Chapter 2
Rural Roads: Concepts and Policies

2.1 Introduction

This chapter describes and reviews the policy environment for rural roads in Nepal. It covers aspects such as definition of rural roads, rural road policy, and institutional mechanisms at national, district, and project levels. It also reviews past efforts at rural road development. It is based on secondary information from sources such as annual and Five Year Plan documents, policy papers, research reports, and published and unpublished project documents of donor agencies such as the Asian Development Bank (ADB), German Technical Cooperation (GTZ), and the World Bank. Particular use has been made of literature from the Priority Investment Plan Project Report (Vol. III), Agricultural Perspective Plan, Rural Infrastructure Development Project Report, Dhading District Development Project Report, and the Pilot Labour-based District Roads Rehabilitation and Maintenance Programme (PLRP) Report.

2.2 The Concept of Rural Roads

Although the road network has been expanding over the years with the assistance of several donors, it has been confined to the main strategic roads and bridges connecting, at best, the district headquarters. The transportation network among villages and between villages and the market centres and district headquarters has remained poor.

In almost all areas in the hill and mountain regions, porters or mule caravans transport goods. According to the freight cost per tonne\km estimate made in the Priority Investment Plan (PIP) Project Report (1996), it was about the same by helicopter, porter, or by mule caravan. Therefore, the transportation cost could decrease drastically if the goods were transported in bulk by trucks. Moreover, village-based development institutions, such as schools, health clinics, and family planning centres, are often just buildings without adequate staff. The provision of improved access is an essential precondition to suitable staff moving into the remote and isolated rural areas.

Conventionally, rural roads are defined as relatively low-cost, low traffic volume, and fair-weather roads, mostly traversing agricultural areas and essentially linking villages or clusters of villages and isolated communities amongst themselves or with an arterial road network (ESCAP 1980). The Department of Roads has classified rural roads as district and village roads. The district roads are defined as those roads within the district which serve primarily to provide access to abutting land with little or no through movement. These roads give access to one or more villages to the nearest market or higher classes of roads. Village roads include short, non-through roads linking single villages directly to district roads (DOR 1994).

In order to make the definition of district and village roads more precise and functional, the PLRP Report on the District Transport Master Plan (DRSW 1996) has proposed classifying district and village roads as given in Boxes 1 and 2 below.

Box 1: Definition of District Roads/Tracks

1. Primary District Roads :	Arterial roads linking two district headquarters or the main trading centres to higher classes of roads with through movement but other than those defined as Feeder Roads by the DOR
2. Secondary District Roads :	Rural roads linking more than one Village Development Committee, connecting services, commercial and market centres, and providing access to abutting land to higher level roads
3. Main Trails including Tracks :	Trails and tracks for the movement of people to enable them to obtain essential goods and services where, because of their arterial characteristics, the travelling distance varies from about one day to several days

Box 2: Village Roads

1. Village Access Roads (VAR):	VAR connect mainly with district roads (including National Highways and Feeder Roads) to a village and they also include firm roads, roads leading to river and *ghat* etc — normally non-through in character.
2. Village Trails (VT):	Non-motorable trails for communication within the village

The above definitions do not include motorable bridges, suspension bridges, and wooden bridges, and these also play a vital role in road accessibility. Given the difficult terrain of the hill and mountain areas of Nepal, there are severe limitations on construction of motorable roads to connect every settlement. Therefore, the definition of rural roads should include tracks, mule trails, and suspension (or wooden) bridges, which connect motorable roads and then feeder roads and highways.

2.3 Design Standard of Rural Roads

The district engineers generally follow the design standard of feeder roads while designing rural road projects as per the definition given in the Classification and Design Standards for Feeder Roads (1994) of the DOR. In order to construct roads in an economic manner, phase-wise construction of roads into five development stages is suggested for implementation (Box 3).

Box 3: The Stages in Road Development

Stage I:	Detailed Design and Project Formulation Stage: planning, engineering design, costing for the construction or upgrading the project
Stage II:	Fair Weather Earth Track: construction of a basic level of dry season vehicular access track
Stage III:	Fair Weather Gravel Track: improve the dry season access track to gravel standards
Stage IV:	All Weather Gravel Track: improve the road to all-weather access of gravel standards with the provision of structures to ensure only minimum restrictions to traffic at stream crossings
Stage V:	All Weather Bitumen Road: improve the road to all — weather access of bitumen standard with the provision of structures to ensure only minimum restrictions for traffic at stream crossings

Feeder roads are further divided into two categories: Category I—Truck Standard (general standard) which is applicable for traffic levels above 50 AADT (Average Annual Daily Traffic) — and Category II—Tractor\Trailer standard (minimum standard) which is applicable for less than 50 AADT. In Category I feeder roads, the following factors are given consideration, among others.

- Feeder roads provide a basic means of vehicular access with low traffic levels (up to a few hundred vehicles per day). Therefore, apart from possibly road width and gradient, geometric standards have much less importance than the performance of the road.
- The concept of selecting geometric standards to suit a predetermined design speed is to be avoided. The geometric standards should be chosen on the basis of safety and minimum construction and maintenance costs.
- Earthworks are costly and should be kept to a minimum in the hills and *Terai*. The use of labour based operations has important advantages in this respect in that excavation and filling can be carried out more selectively to much closer tolerances and with less disturbance than by machine.
- Adequate provision should be made for drainage in construction in Stage II. The improvements needed in successive stages will mostly concern cross drainage such as the replacement of fords by culverted drifts and, eventually, the addition of bridges.

