

Session 4.1: Notes

The Role of Rural Infrastructure

Contents

1. Rural Access Index
2. The Appraisal of Social and Economic Benefits
3. Impact of Rural Road Investment
4. The Design of Rural Transport Infrastructure
5. Financing Rural Infrastructure

Learning Objective

The purpose of this session is to provide an overview of the role of rural infrastructure and its relationship to both transport services and economic and social development. In addition the design and financing of infrastructure are considered.

1. Rural Accessibility Index

(Source: Roberts and Thum, 2005)

Definition.

'Sustainable access to rural transport' measures the number of rural people who live within 2 km (typically equivalent to a walk of 20 minutes) of an all-season road as a proportion of the total rural population. An "all-season road" is a road that is motorable all year round by the prevailing means of rural transport (often a pick-up or a truck which does not have four-wheel-drive). Predictable interruptions of short duration during inclement weather (e.g. heavy rainfall) are accepted, particularly on low volume roads.

Aggregation.

Results for 32 countries (representing 83% of the total rural population in all IDA countries) show that on average 64% of rural dwellers have access to the transport network. IBRD countries have much better access (93%) on average.

Relevance to Poverty Reduction and MDGs.

Physical isolation is a strong contributor to poverty. Populations without reliable access to social and economic services are poorer than those with reliable access. Problems of access are particularly severe in those rural areas which are distant from roads that carry motorized transport services on a regular basis. It is estimated that about 700 million rural dwellers in developing countries (the great majority of them living in IDA countries) are without reliable access. The large majority of them are poor.

'Sustainable access to rural transport' is not an MDG indicator, but it is a key contribution to achieving many of the Goals - underpinning pro-poor growth and improving social inclusion. Surveys have shown that poor people view isolation as a major contributor to their poverty and marginalization. Therefore, improving access to roads for rural dwellers is considered essential to promote rural development, improve access to human development services, raise incomes and stimulate growth for poverty reduction.

While 'sustainable access to rural transport' is a good indication of the shortfall in rural transport, the full picture requires more detailed information. Before upgrading tracks or paths to motorable condition, the availability of affordable transport services that can be operated on the road should be confirmed.

Sensitivity to Change.

The proposed indicator adequately captures changes in performance over time. Relatively small improvements in access to an all season road have marked impacts in terms of improving the overall indicator results. An analysis of preliminary measures for two countries with time-series data (during the period of 1997-2002) confirms the sensitivity of the indicator to change over time.

Current measures of this indicator show a significant difference between IDA (aggregate average of 64%) and IBRD countries (aggregate average of 93%). Amongst the IDA countries there is also a significant difference between those which receive blended assistance (aggregate average of 72%) and those which do not (aggregate average of 45%). Thus, increasing the number of rural people with sustainable access to rural transport is expected to have high and sustainable impact.

Measurability and Reporting.

There are two main approaches to the measurement of this indicator: (1) household surveys that include information about access to transport, and (2) mapping data to determine how many people live within the specified catchments of the road network. Surveys of households and individuals are the most cost-effective way of obtaining information on rural access. The majority of the 32 available IDA country indicators have been established using this approach. The surveys are designed to produce high-quality data and be representative for the main segments of population (thus, the main subgroup 'rural population' is adequately covered).

In establishing this new indicator, priority has been given to the countries with the highest populations so that the 32 countries already covered amount to 83% of the total rural population of IDA countries. Priority has also been given to those countries with the larger land areas for which rural access is likely to be particularly relevant.

Updates of the indicator will largely depend on the frequency of household surveys. These are usually expected to occur on a three year cycle. In collaboration with partner organizations, the Bank is developing a work program to ensure the sustainability of the proposed indicator through regular updating of surveys and expansion of coverage to additional countries. It is planned to establish this indicator for an additional 20 IDA countries within the next 12 months so it will be available for over 50 IDA countries by April 2005. A time series will be established for several countries and there will be further benchmarking against 'non-IDA' countries.

2. The Appraisal of Social and Economic Benefits

(Source: Hine, 2003)

All benefits from road investment are "Social Benefits" in the sense that they accrue to, and meet the needs, of society. In fact the main framework used to evaluate roads is often referred to as "Social Cost-Benefit Analysis". Here the adjective 'social' is used to emphasize that the result covers the effects on the whole population. This is different from a private or commercial cost-benefit analysis where costs and benefits are only analyzed from the point of view of a limited group of people. However the term 'social benefits' is often used to identify benefits that are non-economic in nature, left out from an economic cost-benefit analysis, or

perhaps wrongly valued within an economic appraisal. In order to discuss social benefits in a way in which they may be eventually incorporated properly in an evaluation framework it is first necessary to consider what economic cost-benefit analysis covers or misses out.

Conventional economic cost-benefit analysis provides an integrated framework with which to evaluate investments from society's point of view. After summarising and adding up all costs and benefits the final result may be just one or two numbers such as the Economic Rate of Return (EIRR) or Net Present Value (NPV). This makes such an analysis extremely useful for decision making. A whole variety of investments can thus be easily compared to determine whether any investment should be made and which investment gives the best value for money.

The critical components of a useful decision making framework are as follows:

- i) it should help identify costs and benefits to minimise double counting and at the same time maximise coverage of what is required
- ii) it should incorporate a forecasting procedure to show how the effects of a proposed intervention (on a "with" and "without" basis) will change as a result of the investment over time
- iii) it should incorporate a consistent valuation procedure
- iv) the results should be able to be summarised

Standard Cost Benefit Appraisal

For a typical road investment appraisal benefits are calculated from traffic forecasts and transport cost savings, mostly composed of savings in vehicle operating costs and a valuation of passenger time values. The benefits are then compared with the investment costs of the road and changes in maintenance costs. Future benefits are discounted using a planning discount rate. Valuations are based on economic prices that are essentially market prices corrected for taxation and other possible distortions such as over-valued currency or over-valued labour wage rates.

Passenger values of time are derived in a variety of ways sometimes through Stated or Revealed Preference techniques or with reference to wage rates.

As an economic based approach the overall objective is to maximise real national income. In general, income distribution weighting is not applied. It may be argued that poor people are at a disadvantage compared with the richer sections of the population because a valuation of their transport costs and time savings will naturally be less than for the rich. To counter this it can be argued that we can most improve the lot of the poor by maximising income first (and in the process creating jobs etc.) and then tackle income distribution through taxation and measures to subsidise the poor directly. The obvious counter argument is that the taxation process has its own political limitations, is not that efficient, it consumes resources and creates its own distortions.

Most people would, I think, agree that the standard transport economic appraisal approach is most satisfactory in the following conditions:

- a) There is general agreement within society on the use of market prices to allocate resources. The general developments throughout the world towards adopting a market economy approach supports this view point.
- b) That the transport services are supplied throughout the year to meet demand in an active, responsive and competitive fashion.
- c) That people have sufficient cash reserves throughout the year to meet their needs for emergencies and to travel to clinics, hospitals, schools, markets, government offices and maintain family and social links.
- d) That there are no major income distribution issues involved.
- e) That there are no major changes in modal split (i.e. from walking and pack animals to vehicles).
- f) There are no major changes in the nature and form of access (i.e. road closure is not an issue in either the "with" or "without" investment case).
- g) That we have confidence in our ability to predict traffic growth.
- h) That normal traffic (i.e. traffic that would occur both with and without the investment) represent a satisfactory measure of the major component of total benefits.
- i) There are no major externalities involved.

So for most road investments in most stable rich and middle income countries all of these conditions will be fulfilled and there will be little pressure to include additional "social" benefits. The basis for modelling traffic volumes and the valuation of benefits is accepted. Where cash resources are sufficient and a trip would be happily made both in the "with" and "without" investment cases to hospital, school, market or to visit friends the trip purpose is of no consequence. The benefits of an associated 20% reduction in vehicle operating costs (or a 20% fare reduction) will be virtually identical for any given individual irrespective of the trip purpose when there is little or no change in the number of trips made.

