5. The Context of Mountain Road Planning

Planning roads in mountainous regions is complicated due to;

i) rugged terrain,
ii) resource scarcities,
iii) discrepancies in socioeconomic equity,
iv) growing environmental concerns, and
v) political pressures.

Oftentimes there are conflicts between national level planning and project level planning because of unclear long-term planning and distortions during implementation, arising from the lack of sound macro-micro interactions. Absence of a proper database and of rigorous analysis at sectoral levels does not provide the required feedback from implementators to national planners. This will give rise to inconsistencies in cost-benefit forecasts, resource allocations, timeframes, and input-output relationships.

The five-year road plans in Nepal were primarily dictated by the need for the East-West Highway (primary arterial road), North-South Highway (primary and secondary arterial roads), and District Roads (collector systems linking district headquarters).

Experiences with mountain roads in Nepal indicate that the per km cost of construction is high; time of completion is long (6 to 8 years for a 50 to 60 km long mountain road); maintenance requirements are intensive, since considerable flood damage occurs every four to five years; and priorities are distorted by simultaneous constructions, implementational delays, addition of sub-standard roads, with the accompanying problems of erosion and landslides; and negligible impacts on economic upliftment in the influence areas of road corridors.

Economic feasibility studies carried out for mountainous roads in Nepal have often been completely offset by the actual scenario during and after the completion of road projects, as built construction costs and the recurring maintenance and rehabilitation costs at constant money have been several fold higher, while benefits tend to be lower than projected.

The following scenario emerges from a review of road development in Nepal.

Requirements (Author's estimate, 1992)

1,643km of new ongoing constructions	Rs 12.0 billion
1,809km of proposed new roads	Rs 15.6 billion
Periodic maintenance, 2,740km	Rs 1.6 billion
Upgrading, 4,102km	Rs 5.1 billion
Rehabilitation, 186km	Rs 1.9 billion
Land acquisition	Rs 7.0 billion
Total	Rs 43.2 billion

Eighth Plan Provision

1,720 km ongoing plus 1,258 km new construction	Rs 6.534 billion
Periodic maintenance, 1,745 km	Rs 1.298 billion
Upgrading, 1,083km	Rs 2.365 billion
Rehabilitation, 48km	Rs 0.316 billion
Bridges	Rs 0.476 billion
Total	Rs 10.949 billion

The guidelines for rural roads in India in the 1981-2001 20 years' plan are (Saxena 1989):

i) to link with all-weather roads all villages with a population of 1,500 and above and 50 per cent of villages with a population of 1,000 and 1,500 by the year 1990 and

ii) to link all villages with a population of 500 and above (1981 Census) by all-weather roads by the year 2000.

For hill roads, links are to be provided on the basis of clusters of groups of villages. Villages within 1.6km and at altitude differences of not more than 200m are to be considered as one cluster. Bridle paths 1.8m wide and gradients of one in eight, inclusive of footbridges across streams/drainage, or an all weather road within five km from the village, are planned for populations of less than 500. The road densities planned for hill areas are 40km per 100 sq.km. up to an altitude of 2,000m and 15km for 100 sq.km. above an altitude of 2,100 masl.

Table 24 compares road densities in various countries of the Hindu Kush-Himalayan Region. Clearly, the road density in Nepal is the lowest, considering population-wise road density.

Table 25 shows the existing road lengths and road densities in the various regions of Nepal.

Nepal's Eighth Five-year Plan for roads aims at (Table 26):

i) construction of 2,978km of new roads at Rs 6.5 billion at 1991 prices and

ii) periodic maintenance, upgrading, and rehabilitation of 2,606 km of roads at Rs 3.9 billion.

Table 24: Road Density of Selected Countries

Country Road Length (1984)	Road Density		Vehicle Population, 1982	
	Areawise (1982)	Population-wise (census 1981)	Per 1000 population	Per km of road
Afghanistan	2.9	709	NA	NA
Bangladesh	112.0	571	NA	NA
Burma	3.3	1429	NA	NA
China	9.0	1111	2.5	1.0
India	41.3	5.24	2.8	3.9
Pakistan	11.9	917	11.2	6.4
Sri Lanka	37.7	613	NA	NA
Nepal	5.6	2245	2.87*	7.18*

Note: The hill States of India have road densities of from 12.6 to 37.4 per 100 sq.km. for population densities of 2,341 to 8,155 per sq.km. as of 1987.