The Category II standard applies to those roads that would be considered for construction under a pilot scheme. The purpose of such roads is to serve primarily the tractor\trailer mode of transport, which includes mini-buses, light trucks, and tractor\trailers. In framing the minimum design standards, careful attention should be given to ensuring minimum impact on the surrounding environment. It demands a careful balance of cut-and-fill earth work operations. The design standards for both categories of feeder roads are summarised in Table 2.1.

2.4 Public Policy on Rural Roads

2.4.1 *The Eighth Five Year Plan (1992-97)*

Table 2.1: Design Standards for Stage II Feeder Roads: Fair Weather Earth Tracks

Design Standards	Category I	Category II
Right of way (m)	30	30
Formation width (m)	4.5	4.0
Carriageway width (m)	4.5	3.5
Shoulder width (m)	-	-
Camber (%)	5	5
Minimum horizontal curve radius (m)	12.5	12.5
Minimum vertical curve radius (m)	150	100
Maximum gradient (%)	12*	15
Limitation of the maximum gradient length (m)	300	200
Minimum culvert size (mm diameter)	600	600
Pavement surfacing	Earth	Earth
Stream crossings	Ford	Ford

Source: DOR 1994

* Sections exceeding 7% must be paved with either clay-bound macadam or gravel.

The Eighth Five Year Plan accorded high priority to the development of lead infrastructure, such as rural roads, because other physical infrastructures, such as communications and electricity, also depend upon it. The development of transport was and is considered to have a direct influence on the development of both productive and social sectors. Moreover, the creation of employment opportunities through rural infrastructure was given serious consideration in order to provide work for the growing labour force in rural areas. Furthermore, rural roads can generate employment through the expansion of markets for industrial products in rural areas and can also provide access to surplus agricultural produce from rural areas by providing roads and other forms of transportation to link village communities and market centres. On the basis of these facts, the following policies regarding rural roads were adopted in the Plan.

1. The main goal of this Plan was to develop a national transportation system with a view to making the various means of transport, such as roads, bridges, main trails, ropeways, waterways, and airways, complementary, thereby interlinking various areas of the country in efforts to facilitate economic development. The aim was to formulate a National Transport Master Plan within the plan period. This Plan would identify the appropriate model for helping the structural development of a national transportation system in the coming years. The Master Plan would cover a 20-year span for planned development of a road network.
2. Special emphasis was given to the construction of link roads joining farms to market places or linking the agricultural production centres and the local market centres in the districts. Priorities were given to those projects in which a greater degree of participation could be ensured. District Development Committees (DDCs) would be involved in the selection, formulation, and operation of these projects.
3. At the beginning of the Eighth Plan period, only 52 district headquarters in the kingdom were connected by the road network. Therefore, road connections to the hitherto unconnected districts were scheduled within the Plan period in a phased manner.
4. Priority was given to the construction of mule tracks in the Himalayan region, service tracks in the hilly regions, and cart tracks in the *Terai* region, in order to provide a minimum level of road access.

2.4.2 *Rural Road Programme*

In 1993, the Ministry of Local Development (MLD) introduced a programme called the Rural Road Programme, in which the District Development Committees (DDCs) are provided with a block grant for taking up district and village road projects. The outlay for this programme has been about Rs 180 million per year, ranging from Rs one to Rs 4.5 million per district. The MLD prepared a manual in 1993, which laid down the following principles of planned development for rural roads.

Project Planning

- A rural road project should normally be for less than 10km of road.
- In view of the limited availability of technical manpower and construction equipment and tools at the district level, not more than six projects should be selected per year.
- Only projects that can be implemented within a year should be selected.
- The planning of rural roads should follow the District Road Network Plan (as soon as it is completed by the Department of Roads [DOR]).
- A rural road project should support the rural development process by linking rural areas with good roads or market centres.
- Priority should be given to projects having the least negative environmental impacts and which can be maintained through toll tax collection and mobilisation of local resources.
- In district road projects, the Users' Committee should ensure provision on a free of cost basis of 10 metres of land (on both sides) from the centre of the road as Right of Way. The DDC should make necessary arrangements for transferring ownership.
- In districts inaccessible motor transport, the money should be used in the construction of suspension bridges. For improvement of mule trails and tracks, prior approval of the MLD must be secured.

Users' Committee

- The Users' Committee should be elected from among the people of the VDC(s) connected by the road and labourers from the village used for road construction.
- No elected officials shall be ex-officio chairpersons or members of a Users' Committee. However, the beneficiaries can elect such an official, if he\she is also among the project beneficiaries.
- The DDC should be represented at the meeting of project beneficiaries in which the Users' Committee is elected.

Implementation

- Rural road projects should be implemented through the Users' Committee.
- A Monitoring and Supervision Committee should be constituted to supervise, monitor, and evaluate rural road projects. The members of the Committee should be as follow.