However problems arise with the standard method of evaluation the further we get away from the above conditions. In the extreme case where a new road is being introduced to a remote poor community where in the "without" case people have to walk twenty kilometres and carry sick relatives to hospital but in the "with" case they can travel (perhaps very intermittently) by motor vehicle trip purpose does begin to matter. It can be a matter of "life or death" and the valuation of transport cost savings either for normal traffic (the difference in the opportunity cost of walking versus vehicle operating costs) or of generated traffic involving half the transport cost difference looks distinctly odd.

The case for a different approach is strongest where a remotely located large population makes relatively few trips and the only access is via a poor access footpath, road or track that is cut for several months of the year and vehicle movement is prevented. From the point of view of a feeling of personal security and the need for vehicle access in a medical emergency there is an important psychological benefit of all year round vehicle access even if emergency trips are rarely made. Similarly if a road is cut then it is likely that normal marketing activities in the area will either cease or be severely curtailed. Longer, more circuitous walking trips can be expected. Likewise whilst government services and

external agencies remain crucial to the development of an area there are strong arguments for reasonable all year round vehicle access to major centres within each local district. Any external institution (commercial, government, NGO etc) planning to locate staff and facilities in a remote location will think twice if vehicle access is very poor and cannot be guaranteed throughout the year.

A direct example of this is that in Ethiopia there is an understandable reluctance to locate Food-Aid Distribution posts on roads which do not have all-year round access. (In fact there is evidence that distribution posts have been withdrawn when roads have deteriorated beyond a certain point). In the highlands of Ethiopia it is common for many roads to be cut for three months each year during the wet season. In many cases thousands of people will have to walk for up to two days at a time to a distribution post each month to collect their food allocation. Where people are too weak to go they will often have to pay others out of their allocation to collect their share. With all-year round access Food-Aid Distribution posts could be located much closer to the population and the walking time to each post could be substantially reduced and much of the problem could be avoided.

It is impossible to capture the long term impact of improving accessibility (through the conventional measurement of normal, diverted and generated traffic benefits) when this has a direct impact on the location important facilities. Perhaps correctly, new road investment in rural areas of developing countries is seen as the precursor of many other interventions including schools, clinics, water supply, government offices, NGO activity and commercial investment.

Overall governments, throughout the world, recognize that physical isolation contributes to poverty and prevents development. As a result most western countries will often heavily subsidize transport services to remote rural areas. In this case transport cost savings derived from existing or predicted traffic volumes are not taken to be the sole basis for transport planning and support to the sector.

The Problem with Valuing Generated Traffic

Perhaps the biggest weakness of conventional transport planning is the valuation of generated traffic benefits. Normal and generated traffic benefits are shown in Figure 1.

Normal traffic represent traffic which would exist both with and without the improvement, the benefits are calculated by multiplying this by the change in transport costs per trip. In most circumstances where the transport mode, nature and purpose of the trips made will not change this measure of benefits is reasonable (although one may still have concerns as to whether benefits are passed on to users and income distribution issues).

Unit cost per trip

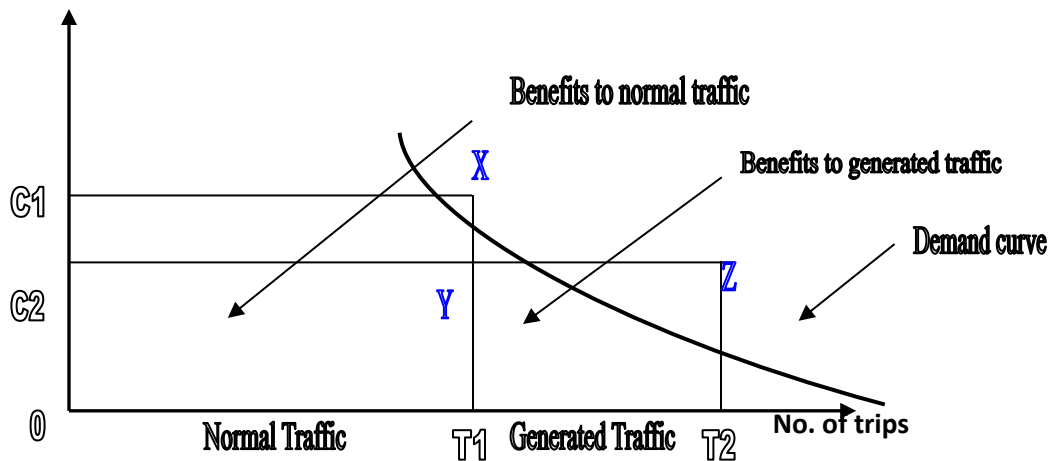


Figure 1. Traffic benefits measured as consumer surplus

Generated traffic benefits (represented by the triangle under the demand curve) is traditionally valued as the predicted increase in traffic multiplied by half the difference in transport costs. If the market economy works well (i.e. perfect information and cost and benefits are internalised by each actor) this may be a reasonable assumption particularly where only marginal changes in transport costs and accessibility are envisaged. However the valuation of "half" the difference in transport costs could well be a gross underestimate of the effects if the new trips that are generated lead to a step change in the social and economic life of those concerned. If the change in accessibility brings about a dramatic change in rural mobility or new school, clinic, water supply project, market or an externally funded new agricultural investment the benefits to the local population may have very little to do with the predicted increase in the volume of trips made and may bear virtually no relationship to the valuation of half the difference in transport costs.

Other Approaches

In the past it has been recognised that for low volume rural roads (often referred to as feeder roads or rural access roads) the conventional appraisal methodology did not fit well and there was a desire to adopt different approaches. (Perhaps for a combination of good and bad reasons; as few road interventions would have been justified as a result). In consequence there was a move to adopt the producers' surplus approach which involved forecasting and adding agricultural benefits to transport cost savings within a cost benefit framework. However in many instances this approach became discredited as there was often no basis for the forecast increases in production. Other approaches were adopted which moved away from economic appraisal and included various forms of ranking.

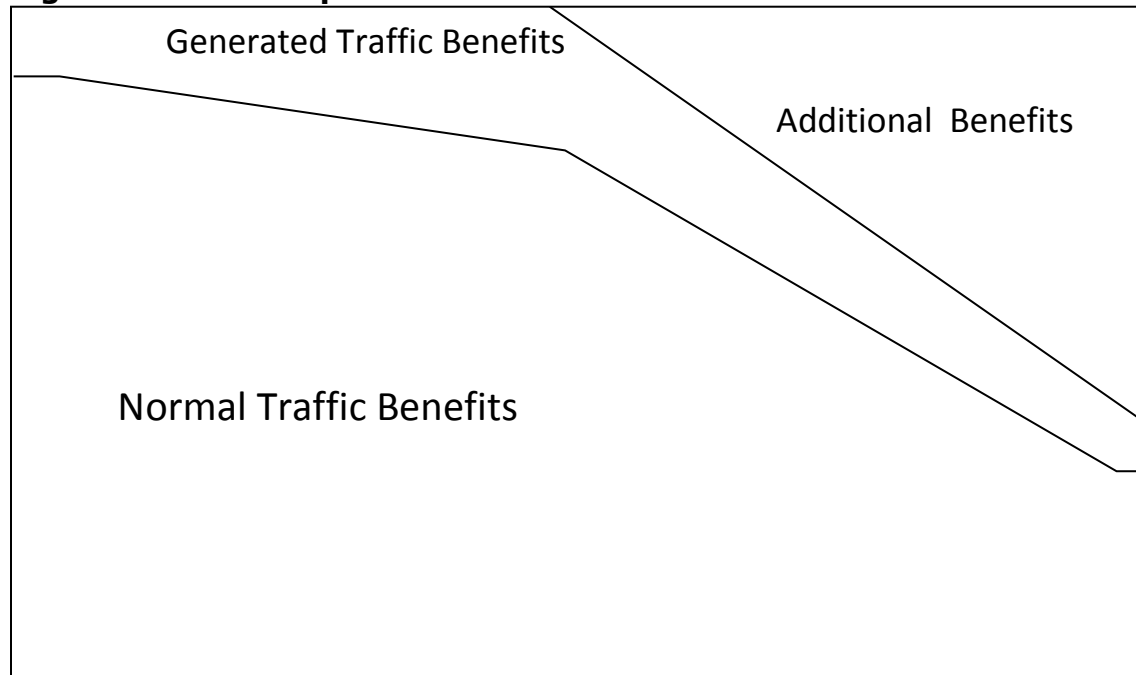
In recent years there has been a desire to formerly introduce social access benefits directly into a cost benefit framework for planning rural roads. The Ghana Feeder Road Prioritisation procedure is an example (Hine et al, 2002). In this case social access benefits were perceived to be a function of population and the predicted change in unit transport costs. Under the prioritisation procedure social access

benefits were calculated from the reduced transport costs of every person in the area of influence of the road making five return trips per year of a given length. So the greater the change in unit transport costs and the larger the population affected the greater the rural access benefits. These benefits were then added to total benefits within the prioritisation procedure.

