



Mountain Accessibility and Rural Roads: Innovations and Experiences from Nepal

The main problems encountered with mountain roads have been their escalating construction and maintenance costs, negative environmental consequences, and limited economic impacts. This paper highlights some of the recent experiences in road building in the mountain areas of Nepal and discusses the achievements in terms of costs, the environment, and economic benefits, at the same time highlighting the problems encountered especially on the management side.

Introduction

Mountains have been formidable barriers against invaders in the past. While this lack of easy access was a great advantage in early times, today it has become a very difficult development hurdle for many mountain areas to overcome. Difficult access has added substantially to the costs of development. Inaccessibility has restricted movements of people, goods, and services; hindered promotion of comparative advantages; and limited the development of markets, services, and communications.

Today's discussion on mountain roads is dominated by cost and environmental considerations rather than by the benefits of improving access, reducing isolation of mountain communities, and providing them with improved options for their well-being in an environment that has few alternatives.

Many mountain areas in the HKH region have invested heavily in mountain roads, airports, and, in some cases, even railways. Many mountain roads were built for security concerns and faced the question of economic viability. Others, built with the promise of producing overnight economic miracles, have become financial and environmental disasters.

Negative decisions related to roads are precluding other investment activities that could have contributed towards improving the welfare of mountain communities. Because of the strategic need in development for improving access, there is serious concern about how to overcome inaccessibility in an affordable and environmentally-sound manner.

The Overall Context of Mountain Road Building in Nepal

Despite a history of about four decades in road construction with technology and managerial practices from practically all the major countries in the World (India, China, Russia, the United Kingdom, Switzerland, USA, and, most recently, Japan), the optimal solutions are still nowhere in sight. At present, the road density in the country is about 5km/100km², while for mountain areas it is as low as 0.6, and for the Terai (plains) it is about 13.4. If Nepal is to achieve a road density target similar to those of other countries, which is about 26km for 100km² and roughly one kilometre of road for every 500 persons, 1,500km/year of road construction would be required (Deoja 1992). At about Rs1 million (US \$ 1 = Rs 56.75) per kilometre, the investment needed for roads alone would account for over 75 per cent of the present annual development budget, giving an indication of the sheer enormity of the task ahead.

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The significant common experience with road building in Nepal has been their high costs per kilometre, exceedingly lengthy periods of construction, significant maintenance costs, considerable flood damage every four to five years or so, frequent landslides, and relatively limited economic impact along the road corridors.

Experience clearly indicates that a system, or a technology, or a product is not continuously appropriate (in terms of local environment) if all concerned and related processes and factors (old and new) do not work in an integrated manner to support it.

Greater efforts are needed to improve the transport situation in Nepal, as it is still far behind what could be considered a minimal network; how to go about fulfilling this is a major challenge. Nepal's main problem is obviously its widespread poverty and very low rates of investment. In future expansion in the road/transport sector will undoubtedly receive fairly significant levels of investment - even if this is not at the desired level. In order to make the best use of limited resources, the main questions are how to improve the access of a maximum number of people at a minimum cost and how to do so in an environmentally-sound manner?

Several rural development programmes in Nepal have made a critical examination of these issues. Experience has shown that improving access is a *sine qua non* for transforming subsistence economies, even if this happens slowly. Resources for improving access are extremely limited and call for more serious efforts in developing low-cost, rural roads. At the same time, road building should be environmentally safe and, because resources are limited, should provide maximum employment to the local people. Implicit in these concerns are critical choices in relation to technology, inputs, organisation, and management. Over the years, a system has started to evolve. In some areas the choices are quite clear cut, but, in others, new problems have arisen.

Rural Mountain Roads

Rural roads (called Local Roads under the District Development Programme) have been constructed in a few districts using an unconventional approach. The traditional approach has been consultant-contractor dominated with heavy emphasis on mechanisation.