DDC Chairman	Chairman
Member of Parliament of the area	Member
DDC *Ilaka* Member	Member
Local Development Officer (LDO)	Member Secretary

- The functions of the Monitoring and Supervision Committee are to help the Users' Committee implement the project, monitor progress, provide technical backstopping, and, in the case of any problems in functioning bring it to the notice of the DDC.
- Rural road projects should be based on labour-intensive technology. Labourers should be employed from the VDC to which the connecting road is being built. Twenty-five per cent of the wages should be deducted at as a source free labour contribution.
- For special cases, the Department of Roads may provide heavy equipment, such as bulldozers and compressors on the request of the DDC. The DDC may use up to five per cent of the budget for use of the heavy equipment to be used for maintenance of the equipment.
- If the allocated budget remains unspent, the amount, along with the service charge, should be used for road maintenance.
- The DDC should plant trees on both sides of the road.
- The expenditure of the Users' Committee must be audited according to government rules.

Road Completion

- The Road Completion Certificate Committee should certify a road project within three months of its completion.

2.5 Institutional Set-up

The Ministry of Transport and Construction (MOTC) is responsible for all types of transport services. For construction and management of motorable roads, there are two departments under the MOTC: the Department of Roads (DOR) and the Department of Transport Management (DOTM). The DOR is responsible for designing, implementing, and maintaining strategic and feeder road networks and for developing standard norms for road construction in Nepal. The DOTM is responsible for operational arrangements such as fixing transport fares\rates for different types of vehicles and roads and certifying road completion for plying vehicles etc. The DOTM has 12 local offices that are mandated to cover all districts with road access. At the district level, there is a District Transport Management Committee headed by the Chief District Officer (CDO) with the Chief of Police, representative of transport workers, and the chief of the Transport Management Office as members. For a newly built road, the committee examines the completion and recommends the DOTM for certifying road completion. Vehicles are allowed to ply on a newly built road only after certifying road completion from the DOTM, otherwise the risk of a vehicle is not covered, e.g, in insurance policies.

Prior to 1993, district roads had also been the responsibility of the DOR. In many districts, the DOR manned the District Road Offices. The construction works used to be carried out through contractors who work as per the DOR norms. At the same time, local self-governing bodies such as District Development Committees (DDC) and Village Development Committee (VDC) also constructed rural roads. Such roads were constructed through users' committees by mobilising voluntary labour. Therefore, there were two operational norms for constructing rural motorable roads: the DOR constructed through local contractors, while the DDC\VDC constructed through the users' committee. The maintenance arrangements after

road completion were not clear as it was expensive for the DOR to continue maintaining such small projects, while local bodies refused to take them over, because they were not constructed by them.

Therefore, from 1993 onwards, the responsibility for rural motorable roads was also transferred from the DOR to the Ministry of Local Development (MLD), as the latter was already responsible for all types of rural infrastructures such as mule trails, tracks, suspension bridges, small irrigation projects, village drinking water supplies, school buildings, and so on. All local-level projects, including rural roads, are then selected, implemented, and maintained by the District Development Committees (DDCs) and Village Development Committees (VDCs) at the local level, which are under the umbrella of MLD. In order to provide managerial support to the DDC, there is a DDC Secretariat headed by a senior executive officer, called a Local Development Officer (LDO), who is appointed by the MLD. At the VDC level, there are Village Secretaries, under the administrative jurisdiction of the LDO.

The organizational processes of these local self-governing bodies at the village and district levels are briefly summarised here. At the village level, there is a Village Development Committee (VDC) to which nine members are elected from among the adult voters of nine wards, and the chairperson and vice-chairperson are elected from all adult voters of the VDC. At the district level, there is a District Development Committee, in which nine to 13 members and chairperson and vice-chairperson are elected indirectly by the electoral roll of the VDC officials. A district is divided into nine to 13 areas called *Ilaka* and one DDC member is elected from the electoral roll of the *Ilaka* (VDC chairperson + vice-chairperson + members x number of VDCs in an *Ilaka*), whereas the chairperson and vice-chairperson are elected from the electoral college of the entire district.

In 1996, a decentralisation policy has been adopted by the government that proposes to modify the organizational structure of the local self-governing bodies and widen their mandate for local development. Accordingly, the government was drafting a bill that was subsequently approved by Parliament.

At the central level, the MLD provides policy guidelines, financial allocation in the form of block grants, and technical support to DDCs and VDCs. After the transfer of responsibility for construction and maintenance of rural roads from the MOTC to the MLD, the technical capability of the MLD was strengthened. The MLD recruited 84 engineers and posted one engineer in each district to supervise all infrastructure projects, including rural roads, undertaken by the DDC. At the five regional headquarters, the MLD has Regional Directorates to provide managerial and technical support to the DDCs within the region. The Ministry has also established a Technical Division at the Ministry level, headed by one Superintending Engineer and assisted by seven Divisional Engineers and seven assistant engineers.

From 1995, the government has been providing a block grant to all VDCs annually, a large component of which is spent in developing rural transport network. But, there was no technical staff at VDC level until 1996 when the MLD recruited about 4,000 low-level technical personnel, called Technical Assistants, one for each VDC. The recruitment process and the quality of the manpower have been subjects of contention between the local authorities and the Ministry. It was alleged that the recruitment process was politically motivated and that the

qualifications of recruited personnel are not commensurate with the qualifications needed for the job.