A Summary of the Arguments So Far

So, to simplify the arguments where there is good accessibility, a high level of personal trip making, and few externalities the conventional method of estimating benefits from traffic volumes and changes in unit transport costs is broadly satisfactory. However when there is poor accessibility (particularly when vehicle access does not exist or is threatened) and there is a low level of personal trip making the conventional measure of transport cost savings (particularly for generated traffic) is an unsatisfactory measure of benefits. The marginal assumptions break down. Figure 2 shows how the composition of benefits might change as the level of accessibility and the level of trip making changes.

Figure 2. The Composition of Benefits



What is the distinction between "Social" and "Economic" benefits? I believe that the two concepts are so fundamentally linked that there cannot be a clear distinction between social and economic benefits. In some ways it is like the artificial distinction between chemistry and atomic physics. Resources are used and money is spent on food, schooling, education, health care and for social trip making. The Livelihoods Analysis approach teaches us that all these activities have a long term impact on social and psychological wellbeing, long term welfare and the capacity for income generation (Carney, 1998).

The main distinction is perhaps in terms of the models and professions we use to help us make decisions. Any prioritisation procedure requires both:

- a) A framework for prediction outcomes
- b) A framework for evaluating the different consequences

Different professions will draw on a different body of knowledge to help predict outcomes and evaluate the consequences. Different professionals may share a similar vision or have similar long term goals but the short term consequences they identify will be different.

In trying to identify what is missing from the conventional method of appraisal I do not think it is that helpful to think of this missing component as purely "Social" in the sense of not being concerned with income generation and only being concerned with matters such as health, education and social interaction. The missing element needs to be clearly recognised; it affects all aspects of life including income generation. Within conventional transport cost-benefit analysis the problem is not a deficiency of economics as such, but more to do with the simplifications of transport planning.

The Way Forward

So how do we incorporate the missing component into our evaluation procedures? The above analysis has identified when there is most likely to be a missing component. The more difficult question to answer is how do we predict and value the consequences? Cross-sectional and historical "before and after" analysis must obviously play a role. But there have been many hundreds of such road impact studies giving widely different results. Drawing conclusions from these studies that can be usefully included into our planning procedures has, so far, been a rather fruitless task. We do not need "more-of-the-same" road impact studies. Perhaps the main weakness of most studies is the lack of a theoretical structure with which to analyse the results. To be of use we really need to identify and quantify the mechanism of change that ties together a change accessibility with improved livelihoods and development. The quantitative change in unit transport costs and tariffs (including the length of time that vehicle access is cut) is, surprisingly, often left out of road impact analysis and it is likely to be crucial in comparing and understanding results.

In addition to studying impact directly we can also use other techniques to identify local priorities. The Participatory Rural Appraisal (PRA) approach can be very useful in helping to identify where the main local problems are and what people worry about. Stated Preference techniques could help with trying to put monetary values on the missing elements. We also need to consider directly how perceptions of accessibility affect the decision making of different institutions. Local governments and rural populations alike place very high value of good road connections, often to the surprise of transport planners who are concerned with the high costs and low traffic volumes. Nevertheless perceptions are critical in influencing the location of all forms of social/economic investment.

In our approaches to improving rural accessibility we should not confine ourselves to just improving road appraisal. Reliable transport services are perhaps even more important. Road investment alone may have little impact without viable and affordable transport services. There are many examples of in the developing world where, because of a low density of demand, there are simply no transport services available to the local population even though the roads are adequate (Hine and Rutter, 2000). (This issue also needs to be considered by those undertaking impact studies.) Sometimes it may be cheaper and more effective to subsidise transport services, or help provide alternative forms of mobility such as animal based Intermediate Means of Transport (IMTs) rather than to construct a new road (Starkey et al, 2002).

Because there may be a "missing element" in the estimation of the benefits of roads this does not mean we should do everything possible to build more roads to make up for the shortfall, but we may need to adjust the balance of road investment programmes. One solution that might help with getting a comprehensive solution to the road planning problem is to allow rural district councils to help decide their own priorities for local road investment and other forms of rural infrastructure. This approach is now being adopted by the Ethiopian Rural Travel and Transport Program (ERTTP). In Ethiopia the approach is not being carried out in a planning vacuum. A wide range of technical advice on planning techniques is currently being provided to local authorities. Improved roads are extremely expensive; often equivalent to more than the total value of the building stock along the line of the road. Better decision making might result if the local authorities could see the opportunity cost of what they are giving up (in terms of schools, clinics, wells, irrigation etc.) when it comes to spending money. Inevitably this will have a knock on effect on the adoption of appropriate road standards.

Conclusion

In conclusion we can see that existing road planning techniques have particular weaknesses when it comes to appraising roads where major changes in accessibility are being considered and there is a low level of trip making. The measurement of generated traffic benefits is at the heart of the problem when a step change in activity might result. There is no simple solution to incorporating the additional benefits into conventional cost benefit appraisal. Drawing on a Livelihoods Analysis of the problem we can see that it is not exclusively "Social" as opposed to "Economic" in orientation; it involves deficiencies in predicting and valuing income generation as well as relating to the use and access to social services and social mobility. A variety of techniques are suggested to help us move forward in this area. These include further road impact analysis (that includes a proper analytical framework), PRA and Stated Preference approaches together with direct interviews with key decision makers to help fully understand their perceptions. Transport services should be directly considered in any solution. Lastly there are grounds to give far more responsibility (properly supported) to local governments who can begin to see the relative advantages and make comparisons between spending money on roads and in other areas.

3. The Impact of Rural Road Investment

Economic theory indicates that road investment is most likely to stimulate rural development if it induces a relatively large change in transport costs (a major improvement of a long road will have a greater chance of impact compared with a minor improvement of a short road), if there are unused resources of land and labor to exploit, and if there are dynamic urban markets to absorb new production. However, despite a general consensus on the importance of rural roads for development and living standards, there is surprisingly little hard evidence on the size and nature of their benefits, or their distributional impacts. Studying the impact of road investment is a tricky subject, as there are often likely to be alternative possible explanations. Although there have been quite a number of studies of the impact of rural road investment, giving varying results, with much of the evidence being anecdotal, there have been relatively few studies that have been carried out with proper controls and subject to rigorous analysis and statistical testing (De Walle, 2008).

Perhaps the most widely quoted recent research into the impact of rural roads has been work carried out by the International Food Policy Research Institute (IFPRI) under the leadership of Shenggen Fan. The approach adopted has been through an analysis of disaggregated national data on household incomes together with various forms of public expenditure (i.e. agricultural research, roads, electricity supply, irrigation, health) which has shown a close relationship between the development of the rural road network, and income growth and poverty reduction. Significant studies have been carried out in China (Fan and Chan-Kang, 2004) Vietnam (Fan, Huong and Long, 2004), India (Fan, Hazell and Thorat, 1999), Uganda (Fan, Zhang, and Rao, 2004), Thailand (Fan, Jitsuchon and Methakunnavut, 2004), and Ethiopia (Mogues, Ayele, and Paulos, 2008). A similar study was also carried out for Tanzania (Fan, Nyange and Rao, 2005) that is discussed below. The Table below shows key findings of the different IFPRI studies. The data shown in last column have been converted to a common price basis.

