Rural Accessibility and Development: Sustainability Concerns in an Ecologically Fragile Mountain Belt

Rinki Sarkar

The governments of the Himalayan hill-states and the international donor agencies have consistently advocated disbursal of funds for improvement of road connectivity in keeping with the mandates of a “development paradigm” that advocates the importance of bringing remote mountain villages under the influence of modernisation and change. This paper evaluates the impact of such accessibility in a mid-Himalayan belt of Himachal Pradesh, through field studies. While road mileage has expanded at a fairly rapid pace, initiating development and change in numerous spheres, the paper argues that reckless road construction activities initiated under strategic, political or economic compulsions have adversely affected the fragile environment of the region.

In the Indian Himalayas, “motor” roads are essentially a feature of the post-planning era. A region where seasonal transhumance paths and some ancient trade-routes, traversed on foot, were the principal corridors of movement, the undulating landscape today is marked by a network of highways and rural link roads. Local inhabitants perceive roads as a necessary prerequisite for expanding economic opportunities. These aspirations have been fully exploited by politicians who are known to promise “road-connectivity”, while campaigning for votes in their local constituencies. A number of rural roads in this region have, therefore, come up, often in haste, due to local political pressure. However, most of the major road arteries in the Himalayas owe their origins to national security requirements. Meant to defend territorial claims in the event of insurgencies or invasion from neighbouring countries, this strategic measure has had other far-reaching socio-economic consequences. Besides ensuring steady supplies to military garrisons, these border roads have indirectly benefited the local community all along the route and even further away, integrating the region with urban centres in the plains.

The objective of this paper is to evaluate outcomes of these accessibility changes in an ecologically fragile belt of the mid-Himalayas. The findings are based on a scrutiny of relevant literature and field studies conducted in 82 villages located across three mid-Himalayan districts of Himachal Pradesh. A large number of these villages were fairly remote about three decades ago. But the extension of road linkages, particularly after the late 1990s, has been crucial in triggering the process of transformation and change. Some of these trends are exemplified by unearthing district-level variations in well-being and development attributable to variations in accessibility. An attempt is also made to reflect upon the emerging environmental concerns linked to these changes.

Section 1 presents a historical account of accessibility developments in the mid-Himalayan belt. Section 2 reviews the evolving debate on the link between transport and development. The core segments of the paper assess the impact of variations in accessibility changes in the study area and the associated environmental externalities. The concluding part delves on the implications emerging from this study. A framework of preventive measures is suggested for ensuring sustainable means of accessibility in ecologically-sensitive belts of the Himalayas.

1 Foot Tracks to Motor Roads

In high altitude belts of the western Himalayas, local inhabitants have exhibited great ingenuity for overcoming accessibility...
constraints due to the harsh terrain. Archival accounts\(^1\) indicate that even during the pre-colonial times, besides regional movement corridors, there were long distance trade routes. In Himachal, trade with neighbouring Tibet was fairly common for procuring necessities such as salt and wool in exchange for barley and wheat obtained from grain surplus regions in the plains. A network of mule tracks and footpaths were carved out for negotiating the rugged landscape and high altitude mountain passes. In many locations since these narrow paths could only be traversed by sheep that served as baggage animals, goods movement was intrinsically synchronised with long distance seasonal transhumance trails necessary for livestock rearing. At the local level, there were innumerable footpaths crisscrossing the steep slopes for connecting neighbouring villages. Wherever required, ropeway-bridges made out of local timber and twigs were constructed for transporting people across turbulent streams and rivers flowing throughout Himachal. Remnants of these indigenous systems of transport continue to mark the landscape providing an adequate proof that construction of these mountain trails and bridges called forth great engineering ingenuity as well as human nerve.

British presence in the region led to a brisk expansion of mule-tracks mainly to ensure better connectivity across colonial bases in the hills. In the more remote well-stocked forests areas, mule tracks or “bridal paths” were developed to facilitate exploration of timber reserves much needed for their ongoing imperial railway construction programmes or the growth of emerging administrative hill towns. A fleet of runners, baggage animals and mules catered to their mobility requirements. Rail-based mountain transportation systems were initiated much later. However, these railheads were invariably truncated at the foothills of the Himalayas. Despite success in some ventures,\(^2\) the colonial administrators eventually passed a verdict against such projects because they anticipated that the threat of recurring natural hazards could endanger the sustainability of railroads, in the region. This policy move, meant to avert the possibility of mishaps, brought to the forefront the inherent constraints imposed by the fragile terrain for future capital-intensive transport developments. Much of this seems to have gone by unheeded during the more contemporary context.

