Design and Appraisal of

Rural Transport Infrastructure:
Ensuring Basic Access for Rural Communities
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Overview and Conclusions

Rural transport networks in most developing countries are underdeveloped and of poor quality. It is estimated that about 900 million rural dwellers in developing countries do not have reliable all-season access to main road networks, and about 300 million do not have motorized access at all. At the same time, resources are being spent on upgrading roads to higher than economically justified standards for populations that already have a reasonable level of access.

Rural Transport Infrastructure and Poverty Alleviation

Various studies have provided evidence that poverty is more pervasive in areas with no or unreliable (motorized) access—what are referred to as unconnected areas. For example, in Nepal, where the percentage of people below the poverty line is as high as 42 percent, the incidence of poverty in unconnected areas is 70 percent. In Bhutan, the enrollment of girls in primary schools is three times as high in connected villages compared to unconnected ones. In Andhra Pradesh, India, the female literacy rate is 60 percent higher in villages with all-season road access compared to those with unreliable access.

There is a growing body of evidence that rural transport infrastructure (RTI) is an essential, but not sufficient, ingredient of rural development and sustained poverty reduction. Additional building blocks for rural development include complementary public and private investment, such as water and energy supply, productive activities, and social and economic services.

For rural transport interventions, a new approach is emerging which requires a more holistic understanding of the mobility and access needs of rural communities. The affected communities themselves are leading this demand-driven, participatory approach. In this context, rural transport consists of three elements: (a) transport services, (b) location and quality of facilities, and (c) transport infrastructure. This approach acknowledges that intervention may be required in all three categories, not simply the latter. To effectively utilize and target available resources, country specific rural transport policies and strategies are required.

The Concept of Basic Access

Basic access is the minimum level of RTI network service required to sustain socioeconomic activity. Accordingly, the provision of basic access is often viewed as a basic human right, similar to the provision of basic health and basic education.

Consistent with a basic needs focus, the *basic access approach* gives priority to the provision of reliable, all-season access, to as many villages as possible, over the upgrading of individual links to higher than basic access standard. A basic access intervention, in this context, can be defined as the least-cost (in terms of total life-cycle cost) intervention for ensuring reliable, all-season passability for the locally prevailing means of transport.

In a particular context or country, the ability to provide basic access is limited by resources. A key questions, therefore, that must be posed: what is *affordable*? Resources for RTI are typically scarce, with very limited support from the central government or other external sources.[i] Affordability therefore will primarily be determined by a population's capacity to maintain their basic access infrastructure over the long term. In cases where motorized basic access is not affordable, improvements to the existing path network and the provision of footbridges may be the only affordable alternative.

Designing Rural Transport Infrastructure for Basic Access

The majority of RTI in developing countries carries traffic of less than 50 motorized four-wheeled vehicles per day (VPD), but often a substantial number of intermediate means of transport, such as bicycles and animal-drawn carts. In most cases, the appropriate standard for these are single-lane, spot-improved earth or gravel roads[ii] provided with low-cost drainage structures, such as fords and submersible single-lane bridges.

The (trouble) spot improvement approach is the key to the least-cost design. Cost savings of 50 to 90 percent can be achieved compared with fully engineered roads of equal standard throughout. However, to put this approach into practice, a variety of constraints, such as political pressure and road agency and donor preference for high-standard, high-cost roads[iii] need to be overcome. More recently, some donor-financed interventions, in close collaboration with the responsible road agencies, have successfully implemented projects based on the spot improvement approach.

Labor-based approaches are best-suited for the implementation of RTI interventions. By transferring financial resources and skills to the local level, labor-based strategies can have a substantial poverty-reducing impact. They also have the potential to improve the gender distribution of income, providing employment opportunities for women where wage-employment is scarce.

Appraising Rural Transport Infrastructure for Basic Access

Due to the increasingly decentralized framework for the provision of local services, and in order to build ownership and mobilize local resources, the planning (and monitoring and evaluation) process for RTI must be participatory. Whereas simultaneously "bottom-up" and "top-down" iterative approaches are required, the starting point for the process consists of consultations at the local government and community level.

A key tool for the participatory planning process is a local government or community transport plan. Local engineers or consultants, in consultation with communities, should conduct a low-cost inventory and condition survey of the local transport network,

including roads, tracks, paths and footbridges, with a focus on existing obstacles. On the basis of the information generated, and additional economic, social and demographic information, an "as is" map should be produced. Based on such information, stakeholders can cooperatively decide upon desired improvements in the RTI network, taking into account objectives and available resources.

Establishing the priorities of an RTI intervention requires a selection process consisting of a combination of screening and ranking procedures. The screening process reduces the number of investment alternatives. This can be done, for example, through targeting of disadvantaged communities based on poverty indexes, or by eliminating low-priority links from the list according to agreed criteria. The balance of the alternatives will need to be ranked according to priority. Three methodologies for ranking are discussed: (a) multi-criteria analysis (MCA); (b) cost-effectiveness analysis (CEA); and (c) cost-benefit analysis (CBA). MCA often leads to non-transparent results, and is recommended only if cost criteria are included, and if the criteria are few, relevant, and have been determined (including their relative weights) in a participatory way.

This publication proposes a specific CEA approach for the majority of RTI where traffic is less than 50 motorized four-wheeled vehicles per day. A priority index is defined for each RTI link based on a cost-effectiveness indicator equal to the ratio of the total life-cycle cost necessary to ensure basic access, divided by the population served. With this approach, a threshold CE-value needs to be determined below which a link should not be considered for investment. The recommended method for determining a threshold CE-value is to do a sample cost-benefit analysis on a few selected links applying enhanced benefit measurement approaches for establishing a threshold CE-value.[iv]

For roads where higher than basic access standards seem justified—for example, those that provide an alternative access to the same location, or experience traffic levels above 50 VPD (but below 200 VPD)—the use of standard cost-benefit analysis is recommended. Appropriate computer-assisted models exist to aid transport planners and road agencies to optimize decisions on, among others, the threshold traffic for upgrading to a higher standard gravel or bituminous surface road. Such models include enhanced CBA and RED (Box 4.4). For roads that carry above 200 VPD, the utilization of HDM-4 is recommended.

Conclusions

In order to complement poverty reduction strategies, rural transport interventions must be an integral part of rural development interventions and focus on the mobility and access needs of rural communities. Substantial gains in accessibility—for more communities, in more regions of a country—are possible if rural transport infrastructure interventions are designed in a least-cost, network-based manner focusing on eliminating trouble spots. In view of budget constraints, selecting interventions requires a participatory physical planning process undertaken jointly with concerned local governments and communities, supported and coordinated by regional or central government agencies. Simple screening methods facilitate the selection process, reducing the number of alternatives to a manageable level. Ranking is then applied to the remaining options, and in most cases

(below 50 VPD) the use of cost-effectiveness methods is recommended, supported by sample cost-benefit analysis on selected links, where appropriate.

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[i]. Particularly for maintenance, the support of central government can rarely be relied upon. Exceptions are some road funds and other transfer mechanisms. See Christina Malmberg Calvo.

[ii]. In some cases, at steep hills (see Appendix B) or where suitable gravel material cannot be found (as in Bangladesh), paving may be the most economical solution.

[iii]. Often justified based on anticipated lack of maintenance and a lack of willingness to tackle this problem.

[iv]. This approach is further elaborated upon in Chapter 4 and Appendix E of the full text of the Design and Appraisal of Rural Transport Infrastructure, published as World Bank Technical Paper No. 496 and also available at http://www.worldbank.org/transport/publicat/twu-45.pdf