A summary of Key Findings by different IFPRI Studies Involving Road Impact

| Country | Road Type | Benefit/ Cost Ratio of expenditure on increasing road length | Road sector ranking | Sector with highest returns | No. of people lifted out of poverty with \$10,000 (2011 prices) road investment |
|----------|-----------------|--|---------------------|-----------------------------|---|
| China | Low quality | 6.37 | - | - | 10.5 |
| | High quality | 1.45 | | | 0.1 |
| India | Rural roads | 3.03 | 1 st | Roads | 32.9 |
| Thailand | Rural roads | 0.86 | 3 rd | Ag. Res. | 30.2 |
| Tanzania | Rural roads | 9.13 | 2 nd | Ag. Res. | 170 |
| Uganda | Feeder | 7.16 | 2 nd | Ag. Res. | 261 |
| | Murram (gravel) | - | | | 31.5 |
| | Tarmac | - | | | 20 |
| Vietnam | Rural roads | 3.01 | 2 nd | Ag. Res. | 9.6 |

The table shows that after agricultural research, rural roads, as a component of public expenditure, have the next highest Benefit Cost ratios, and can lift many

rural people out of poverty. The Benefit Cost ratios, ranging from 0.86 (Thailand) to 9.13 (Tanzania) should be interpreted in terms of returns to expenditure on providing new access rather than total expenditure on roads, i.e. it does not cover expenditure on rehabilitation, upgrading or maintenance. This is because the analysis is based on differences that increased road length (via road density or distance to roads) has on measures of household income.

The results of the IFPRI analysis from China and Uganda indicate that the returns from rural roads appear higher than for more expensive better quality roads. It is also interesting to note the much higher impact of expenditure on new rural road access on poverty reduction in Africa (Uganda and Tanzania), particularly in terms of the numbers of people lifted out of poverty, compared with that for Asian countries. The results for Tanzania are discussed further in the next section. However, it should be recognized that the IFPRI research is highly technical and is derived from a complex macro modelling process. Despite the very positive results, uncertainties remain as to whether there are other possible explanations.

Perhaps, as expected, micro studies of road impact have produced a wide range of results. The Asian Development Bank recently commissioned a series of studies in Indonesia, Philippines and Sri Lanka (Hettige, 2006). The studies found that improved rural roads provided a better mix of transport services, shorter travel times and increased traffic. The impact of the improved roads on transport fare levels was found to be variable; it depended upon competition in transport markets. More buyers visited the communities with improved roads, more seasonal markets were established and there was an increase in the number of small business established. Improved roads appear to have been a major factor in deciding to start a new business. Although, there was some evidence that the richer sections of the rural population were more likely to benefit from better access, poorer groups were also able to benefit by being able to use hand carts (where previously they had to carry their goods) and there was, on balance, an increase in job opportunities, although this was associated with a reduction in jobs for porters.

A comprehensive analysis of road impact was carried out in Bangladesh, using the double-difference approach involving a repeat panel survey with controls, for two World Bank funded 'Rural Roads and Markets Improvement and Maintenance' Projects, (RDP and RRMIMP). The study involved upgrading roads to bitumen standard and the construction of bridges, culverts as well as improvement of growth centre markets and improvement of river jetties. Benefits from the projects arose from reduced transport costs for farm inputs and outputs, improved labour supply and effects on earnings, consumption and schooling. The study found that household travel expenses were reduced by 36 % for RDP and 38% for RRMIMP villages, and that for RDP agricultural wages increased by 27%, while fertiliser prices fell by 5% and farm gate crop prices increased by 4% for both projects. As a result of the improvements, agricultural output rose by 38% in RDP villages and by 30% in RRMIMP villages. The road investment improved labour supply, in RDP villages and schooling for boys and girls. Household per capita consumption increased by 11% for both projects (Khandker, Bakht and Koolwal, 2006).

There is general evidence that rural roads have an important impact in reducing poverty in rural Ethiopia. In an analysis of a range of different factors, Dercon, (2001) found that the presence or absence of a road was the major factor in reducing rural poverty. Although average consumption in the study areas rose by 8% between 1989 and 1994, just over 50% of the change was attributed to road infrastructure and location. In an analysis drawing on more recent data from Ethiopia, Dercon and Hoddinott (2005) have found that increasing road quality to enable reasonable accessibility in the wet season had a major effect in stimulating higher consumption growth. There appears to be a persistent cumulative effect of improving road quality. The better the level of past road quality then the higher the subsequent growth rate.

Research has shown that there are major differences in the likely effects of opening up first vehicle access compared with the rehabilitation of existing roads. From an agricultural perspective, the first type of intervention is more radical than the second which tends to be incremental in its effect. Thus, Hine et al's work in Ghana (1983) indicates that the improvement or rehabilitation of an existing rural road had a negligible impact on agricultural prices but the upgrading of a footpath to a road providing vehicle access had a beneficial effect, in the order of a hundred times greater, on farm gate prices as farmers and traders shifted from head loading to motorised vehicles to buy and sell their crops.

The benefits of road investment are not confined to economics. Levy (2004) found that in Morocco improved roads led directly to an improvement in the quality of education. It was easier to recruit and retain teachers and absenteeism of both teachers and students dropped. Similarly the rural population doubled their use of health care services, the supply of medicine improved and it became easier to implement immunization programs. Women and girls benefited especially from the provision of all-weather access roads. Girls' enrolment in primary education trebled, very largely because, with the improved roads, butane gas became affordable and it was no longer necessary for the daily collection of firewood for cooking and heating. Rural-urban interaction also increased several-fold as it became easier for people to visit their relations.

An investigation of Pakistan data has also indicated the social benefits of roads. A recent analysis suggests that the presence of an all-weather road in a village is associated with higher school enrolment rates. The enrolment rate for girls living in villages with all-weather road access was 41% compared with 27% for those living in villages without all weather road access. Higher female literacy rates, higher immunization and more births assisted by a skilled attendant were also found to be associated with the presence of all-weather roads (Essakali, 2005). The importance of adequate transport services for improving key health outcomes such as the rates of maternal and infant mortality is emphasized in a review by Babinard and Roberts (2006). The situation is most serious in Sub-Saharan Africa where poor transport not only inhibits user access to health facilities (particularly for emergency cases) but also constrains the staffing and equipping of the remote facilities. In addition, the maternal mortality rate is more than double the average for developing countries and more than 40 times the rate for high income countries.

4. The Design of Rural Infrastructure

(Source: Lebo and Schelling, 2001)

Introduction

Three billion people in developing countries, or about two-thirds of their population, live in rural areas. The majority of them survive on less than two dollars a day, and about 1.2 billion live on less than a dollar a day. Their lives, are characterized by isolation, exclusion, and unreliable access to even the most basic economic opportunities and social services. For the majority of their transport needs, they rely on non-motorized means and on rugged paths, tracks and roads, which are typically in poor condition and often only passable in dry weather.

For purposes of this paper, rural roads, tracks, paths and footbridges are referred to as rural transport infrastructure (RTI). The RTI network in developing countries consists of an estimated 5-6 million kilometers of designated² rural roads and an additional expansive network of undesignated roads, tracks, and paths. While the length of the undesignated network is unknown, it is estimated to be several times the extent of the designated network (Malmberg Calvo, 1998). The vast majority of trips that take place over RTI (more than 80 percent) are short distances (less than five kilometers) and made by non-motorized means, including walking, animals, bicycle, and portage.

This paper focuses on the appropriate design of rural transport infrastructure. The task is especially urgent considering evidence that developing countries have often adopted excessively high standards of access, particularly when donor financing was involved. Given scarce resources, such higher than necessary standards of access to limited populations lead to costly long-term maintenance and the denial of access to underserved populations. Therefore, a basic access approach, whereby priority is given to the provision of reliable, least-cost, all-season basic access to as many people as possible, is promoted.