The motor-road network essentially came up during the post-independence planning era. Major arteries were first constructed for strategic reasons in response to rising possibilities of military encounter with nations bordering the Himalayan arc. About 10,000 km of highways came up immediately after the 1960s (Ives and Messerli 1989). The Himachal government allocated nearly half of the First Five-Year Plan fund outlay to the transport sector in keeping with these exigencies. Though the relative share of the transport sector has declined over the years due to greater emphasis on the energy and social sectors, a sizeable amount of resources continues to be invested in the construction, maintenance and upgradation of roads for promoting regional development as reflected in Figure 1.

Because of these interventions, there has been a phenomenal increase in the length of the road network. In 1950-51, Himachal’s surface road density of 8.5 km per one lakh population was the lowest in India (Planning Commission 2005). Since then, there has been a marked increase in road length which is currently around 27,000 km or 454 km per one lakh population. As per the latest estimates available with the public works department, 80% of the road network caters to the predominantly rural population in the state and 60% of the villages have already been connected by roads. This is quite an achievement given the difficult nature of the mountain terrain. Roads have also been progressively upgraded. In 1948, the state had only 37 miles of metalled roads (GoHP 2002), which is a pittance in comparison to the present scenario wherein metal-roads account for 43% of the entire road network.

These developments have significantly reduced goods transportation costs at the village level as evident from Table 1 which provides a comparative picture across traditional and modern modes of goods transport. Road linkages have been progressively designed to provide better connectivity to wholesale markets in larger towns and metropolitan centres ensuring a better price for local produce. Roads also allow fuel and much of the food needed to support the growing highland population to be brought in from the Indo-Gangetic plains (Owen 1996). With improvement in economic well-being the urge to have access to a host of non-food items and consumer-durables has dramatically risen over the last two decades. These mass-produced “urban” goods are routinely transported to cater to the rural population through improved road connectivity to wholesale market centres in neighbouring states and even distant ones. It is primarily for these reasons that the road capacity of eight major arterial road corridors of the state are being widened to enable swift “two-way” flow of goods through financial aid sanctioned by the World Bank.\(^3\) The present state-road programme also seeks to cater to the complex goods and personnel movement requirements of a host of small, medium and large hydroelectric projects that are coming up in the region, for meeting national energy needs of a rapidly growing economy.

**SPECIAL ARTICLE**

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**Figure 1: Plan Outlay on Roads and Bridges (Himachal Pradesh)**


**Table 1: Goods Transport Costs across Different Modes of Travel**

<table>
<thead>
<tr>
<th>Modes of Transport</th>
<th>Cost per km per Apple-box of 20 kg (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human porter (headload)</td>
<td>20.00</td>
</tr>
<tr>
<td>Mules</td>
<td>4.50</td>
</tr>
<tr>
<td>Ropeway</td>
<td>4.50</td>
</tr>
<tr>
<td>Motor carrier (unmetalled road)</td>
<td>0.50</td>
</tr>
<tr>
<td>Motor carrier (metalled road)</td>
<td>0.25</td>
</tr>
</tbody>
</table>

(source: Field interactions in Shimla district, November 2007)
2 Link between Transport and Development

Nurturing a policy that gives impetus to the transport sector is deeply rooted in the notion that transport is important for economic development. This is of particular relevance for hill-states such as Himachal Pradesh, where the terrain can impose major obstacles to goods and passenger transport movements. Viewed from this perspective, the important role of the transport sector is summed under what is generally known as the “development argument”. In a nutshell, transport is considered to be central to overall regional development as without physical access to jobs, health, education and other amenities, the quality of life suffers and without proper access to resources and markets, growth stagnates and poverty alleviation cannot be sustained (Banister and Berechman 2000). Therefore, in a number of developing countries, transport policy objectives have been largely in consensus with this historic and most common view. Creighton’s (1993) comprehensive review of longitudinal studies undertaken in Latin America, Africa, south and south-east Asia showed that good quality transport improved economic performance and human well-being. Besides overall benefits from travel time savings, better accessibility led to enhanced levels of agricultural output in rural belts, increased fertiliser usage, improved access to credit and there was greater scope for technological diffusion. Educational attainment was better and access to health facilities was easier as educational institutions and health centres were invariably found to be located closer to the road network. The upward trend in the growth rates of the Himachal economy, presented in Figure 2 is considered to be partly attributable to returns from a conscious policy of sustaining investment in physical infrastructure such as roads (GoHP 2002).