2.6 Rural Road Development in the Past

Because of the difficult mountain terrain, the majority of the population is scattered throughout remote and isolated villages all over the country. To break this isolation and link them with the mainstream development process, the government has been giving high priority to the development of rural infrastructure. In this noble endeavour, the international community has also provided constructive support in need identification and development of rural infrastructure projects through government and non-government organizations. The principal donor agencies involved in this sector are the World Bank (IBRD\IDA), the Asian Development Bank (ADB), the UK's Overseas' Development Administration (ODA), Germany's GTA, the Swiss Development Corporation (SDC), and the European Commission. In the development and upgrading of the trail and suspension bridges in the hills and mountains, the Swiss agency Helvetas has had a long involvement with the government through the Ministry of Local Government (MLD). With this background, some of the work carried out in need identification, technology experimentation, and programme development, either by the government or through the support of donor agencies, have been summarised in this section.

2.6.1 District Road Network Studies

The Department of Roads (DOR) carried out two major studies during 1992 and 1993 for identification and development of a rural road network in eastern and western parts of Nepal. The study for the eastern sector covered 33 districts (excluding Rasuwa and Dhading districts) of the Eastern and Central Development Regions, whereas the western sector covered 40 districts of the Western, Mid-Western, and Far Western Development Regions. The overall objectives were to identify road access to district headquarters, feeder roads, and farm to market roads, with priority being given to those districts without motorable road access.

Eastern Nepal: The analysis of the eastern sector study was based on the development of various computer-based models using a number of socioeconomic and demographic variables to assess overall development potentials. In addition to the socioeconomic and demographic parametres, the database of the study included information of agricultural parametres together with data on road construction, maintenance, and user and environmental costs. The socioeconomic database included population, agricultural land, manufacturing output, marketing network, and service facilities. The analysis was carried out, as far as possible, at the VDC level with the aid of GIS-based digitised maps.

Computer-aided models were used to rank the VDCs in order to determine the proposed road network. A gravity force model that was modified for application to the specific socioeconomic context of Nepal provided the basis for the modelling work. Ranking of VDCs was achieved by estimating their overall development potential in terms of certain key variables. These variables covered households, health facilities and schools, cottage industry development, cultivated land, and fertilizer usage. The ranking system was based on the

total scores of each VDC as a function of the individual weighted scores of each of the socioeconomic variables.

Taking into account topographical constraints, the gravity model approach then used the total score values of the VDCs to determine, on the contour basis, the degree of interaction between these key socioeconomic and demographic variables and so generated the road network for each district. The gravity force principle provided the conceptual basis on which VDC to VDC attractiveness was calculated in order to determine proposed road alignments within a district. Regression analysis was also carried out in this study in order to assess the causal relationships between road density and the various socioeconomic factors, thereby giving an indication of likely potential demand for roads in relation to the output of the gravity model. For eastern Nepal, the study proposed an additional 5,536km of roads on to the existing network of 6,091km, that is an increase of 91 per cent. Of this addition, 1,536km account for the construction of new roads into presently inaccessible districts.

Western Nepal: The development of the road network in western Nepal was appraised through examining the demand generating factors for roads, at the same time taking into account the need for any network proposed to be economically viable. The analysis was based on a review of road density and connectivity in terms of land area and population and by analysing a number of key socioeconomic variables such as agricultural land area, production potentials, population distribution, and nodal points. Nodal points were identified as important centres of market\commercial activities, representing integral parts of the network where key junctions exist. Road connectivity measured the relative positions of settlements and markets in terms of trade interaction and traffic flow. For specified geographical areas, these measures examined the spatial nature of the existing road network as well as the relationship between the number of road links and the number of nodal points.

The database of the study included information on population, GDP and income, agricultural land, service facilities, road lengths, vehicle operating costs, and road construction costs. Together with these data, other criteria were determined with reference to road densities, the functional type and magnitude of market centres (in terms of provision of services and shops), and connectivity and linkage patterns of market centres to one another. The proposed road network in western Nepal called for an additional 8,651km over and above the existing level of 3,154km, that is an increase of 274 per cent. Of this addition, 2,159km account for the construction of new roads into presently inaccessible mountain regions.

For the country as a whole (excluding Rasuwa and Dhading districts), based on these two road network planning studies, the optimum proposed road network, which would connect all districts and meet the projected demand for roads, would entail the construction of over 14,000km of new roads, representing an increase of over 150 per cent above the current total of 9,200km (all roads including the strategic network). This is summarised in Table 2.2 below.

However, these studies were carried out at the national level and were not very clear on the implementation and operational aspects of rural roads at the local level. They seem to have taken for granted that the objectives can be achieved by strengthening the organizational structure of the DOR. Although it has been recognised that both these District Road Studies

Table 2.2: Proposed Road Network for Eastern and Western Nepal (km)

Region	Ecological belt	Existing (1991)	Proposed	Total
East Nepal	*Terai*	3946	1448	5394
	Hills	1871	3073	4944
	Mountains	274	1015	1289
West Nepal	*Terai*	1721	800	2521
	Hills	1433	5692	7125
	Mountains	-	2159	2159
All Nepal	*Terai*	5667	2248	7915
	Hills	3304	8765	12069
	Mountains	274	3174	3448
Total	All belts	9245	14187	23432

Source: PIP Project Report, Vol.III

have their shortcomings, in terms of methodology and accuracy of the data, they nevertheless represent a very comprehensive review of the possibilities and potential for the development of the rural road network throughout the country.