Concepts and Definitions

Basic Access Approach to RTI Investments

The RTI network is the lowest level of the physical transport chain that connects the rural population, and therefore the majority of the poor, to their farms, local markets, and social services, such as schools and health centers, potentially increasing their real income and improving their quality of life. A minimum level of service of the RTI network, referred to as *basic access*, is therefore one of the necessary building blocks of poverty reduction. In this context, the provision of basic access should be considered a basic human right, similar to the provision of basic health and basic education.

Basic access infrastructure must ensure that the prevailing type of rural transport vehicles (motorized or non-motorized) can expect reliable access. Reasonable levels

of delays at river crossings or temporary road closings during the rainy season must be tolerated, which in turn can reduce investment costs considerably. The maximum time allowed for temporary closures is both a political decision and an affordability issue.

A basic access intervention is defined as the least-cost intervention (in terms of total life-cycle cost) for providing reliable, all-season passability by the prevailing means of transport. If affordable, this may mean all-season passability for a pick-up truck, a small bus, or a truck, even if these present only a small fraction of total traffic. However, it should be recognized that appropriate RTI is also required for the efficient and economical use of non-motorized (or intermediate) transport.

What is Rural Transport Infrastructure (RTI)?

RTI is the rural road, track, and path network on which the rural population performs its transport activities, which includes walking, transport by non-motorized and motorized vehicles, and haulage and transport of people by animals. RTI includes the intra- and near-village transport network, as well as the infrastructure that provides access to higher levels of the road network. Following are the key features of RTI:

Physical Features

Community RTI consists mainly of tracks, paths and footbridges, and sometimes (partly) engineered roads. They should normally not exceed five kilometers in length to ensure that the community has the capacity to maintain it.

Traffic Characteristics

Transport activities on RTI are performed to a large extent on foot, sometimes by intermediate means of transport (IMT), such as bicycles and animal drawn carts, and sometimes by using the services of motorized transport. Average daily motorized four-wheeled traffic on the majority of the RTI network is below 50 vehicles per day (VPD), while non-motorized traffic (NMT) can be a multiple of this number.

Ownership

By definition, RTI is the local access infrastructure that is normally owned by local governments and communities. Community RTI is usually undesignated, or not part of the formally recognized transport network. In the absence of a respective legal framework, community RTI belongs to communities. However, the capacity of communities to own and take care of RTI is limited usually to the intra- and near village network and to short links to the main road network.

Managing and Financing

Many different arrangements exist for managing and financing RTI (Malmberg Calvo, 1998). Financial resources available for RTI include transfers from central government (from the Treasury, dedicated road funds, or through donor financing), which should be leveraged to generate local resources in cash or in kind. In most cases, financial resources are extremely scarce, particularly for maintenance.

Designing RTI 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 provided with low-cost drainage structures, such as fords and submersible single-lane bridges.

The removal of surface water is crucial for the success of basic access RTI, since at this traffic level, the weather causes more damage than does the traffic (Robinson et al, 1998). This means that a good camber of 5 to 8%, adequate side drains, and carefully designed cross drainage structures are required. Stone or concrete drifts, or splashes, are acceptable as a substitute for culverts. Major river crossings can be designed to allow traffic passage at low flows, and be closed at high flows. In many situations, peak flows may only last for a short duration (less than three hours).

However, where rivers can not to be crossed for long periods, high-level and relatively expensive crossings should be provided to achieve basic access standards. If these are not affordable, providing an all-season footbridge should be considered, to allow pedestrian and IMT crossings during the rainy season.

Although roughness and speed are not important design parameters for basic access RTI, there are certain limits of roughness that should not be exceeded to avoid damage to vehicles. Speeds should normally not exceed 30 km/h, taking into account the varied use of basic access roads, by people, non-motorized, and motorized traffic the carriage way. The most important criterion for the infrastructure is to be able to withstand the elements and traffic without extensive damage.

The (Trouble) Spot Improvement Approach

The situation faced by the rural transport planner is a deteriorating network of roads, tracks, and paths, passable only in the dry season, with difficulty, and not at all in the rainy season. In these situations, the spot improvement approach, focusing interventions only on difficult sections, is an appropriate method to provide basic access at a lower cost.

Road failure is most likely to occur on steep hills, at water crossings, and in low-lying areas. Solutions include realignment, paving of steep sections, provision of simple but permanent water crossings, and raising low-lying areas on embankments. All interventions must be properly designed and engineered, but will only apply to a specific spot. In many situations, upgrading an existing track or earth road to basic access standard will only require interventions on 10% of the road length—greatly lowering the costs of providing all-season passability. The construction cost savings can be in the order of 50 to 90% when compared to full improvement.

On the other hand, Spot improvement interventions require considerable judgment on the part of the design engineer. The types of interventions will vary according to

the terrain, weather, and vehicle types. It is essential to ensure that untreated sections have sufficient capacity for the prevailing conditions and transport types. If the in-situ soils are incapable of bearing traffic loads when soaked, then it may be necessary to provide camber and drainage throughout. If the soils are not of sufficient strength, even in this condition, then a gravel surface should be provided throughout. During the design process, each section must be carefully analyzed in order to find the least-cost solution. The spot improvement approach also applies to periodic maintenance, where in many situations spot re-groveling, instead of full groveling, is the right approach.

However, there is generally a great deal of resistance to spot improvement as a technical solution, especially in donor-financed interventions. A variety of constraints, such as political pressure and road agency and donor preference for high-standard, high-cost roads⁹ 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. In addition to the above-mentioned problems, spot improvement approaches will not work in areas that have very poor soils or are prone to flooding. Despite these problems, there is a strong case for the spot improvement approach. Without it, most developing countries simply cannot afford to provide basic access to the majority of their rural populations.

Great potential for furthering the spot improvement approach is also seen in the implementation of performance-based road management and maintenance contracts. Until recently, these contracts have only been applied on major highways, and not on low-volume unpaved roads. A recent World Bank-financed project in Chad is proposing to introduce such types of contracts on approximately 450 kilometers of the unpaved main road network. Performance criteria are: (a) passability at all times; and the assurance of (b) a specified average speed; (c) minimal riding comfort; and (d) road durability and preservation. This type of contract should guarantee an approach whereby the contractor, in his own self-interest, will focus on the critical spots of the network, while assuring a minimal comfort for the road user.

Staged Construction—not recommended for RTI

Staged construction is understood here as investment into structural elements of RTI to accommodate upgrading needs which might be required in the future due to traffic growth. While it might be possible to demonstrate long-term savings through staged construction in the case of trunk or provincial roads, where substantial traffic growth can be expected, the same is normally not possible for RTI, especially when initial traffic levels are very low. Where road agencies insist on such “advance” investments, economic analysis should be carried out to determine their justification. Such analysis must take into account the additional short-term maintenance because of higher-than necessary investments.

Engineering Design of Basic Access RTI

Basic access RTI has to be properly designed if it is to resist the weather and traffic, and produce a maintainable and sustainable asset. The engineering design, traffic, safety, environment and social impact considerations, needs to take into account a few key design considerations. These are related to the type of traffic use expected on the RTI, road safety considerations, the expected impact on the environment, and the social impact of RTI interventions. These requirements are briefly explained in the paragraphs below.

Traffic

A wide variety of motorized and non-motorized traffic should be expected on RTI. However, roads and structures need to be designed to allow the largest and heaviest users to pass safely without damaging the structures. Often these largest users are seven-ton trucks, and, in other cases, pick-up trucks or motorcycles, and power tillers.

In some cases, a design for non-motorized means of transport might suffice. Design to a low standard suitable only for 4WD-drive vehicles should normally be avoided, since these vehicles are rarely used by local transporters or the local population. One potential problem is the possibility of large trucks using the road to evacuate heavy natural products and resources, such as crops, timber, minerals, etc. The likelihood of such traffic must be confirmed at project appraisal.