![Figure 2: Growth Rate of Himachal Pradesh and the National Economy](image)

Despite widespread belief in the importance of better accessibility, critics have consistently expressed scepticism about the inevitability of outcomes associated with investment in transport infrastructure (Gauthier 1973 and Wilson 1973). The argument put forth is that development is a complex process and it is hard to visualise how one factor can be singled out as a causal agent. They emphasise the significance of other complementary “non-transport” factors that are equally crucial for promoting growth and development. These include education, appropriate psychological attitudes towards economic activity and change, entrepreneurial and technical abilities, the legal, political and social environment as well as the natural resource base. In response to these reservations, roads are now considered to be necessary, but not sufficient for economic development. However, if a region exhibits the presence of buoyant economic or other particular conditions conducive to growth, then its full potential will not be realised without further transport investment.

While there has been much discourse on the role of transport in triggering development, the associated environmental problems arising due to road construction activities and increasing regional integration have been less addressed both in academic and policy circles. This is because analytical endeavours have mostly focused on the more physical and quantifiable benefits associated with improvements in accessibility (Banister and Berechman 2000). The deteriorating social and environmental consequences, linked to the “transport-development” debate, also need to be objectively assessed and evaluated. The next sections focus on some of the positive and negative externalities associated with transport developments in an ecologically fragile region of the Himalayas.

3 Impact of Accessibility Changes in the Study Area

3.1 The Study Area

In order to assess the impact of accessibility changes more closely, field studies were conducted in the mid-Himalayan belt between 1,800 and 3,000 metres encompassing three districts of Himachal Pradesh (Figure 3). The region chosen for study reflects more or less similar geographical characteristics where the undulating terrain imposes inherent constraints to accessibility.

By tracking contour lines on the Survey of India topographical sheets, the relevant altitudinal belt was identified. District census village location maps were then superimposed on to these topographical sheets for locating all the revenue villages to form the sampling frame. For initiating field studies, a sample of 82 representative villages scattered across a wide expanse of the demarcated zone were then randomly selected. Field surveys were conducted between 2000 and 2001. The objective was to assess how villages with disparate accessibility conditions have performed in terms of basic development parameters such as economic
condition, educational attainment and the nature of access to a host of physical and social infrastructure services in the region. Detailed field investigations were also undertaken to identify other “non-transport” factors that could have affected these outcomes.

A sample of 20 households were surveyed in each village based on a stratification procedure that captured variations in landholding and caste composition. Structured as well as open-ended questionnaires were used to record socio-economic characteristics of each household, access to a host of infrastructure services at the village level and anecdotes about accessibility developments in the region. Table 2 summarises the nature of variation in road access for the sample of villages.

The survey results clearly showed that there has been a marked change in accessibility in this region. The mean distance to a motor road was around 9 km, 25 years ago. Today the road is only 3 km away from a village, on an average. This has resulted in travel time savings of nearly one and half hours of arduous walking. The road surface has also improved. In 1975, only 12% of the village roads were metalled. However, in 2000, 54% of all rural road links in the region were found to have attained metalled status as per the field surveys.

A composite accessibility index was developed for ranking the three districts for scrutinising the impact of accessibility changes in the study area. A simple index was computed in terms of the proportion of villages in the district connected by roads times the proportion of those roads that were metalled so as to reflect an overall picture of accessibility in the region. An index of “1” would indicate very high levels of accessibility both in terms of road linkages and the quality of infrastructure. There was no data on the length of road blockages per annum due to natural calamities which, if incorporated, would have provided a more accurate representation of accessibility. District-wise variations in accessibility levels are presented in Table 3.

### 3.2 Accessibility Narratives

Kinnaur’s high accessibility status (Table 3) is largely attributable to special enabling factors such as the speedy development of National Highway 22 following the 1962 Indo-China war. Prior to that, the old-Hindustan Tibet salt-trade route was the only track of any significance. The British had upgraded this path to a three-metre wide mule-track and after independence a jeep road was constructed along the same alignment. Because of heavy snowfall, this high altitude road was unusable during winter months. Therefore, a new low altitude link along river Sutlej was speedily constructed to cater to emerging strategic compulsions by extending the road from adjacent Shimla district towards Kinnaur. In 1973, the road was declared as a “national highway”. Beyond Wangtu-bridge, the Border Roads Organisation was entrusted with the jurisdiction of maintaining the road. The “national-highway” status and involvement of the Border Roads Organisation has ensured investment of ample funds and the use of latest technology for road maintenance and upkeep. As Kinnaur is a tribal area, special assistance funds are allocated for catering to infrastructural needs of the region under the Integrated Tribal Development Programme. A large fraction of these funds has been invested for improvement of the road network. Further, Kinnaur has always had a politically favoured status because representatives from the erstwhile “Bushahr” dynasty and other influential visionaries who hail from the region have consistently assumed office at the state government level, influencing infrastructural fund disbursements to the region. All in all, this has led to a major improvement in accessibility conditions across the region. The all-weather National Highway 22 cuts through the entire district and is connected to rural roads at regular intervals for linking villages located on either side of the mountain facade (Figure 3). Interactions with the local community revealed that the National Highway has been a potent force for boosting horticulture development in the region by facilitating the transporation of apples to major wholesale market centres all over India (Sarkar 2007a).

