8 Training Requirements at the Local Level

Capacity building and training of the participants of the contracted user groups should be organised and undertaken before making a start on the on-site physical implementation of the project. The required types of training and capacity building activities must therefore be identified early in the planning process. In order to enable the user groups to produce a high value crop with low costs, the types of training that are likely to be required include: plantation establishment and maintenance, harvesting and marketing procedures, and any necessary processing and packaging aspects. To facilitate these training aspects, a local service provider can be engaged to both evaluate the need for different trainings, and to provide the training to the selected beneficiaries.

3.9 Prepare a Tripartite MoU among Key Stakeholders

First the legal requirements for formal understanding must be identified. According to the existing provision of the Public Roads Act, the DCC owns the land of the RoW of the DRCN Roads, including the roadside which will be utilised for this pilot project. To some extent, the LGOA 2074 also delegates roles and responsibilities to the Municipalities – for example, the protection of the area including the trees or other species growing along the roadside.

The local communities must, therefore, **obtain formal consent or approval from the local government to utilise the RoW land**, based on a tripartite MoU between DCC, the Municipality and the local community, and service provider if required and appropriate. These three parties need to enter into a formal process for preparing the MoU before implementing the project activities. The DoLI can facilitate the required arrangement process - see Annex G for a model MoU.

The LGOA 2074 has made a provision for local communities to implement local level development and income generating activities – and as a result, local governments can implement this project through local communities. The local governments can **provide financial, technical and capacity building support** to local communities based on a particular contract or a MoA between the local government and the local community.

Local governments and local communities therefore need to enter into a formal agreement process in order to receive support, be it financial, technical or in the form of capacity building, from local bodies to implement this pilot project; Annex H documents a sample MoA.

3.10 Training and Capacity Building Activities

IDO (IDS in case of Municipality) experts shall conduct the required training courses and capacity building activities for the project participants; alternatively, the IDO /IDS can select and appoint an NGO or consultant capable of conducting the necessary training. The capacities of the local nurseries also need to be assessed, and if necessary short trainings can be provided to ensure sound technical and management capabilities.



In most areas, the relevant district offices or NGOs or private entrepreneurs will already be operating nurseries for plants suitable in that area. It is envisaged that in some more isolated areas, however, a new project nursery will need to be established; in this situation, it is advised that the project managers should cooperate with the Municipality office staff or appoint an experienced NGO to train the selected representatives of user groups in the required skills for nursery establishment and management.

3.11 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 area details.

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.

Before starting any of the on-the-ground implementation activities, the IDO/IDS Chief with her/his team, in coordination with the contacted user group, should conduct a reconnaissance survey of the whole road section chosen for the project in order:

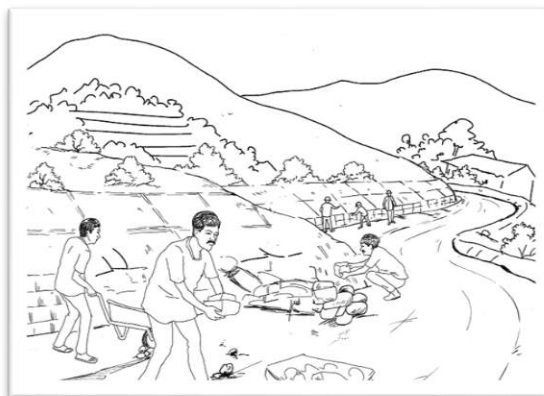
- to identify the project location, and ensure that all boundaries are properly and securely marked out,
- to measure the potential plantation area, and to identify locations where physical interventions are required, such as sites needing general maintenance of existing structures, gabion installations, masonry or dry wall constructions, or fencing.



Measurement of the plantation area is important in terms of estimating the plant or sapling requirements and for calculating a potential cost benefit to the community.

3.12 Collection of Plantation and Construction Materials

If material is not available locally, the IDO/IDS Chief will have to order construction and plant materials in good time so that all required supplies and resources are ready at the start of the physical works and plantation establishment. The involved local community may be able to collect the required construction materials from the local area – such as sand and fencing materials. The IDO/IDS Chief is responsible for ensuring the quality and quantity of the materials to be collected and identifying safe locations for its deposition and storage. When needed, the RoW user group will collect the required plant material from defined areas or nurseries.



Low-cost fencing options should be applied where necessary to protect from roaming livestock.

Developing a Water Management Plan

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-in the plants at planting time. Likewise, during the construction, for example of stone masonry work, a water supply will be needed. In such situations, the contracted user group with the help of the IDO/IDS team need to plan and establish a system to supply and manage water before starting the construction activities. A temporary water provision may be all that is needed while any construction work is completed, and the plantation is established – this could be managed through the provision of a water tank, by hiring a water pump for the required period, or making an arrangement to temporarily tap water from a village water supply, irrigation canal, or nearby natural water source, such as a spring or stream.

Completion of On-Site Physical Works - before plantation

All physical construction activities and the land preparations for planting must be completed before establishing any plantation. The surface of the slopes must be trimmed to a smooth profile, with no vertical or overhanging areas, and 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).