Road Safety

Road safety is of primary importance for all road users. However, the safety concerns of basic access RTI are different than those for higher-level infrastructure. Typical problems are single-vehicle accidents and accidents between motorized and non motorized vehicles, pedestrians and animals. The challenge for the rural transport planner is, therefore, to ensure that the speed of motorized traffic is low, say, not more than 30 km/h, particularly within villages. It is often argued that since single-lane roads with passing places are inherently dangerous, wider roads should be built for safety reasons even when the traffic levels are low. However, the risk of vehicle-to vehicle collision only increases slightly (Ellis and Hine, 1998), even if the volumes increase from 10 vehicles per day to 50 vehicles per day, and this level of traffic can be accommodated by passing places. However, where the road is expected to carry large volumes of pedestrian, or NMT, consideration needs to be given to their safety and a wider road shoulder or separate pedestrian and NMT-ways should be constructed (particularly within villages).

Environmental and Social Impact Mitigation

Basic access RTI interventions have both direct and indirect environmental and social impacts. Improved access might require the acquisition of productive agricultural land and housing, which might necessitate resettlement. Such resettlement will likely be minimal in the case of improvements to existing roads. Other major direct environmental impacts are dust from vehicles and erosion of RTI surfaces, drainage structures, and outlets. Indirect impacts are the opening up of previously inaccessible, or marginally accessible, territory to immigration and

resource harvesting. The processes that help to identify and mitigate the potentially adverse impacts of RTI projects, while enhancing their positive effects, are the environmental assessment (EA) and social assessment (SA). Both EA and SA processes must be initiated at the beginning of the project cycle and continued throughout.

Implementation Methods

Labor-Based Technology

The application of labor-based approaches to basic access RTI interventions contributes to their poverty-alleviating impact. Constructing RTI with labor-based methods requires between 2,000 and 12,000 person-days per kilometer for construction and 200 to 400 person-days per kilometer for maintenance. Utilizing local labor allows the local community to earn wages, as does procuring materials and tools from local sources. Furthermore, labor-based methods contribute to local empowerment through skills-transfer and creation of ownership. Also, if correctly designed, labor-based methods can have a substantial gender-specific impact.

The type of work associated with basic access is ideal for labor-based methods. Spot improvement interventions are small-scale and varied, requiring attention to detail, and often do not require heavy construction equipment. In the case of community RTI, the full involvement of the community gives them the opportunity to acquire the skills for the eventual infrastructure maintenance by labor-based methods. It is important to note that equipment (for example, graders) are seldom available for subsequent maintenance activity for RTI, a fact that should be planned for at design.

There are certain prerequisites for effective labor-based contract execution, including labor availability in sufficient numbers, supervision experience, and the availability of qualified contractors. These contractors must be small-scale and have experience in labor-based project execution. They should possess, or have access to the appropriate equipment. If they have no direct experience in labor-based execution of works, they must at least be willing to undergo respective training.

Despite these advantages, it has been difficult to mainstream labor-based approaches. The difficulties encountered include inflexible labor laws, the availability of cheap second-hand heavy equipment, unsuitable procurement laws, and a lack of capacity to rapidly pay labor-based contractors (Stock and de Veen, 1996). To mainstream labor-based approaches, these obstacles need to be overcome at the policy level.

Small-Scale Contractor Development

By their very nature, basic access interventions are small-scale, varied, and scattered. The work is ideal for execution by small-scale labor-based contractors and by community contracts. Such types of contracting require (a) an appropriate policy environment; (b) capacity building programs for designing, managing, and execution of contracts; and (c) appropriate procurement procedures.

Considerable experience is available for the development of small-scale labor-based contractors (Bentall, Beusch, de Veen, 1999). An enabling environment must be created. If the contractors are to survive, they require a regular workload, rapid payment of bills, and access to credit facilities and equipment rental opportunities.

The key is the management capacity of the contracting agency. To overcome capacity constraints at the local government level, it is often recommended that government entities join together to form joint-services committees or hire consultants to assist in contract management (Malmberg Calvo, 1998). Contractors' associations have an important role to play in the capacity building process as well (Larcher, 1999).

The limited capacity of single small-scale contractors may require the employment of numerous contractors if major earthworks are involved (average capacity will be about 1km of earthworks per month and 0.5km of gravelling per month). Part of the capacity building process is assistance to the contractors with appropriate equipment, which in most cases is tractor-towed equipment, such as trailers, water bowsers, rollers and towed graders.

Community Contracting

Community contracting has become a major means of channeling grant funding to the rural poor. Community contracting means procurement by, on behalf of, or from communities. Implementing agencies are the communities themselves who take direct responsibility for their own development, and the role of government here is to provide facilitating support (usually through the assistance of NGOs). Participation from the community has to be an overriding consideration in designing the various procedures, including procurement and disbursement. Simplified procurement procedures for community contracting are required (World Bank, 1994). Experience from such community-based investment operations has shown that participation greatly assists accountability. A key feature for successful community contracting is the existence of a legal framework that gives communities legal status, without which they are unable to receive or manage funds.

Maintenance of Basic Access RTI

A common feature of RTI is insufficient or non-existent maintenance. Financial allocations to RTI maintenance are almost always inadequate, both relative to the main road network and compared to general expenditures for construction.

Moreover, capacity to execute maintenance is lacking. A good indicator for the lack of maintenance capacity is the need for rehabilitation, which by definition is caused by a lack of maintenance. Earth and gravel roads and paths are very vulnerable to the elements and will often not survive a single season without proper maintenance. A road or path is no better than its weakest link, and one failed drainage structure or section can be sufficient to disrupt access. The principle roots of maintenance neglect are institutional and financial. These must be addressed prior to any consideration of investments in RTI (Malmberg Calvo, 1998).

It is often argued that in light of insufficient maintenance capacity, initial higher standards are required. However, this is a short-term view. While higher standards, such as bituminous surfacing, might extend the useful life of the RTI by a few years, a lack of maintenance on such a surface eventually causes even higher costs for the users and the agencies, as total-cost analysis would demonstrate. Furthermore, routine maintenance is required in all circumstances. In its absence, the useful life of an “over-designed” surface will be reduced substantially. Maintaining an earth or gravel road is relatively costly. As a rule of thumb, undiscounted maintenance costs over the typical life of RTI will equal the initial construction costs. For example, a typical US\$5,000/km basic access road may cost an average of US\$250 a year per km to maintain over its assumed twenty-year life.

From an engineering point of view, there are important tradeoffs between routine, recurrent, and periodic maintenance, and further investments. Often, enhanced routine maintenance is able to provide the required “passability,” which reduces the need for periodic maintenance or further investments in the form of spot improvements. This is of particular importance with respect to periodic maintenance. In many developing countries, reserves of naturally occurring gravel used for periodic renewal of gravel layers are simply no longer available. The maintenance of a proper camber and the protection of drainage structures will reduce the need for periodic maintenance and rehabilitation. If comparing the costs of increasing the grading frequency on earth roads against gravelling at low traffic levels, the former is usually much more economical (Hine and Cundill, 1994).

Conclusion

In order to complement poverty reduction strategies, rural transport interventions must be an integral part of rural development interventions focusing 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.

The (trouble) spot improvement approach is the key to the least-cost design. Cost savings of 50 to 90% 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 need to be overcome.

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.

5. Financing Rural Infrastructure

(Source: Malmberg Calvo, 1998)

Introduction

All countries have a boundary beyond which direct government responsibility for the road system ends and the network of community roads and paths begins. Private ownership can significantly increase the kilometers of roads that receive regular maintenance and reduce the cost of maintenance to less than half that of public roads of equal engineering standards and traffic. An effective financial framework will be based on the creation of appropriate incentives to engender community ownership, empowerment, and local resource mobilization. These incentives include legal instruments, cost-sharing arrangements, and technical and managerial advice.

Cost-sharing arrangements verify demand, expand the revenue base, and give communities strong incentives to organize themselves into road associations. A written contract should be set between the community road association and the local road agency or the road fund. Communities not meeting contract obligations should forfeit the cost-sharing privilege and pay back funds received. In Madagascar and South Africa cost-sharing arrangements between local governments and communities for financing maintenance encourage communities to assume the maintenance responsibility of some roads.