*: Year 1993

Table 25: Road Density in Nepal

Region	Population in millions (1990)	Area (sq.km.)	Road length in km as of 1991	Road Density	
				Area-wise (km/1000 sq.km.)	Population-wise (km/1000)
Terai	7.97	25,021	3,367	13.46	2,366
Mid-Hills	8.82	10,0083	4,034	4.03	2,187
Himalayas	1.61	22,077	00	-	00
Total	**18.50**	**1,47,181**	**7401#**	**5.03**	**2.500**

: About 1,000 km of village roads (motorable fair weather tracks) are not included in this figure.

Table 26: Road Networks in Nepal - Eighth Plan

Region	Road length in km, planned for the 8th Five-year Plan						Costs (million Rs)	
	E/W	N/S	D/R F/R	V/R	U/R	Total	Total as per 8th Plan	Total author's estimate
New Constructions								
o *Terai*	10	-	62	720	50	842	6,534	8,568
o Mid-hills	54	699	853	480	50	2,136	-	-
o Himalayas	-	-	-	-	-	-	-	-
Periodic Maintenance	337	553	585	-	-	1,475	1,298	1,582
Upgrading	477	436	170	-	-	1,083	2,326	3,519
Rehabilitation	-	-	-	-	-	48	317	773
						Total	**10,475**	**14,442**

Note: The drainage restoration for the 1993 flood disaster alone is estimated to cost Rs 1.3 billion approximately.

About 250 km of road construction per year was achieved at an average expenditure of about Rs 486 million per year or at the rate of Rs 1.93 million per kilometre of road during the Seventh Five-year Plan in Nepal. The average annual expenditure for road maintenance during the Seventh Plan period was about Rs 106 million per year.

The Eighth Plan target requires 596km of new road construction per year at an average annual expenditure of Rs 1,308 to 1,700 million per year (Table 26) besides maintenance (periodic upgrading and rehabilitation) of 521km per year at an average annual expenditure of Rs 788 to 1,174 million. It is therefore clear that, during the Eighth Five-year Plan, the physical and financial capabilities have to be more than double for new constructions, and the maintenance capabilities have to be greater by six to seven times those of the Seventh Plan.

If the road development trend in Nepal is to follow the trend of other countries, for a road network of about 26 km for 100 sq.km. and at one km of road for every 500 persons (as of the 1991 population) by 2010 A.D., new road constructions have to be carried out at the rate of about 1,500km per year at annual expenses (1991 prices) of about Rs seven billion per year. This requires physical and financial capabilities greater by seven to 14 times those of the Seventh Plan period for new constructions alone (Table 27).

Table 27: Road Networks in Nepal for a 26 km/100 sq.km. Road Density

Region	Population in millions (1990)	Area (100 sq.km.)	Length (km)	Area-wise road density (km/100 sq.km)	Population-wise road density (ppln/1 km road)	Additional road length required beyond 1991 (km)	Estimated cost at 1991 prices million (Rs)
Terai	7.97	25,021	17,000	67.9	468	13,633	40,900
Mid-hills	8.87	1,00083	18,000	17.99	490	13,966	83,800
Himalayas	1.66	22,077	3,000	13.59	537	3000	18,000
Overall	18.5	1,47,181	38,000	26	487	30,599	1,42700

Formidable problems will be created by the need for maintenance of additional networks and the rehabilitation of damage from floods and natural disasters. Damage to roads, linking Kathmandu with the *terai*, during the recent (July 1993) flood disaster cut off Kathmandu for about 28 days. With practically no damage to the airports, air transport remained the only link. The normal traffic of about 100 movements per day at Tribhuvan International Airport in Kathmandu increased to about 200 movements per day. Similarly, the traffic at Bharatpur and Simara airport increased from 26 and 40 to 54 and 108 movements per day respectively.