3.13 Establishing the Plantation

Before planting:

- remove weeds and debris;
- fill in any surface irregularities;
- prepare sapling pits before planting if required;
- carefully plant the seedlings, slips or saplings in the pit, filling the holes with soil crumbs around the roots of the planted material;
- if available, use some dried leaf litter in the base of the hole, and mix a handful of compost or well-rotted farmyard manure with the soil as the pit is filled up - this will increase fertility and water holding capacity.

It is essential to water in the seedling at this stage; and the young plants will require water regularly if there is no rain within the first 3 months of planting.

For a visualisation of road sections after project implementation, please refer to Annex I.

Regular Maintenance

The contracted local user group is responsible for plant care after plantation: this will include watering during dry spells in the first season, mulching, weeding of unwanted plants, and protection. In some areas where there is a high population of free grazing domestic or wild animals, fences will be required – these can be made of local materials (e.g. thorn bush or bamboo) – and these too will require regular checking and maintenance. Annexes C4 and C5 provides information on low cost fencing using barbed wire, which may be necessary in certain locations.

3.14 Harvesting and Marketing of Products

The implementing agency (TID represented by the IDO or the Municipality represented by the IDS), should develop a plan to support the local community in harvesting and marketing of their product or products. The types of support required may be identified during the baseline study or during the training needs assessment. Such support is likely to include:

- business analysis;
- business and production plan including the investment;
- the expected return from the plantation project;
- identification of potential markets;
- value addition potential of the products.

An example of a business plan for the implementation of a roadside plantation is presented in Annex J, based on the pilot project “Developing a participatory approach for roadside protection of rural roads in Nepal (2020)”.

PART 4

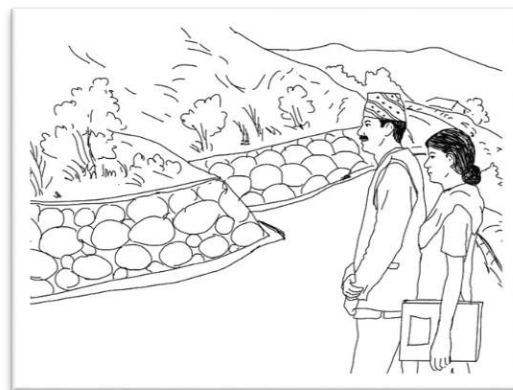
4 Monitoring and Evaluation

Both internal and external monitoring and evaluation of the project achievements against specified milestones is proposed.

Firstly, the beneficiaries and service providers will regularly monitor the implementation of activities against the milestones, and its impacts on an on-going basis; this internal monitoring should have representatives of the key user committee members.

Secondly, evaluations by external consultants are recommended at one or more mid-term stages and at the end of the project cycle.

It is essential that the implementing bodies, the IDO or the IDS Chief and her/his team, document the project process from the beginning and throughout the project duration; this documentation should include short notes on interim field visits and minutes of discussions with local authorities and communities.



4.1 Process Documentation

It is essential to observe and assess the changes and impacts achieved by the project, both in terms of technical and socio-economic progress; this will allow analysis of why and how the observed changes have happened and to what extent the project has contributed to these changes. This information is relevant for the implementing agency (IDO or IDS at municipality level) to identify key lessons that can feed into recommendations for future RoW protection projects. The concerned lead agency can use its own existing human resources, but may take the support of a service provider if deemed more appropriate.

4.2 Regular Monitoring and Supervision of Works by IDO/IDS

The IDO or IDS Chief and her/his team will be responsible for conducting regular monitoring, and evaluation of the progress (or results) should take place annually. The evaluation and 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.

4.3 Mid-term and Final Evaluations

The main aim of the mid-term and final evaluations is to systematically compare the concrete results achieved through the project and its underlying working mechanisms against the proposed outcomes. Findings, learnings and recommendations from these evaluations can be used to improve other on-going and future projects. Based on budget-availability and the importance of the work, the TID or the Municipality are therefore strongly encouraged to consider a mid-term and final evaluation of the project.

It is suggested that a simple mid-term evaluation should take place after 2 years to ensure that a good start has been made, and the final evaluation after maturity of the selected crop has been attained. For example: In the case of Broom Grass, the final evaluation would be after 4 years of plantation. Some projects may need more than one mid-term evaluation. The provincial or local government or the funding agency may hire external experts to conduct these evaluation studies.

At a minimum, the criteria for the external evaluation should include the number of activities implemented and physical progress on the ground, the number of people trained, the extent of awareness

raised in the project area, and the number of policy makers included, particularly in the utilisation of the RoW. Later mid-term evaluations and the final evaluation should also include an examination of product marketing, product sales, and how the proceeds are being saved and utilised.