Symptoms of Inadequate Finance

Unclear Responsibilities

Local communities have often been asked, ad hoc, to contribute to improving and maintaining roads constructed and improved through government, NGO, and donor programs. Whilst local acceptance of responsibility is encouraged, community contributions should not be mistaken for commitment to maintenance or assumption of ownership responsibilities. Very rarely have communities been consulted on and agreed to their responsibilities and those of the rural road agency for maintenance. Experience in Malawi shows that communities are more forthcoming with in-kind contributions, including labor, for the construction of a bridge or a road than for maintenance. In Zambia donor programs paid communities (in cash and food) to improve roads and tracks, which they were subsequently expected to maintain on a voluntary basis. But communities are unlikely to perform tasks for nothing if they were once paid to do so. Reliance on unpaid volunteer labor for regular maintenance of local government roads is not sustainable and leads to confused responsibilities.

Disintegration of the Planning System

A lack of an effective planning process has meant that financial resources are often not allocated economically. One of the main reasons is that the key actors respond to biased incentives. Capital and maintenance expenditures fall under separate

budgets. Capital budgets are typically supported by donors and have also been favored by local politicians. Funds are allocated for capital works, while regular planning of recurrent activities and expenditures (previously a key part of the planning process) is neglected. In road maintenance expenditure, full rehabilitation is preferred over spot improvements, even though most road agencies are aware that maintenance is highly cost-effective and that improving trouble spots can enable all-season access at a lower cost than rehabilitation. Road works are favored over footbridge and path improvements. Thus existing resources are sub-optimally allocated between capital and maintenance expenditures and between roads and simpler RTI improvements.

Insufficient and Uncertain Maintenance Funding

There is an overall shortage of maintenance funds in nearly all developing countries. Most government allocations to road maintenance fall short of the amount needed for network preservation. The shortage has been especially severe at the lowest levels of the network—allocations for maintaining local government roads commonly have been only 5–15 percent of requirements. In many countries recurrent budgets have withered to the point at which they barely cover staff and administrative expenses and a few emergency repairs—little is left for maintenance. Donors were initially part of the problem in that they primarily supported the capital budget. But now they are not willing to finance rehabilitation projects without viable arrangements for road maintenance.

Further, central government funding allocations to local governments are unpredictable and irregular. Local governments are generally given an estimate of the budget resources they will receive in the next fiscal year so that they can make realistic plans. Unfortunately, actual receipts nearly always fall short of original estimates. Even in countries with road funds (which should facilitate more regular and programmable allocations), funding can be highly irregular and unreliable, particularly during a fund's early years. In Tanzania, for example, local district councils were not told of expected funding levels from the local government road fund, turning planning and programming of works into a futile exercise.

Inadequate Local Capacity

A lack of steady finance leads to a lack of incentives for road staff at the local level. Civil servant salaries—inadequate when compared with private sector salaries—have adversely affected the technical capacity of road agency staff, leading to high vacancy rates and poor motivation. Local government employees have fewer career prospects and opportunities for training than staff working for a strong central sector ministry. Many district works departments are headed by underqualified and indifferent staff, and have unfilled positions.

A Framework for Reform

After decades of highly centralized systems of governance, many countries are moving toward decentralization. Effective decentralization (devolution) hinges on a balance of political, institutional, and fiscal responsibilities. Allocation and control of finances lie at the root of decentralization. Many decentralization efforts are,

however, partial: administrative responsibilities are assigned to local governments whereas central governments remain in control of fiscal instruments. Partial decentralization risks perpetuating weak local governments and forces the central government to take back or temporarily assume local government responsibilities because of poor performance.

Financing

The main financial issue to be addressed for RTI is who will pay for maintenance? The four most common sources for finance are donor funds, central government grants from the general budget, local revenues (from the local government and the community), and allocations from a dedicated road fund. These sources provide funds for capital and recurrent expenditures. Some funds are only available for one or the other. Until now, and for the foreseeable future, the lion's share of funds for capital expenditures have and will come from donors. Among six African countries (Cameroon, Kenya, Malawi, Nigeria, Senegal, and Tanzania), external finance accounted for 50–90 percent of total resources for investment in rural roads and 10–20 percent of resources available for maintenance (Gaviria 1991).

Donors, however, are increasingly reluctant to finance capital expenditures unless credible arrangements for maintenance are made. The first challenge is, therefore, to secure a sufficient and reliable source for funding maintenance. The source must be domestic to ensure that investments are sustainable and, in the long run, must rely on cost-sharing arrangements with local governments and beneficiaries. Cost-sharing between the central government and local institutions gives local institutions a powerful incentive to maintain RTI and is an important way of leveraging scarce resources at all levels.

Financing Local Government Roads

Financing Maintenance

The sustainability of all roads hinges on the timely execution of routine maintenance. Financing maintenance requires a steady and adequate flow of funds. The local entity responsible for local government roads must know how much it will receive and when. Without clear allocation schedules, work programming becomes impossible, and unit costs increase as contractors build foreseen payment delays into their costs. A rough estimate of network maintenance requirements can be obtained by applying an asset-based approach to financing needs.

Locally Raised Revenues

Local governments mobilize only modest revenues, which vary widely because of differences in economic bases and administrative capacities. The main sources of local revenues are often market and business taxes. For example, in a rural district in Malawi market fees accounted for 67 percent of revenues. Other tax instruments include levies on property, locally produced agricultural, and building. Land-based taxes on local commerce are relatively easy to collect and are rational taxes for good access and road usage. Local governments often also engage in various business projects such as bars, hotels, and transport services to expand their revenues. But these enterprises often lose money.

Local revenues account for only a small proportion of the total resources allocated to local government roads in most developing countries. Maintenance funding from local taxes is likely to be as irregular and unreliable as funds from the central budget. Much can be done to improve local revenue collection, like maintaining strong enforcement, a reliable local court system, and incentives to tax collectors.

Most countries have limited experience using local road-user charges (such as licenses) as a source for maintenance funding. In some cases local transport operators, other business people, and, to a lesser extent, farmers have contributed money to improve local government roads. But these tend to be one-time contributions, certainly not a formalized source of funding, and generally cannot be relied on. An important source could be property taxes. Road access is a component of property taxes in many countries. Property taxes are not collected in many countries, especially where land is not traditionally held by private individuals or is ceded to the central government. The possibility of imposing maintenance and access charges tied to property taxes should be explored.

Central-Local Fiscal Transfers

Transfers to local governments from the central government budget are the main source of domestic funding for local government roads in many countries. The central government sets the amount of funding allocated to local government roads. Often, transfers are sector-specific, not given as block grants, which are unrestricted in the usual sense. Three main problems result from relying on the central budget for maintenance funding:

1. In most countries only a small share (5 percent or less) of aggregate public sector revenue is made available to rural governments.
2. General budgets rarely allocate adequate funds for maintaining main roads, much less rural roads.
3. Local governments often receive their allocation in two separate envelopes—one for capital expenditures and another for recurrent expenditures. The allocation for recurrent expenditures may barely cover the salary expenditures of the local rural road unit. A significant difference often appears between the authorized estimates local governments are told they will receive and the amount they actually receive.

Road Maintenance Funds

Instead of depending on central budget allocations, a number of countries have turned to dedicated road maintenance funds to finance maintenance. This “new generation” of road funds, which rely on road-user charges, is a promising approach. Road-user charges are generally collected centrally and include fuel levies, vehicle license fees, international transit fees, and road tolls (the latter particularly in francophone African countries). The main source of revenue for road funds is the levy on fuel. Because fuel is consumed by vehicles everywhere on the entire network, the road fund should finance all roads, not just main roads.

Cost-Sharing for Maintenance

Cost-sharing with local governments is a way of leveraging available funds for road maintenance and increasing the proportion of the tended network. Cost-sharing in

the form of matching grants can involve road users, the central government, or donors financing an amount proportional to that provided by the local government. Financing maintenance of local government roads from a road fund is more complex than financing main roads because some local government roads are not economically viable even though they meet important economic, social, and administrative needs. Road users should not and cannot be fully responsible for financing maintenance of local government roads. Local people benefit primarily from access to important services. Local governments must share this cost with road users. Local governments can opt to meet their share from locally raised revenues or by applying a proportion of their transfer from the central government (block grant).