Box 1 **Characteristics of Low-Cost Rural Mountain Roads**

- Single lane; 4.5m with bypasses every 200 metres
- Designed for single lane limited number of vehicles per day
- Earthen, fair weather, open to traffic for only 8-9 months, closed during monsoon
- Step-wise construction allowing natural compaction of soil
- Implementation of bioengineering methods
- Maximum use of local materials, persons, tools, and contractors
- Participatory organisation to manage the entire road construction
- Most of the construction costs (75% to 90%) go to labour payments
- No use of heavy equipment/machinery, no blasting

The main objectives behind the new approach are (a) to improve access to the rural population at relatively low cost, (b) to achieve this without damaging the environment - environmental protection is an integral part of the design, implementation, and maintenance, and (c) to mobilise the people in organising and managing this infrastructure so that the local employment benefits for the poorer groups are not only maximised but also local community develops skills and experience for future maintenance of the infrastructure. Some of the main features of this approach have been outlined in Box 1. Notable here are the absence of blasting, cut and fill rather than cut and throw (of excavated sides), and a focal role for the local population. Its uniqueness lies in providing a set of guidelines in different

areas for all stakeholders to follow rigorously (see next page).

Multiple Actors and Stakeholders

At first glance, one would assume that the only stakeholders involved are the local construction groups and the project authorities. In the conventional approach, there are a few main actors - the contractor and the project. However, in the present approach, different agencies are involved and play active roles in the process - from the farmer, through whose fields the road may pass, to the engineer, who supervises the entire construction, and the district politicians and governments who have to agree to enforce some of the rules, there are numerous parties and any one of these could create enormous setbacks for the entire Local Roads' Programme. Based on experiences from the two districts, the main actors are the district and village governments, project offices, NGOs involved in the project, road construction committees, and local income-generating groups and work groups (Box 2). The project has been attempting to promote a participatory

Guidelines and Underlying Features of the New Approach to Local Road Construction

Environmental Guidelines

- Minimise damage to local vegetation through selection of appropriate construction planning and practices
- Early introduction of revegetation and bioengineering solutions to exposed earth surfaces and landslides
- Prohibit mass wasting during construction and safe retaining of all excavation behind drystone and gabion wall structures
- Prohibit export of timber via the road
- Do not disturb existing trails, temples, resting places, water taps, springs, etc - in fact try to integrate these with the constructed road when possible
- Discourage ribbon settlement or encourage the local community to locate houses, shops, etc at appropriate distances from the road to avoid dust pollution and misuse of the road (and adding to the maintenance costs).

Technical Guidelines

Technical guidelines have been developed on the basis of experience gained from local roads' construction and management in the districts of Palpa and Dhading in Nepal. The important guidelines that were adopted were that the design speed should be 20-40 (kph) for a single lane road for use in the dry season only, passing places on an average should be 200m to 500m apart, 6 metric tonnes should be the maximum trading capacity on the road, 75 vehicles/day should be the maximum traffic carrying capacity, the road surface should be earthen, and the road should be closed during the rainy months (monsoon period).

- Sparing use of blasting materials only when labour options do not work
- Low priority to construction of concrete bridge and culverts
- Phased construction approach allowing for natural stabilisation
- Balanced cut and fill
- Management of water runoff without disrupting natural drainage patterns
- Bioengineering for slope protection
- Labour-intensive construction methods using local labour groups from up to two hours' walk from a construction site
- Use of indigenous skills, materials, and tools to reduce costs and encourage local maintenance

Social Guidelines

- Investment in roads should increase the self-help capabilities of the people and help their all-round development through awareness generation and mobilisation of group savings.
- Women are encouraged to work for pay equal to that of men.
- Children under 16 are not allowed to work.
- Alcohol consumption on the worksite and in the workers' camp is prohibited.
- Treatment and compensation are provided for workers injured while at work. Compensation is given to the next of kin when a worker is killed on the job.