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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
Public land (owned by local bodies and other institutions)	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
Riverside land	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
Irrigation channels	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 trees or NTFPs, use, marketing and income generation	Based on approved work-plan
RoW under high-tension lines	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)
Public roadside land acquired for public interest	PRA, 1974 (Sect. 16.4)	Plans of local bodies, agreement paper, operational plan	Local institution (communities), local levels and DoLI/DCC	Local bodies, DoR, DoLI, DDC, DFO, Agricultural Knowledge Center	Poor groups, groups of landless people, local communities	Plantation, agro-forestry, agriculture (cash crops), bio-engineering	Based on agreement between communities and municipality

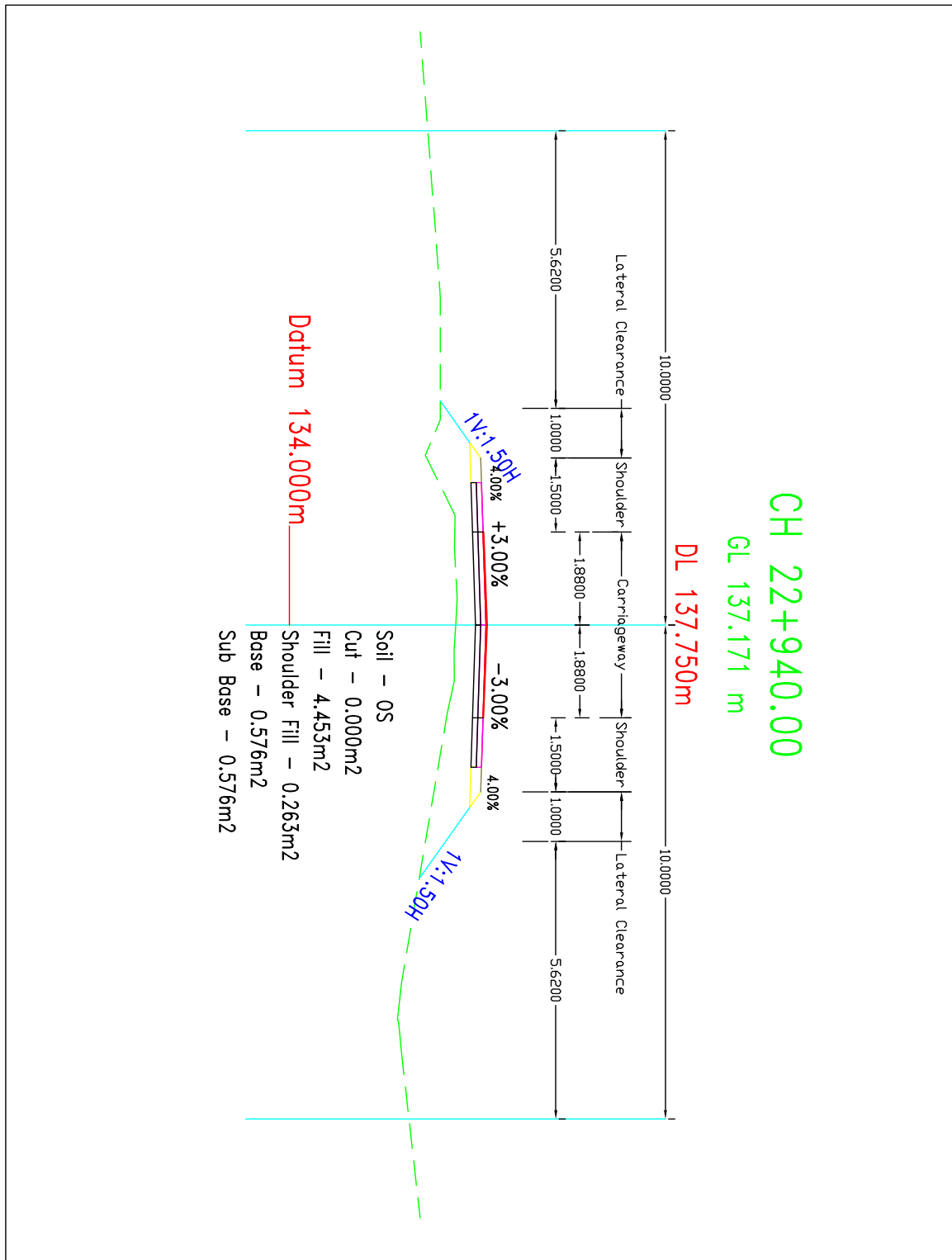
Annex C1: National Road Geometrics Design Standards

The detailed Road Geometrics Design Standards and Surfacing Options for Rural Roads (DRCN) are given in the following table.