2.6.2 Agricultural Perspective Plan (APP)

The APP was prepared in 1995 with the financial and technical support of the Asian Development Bank (ADB) in order to provide a framework for a period of 20 years for stimulating the agricultural sector on to a sustainable high growth path. Under the APP, the basic stimulus for rising income and rural business was considered through the increase of agricultural productivity. One of the priority inputs identified as a key element towards achieving rural development and transforming the agricultural sector from a subsistence base into a commercial base was road building. At the same time, great emphasis was placed on the need for institutional strengthening to provide the necessary support for implementing and maintaining the proposed agricultural road network.

Particular emphasis was placed on the need for roads in the *Terai* to facilitate drilling and maintenance of shallow tube-wells (for improved water control) and in the hills to facilitate marketing and agribusiness activities associated with high-value agricultural commodities. For the *Terai*, road needs were calculated by taking into account the time needed to reach the market and return on the same day. On the basis of an influence area of up to four km either side of a rural road, a hypothetical network was developed which inferred a density of 22km per 100 square kilometres. In the case of hill and mountain districts, the Plan proposed that the missing linkages to the district headquarters be completed and provided with a road density of 11km per 100 square kilometres of mapped agricultural land for the hill districts and four km per 100 square kilometres of mapped agricultural land for mountain districts. The additional agricultural roads proposed by the APP are shown in Table 2.3 below.

The Plan identified, as an initial objective, the construction of a rural road grid for the *Terai* based on the existing trunk and district road system. Accordingly during the first ten years of the APP the construction of 5,146km was envisaged, with a balance of 1,054km to be constructed in the second ten-year period.

Table 2.3: Proposed Additional Agricultural Roads by the APP

Region	Eastern	Central	Western	Mid-Western	Far-Western	Total
Terai	1045	1040	600	425	290	3400
Hills	447	424	549	343	187	1950
Mountains	246	238	16	170	180	850
Total	1738	1702	1165	938	657	6200

Source: APP Report 1995

The magnitude of rural road construction at the district level as proposed by the APP was enormous. However, the operational plan to achieve that target was not clearly visualised. The Plan proposed the creation of a Department of Agricultural Roads under the Ministry of Local Development (MLD) to provide technical backstopping at the district level. The government implemented this recommendation by strengthening the existing technical division of MLD. At the district level, the District Development Committees were made responsible for construction and maintenance of the rural road network. However, as the DDCs are self-governing, local statutory bodies, no effective linkages were visualised between the policy, the programme, and the project levels to achieve the target while maintaining the technical standard.

2.6.3 Priority Investment Plan (PIP) Project

The PIP Project (1996), which was carried out by the Department of Roads, with financial and technical support from the World Bank, reviewed the road sector as a whole. The review included strategic roads, rural transport, bridges, and domestic aviation and presented an overall plan in the road sector over a period of 10 years corresponding to the Ninth and Tenth Five Year Plans (1997-2006).

The Report identified and prioritised a number of road projects for Eastern, Mid-Western, and Far-Western Regions. The priorities are based primarily on the potential costs and economic benefits from individual project components, using standard cost-benefit appraisal techniques applicable to road projects. The cost per kilometre is calculated at four standards: earth road, fair weather gravel, all weather gravel, and black top. The benefits included transport savings from the replacement of porters or mule transport by freight with truck transport; savings from the replacement of walking by bus journeys for personal travel; road users' savings in the form of vehicle operating costs and passenger time saving; and producer surplus benefits in the form of increases in farm incomes from the growing of cash crops for sale in markets outside the hill areas. These benefits are determined by the size of the population served. The result of this analysis has supported the thesis that, in rural areas, the greatest net benefits are obtainable from the construction of low-cost earth roads into currently areas not served by roads.

The Report recommended development and extension of the national road networks that can contribute to the regional integration by providing high-quality links between all regions, thus reducing the transport costs and travel time. Extension of the road networks into hill districts currently not served by roads provides the single-most effective and demonstra-

ble benefit for uplifting the overall economic conditions of these presently inaccessible and poorly accessed areas.

In the rural transport sector, the Report recommended maintenance of the existing facilities as a first priority, followed by the expansion and development of the road network as justified and as resources permit. The concern for the long term should be the sustainability of and the maintenance of the resultant increases in road length. Beyond the maintenance commitments, the PIP Report identified priorities for the extension and development of the rural road transport network. These are summarised below.

- First, construction of earth standard roads into currently non-road served areas: this includes the completion of the on-going programme of new Feeder Roads to district headquarters not connected by road.
- Second, construction of a limited number of additional district roads, mostly in hill areas, to provide access to significant pockets of the population or to improve network connections and linkages.

In the *Terai*, there is already a basic network of roads and tracks available and some form of wheeled transport operates to virtually all areas. Therefore, the Report has concluded that the construction of additional roads in the *Terai* areas cannot be supported on the basis of transport cost savings or agricultural development benefits alone. Such roads may, however, be required as part of other broader development programmes, for example, as a component of an irrigation project or an integrated rural development project. This conclusion is in conflict with one of the main recommendations of the Agricultural Perspective Plan (APP), which proposed an approximate doubling of the length of farm-to-market roads, particularly in the *Terai*.