It is therefore clear that substantial increases in terms of investment and implementation in the road sector are far from practical in the current economic climate and within the implementational capabilities foreseeable in the near future. Trails, suspension bridges, and airports are more practicable in terms of sustainable and cost-effective modes of transportation. Remote mountain areas under minimal economic activities, food-deficit conditions, and vulnerable geo-ecological environments do not lend to accelerated road network expansion.

Lukla and Jomsom are socioeconomically prosperous, remote places because of the flow of tourists, although these places are connected by air transport only. Connecting these places by road network is neither economically feasible nor environmentally desirable.

Seven hundred and thirty-three km of trails and 105 suspension bridges were constructed during the Seventh Plan period at Rs 31 million and Rs 148 million respectively. Additionally, 59 km of trails were constructed under the Food for Work Programme at a progress rate of 70 to 95 per cent.

The Eighth Five-year Plan has targetted 955km of trails at Rs 200 million and 300 suspension bridges at Rs 850 million. The allocation for non-motorised, rural transport thus comes to 8.6 per cent of the total outlay for roads.

In the Civil Aviation sector, Rs 275 million have been allocated in the Eighth Plan for hilly airports against a total outlay of Rs 2.63 billion for Civil Aviation in the Eighth Five-year Plan period.

In the irrigation sector, a total of 2.67 billion rupees has been allocated to irrigate 58,240 ha of land in the hill areas. This comes to about 16 per cent of the total outlay for the irrigation sector.

Experiences of irrigation in mountainous areas have shown that only 113,000 ha, or less than 27 per cent of the total irrigable area (435,000 ha), have the potential for irrigation. The development of hill irrigation under central level programmes has not produced any significant improvement in the agricultural yields in mountain areas of Nepal (Deoja and Adhikary n.d.).

Thus, the allocation of Eighth Plan Expenditure for hill airports and for hill irrigation comes to about 2.5 per cent and 24 per cent of the outlay for roads respectively.

Construction of new unpaved STOL (Short Take-off and Landing) field airports in the mountainous regions of Nepal costs 60 to 80 million rupees for each airport, which is equivalent to the cost of six to 12 km of road construction. Improvements in the existing STOL fields to bring them up to paved standards with additional navigation and communications' aids will cost about 30 to 80 million rupees each. Similarly, improvement of the existing HS-748 (Avro) capability airports, such as Pokhara, Bhairahawa, Biratnagar, Nepalganj, and Simara, will cost about 150 to 300 million rupees each. Thus, the total cost of the improvements necessary for the 42 domestic airports comes to about Rs 2 billion which is equivalent to construction of about 200 to 400 kilometres of new road.

The remote area access study, carried out for Surkhet-Jumla in Nepal, in 1990, shows the comparative costs of different modes of transportation for the study area (See Table 28). The cost of initial investment comes to about 0.546 times for ropeways and about

0.0041 times for waterways than for road transportation (BECOM DEVTEL 1990). Transportation costs come to 1.17 times those for ropeways, 2.47 times those for air, 1.65 times those for mules, and 0.25 times those for waterways in comparison to road transportation costs. These routes indicate that air transport holds promise as a viable transportation mode in view of the low initial investment as well as the low maintenance costs.

Table 28: Comparison of Transportation Costs for Various Modes of Transport

	Road	Ropeway	Air	Mule	River
Investment	Rs. 1205×10^6 (169 km)	Rs. 659×10^6 (39 km)	Rs. 60×10^6 (1 STOL Field)	Rs. 2×10^5 per km	Rs. 4.987×10^6 (60 km)
Maintenance	Rs. 57000 to 66000 per km per year (10.4×10^6 per year)	4.4×10^6 per year	Rs. 6×10^5 per airport	Rs. 10,000 per km	N.A.
Transportation costs, excluding investment	Rs. 3579-4997 per tonne (Rs 14.3-26.6 per tonne per km) (Dailekh-Jumla)	Rs 6585-8466 per tonne (Dangar *gaon* - Kalikot--Jubitha)	Rs 8667 to 11143 per tonne (Surkhet-Jumla)	Rs 6141 - 7190 per tonne	Rs 885 - 1138 per tonne

Source: BELCOM, DEVTEC, "Remote Area Access Study," UNDP Project NEP/86/016, 1990 - Modified by B. Deoja