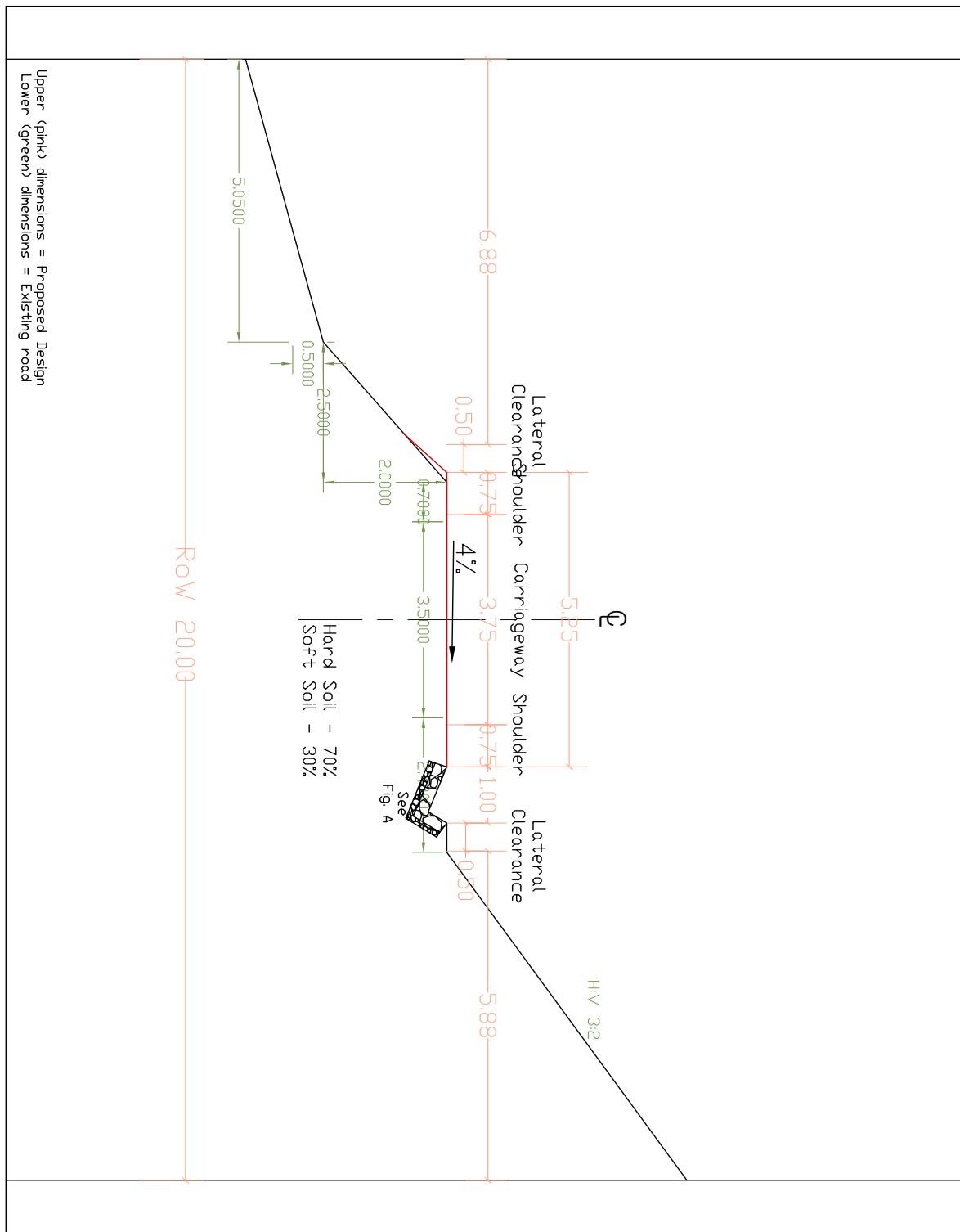
Road Geometrics Design Standards				
Sr. No	Road components	Design Standards		Remarks
		Terai	Hills	
1.	Carriageway Width (m) Traffic < 100 VPD Traffic > 100VPD < 400VPD	3.00 3.75	3.00 3.75	
2.	Shoulder Width (m)	1.50	0.75	On both sides
3.	Roadway Width (m) Traffic <100 VPD (see notes below) Traffic > 100 VPD < 400 VPD	6.00 6.75	4.50 5.25	Excludes width of drain, parapet & retaining wall top
4.	Right of Way (m)	20.00	20.00	10 m RoW on either side from the road centreline
5.	Corridor of impact or COI (see notes below)	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.	Design Speed (km/h) Ruling Minimum	50 40	25 20	
7.	Stopping Sight Distance (m)	45.00	20.00	
8.	Lateral Clearance (m) Normal Minimum	1.50 1.00	1.00 0.50	
9.	Vertical Clearance (m)	5.00	5.00	
10.	Radius of Horizontal Curves (m) Ruling Minimum	>=90.00 60.00	>=20.00 12.50	Exceptional case: 10 m
11.	Hairpin bends			
	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.	Gradient (%)			
	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	

Road Geometrics Design Standards				
Sr. No	Road components	Design Standards		Remarks
		Terai	Hills	
13	Extra Widening (m)			
	For curve radius <= 20	1.50	1.50	
	For curve radius 20-60	0.60	0.60	
	For curves radius > 60	Nil	Nil	
14.	Camber minimum (%)			
	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.	Passing Zone/ Bus lay Bys	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.	Traffic Signs and Road Safety	As detailed in the NRRS 2013		
17.	Carriageway Width (cross-drainage structures)			
	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
18.	Road side Drains	<p>Hill road: tick drain with masonry (1:4) back wall and 10 cm thick M-15 grade concrete sloped bed throughout the road length as required</p> <p>Built up areas: Type G drain specified in DoLIDAR Technical Guideline with adequate cover slabs for crossings</p>		