The PIP study, conducted under the DOR, reviewed several sectors such as strategic roads, rural transport, bridges and domestic aviation. The rural transport sector should have been reviewed by the MLD, which is the responsible policy-making body for the rural transport sector. This could be one of the reasons why, as in other previous key studies, it also failed to visualise the operational arrangements, i.e., the effective linkage between the policy, the programme, and project levels.

2.7 Experimentation with Sustainable Rural Road Projects

2.7.1 The Concept of a District Transport Master Plan in the Pilot Labour-based District Road Rehabilitation and Maintenance Project (PLRP)

The PLRP, which was carried out with the financial support of the World Bank and the technical support of Helvetas, aimed to improve rural access by rehabilitation and maintenance of rural roads in three *Terai* districts and one hill district in the Western Development Region, namely, Kapilbastu, Rupandehi, Nawalparasi, and Syangja. The responsibilities of construction and maintenance of district roads were transferred to the DDCs in 1993, but the technical units of the DDCs were not capable of maintaining technical standards while, at the same time, resisting political pressures from local political leaders. Moreover, several agencies were constructing roads in their respective areas of interest, and the DDCs did not

possess exclusive information about the road inventory. *Ad hoc* decisions, rather than a thorough understanding of socioeconomic linkages and geological and topographical constraints, largely guided road construction. In order to deal with this chaotic situation, the PLRP conceived a District Transport Master Plan as an essential document for the DDCs, in order to prepare an annual programme and maintenance and rehabilitation of the district transport network.

The Master Plan would be basically confined within a district. Nevertheless, the existing and planned road network in neighbouring districts would also be considered. Similarly, while focussing mainly on district roads, the highways, feeder roads, urban and village roads would be included. In addition to that, the major foot trails would also be located on the map and considered for planning. The Master Plan was conceived for a 20-year period which would materialise during the tenure of four successive district governments.

The Master Plan would be largely prepared on the grounds of economic linkages among settlements. The engineering considerations in the alignment selection based on the topography and other engineering details were given least emphasis. The findings would thus remain as an indication, subject to being checked later on by detailed engineering studies. Similarly, the cost estimates would also be approximate for the most park.

The methodology for the preparation of the Master Plan was designed to be transparent, objective, and simple. Moreover, the involvement of all parties concerned from the very beginning of the process was sought so as to ensure their commitment. Accordingly, the following steps were proposed for the preparation of the Master Plan.

First, a workshop of district level policy-makers would be organized for discussion of policy issues such as functional issues to do with rural roads and criteria for prioritisation. Another seminar of NGOs and community-based organizations would prepare the ground to spell out conditions for GOs' and NGOs' partnerships in road construction, maintenance, and operation. These discussions would provide a certain basis for policy formulation for the proposed Master Plan.

Second, a series of meetings of DDCs would discuss and define the road prioritisation criteria. The PLRP professionals and experts developed a list of criteria, given below, which could be adapted according to the local situation and given certain importance for prioritisation of individual projects by the respective DDCs:

- population,
- investment cost (initial + maintenance),
- economic returns,
- accessibility (time, safety, reliability),
  - ♦ accessibility to nearest road head,
  - ♦ accessibility to the market centre and
- environmental impact.

The DDC meetings would also define the level of accessibility. Accordingly, the existing road networks and other physical and topographic factors, such as travelling time to the district

headquarters and market and service centres, would be assessed to define the zone of influence of road accessibility. The DDC would then call upon the road demand list from VDCs or any interested persons or groups. The road demand list would, in fact, be a collection of wishes of people, irrespective of the financial capacity of the district. Nevertheless, such a list enables us to gain insight into the perception of the people and also provide the opportunity to find more alternatives.

Third, secondary sources of information, such as district maps, land-use maps, main trail maps, demographic information, and other research studies, would be collected and consulted. Moreover, a study team would travel throughout the district to assess the existing road conditions, land-use patterns, settlement patterns, existing modes of transport, and so on. Structured interviews would be taken with different groups, as necessary. Based on secondary and primary sources of information, consideration would be given to different alternatives for prioritisation.

Finally, the entire set of exercises are structured into a report in a sequential order, starting from setting objectives. The report would include technical and financial assessments of all alternative routes for the consideration of the DDC and the final approval of the District Assembly.

2.7.2 *Experimentation with the Low-cost, Environmentally Friendly and Self-help (LES) Approach in Palpa and Dhading Districts*

The LES approach was used experimentally during the pilot road construction directed by the Palpa Development Project and later extended to the Dhading Development Project. The Swiss Development Corporation (SDC) and German Agency for Technical Cooperation (GTZ) provided the technical and financial support. The Local Road Improvement Projects (LRIP) of Palpa and Dhading Districts were based on the following objectives:

- providing rural villages with better market and communication access to enable greater socioeconomic mobility among the people of the district;
- creating off-farm employment, during the slack agricultural period, by using labour intensive construction methods;
- retaining most of the investment in the road in the district by using only locally available resources such as manpower, skills, and materials;
- using technically sound and environmentally sustainable construction methods which will cause minimum damage to the environment during and after construction; and
- helping the district officials and staff to develop technical and administrative skills for local road construction and maintenance.