As compared to Kinnaur, accessibility developments have been less of an all-pervasive phenomenon, in Kullu district. National Highway 21, which meanders along the right bank of River Beas (Figure 3), was developed after the 1962 Indo-China agression as an alternate route to the border areas of Ladakh and Lahaul Spiti. The highway was essentially a mule track created by the British for accessing the Manali area which was an important timber reserve. Manali was also a retreat of sorts since the climatic conditions in this area resembled that in Europe. Later, they upralded the mule track to a jeepable road. After independence, the highway was patronised by Nehru for whom the region was a retreat. A parallel road known as the left bank-road was constructed around the late 1950s to promote horticulture in the more fertile belts along the river. At that time, Kullu was a part of Punjab hill states and political leaders such as Lal Chand Prarthi perceived the “comparative advantage” of nurturing apple cultivation in these parts. They succeeded in persuading the locals to raise orchards in place of traditional subsistence-oriented foodgrains and promised to ensure foodgrain supplies from the booming graneries of Punjab. The left bank road was supposed to aid in materialising these policy moves. The road was also an important link to the Russian artist Svetoslav Röerich’s estate in Nagar. Röerich was a close associate of Nehru at that time and these diplomatic associations partly influenced the coming up of roads in the region. The post-1985 tourist influx, following insurgency problems in Kashmir, has increased the significance of National Highway 21 for such purposes. All along the highway, cash crops such as vegetables are grown in the low-altitude belts, while horticulture and tourism flourishes in the high altitude areas.

### Table 2: Accessibility Variations across the Sample of Villages

<table>
<thead>
<tr>
<th>Distance from Road (km)</th>
<th>Villages (Nos)</th>
<th>Mean Distance (km)</th>
<th>Std Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>23</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>0-4</td>
<td>36</td>
<td>2.2</td>
<td>1.06</td>
</tr>
<tr>
<td>4-8</td>
<td>15</td>
<td>6.17</td>
<td>1.16</td>
</tr>
<tr>
<td>Above 8</td>
<td>8</td>
<td>13.25</td>
<td>2.05</td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
<td>3.38</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Field Surveys 2000-01.

### Table 3: Index of Accessibility across Districts in the Study Area

<table>
<thead>
<tr>
<th>Distance from Road (km)</th>
<th>Villages (Nos)</th>
<th>Mean Distance (km)</th>
<th>Std Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>23</td>
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<td>Total</td>
<td>82</td>
<td>3.38</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Field Surveys 2000-01.
Road connectivity in other parts of Kullu district such as the interiors of Sainj and Banjar tahsils has received comparatively less impetus. Field surveys indicated that the locals have to trek nearly 7-9 km for accessing a road. These areas have, therefore, flourished less in comparison to the belts along National Highway 21. The occupational structure is tilted towards traditional occupations such as agriculture and livestock rearing. However, the locals have found resilient ways of adapting to accessibility constraints for generating cash sources of income by selling opium and cannabis illegally and by collecting medicinal herbs and lichen from oak trees in the wild for sale. These non-timber forest products that are manually transported by the collectors have assumed high commercial significance over the last two decades to cater to demands from the overseas tourist population, pharmaceutical and cosmetic industries. Trade in these “light-weight-high-value” commodities becomes an economically viable proposition under such inaccessible conditions. Poor road access is a boon of sorts for these engagements as it assists in warding off security threats from the forest department and the police force due to the illicit nature of some of these activities. The recent construction of hydroelectric projects in some areas has widened employment opportunities somewhat besides expanding the road network.

Accessibility developments in Chamba district are much more recent. Field insights revealed that the impact of new roads has yet to be fully realised. It is only after the terrorist massacre of local shepherds near Satrundi close to the Jammu-Kashmir border, in 1998, that State Highway 33 has assumed strategic importance for catering to the daily requirements of the newly stationed Indo-Tibet Border Police regiments in the vicinity of Bairagarh. The local population essentially relies on traditional sources of income supplemented by casual employment in block development programmes, private construction sector and in-road maintenance ventures of the State Public Works Department. On the whole, the level of commercialisation was found to be relatively weak. Except for the tribal belt of Bharmaur, rural link roads have mostly come up after the mid-1990s and in response to routine state road expansion programmes, especially where the local politicians or panchayat representatives have been able to articulate their demands more eloquently and forcefully. As regards accessibility developments in Bharmaur tahsil, the role of Naga-baba, a saint-cum-social reformer, needs a special mention. Besides stressing the long-term benefits of education, cultivation of cash crops and the need to set up block-level administrative offices in the vicinity, he was able to convince the district administration that a road link was crucial for initiating social and economic change. The speedy extension of the road from Chamba town to this remote belt and the construction of the Karamukh bridge across the Ravi river, after the 1970s, is considered to be largely attributable to his efforts. The evidence of accidental events such as the presence of a political or social visionary is less common in other parts of Chamba district where villages are still getting connected by roads.