Annex C2: Typical Cross Section of a Provincial and Local Road in the Terai





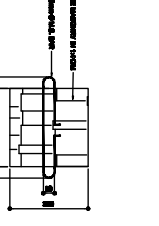
Annex C3: Typical Cross Section of a Provincial/Local Road in Hilly Areas



Upper (pink) dimensions = Proposed Design
 Lower (green) dimensions = Existing road

Annex C4: Low Cost Fencing Design

<p>Government of Nepal Ministry of Federal Affairs and Local Development Department of Local Infrastructure Development and Agriculture Works (DLDW)</p>	<p>Name of Project:</p>	<p>MANDELA DRAWN BY : CHECKED BY :</p>	<p>SCALE 1:50</p>	<p>BARBED WIRE FENCING DETAILS</p>	<p>DATE: March 2016 DWG NO: SHEET NO:</p>
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<p>Government of Nepal Ministry of Federal Affairs and Local Development Department of Land Management, Development and Agriculture Works (DLMW)</p>	<p>Name of Project:</p>	<p>DEPARTMENTAL DIVISION NO. : DRAWING NO. :</p>	<p>SCALE 1:30</p>	<p>DATE: March 2016 DRAWING NO. : SHEET NO. :</p>
<p style="text-align: center;">BARBED WIRE FENCING DETAILS</p>				
 <p style="text-align: center;">BARBED WIRE FENCING DETAIL TYPE-II</p>				
 <p style="text-align: center;">SECTION A-A</p>				
 <p style="text-align: center;">FENCING DETAIL TYPE-A SCALE 1:30</p>				

Annex C5: Example of Cost (NPR) 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	Materials	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

Note: cost is in NPR.

Actual cost (GBP)

DESCRIPTION	Site-1	Site-2
Estimated Cost of fencing	£190	0
Per-m estimated cost	£1.90	0
Actual cost for bamboo fencing	£2,141 (1,000 m)	£207 (350 m)
Basic rate of fencing per meter length	£2.14	£6.0

1£= 145 NPR

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	B	H	QUANTT	Unit	Rate	Amount	Labour Amount	Material & Equipment Amount	Overhead 15%	norms no.
N			(m)	(m)	(m)			Rs	Rs				
1	Site Clearance								500.00	391.30	43.48	65.22	LS
2	E/W in excavation	21	0.35	0.35	0.60	1.54	m ³	290.20	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 ³	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 ³	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 ³	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							
						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	B	H	QUANTT	Unit	Rate	Amount	Labour Amount	Material & Equipment Amount	Overhead 15%	norms no.
N			(m)	(m)	(m)			Rs	Rs				
1	Site Clearance								500.00	391.30	43.48	65.22	LS
2	Excavation work	21	0.35	0.35	0.60	1.54	m ³	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 ³	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 ³	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 ³	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			6.47							
	long bars	84	2.00	@.22 kg/m		36.96							
	stirrups	189	0.40			16.63							
						60.06	kg	113.69	6828.22	648.65	5288.88	890.63	7.5
7	Formwork for RCC works in poles	21	0.40		2.00	7.92	m ²	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							
						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	B	H	QUANTT	Unit	Rate	Amount	Labour Amount	Material & Equipment Amount	Overhead 15%	norms no.
N			(m)	(m)	(m)			Rs	Rs				
1	Site Clearance								500.00	391.30	43.48	65.22	LS
2	E/W in excavation	35	0.25	0.25	0.50	1.09	m ³	290.20	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 ³	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 ³	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 ³	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							
						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	

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
Trees, shrubs							
Ainselu	<i>Rubus ellipticus</i>	1'000-2'500	varied	1-3	berry	seeds, root cutting	
Alainchi	<i>Elettaria cordonomum</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 cutting	ornamental use

Nepali name	Scientific name	Altitude (m asl)	Site conditions	Growth height (m)	Productive use	Propagation	Comments
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
Grasses, herbs, legumes							
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		

Nepali name	Scientific name	Altitude (m asl)	Site conditions	Growth height (m)	Productive use	Propagation	Comments
Kagati ghans	<i>Cymbopogon citratus</i>	Terai-1'500	stony, poor, rather dry	1	medicinal, cosmetics	slip cutting, seed	Increasing demand
Phurke	<i>Arundinella nepalensis</i>	700-2'000	stony, poor, rather dry	1	thatch, fodder	seed, slip cutting	
Bamboo species							
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 the RoWs in the Terai and in the Hills

Local Name	Latin	English	Suitable for Road Side Cultivation	Parts used	Known species	Available	Skills developed	Processing in place	Market chain
Dhankuta									
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 Survey and Analysis and Plant Selection for RoW Utilisation

1. Socio-Economic Analysis of the Area

- Obtain information about the settlements nearby the road in the village/municipality, and on both sides of the road.
- 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 programme, giving priority to poor and landless households.
- Hold discussions with the Municipality in order to identify the 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 the skill sets required for implementing the project which are already available, and identify those fields in which further training is required.