The model adopted a series of principles to address a broad range of technical, environmental, and socioeconomic issues (ARD 1994) as summarised below.

Phase-wise construction approach

In areas where the road had to cross steep slopes requiring considerable excavation, construction of the road profile was carried out in phases to allow for natural settlement and stabilisation. In the first year, a 1-1.5 metre wide track was opened. In the second and third

years, the width was progressively widened to 3.5 to 4.5 metres and, finally in the fourth year, it was extended to six metres. In this period, stabilising and strengthening work was carried out using gabion retaining walls and bioengineering methods.

Balanced cut and fill

In order to make the roads merge with the landscape, the LES approach minimised the excavation to the absolute minimum to cut the road profile along hill-slopes by positioning the centre line of the road so that all the material obtained from excavation on the mountain side was used in extending the road profile on the valley side. Surplus material was spread along the road alignment.

Management of water runoff

Traditional road designs called for drainage channels along the sides of the road, which interrupted the natural drainage patterns. In contrast, where possible, the LES approach used a five per cent cross-fall from the hill to valley side of the road that was designed into the road profile to shed the surface water. Thus, the natural drainage pattern was not disrupted and the need for a drainage channel was largely eliminated.

Bioengineering for slope protection

Vegetation with wide—spreading root systems bound the soil together and increased its shear strength, limiting the extent of slope failure. Large mature plants, such as bamboo clumps or trees, can support a slope by propping its base. In addition to contributing to the long-term sustainability of the fragile mountain ecosystem, the increased vegetative growth provided essential fodder for farmers and bound the road into the landscape. Vegetation planted at the beginning of one rainy season can be well established by the second rainy season.

Labour-intensive construction methods

In order to use the under-employed rural labour force, the road construction period coincided with the agricultural slack period from October to May. Labourers were employed from an area of up to two hours' walk from a construction site, so that they brought their own food and did not require accommodation along the road. Labourers were organized into groups of about 15, each with a locally-selected *Naike* (group leader). A supervisor directed two to four groups, which in turn were supervised by an overseer. An overseer managed up to five supervisors. An engineer supervised two overseers.

Use of indigenous skills, materials and tools

Stone, topsoil, and locally available vegetation were used in road construction. Stone was used for filling gabion and building dry stone walls and pitched drainage structures. The topsoil and vegetation were used to re-vegetate slopes and road surfacing. The labour force was familiar with and skilled in the use of local materials. Steel, cement, and concrete were avoided as far as possible because of cost, transportation problems, and the special skills required to use these materials properly.

Participatory approach

Collective responsibility to construct and maintain local roads required the involvement of local government and beneficiaries in all phases of the project. This was ensured by forming

project implementation committees at two levels: one at the DDC level for policy guidelines and the other at the project level for project implementation.

The technical standards used in the LES approach of road construction are summarised in Table 2.4 below.

2.7.3 *Rural Infrastructure Development Project*

This project, funded by the Asian Development Bank (ADB), has the objective of reduction of rural poverty in three hill districts of Nepal, namely, Baglung, Tanahu, and Kabhre. This is to be achieved through the provision of rural infrastructure and associated increased economic benefits in the agricultural sector. There are three main components.

Development of rural roads and structures

About 250km of motorable fair-weather earthen roads, connecting village settlements with market centres, will be constructed in three hill districts, i.e., Baglung and Tanahu in the Western Region and Kabhre in the Central Region, using extremely labour-intensive methods with the minimum use of heavy equipment and explosives. These rural roads will be developed from improvements of existing trails and tracks and will follow, to the maximum extent possible, the existing alignments. The low-cost, environmentally-friendly and self-help (LES) approach used experimentally in Palpa and Dhading districts will be adopted for road construction. These roads can be used in dry season, during September to May, and will be closed to traffic during the period of heavy monsoon rains. They have been designed for light vehicles, such as jeeps, tractors, minibuses, and light trucks, with a maximum traffic of about 50 vehicles per day and speed limits of from 20-40km per hour. The maximum load capacity of the road is estimated at five tons.

Village-level institution building

Single story, multi-purpose buildings with a simple structure will be constructed at the road head in order to enhance village-level community development activities. The buildings will have concrete floors and columns and include a room of about 200 square metres with a small office and an open space for a *Bazaar*. These promises can be used for meetings, workshops, education, and NGO activities in villages and can also function as a market place for agricultural and dairy products brought from villages along the road.

Self-help and environmental awareness campaigns

Various awareness campaigns, including public meetings, study visits, and seminars will be organized at selected locations in the project area to increase public awareness on: (i) advantages of the LES approach in road construction and maintenance; (ii) importance of local self-help initiatives in development; (iii) need for women's active participation; and (iv) long-term risk of environmental degradation.