3.3 Accessibility and Development

Better access through roads is of special significance for widening economic opportunities, particularly in regions where there are severe geographical constraints imposed by the terrain. Therefore, besides unearthing the possible reasons behind variations in accessibility across the three districts, an attempt was also made to decipher whether these conditions could have affected economic prosperity. Consumption expenditure levels derived from household surveys, which is a conventionally used measure of economic well-being, are summarised in Table 4.

The overall trends do indicate a positive link between accessibility levels and economic status. An important reason for these outcomes is that roads have opened up the possibility of tapping a host of economic opportunities for these mountain villages. Nearly all parts of Kinnaur and some belts of Kullu district have witnessed these developments in consonance with better road connectivity. Anecdotal evidence based on field studies in the region indicates that road expansion has invariably led to a transition from subsistence farming to cash crop cultivation for sale. The scale of production tends to vary directly with the nature and range of road access. Roads have also opened up opportunities for engaging in non-farm sources of income. In most parts of the study area, access to casual employment in building construction, road development and other block-level civil works was found to have increased with better accessibility conditions. The growth of a number of ancillary activities such as petty retail trade and transport was also a common phenomenon in these parts.

It has been observed that a host of essential physical and social infrastructure services tend to cluster along roads (Rawat and Sharma 1997) which provides a further boost to the productive potential of a relatively more accessible region. Trends emerging from the present field study reinforce these findings. Inter-district variations in access to public transport, health and financial services such as banks appear to be positively associated with variations in accessibility levels as indicated in Figure 4.

Table 4: Accessibility and Economic Well-Being in the Study Area

<table>
<thead>
<tr>
<th>Districts</th>
<th>Accessibility Index</th>
<th>Mean Consumption Expenditure Per Household Per Annum (Rs)</th>
<th>Mean Per Capita Consumption Expenditure Per Household Per Annum (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinnaur</td>
<td>0.31</td>
<td>61,223</td>
<td>10,764</td>
</tr>
<tr>
<td>Kullu</td>
<td>0.16</td>
<td>38,777</td>
<td>7,114</td>
</tr>
<tr>
<td>Chamba</td>
<td>0.09</td>
<td>30,302</td>
<td>5,749</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2000-01.
A glimpse at the status of education of the current school-going age cohort clearly indicates that the proportion of dropouts and those not attending schools increases with remoteness. This is evident from Table 5. Most of the respondents indicated that proximity to the school is an important consideration affecting school enrolment and attendance, especially for the girl child. The mean age of dropouts was found to be 16 years and their educational attainment was limited to middle school level. This is because, primary and middle schools have largely been established in close proximity to the village, while high schools, intermediate schools and colleges tend to be located adjacent to roads.

Table 5: Accessibility and the Status of Literacy

<table>
<thead>
<tr>
<th>Districts</th>
<th>Accessibility Index</th>
<th>Total Population in the School-going Age Cohort: 5-19 Years of Age (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Studying</td>
</tr>
<tr>
<td>Kinnaur</td>
<td>0.31</td>
<td>86.22</td>
</tr>
<tr>
<td>Chamba</td>
<td>0.09</td>
<td>65.87</td>
</tr>
<tr>
<td>Kullu</td>
<td>0.16</td>
<td>84.45</td>
</tr>
</tbody>
</table>

Source: Field Survey 2000-01.

In Kinnaur, primary, secondary and high schools are located within a radius of 3 km of every village in the district. However, in Chamba, high schools can be as far as 6 km away. For remote mountain villages, increasing distance to educational institutions makes it cumbersome for the girl child to attend school because in addition to pursuing studies, she usually assists in a multiplicity of household activities such as grazing, firewood collection, fodder collection and other domestic chores. Field investigations revealed that lack of proper access to high schools and colleges has resulted in a certain level of inequity as regards educational attainment because only those households that have the financial means to rent accommodation close to road focused centres of learning have enabled their children to pursue higher studies.