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 environment road stabilisation,
- availability of plant materials such as 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. Undertake an Economic/Financial Analysis of the Plants

- A. Estimate costs for the following items:
- fixed inputs if any,
 - seedlings, planting materials,
 - labour costs - for activities like land preparation, plantation, weeding, irrigation, fertilizer application, harvesting,
 - fertilizer (compost, farmyard manure, micronutrients for particularly sandy or degraded areas etc.),
 - insecticides and pesticides,
 - transportation costs,
 - processing costs,
 - costs in the first year and costs in subsequent years.

B. Estimate return

Estimate the return on the basis of the following:

- Estimated quantity of product, output,
- 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.

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 (at present prices) exceed the anticipated costs (at present prices). 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 evaluate 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. A 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. The IRR is also defined as the interest rate received for an investment consisting of payments and income that occur at regular periods.

If there is only one period investment, the IRR represents the expected return from the initial investment after 5 years if a return comes over each of the 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 a SWOT Analysis and a 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
TID/IDO, Office of the Municipal Executive, RM/M
and
..... RoW users group/committee/sub-committee

This Tripartite Memorandum of Understanding (MoU) sets out the following terms and understanding between the TID/IDO, RM/M, and the RoW user groups/committee.

Background

The utilisation of RoW in(name of road) is very important for the maintenance of this road and the mobilisation of nearby roadside households, especially for the poverty alleviation of poor families and landless people through the utilisation of RoW. Therefore, based on the legal provision of PRA 1974 and LGOA 2017, this MoU has made between TID/IDO,Municipality/RM andusers group/committee/sub-committee.

Purpose

This MoU has been prepared to maintain a long-term partnership between the local government and the local communities to achieve the poverty reduction through utilisation of the RoW by local communities.

The above purpose 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. Capacity building:
3. Maintenance of road and fencing:
4. Plantation:
5. Income generation activities:

Funding

The local governments will provide some non-research funding resources to implement the pilot projects in this road for the utilisation of the RoW by local communities. (The local levels of government are not compelled to provide financial support to local communities without other specific agreements between the local bodies and the concerned local communities; however, this MoU is a window of opportunity for the local community to request funding support).

Other Source of Support

It is agreed by the signatories that the RoW user group/sub-committee may also explore other sources of funding and necessary support from different government agencies, local governments, NGOs and the private sector for the implementation of the approved RoW utilisation programme. The RoW user group/sub-committee will inform the signatories of this MoU about any contracts or agreements, and any other sources of funding in verbal or documented progress reports.

Duration

This MoU will and may be modified by mutual understanding between the contracting parties and consent of authorised officials from(TID/IDO/Municipality). This MoU shall become effective upon signature by the authorised officials/representatives from all 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 governments 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 staff of local governments and other relevant local organisations. The local communities will prepare and provide progress reports on the basis of the requirements of any specific agreement between local governments and local communities.

Contact Information

Name of local government:	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 government:

Name of authorities:

Position:

Address:

Telephone:

Fax:

E-mail:

(Partner signature)

Date:

Annex H: Sample Format of a MoA Between the Local Government and RoW Users Groups

Memorandum of Agreement

Office of..... (Local Government/Province government agencies/NGOs)

1. Parties and Representative to Agreement and Project

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

1. Name
2. Designation
3. Address

(b) Particulars of the User Group (and committee or sub-committee, if relevant):

1. Name
2. Designation
3. Address

(c) Particulars of the project:

1. Name
2. Address
3. Objectives
4. Envisaged activities
5. Project approving body
6. Beneficiaries (Households) involved in the programme
7. Date of beginning of the project
8. 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:

- | | |
|----------------------------------------------------|----------|
| • from Government of Nepal | Rs..... |
| • from Province Government | Rs. |
| • from the concerned local government | Rs..... |
| • from non-governmental organisations | Rs..... |
| • from community-based organisations (CFUGs, etc.) | Rs..... |
| • from the user group/sub-committee | Rs..... |
| • from others | Rs..... |

Total **Rs.....**

(c) Particulars of construction or any other materials.

	Name of material	Quantity	Unit
a) From provincial government sector			

- b) From concerned local government
- c) From non-governmental organisations
- d) From community-based organisations
- e) From users groups/committee
- f) From others including the private sector

(d) Beneficiaries of the Project

- a) Number of households (families)
- b) Total population
- c) Community
- d) Others: poor households.

3. Particulars Relating to the User Group (and committee or sub-committee, if relevant)

- a) Chairperson
- b) Vice-chairperson
- c) Secretary
- d) Treasurer
- e) Member
- f) Member
- g) Member
- h) Member
- i) Member

4. Experience of User Group in Operation of Projects

5. Details of the instalments to be received by the User Group

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

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

- a) Name of the User Group responsible for the maintenance of the project:
- b) Contribution from households Rs....
- c) Contribution from household fees, donations Rs....
- d) Contribution from grants Rs....
- e) Contribution from interest or other savings Rs....