Training in road construction is envisaged for all the stakeholders - engineers, overseers, NGO motivators, supervisors, storekeepers, work group leaders, and road construction workers. Apart from training on environmental, technical, and social aspects, training in group organisation and management is also provided. Local officials and politicians, including different income-generating groups, are also trained on different aspects of post-road construction development.

approach to the organisation and implementation of the investment programme so that costs can be kept low, environmental impacts minimised, and positive economic impulses generated.

Performance of Local Roads

So far, the construction of local roads using this approach has been used in Palpa, Dhading, and Gorkha districts. Although in terms of total kilometres, this amounts to only a 100km, it is a significant achievement. With the same level of investment, conventional road building would have achieved only one-third of this. In the districts, with these programmes, more people enjoy improved access than would have been feasible with the conventional approach. The impact of this approach has also been favourable at the national level, because the government has realised the need for a similar approach to local road construction in the mid-hills. Measures to apply a similar approach throughout the country are being discussed. Some of the specific achievements of this Local Roads' Programme are discussed below.

Box 2

Different Actors and Their Potential Roles under the Local Roads' Programme

Local Income Generating Groups/and Construction Working Groups involved in road construction and maintenance generate group savings and use these in various revolving income-generating activities; pledge (in writing) to maintain a portion of the road; protect encroachment on the road; and preserve the road as their own property.

User Group Organisations mobilise local income-generating groups for road construction; make land available free of cost for road construction; establish linkages with government, project, and local people to solve site-specific problems; help develop the concept of local maintenance, promote group activities, and management; and assist in making decisions and actions transparent and participatory.

District Government (District Development Committee) - policy coordination, monitoring, approval of the approach and the TOR (for the project), recognise and empower user organisations for project work, provide resources and technical support, and help solve site-specific problems.

Role of Private Engineering Consultant appointed by the project - provides the services of different technical personnel needed to support and supervise project implementation; provides advice on all technical matters based on the approach of the project; provides training on all technical aspects; certifies work output, quality, and standards; and evaluates performances of work groups and provides progress reports.

Role of NGOs is to motivate income-generating groups, provide necessary training and orientation to these groups, help develop road maintenance organisation by promoting self-help concepts, motivate and organise other village communities to undertake construction and other development activities, obtain funds for the project for different activities, undertake payments to workers, purchase tools and equipment, provide progress reports, and maintain records, accounts, etc.

Cost Considerations - According to recent estimates, most roads constructed by the Department of Roads (DOR) are costing about Rs 5 million to Rs 8 million per kilometre. Obviously differences are created by many factors, but Rs 5 million per kilometre appears to be about the minimum for a hill-mountain road. District roads built by the DOR may be about Rs 3 million per kilometre on account of their smaller size.

In 1993/94, the cost of construction of one kilometre of road under the LRP was about Rs 950,000. This did not include overheads and management costs of the project. While this is also substantially lower than conventional road costs, local road construction costs in Dhading have varied from about Rs 600,000 to about Rs 1 million per kilometre. If some of the structural aspects are reduced and environmental safeguards compromised to some extent, the costs come down to about Rs 400,000/km (Table 1).

Allowing for many local variations, it can be argued that, based on the experience so far, it is possible to get four kilometres under the new approach for the cost of one kilometre under the conventional approach.

In terms of access, this should be a far more viable option for rural people even if there are a few limitations. From the point of view of costs, this does appear to be a major improvement, at least for rural roads in mountain areas.

The Environmental Aspects - The environmental impact of the new approach also appears to be very favourable. With no cut and throw practices, there is hardly any damage to sloping agricultural fields. Deforestation has also been kept to a minimal. New plantations are being seen along the roadside. The combined impact of all these measures has been to limit landslides and soil erosion.

The major indirect effect on the environment is manifest in the increase in new housing construction, leading to unplanned quarrying and deforestation (both from private lands and other parts of the district). Efforts to control ribbon settlements along the road have not been very successful. Dust pollution caused by dense traffic is a problem for residents along the road. Certain parts of the road are poorly maintained, and there has been a breakdown in the drainage system. This could lead to significantly higher maintenance costs in the future.