The overall scenario presented in the above analysis does indicate a relationship between variations in the level of accessibility and human well-being across the three mid-Himalayan districts in the study area. These trends also support empirical relationships observed for other developing countries (Creighton 1993). It may be worthwhile to note that in addition to accessibility changes, a host of other non-transport factors may have fostered these outcomes making accessibility an important but not a sufficient condition for economic development. For instance, Kinnaur has better natural resource endowments. The climate is extremely suitable for growing good quality apples. Water from melting glaciers can be seasonally tapped for irrigating apple orchards. The average landholding is also higher as compared to Chamba and Kullu permitting more opportunities for diversifying agricultural production towards horticulture which is a risky venture with a long gestation period.7 Further, as Kinnaur is located at a relatively higher altitude, the apple crop matures much after the output from other apple-producing belts of Himachal Pradesh have been harvested and transported to wholesale markets in the plains. As a result, the fruit fetches a high off-peak price (Sarkar 2007b). The Kinnaurs are known for their “entrepreneurial” abilities due to their engagement in trans-montane trade with Tibet since traditional times. These cultural traits are important for risk-taking and proficiency in market-dealings. Income from government jobs supplements returns from horticulture as the local population has judiciously exploited the special job reservation policy benefits granted to them by virtue of their tribal status. Progress on the literacy front has also been somewhat higher as compared to Kullu and Chamba for historical reasons8 and also because education is perceived to play an instrumental role for having access to reserved jobs in various government departments.

In contrast to Kinnaur, the productivity of land, which is entirely rain-fed, is much lower in Chamba and so is the average landholding which thwarts possibilities of shifting towards horticulture and other kinds of cash crops. On the whole, the attitude towards new kinds of economic activity and change appeared to be somewhat perverse in Chamba district. While conducting field studies it was a common sight to find well-nurtured orchards owned by business interests from outside the region. However, these overzealous alien entrepreneurs did not seem to have any kind of demonstration effect for the local population of the adjoining villages, who were sceptical about embarking on such risky ventures. Interactions with the local community invariably revealed their preference for traditional occupations reflecting a kind of psychological inertia against crop-shifts. What has made things worse is that Chamba is also administratively and politically less favoured as compared to Kinnaur. There are very few state level bureaucrats who hail from the region partly because of the low educational status of the population. Consequently, these villages are less patronised for special treatment in policy quarters through local bureaucrats. The region is also known to have consistently hosted less motivated political leadership that has further crippled whatever development potential exists. Put together, these unfavourable conditions have staggered opportunities for economic growth and development.

Kullu lies somewhere in between as regards landholding endowments, soil fertility and the degree of political patronage. The more accessible regions have progressed in predictable ways by diversifying into cash crops or tourism. The less connected pockets of the district have continued to pursue traditional livelihood-based occupations mainly for subsistence. Their need for cash is realised through excessive extraction of medicinal herbs that threaten the region’s biodiversity or indulgence in other illegal activities such as hemp cultivation and sale that are socially harmful. But there are other devastating environmental concerns attributable to mountain roads which are scrutinised in the next section.

4 Environmental Costs and Mountain Roads

More often than not, environmental repercussions associated with the transport sector arise because users or suppliers of transport services do not perceive such effects as costs that need to be internalised or mitigated. Rather than overcoming these distortions, there is evidence that state intervention in transport markets has accentuated the incidence of environmental costs as governments tend to manipulate a transport provision in the hope of achieving regional growth or simply give vent to political motives without accounting for environmental damage (Burton...
In mountain states, infrastructure projects, for instance, roads, hydroelectric plants and special economic zones (SEZs) all have such untoward ramifications. Local, global and inter-temporal environmental effects associated with these projects are hard to quantify and assess. These are either ignored or passed off as trade-offs necessary for giving priority to national development goals.

The massive road construction programmes that were speedily implemented during the 1960s after the Indo-China conflict, clearly illustrated how military expediencies outweighed sound engineering (Ives and Messerli 1989). In the more contemporary context, reckless expansion of the road network continues overtly in accordance with well-framed “inclusive” growth policies, while environmental considerations are either ignored or partially addressed. In many cases roads have been constructed in haste because of potential political gains. In an intensive all-India study on the politics of infrastructure provision, Wilkinson (2006) empirically showed that electoral volatility is related to both road spending and actual road construction. However, he found that most of this construction was of poor quality. It is claimed that despite liberal central funding for Himachal Pradesh, much of the ongoing infrastructure projects, particularly roads, have been initiated for generating casual employment with less concern for the provision of good quality services (Sanan 2004). Such policies, undoubtedly, reflect political exigencies and the necessity of building and securing vote banks. An assessment report on roads in the state (Planning Commission 2005) found that the quality of roads was not up to the mark with poor compaction and drainage design causing disintegration, particularly during monsoon months. The same report also found that road design and construction paid little or no heed to environmental considerations.