7. Other Technical and Management Details

- (a)
- (b)
- (c)

8. Terms of Agreement:

- a) The funds, the materials and any other goods received under this agreement shall be used only for the RoW project and the purpose for which those materials have been received.
- b) A record of all receipts of both cash and materials from all sources will be properly and regularly maintained, together with a record of all expenditure and a summary current balance.
- c) A record of the details of project progress will also be regularly maintained; this should also record the number of individuals and person days involved in project implementation on any specified date.
- d) The physical particulars and expenditure statements of the project shall be sent to the local government.
- e) Fund instalments shall be requested by the User Group after reporting all the particulars of income against expenditure, together with work progress reports.
- f) In cases where a project has been completed at less cost than the total estimated cost of the project, it is agreed that the primary stakeholders including the funding agency will meet to discuss the further use of the remaining funds.
- g) The User Group launching the project will make arrangement for regular maintenance of the project site.
- h) All the works of the project shall be undertaken as per the decision of the User Group.
- i) Project shall begin from and be completed by.....
- j) Other terms
 - a)
 - b)
 - c)
- k) Upon completion of the project, approval and clearance shall be taken from the local government.

All aspects of the above Memorandum of Agreement are agreed by all the signatories below.

On behalf of the Local Body/Government:

On behalf of the User Group:

Name:

Chairperson:

Designation:

Name:

Signature:

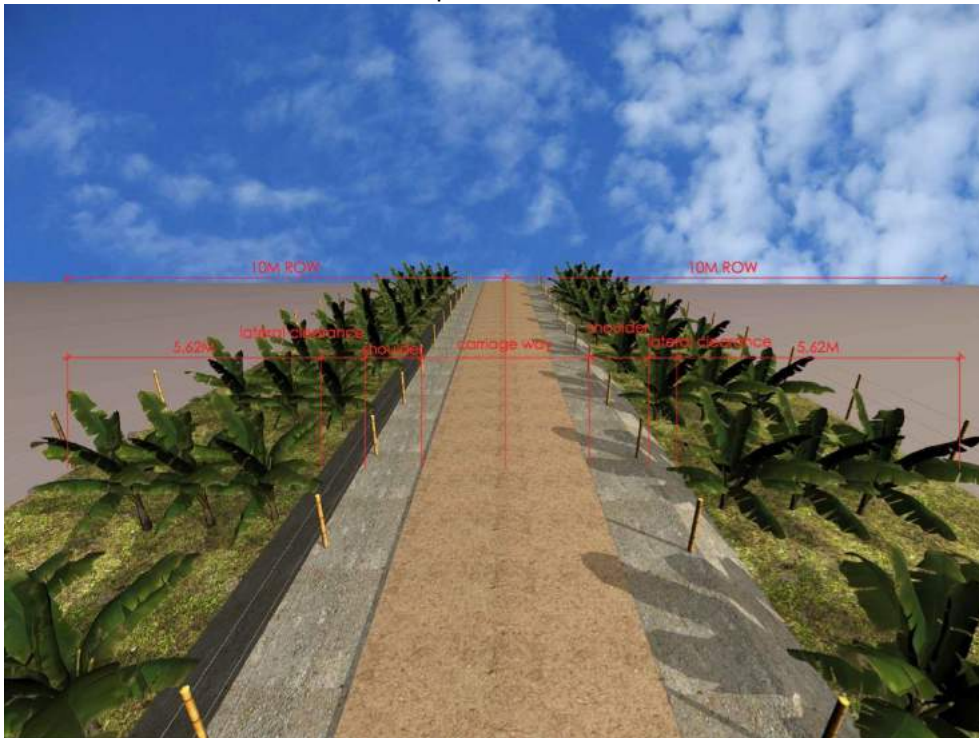
Signature:

Date:

Date:

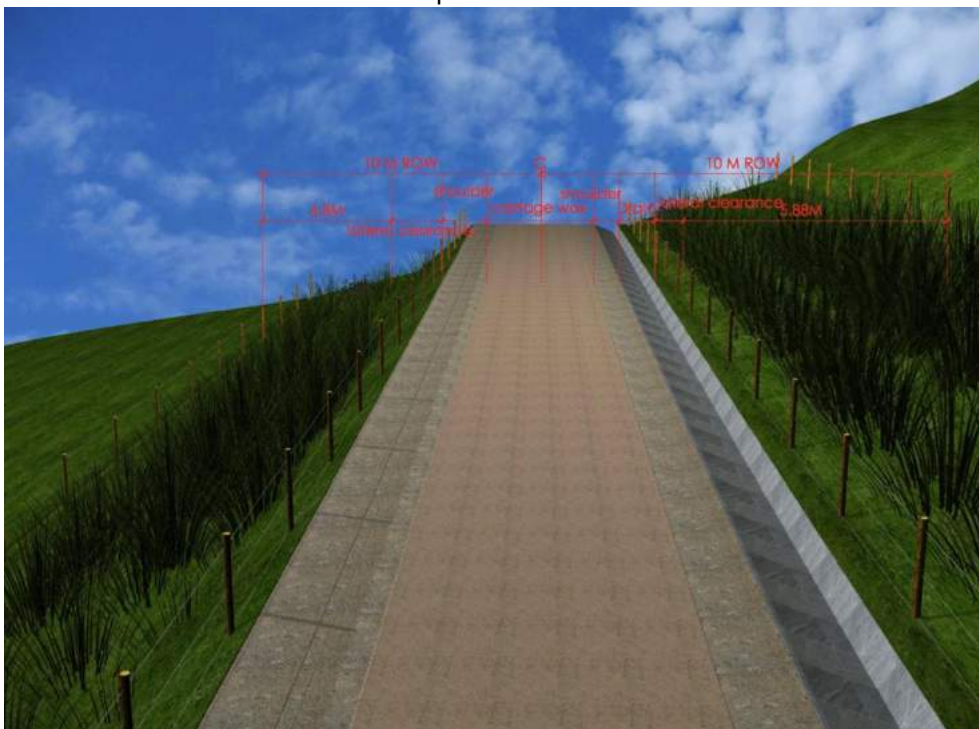
Annex I: Visualisation of Road Sections After Project Implementation

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 a Business Plan for RoW Plantations

A simple business plan is presented in the report of a 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 study is 2.86 ha in Dhankuta. Broom grass (amriso) was selected for planting at Dhankuta.

Table 1 below shows the business analysis of the amriso in Dhankuta.

Table 2 shows the production plan with different activities and related costs for the plantation of the amriso in the road section.

3 scenarios are presented:

Scenario 1 includes only the cost for the cultivation of amriso.

Scenario 2 includes the cost of fencing using bamboo poles for fencing.

Scenario 3 includes labour costs required for the establishment of fencing.

Table 3 shows the return from the RoW amriso plantation on the selected road section.

It is assumed that the amriso need to be replaced in the 6th year to ensure continued good returns.

A brief analysis of the results is shown after the tables.

Table 1: Business Analysis

S.No	Items	Dhankuta
1	Type of the product selected	amriso (1.275 ha)
2	Targeted market (for detail see the value chain analysis)	Local collector, middleman, Hile traders, Birtamod wholesalers, Itahari wholesalers, Indian importers
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.

Table 2: Production Plan

Items	Dhankuta		
Area	1.275 ha		
Plants	Broom grass (amriso)		
Costs	Scenario 1	Scenario 2	Scenario 3
Cost for fixed inputs (in NRs)	no inputs required	1'369'010	54'5244
Fertilizer	13'000	13'000	13'000
Land prepar. and pit digging	20'000	20'000	20'000
Seedling	12'752	12'752	12'752
Insecticides and Pesticides	0	0	0
Irrigation	0	0	0
Rental cost for tractor	0	0	0
Other labour cost	39,963	39'963	39'963

Items	Dhankuta		
Support material	0	0	0
Transportation	0	0	0
Total cost in Year 1	85'715	1'454'725	630'959
Additional cost in Year 2	39'888	39'888	39'888
Additional Cost in Year 3	39'888	39'888	39'888
Additional cost in Year 4	39'888	39'888	39'888
Additional cost in Year 5	39'888	39'888	39'888
Total cost	245'267	1'614'277	790'511

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

Table 3: Return from the plantation

Item	Amriso (Amount in NRs)
Price	NRs 35/broom
1	57'384
2	191'280
3	717'300
4	573'840
5	573'840
Total	2'113'644
NPV in Scenario 1	1'304'551
NPV in Scenario 2	-55'368
NPV in Scenario 3	698'543
IRR scenario 1	746%
IRR scenario 2	9%
IRR scenario 3	40%
B/C scenario 1	8
B/C scenario 2	0.96
B/C scenario 3	2.05

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

ANALYSIS

Analysis of the above data indicates that the plantation of amriso in Dhankuta is profitable and suitable for poverty reduction of the poorest of the poor in the selected area. However, if barbed fencing applied the plantation of amriso in Dhankuta would not be viable. So low cost fence using local materials for only in critical areas is recommended.

Annex K: Sample format for monitoring and evaluation

Name of Municipality:

Name of road section:

Name of Users Group:

Location of site/s:

Programme Start date:

Expected date for completion:

Key person/s name and contact No.

- 1.
- 2.
- 3.

Purpose of this programme:

1. **Expected results/outputs from this programme**
 2. **General findings**
 3. **Expected findings to the period of project end**
 4. **Opportunities for scaling up or its replication in other areas**
 5. **Problems and Issues**
 6. **Possible solution/mitigation measures of problems and issues**
 7. **Suggestion and recommendations**
-

Monitoring team members

- 1.
- 2.
- 3.
- 4.