Awareness about the new approach, including the do's and don'ts is high. There appears to be a greater degree of realisation about the need to protect the road corridor environment as well as the other environmental resources in the area.

Table 1:
Local Road Construction Programme: Completed Road Status
(April 1988-June 1996)

1. Completed Road Status	60 km
2. Average Annual Direct Employment Created	120,621 (man days)
3. Workers Employed per km	19,332 (man days)
4. Construction Costs (at market prices)	
- 1987/1989	1,683,100.00
- 1988/1989	1,698,100.00
- 1989/1990	4,334,500.00
- 1990/1991	4,369,600.00
- 1991/1992	4,058,800.00
- 1992/1993	6,661,700.00
- 1993/1994	9,296,559.00
- 1994/1995	9,602,906.00
- 1995/1996	10,571,997.00
Total NRs	52,257,262.00
Average Construction Cost/km¹	870,964.00

Total Investment Pattern for Different Items (1987/88 - 1995/96)

Item	Units	Amounts	% of Total Investment
(i) Labour Payment	NRs	36,438,665.00	69.73
(ii) Construction Materials	NRs	8,230,077.00	15.75
(iii) Tools and Equipment	NRs	2,851,530.00	5.46
(iv) Supervision and Overhead Costs	NRs	2,920,921.00	5.59
(iv) Other Costs	NRs	1,816,069.00	3.47

Source: Dhading Development Programme, Annual Local Roads' Construction Programme, SIDF - DDP/GTZ, Kathmandu, August 1996

The Economic Effects - Although not fully quantified, some of the principal economic benefits of the LRP, based on the experience of Dhading District, have been given as:

- increase in house construction along the road corridor,
- increase in land values,
- increase in the availability of agricultural inputs,
- increase in agricultural exports from negligible levels to about 2,850MT over a period of six years,
- increase in road traffic,
- substantial reduction in transport costs of imported goods from about 60 per cent to 90 per cent in some cases,
- substantial local employment (see Table 1) with major benefits to poorer households and marginal farmers, and
- a wide spread of construction skills which have been used in private sector construction activities.

There are other indirect effects on agricultural and livestock production, and clearly there is a need for systematic quantification of all the costs and benefits. Among the disadvantages appear to be the loss of portering activities along the road. However, this could have been easily compensated for by the increased opportunities for local employment.

Problems Encountered

While the overall experience so far appears to be very encouraging, at least from the perspective of costs, environment, and some economic aspects, some problems are being encountered on the management side. These problems appear to be fairly serious, as some of them are related to the compromise on some of the guidelines.

Some of these problems are quite serious - especially the inadequate and wavering commitment of the local policy-makers.

- With frequent transfer of and changes in district administration personnel, understanding of the new approach as well as the continuous follow-up needed have been relatively weak, leading to delays, new compromises, and setbacks in construction activities. Without the full and continuing support of the district administration, construction work becomes seriously hampered.
- Progress with construction has been very slow also, on account of poor training, low priority given by the district administration, and sub-optimal working methods in certain areas.
- There have been many examples in which the agreed arrangements and principles of the new approach have been breached by the district authorities. The main example is the use of the road during the monsoon which has led to significant damage and increases in maintenance costs. Another example is the use of a contractor rather than local work groups. Pressures are being mounted to gravel the road and make it an all-weather one. It is not clear how this will be financed, especially when the District is unable to maintain even small portions of the present road. The impression being given by politicians is that gravelling will reduce maintenance costs, but this is also a questionable proposition and is not part of the local roads approach accepted by the district authorities at the beginning of the project.

This new approach to Local Roads' Programme has been a very appropriate response to some of the specific problems encountered in the past in overcoming problems of inaccessibility. While there are many questions regarding specific measurements of costs and benefits, the advantages of the new approach to the rural economy and the poorer sections of the mountain people are quite obvious. However, compromises are beginning to appear and this could diminish the overall attraction of this approach substantially. Unfortunately, the problems appear to be originating precisely from those who should demonstrate maximum commitment.

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