Academic studies undertaken in the region have reiterated that road construction in the Himalayas has been widely pursued disregarding geomorphologic constraints that characterise the region (Owen 1996; Gardener 2000; Saczuk 2001; Petley et al 2006; Sarkar 2008). Ill-conceived road alignments, defying natural conditions and a terrain susceptible to tectonic movements, have accentuated the occurrence and impact of landslides. It has been estimated that in the Indian Himalayas, for each linear kilometre of mountain road, nearly 10 small to medium landslides occur as a result of slope instability caused by the road (Ives and Messerli 1989). The use of heavy explosives for blasting operations has aggravated these problems. Deforestation caused by road construction has deprived the region of all the tangible and intangible ecosystem services that forests provide in terms of watershed protection and soil conservation enhancing the susceptibility to landslides (Sarkar 2007a). Besides, illegal smuggling of timber and other kinds of non-timber forest produce tends to heighten with better road connectivity threatening the overall biodiversity in the Himalayas (Kreutzmann 1991). Roads tend to trigger landslides which, in turn, cause periodic road blockages. Such calamities impose a sizeable burden on the state exchequer for maintenance and upkeep of roads besides erecting temporary obstacles to mobility requirements of the local population. Frequent damages to poorly designed roads also undermine the high degree of capital infusion invested for laying mountain roads, that can vary between Rs 50 lakh and Rs 1 crore per kilometre of road constructed (Sarkar 2007c).

Road debris generation and disposal is another source of environmental degradation in the hills. A kilometre of road requires the removal of nearly 60,000 to 80,000 cubic metre of debris which causes slope instability prompting landslides. Even after construction, the slope instability continues to produce enormous volumes of debris amounting to nearly 600-700 m³ per annum, per kilometre of road. The debris is usually dumped down slope causing damage to vegetation, forests, pastures and agricultural lands. Ives and Messerli (1989) quote a number of studies that ascribe the enormous annual amounts of debris production to unsatisfactory road alignment and poor design.

Even local public opinion is oblivious linked to the more vivid economic benefits emanating due to roads. Pilgrim’s (1999) field studies on community perception of natural hazard risks, in a high altitude village of the western Himalayas, demonstrated how locals ascribed the occurrence of a landslide along their village road link to the wrath of gods rather than to an inadequate road site survey. For the village population, vulnerability to risks was secondary to the advantages of market integration and lucrative gains from sale of apple produce which the road facilitated. As part of the present study in the mid-Himalayas, interviews with the local population indicated that as roads provide potentials for augmenting cash sources of income and as roads tend to attract a host of essential infrastructural services, the local inhabitants prefer to live within the region instead of migrating out for employment. The doubling of village population between 1975 and 2000, in the study area, is partly attributable to such emerging “introvert” patterns of development. But demographic changes of this nature have started exerting undue pressure on the fragile natural resource base in the vicinity because of excessive biomass extraction pressures, particularly firewood, for catering to the rising numbers (Baland et al 2007).

These socio-economic processes have also induced unwarranted land use changes resulting in habitat use and abuse. In tectonically active mountain chains such as the Himalayas, landslides provide natural mechanisms by which a mass balance can be achieved between uplift and erosion (Petley et al 2006). The traditional mountain-village land use morphology was characterised by a compact cluster of houses. The forests and terraced fields, in close proximity, regulated the downslope movements of water and soil keeping the natural erosion processes at bay. With changing circumstances road construction, expansion of cultivation areas for meeting cash-income compulsions and the haphazard construction of built-structures on to natural erosion paths through the expropriation of forest land and terraced fields have hindered the functions that the traditional village land use structure was meant to perform for mediating damage caused by natural hazards such as landslides. Saczuk’s (2001) inter-temporal study of developments along the National Highway 21 in Kullu district of Himachal Pradesh, based on satellite imagery, vividly indicates rapid land use change into geomorphologically active regions. The highway opened up a hitherto remote area to commercialisation pressures through horticulture and later tourism,
transforming the region. He concluded that an increase in settlement areas in active “deposition zones” near the valley bottom combined with the reduction in forest cover in “release areas” and the associated soil anchoring that trees provide could certainly lead to an increase in the activity of natural erosion processes and result in damage to life and property. These transformations are depicted in Figure 5.

**Figure 5: Changing Characteristics of Land Use and Village Morphology**

High-altitude mountain roads are prone to accidents because of high road curvature, slope, and narrow width that cause fatigue as well as poor visibility. Such problems intensify during nighttime driving. Due to these geotechnical constraints and delay in access to post-accident medical care for the victims, road accidents tend to be more fatal in the mountains (Rautela et al. 2007). Based on government data sources, the fatality index, which is the ratio of fatalities to the number of people injured through road accidents, was separately computed for mountain districts and those in the plains of Himachal Pradesh. The index for high-altitude areas turned out to be twice the value obtained for the plains confirming the occurrence of more fatalities in the mountains. Thus, while there has been a spectacular increase in road expansion across the mid-Himalayas, so has the vulnerability to accidents.