As the road construction methods of this project will be mainly based on labour, a minimum of 70 per cent of the labour force during road construction is expected from areas of influence along the proposed road corridors. Market surveys carried out during the Bank's feasibility study for this project indicated that local traders and wholesalers draw a profit margin of over 30 per cent of the farmgate price (ADB 1995). The provision of motorable

Table 2.4: LES Road Standards and Specifications

S.N.	Design Parameters	Unit	Recommended Value	Remarks
A. Geometric standards				
1	Design speed	kph	20-40	
2	Number of traffic lanes	no	1	
3	Carriageway width	m	3.50	
4	Shoulder width on each side	m	0.50	
5	Drain width case (a)	m	1-1.30	Short drains provided only in those places where surplus accumulated runoff flows into the road from the mountain side, viz, into paddy fields, and where the longitudinal gradient of the road is more than 8%. Such drains discharge into the nearest causeway, pipe culverts, or cross drains.
	Drain width case (b)	m	0	A 5% outward slope to the valley side is provided on the road surface in roads with longitudinal gradients of less than 8% and in longitudinal gradients of more than 8% and in other special cases, normally, diagonal drains towards the valley side are also provided.
6	Min length of passing bay	m	25	
7	**Formation Width** a) In general	m	4.5	
	b) At places with side drains	m	5.50	
	c) At passing bay without a side drain	m	6.00	
	d) At very steep rocky cross slopes	m	3.5	
8	Ruling gradient	%	5	
9	Maximum gradient	%	8	
10	Exceptional gradient	%	12	
11	Maximum length of exceptional gradient	m	60	
12	Minimum radius of horizontal curve	m	10	This is in hairpin bends and switch backs.
13	Right of way from road centre line on each side	m	7.5	The total right of way would be 15m
B. Other Standards				
1	Type of road: Single lane road for use in dry season only.			
2	Passing places: On an average at 200 meters interval apart.			
3	Maximum loading capacity of the road: 6 Tons.			
4	Maximum traffic carrying capacity: 75 vehicles per day.			
5	Type of road surface: earthen.			
6	Period when vehicle is permitted: October to June.			
7	Period when vehicle traffic is prohibited: from July to September.			

Source: ARD Report 1994

access is expected to increase the marketing opportunities for remote villages in the hill areas significantly through the ability to move surplus agricultural produce to the market in bulk. The household income is expected to rise by over 50 per cent through the introduction of the rural road.

The project will be implemented over a period of seven years commencing in 1996. The Ministry of Local Development (MLD) will be the executing agency, responsible for channelling funds, monitoring project activities, and coordinating at the central level. At the local level, the respective DDCs will establish a District Implementation Office (DIO). The Local Development Officer (LDO) will be the head of the DIO. At the project level, local road committees will be established as a venue for public consultation and participation. The DOI will interact extensively with local road committees for specific road alignments and land acquisition issues. NGOs selected by DIOs will help organize and motivate local labour groups and will work closely with local road committees.

2.8 Conclusion

The concept of a rural road is defined as an access to the market in order to realise the development potentials of the area. It includes track, mule trail, and suspension (wooden) bridges connected with rural motorable roads, which in turn connect to the feeder roads and highways. Such a combination would become the 'rural road network'. Among other features, great attention should be given to minimising the damage to the environment, as the alignments of rural roads are likely to pass through village settlements. Since various types of rural road are interconnected, the economic benefits from a rural road network are also likely to be inter-dependent.

In the Eighth Five Year Plan (1992-97), the lack of effective rural infrastructure to facilitate access to agricultural inputs and outputs as well as basic services has been regarded as the main impediment to poverty alleviation. The Eighth Plan called for the development of an extensive rural road network in the country as a prerequisite to achieving the national objectives of faster economic growth and poverty reduction. During that period, several national level studies were made to identify the need for a rural road network in the country. The District Road Network Studies (1992-93) proposed the construction of over 14,000km of new roads representing an increase of over 150 per cent above the current level. The Agricultural Perspective Plan (1995) proposed the construction of an additional 6,200km of rural roads in the next 20 years in order to provide a reasonable road density for rural areas. The Priority Investment Plan (1996), although it did not sum up the total additional mileage, recommended the maintenance of the existing road facilities followed by construction of earth standard roads into areas currently not served by roads, especially in the hill districts.

Although plenty of work has been done at the national level for identification of rural road needs, the operational plans for these key studies were not clearly conceptualised. For example, the District Road Network Studies (1993) and Agricultural Perspective Plan (1995) seem to have taken for granted that the objectives can be achieved by strengthening the existing bureaucratic structure or creating a new one such as the Department of Agricultural Roads. However, in reality, the real implementing agencies are the DDC\VDCs all over the

country. DDC\VDCs have very limited technical capabilities for carrying out such large engineering works. Moreover, as the DDC\VDCs are self-governing statutory local bodies, they are competent enough to set their own priorities and operational procedures (Chapter 3). Therefore, the target set at the national level and the standards prescribed will only be meaningful when they are actually carried out at the local level with the same technical standards. Keeping these institutional linkages in mind, a clear rural road policy should have been prescribed as a part of the study. This would have helped to achieve the target. For the development of rural roads in a sustainable manner, several innovative experiments have been carried out, which have shown encouraging results. The concept of a District Transport Master Plan, which was developed and tested in a number of districts, can prove to be a useful document for the DDC in preparing annual programmes and planning for the maintenance and rehabilitation of district transport networks. Another innovative, low-cost experiment, which is environmentally-friendly and can use the self-help is the (LES) approach to rural road construction used in Palpa and Dhading districts. The LES approach, which is based on labour-intensive technology, has proved to be very suitable for a labour surplus economy such as that of Nepal. Another Rural Infrastructure Development Project in which rural roads will be constructed using the LES approach is underway in three districts, and has combined road building with community development activities.