The rapid pace of development and change being witnessed in the region has also led to unforeseen circumstances in the social sphere. Critics assert that while road expansion programmes have led to regional integration enhancing economic, social, and geographical mobility, adverse environmental consequences have arisen, concomitant to these changes. For instance, these trends have disrupted village solidarity, as the need for cash arises to cater to the desire for new consumption patterns and modes of living, introduced through roads. This has modified the village community’s rate of time preference in favour of present consumption with little regard for long-term environmental implications (Baland and Platteau 1996).

Field interactions with senior members of the local community confirm these emerging trends (Sarkar 2006). There was a fairly unanimous consensus that development and change initiated through roads has led to the weakening of collective action and cooperative spirit in the community, which was crucial for managing and conserving natural resources, cultural heritage sites, local art and architecture, diet and dialect endangering the cultural identity of mountain people. There has been a progressive demise of social institutions which formed the core of livelihood systems based on division of labour within the family and cooperation across households for ensuring judicious use of natural resources. In course of fieldwork undertaken in the region, it was found that customs, traditions, and social norms created to adapt to environmental constraints and contextual parameters are now being steadily abandoned as the process of modernisation takes precedence. The powerful role of the local deity which served as a binding force for maintaining social integrity has narrowed down to the more “ritualistic” spheres of life in a fervent bid to preserve indigenous cultural traits.

### 6 Conclusions

Over the last five decades, the expansion of the road network across the Himalayas has been quite phenomenal, particularly in states such as Himachal Pradesh. There is no doubt that roads have been instrumental in promoting economic growth and in opening up a haven of opportunities, especially in potentially buoyant areas. This was quite evident from field studies conducted in the region as exemplified in this paper. However, concomitant to these changes, undesirable environmental consequences have arisen. Reckless road construction activities initiated under strategic, political, or economic compulsions have adversely affected the fragile environment of the region. Poorly aligned road linkages, on predominantly sloped terrain that forsake the importance of geomorphologic constraints or slope stabilising vegetation, have enhanced the occurrence and impact of landslides in a region inherently prone to natural hazards. Under these circumstances there is an urgent need for formulating a framework of preventive measures so as to ensure sustainable means of accessibility in ecologically sensitive belts of the Himalayas.

To begin with, a geographic information system (gis)-engineered data-base for the region, which consists of geomorphologic information, landslide-zonation specificities and land use maps need to be constructed and monitored. This must form the basis for all future road network extension or upgradation programmes in the region. These maps coupled with ground truthing in crucial locations can certainly prevent road alignments from coming up in zones that are landslide-prone or where slope stabilising vegetation needs to be preserved for hydrological reasons or to check soil erosion. At present, there is hardly any resource base in this respect. Neither is there any designated authority set up for recording and generating such maps. In effect, there is no geomorphology map of India and the infrastructure project authorities hardly demand such a map at planning stages (Sarkar 2008). Recourse to environmentally benign technology for constructing roads is also crucial. Some road stretches are particularly prone to accidents. These zones must be tended to...
through adequate safety measures by better road geometrics, road signage and local awareness programmes. Above all, local, global as well as inter-temporal environmental costs need to be anticipated and accurately incorporated into road investment appraisal mechanisms. Wherever possible, sustainable means of transport such as ropeways that work on gravity must be installed as an effective alternative to rural link roads. These measures will need to be articulated effectively to the local community by highlighting the environmental benefits. The effectiveness of such public education will, of course, depend on the pace of social change and the concomitant sensitivity to environmental issues at the local level.

NOTES


2. Such as the Kalka-Shimla (1900), Haridwar-Dehradun (1900) and the Siliguri-Darjeeling (1886) rail links.

3. Based on personal communications with Public Works Department officials in the state (November 2007).

4. As early as 1892, the colonial administrator, Lord Lugard wrote that the material development of Africa could be summed up in one word—“transport”. In similar vein Munby, emphasised that there is no escape from “transport” through his academic publications in the 1960s (Hoyle 1973).

5. These narratives are largely based on field interactions.

6. Nine per cent of the state-kitty is allocated every financial year for development of Tribal areas.

7. The average landholding per household in Kinnaur, is 0.06 hectares, in Kullu it is 0.64 hectares and in Chamba it is 0.54 hectares.

8. Ethnographic interviews in many villages in the region indicated the presence of educated elderly villagers who took great pains to secure education by residing away from the village. Kings from the local dynasty were also responsible for encouraging literacy by awarding scholarships to aspiring students.

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