Establishing a Planning Framework and Planning Methods

Planning for local government roads should be based on a recurrent dialogue between local constituents and local government officials. Local governments must consult with their constituents, who should voice their concerns and preferences. Because local constituents, through the local government, are expected to allocate substantial resources to maintenance, the planning process must respond to their demands and observations. Plans (and planning criteria) should be transparent and vetted by constituency representatives.

Local governments must articulate constituent demands in a plan and forward it, with a request for funding, to a provincial rural road or administrative office. Alternatively, the plan may be sent directly to the central coordinating unit for local government roads. Road programs are generally coordinated at the regional level by a development committee, the regional office of the main road agency, or a regional road board. At this time plans are gathered from the respective local governments and the main road agency determines how it sees the road network evolving in terms of development, upgrading, and rehabilitation. Local governments can then provisionally adjust their plans and improve work programming.

The participatory planning process then becomes an exercise in participatory budgeting in that local constituents are faced with an actual budget constraint. Local constituents and local governments may have to choose between technical standards and physical coverage. When investment grants require proof of maintenance of current assets, constituents are encouraged to raise additional resources to meet the maintenance requirements of existing roads. In other words, when capital and recurrent expenditures are assessed side-by-side, it becomes clear that investment decisions must be based on the future annual demands that a specific investment will place on the recurrent budget. Stakeholders must now determine whether they can afford the new investment.

An important objective of planning is to ensure optimal allocation of available resources. Local governments must be aware of the high return on maintenance compared with most capital projects and the high return on spot improvements compared with full rehabilitation. The principal argument for keeping a consolidated budget is the importance of assessing maintenance requirements alongside development and improvements. A consolidated budget framework helps local

governments and constituents consider their options in light of the demand maintenance costs will put on future revenues.

Financing Community Roads and Paths

A basic institutional framework is required to empower and encourage communities to claim responsibility for those roads and paths that have no legal owners and for those designated roads that the local government road agency fails to maintain. A strong argument in favor of creating a private-public partnership for community roads and paths is economic: private ownership can reduce the cost of maintaining roads to less than half the cost of public ownership and significantly increase the kilometers that receive regular maintenance (Ivarsson and Nydahl, 1995).

Cost-Sharing Arrangements

Cost-sharing arrangements for maintaining community roads and paths fulfil three important functions.

1. They constitute a financial incentive for communities to organize themselves.
2. They expand the revenue base.
3. They can verify demand and improve allocative efficiency.

Communities often apply to donor-financed projects for grants to improve access roads and paths. But seldom are there any cost-sharing arrangements for maintenance. To effectively manage and maintain roads and paths, communities must buy materials and obtain technical advice that may not be available locally. There are informal cost-sharing arrangements for road maintenance. For example, communities may motivate road agency staff to provide technical assistance by paying overnight allowances, while the communities provide resources such as land, labor, and materials for maintenance or improvement works. In Ghana local communities pay for the fuel and overnight allowances of grader operators assigned to them by the regional engineer. In the long-term, however, cost-sharing agreements for both improvement works and maintenance are best formalized through written contracts.

Technical and Managerial Advice

Communities require advice on contract management and procurement. The principal challenge to community procurement is not just to keep proper accounts, but to strengthen village organizational structures. In some donor-financed investment projects (such as social and community infrastructure development funds), community groups have become end-users of foreign credit. They must therefore learn to keep proper financial accounts when they act as executing agents in procuring goods, works, or services from inside and outside the village.

Community cost-sharing with a road maintenance fund also demands financial and technical accountability. Current legal frameworks in many countries and donor agencies are frequently unsuitable for community-based procurement and disbursement to communities. The local government road agency and donor-financed projects can initially help communities to procure goods and services. A survey of Bank-financed projects indicates that community involvement in procurement enhanced the sustainability of investment and a larger proportion of

investment was spent in the local economy, generating employment and economic opportunities; capacity and know-how was built in the community.

Financing Community Roads and Paths

The main source of funds are likely to be communities themselves and external donors, at least in the short and medium term. In the long term, with increasing decentralization, partial funding for community-level infrastructure may be forthcoming from local governments. Nevertheless, communities themselves will have the principal responsibility for financing maintenance of RTI, though there may be nominal cost-sharing with a road maintenance fund.

Donor Financing of Investments

In many countries, especially in Sub-Saharan Africa, external donors provide most funds for rural infrastructure investment. Until recently, rural road projects financed by donors have not offered communities a choice among investments. They simply offered "roads or nothing." Although communities may accept and even contribute to improving roads, they may opt for other types of investment, such as improving the water supply, when permitted a choice. Community priorities can be identified through the use of cost-sharing requirements and by allowing communities to choose among various types of investments. Social and community and rural infrastructure funds (referred to as "the funds") possess both of these features.

However, the funds have important limitations. One is the risk of funding ad hoc projects without giving adequate attention to the institutional arrangements of the sub-sector. The funds finance local government roads and community roads and paths without ensuring adequate maintenance and without distinguishing between the community contributions required for these two administratively different types of RTI. This limitation can be addressed through improved coordination with the local government road agency and through implementation of a national strategy for rural transport.

Another limitation of the funds is the lack of ability to formulate projects at the community level. Communities are not aware of available opportunities. Some of the most successful social funds in Latin American countries created an outreach unit that traveled to all parts of the country. The unit disseminated information on the social fund and its selection criteria in local meetings and on the radio. It clarified the procedures for proposing projects, helped communities determine if specific projects met the criteria, and helped communities to formulate their projects. Communities were also taught project management and basic bookkeeping skills.

Yet another limitation of the funds relates to the bias against roads that is built into their rules requiring that all casual/unqualified labor be contributed by the communities. The proportion of unqualified labor on road works using labor-based work methods in rural areas is many times higher than the proportion constructing buildings. Thus some communities opt to construct schools and clinics instead of roads or to carry out road works using relatively equipment-intensive methods. For example, in the Tanga region in Tanzania a village that needed an access road

opted to raise its contribution in cash (25 percent of the total cost) rather than do the physical works itself because the share of casual labor would have been 60 percent of the total cost using labor-based work methods. The village chose to hire a road grader. Had the community been allowed an unbiased choice of technology, that is, not had to adhere to the condition that all casual labor be voluntary, it is likely that it would have opted to improve the road using labor-based work methods. By doing so, community members themselves would have earned much of the project costs working as paid laborers.

A village infrastructure project in Indonesia has had the opposite experience. This project provides a block grant to each community, does not require cost-sharing arrangements, and allows villagers to pay themselves for the work. Two-thirds of the villages have opted to improve roads. Among all the infrastructure sub-sectors, road works probably have the highest labor requirements. This indicates that the incentive structure can have a significant impact on choice.

The first step in financing rural infrastructure should be allowing communities to identify their priorities across sectors. Transport sector investment programs and projects can collaborate with existing social funds to acquire this feature. The second step is providing sector linkages, possibly through a national rural transport strategy. The strategy should provide the institutional framework, including the financing arrangements for investment and maintenance of community roads and paths.

Community Financing of Investment and Maintenance

Despite the poverty of most rural populations, communities often raise resources to partly finance their high-priority investments. Communities may pay their share of an investment in cash (in agriculturally productive areas, for example), but frequently prefer to pay in-kind with labor or locally available materials.

Instead of raising cash, many communities have a system whereby a half or whole day per week is assigned to community work, frequently referred to as "self-help" or "communal labor" activities. For example, under the Umuganda system in Rwanda, each adult dedicated one day per week to work organized by local administrative and political organizations. If a household fails to participate, its members usually have to pay a fine.

Government and Road Fund Financing of Maintenance

Community roads and paths are mainly local concerns. Given the low volume of traffic on community roads and the constrained finances of governments, communities have to shoulder a larger share of the financial responsibility for maintaining these roads and paths. Nevertheless, a road maintenance fund has great potential for providing partial financing to rural communities. Partial funding of maintenance for selected access roads and paths should also be feasible. Sensitization and possibly a change in the membership structure of some road fund boards may be needed to redirect road fund revenues to community roads.

Any cost-sharing arrangements between a private road association and a road fund must be formalized in a written agreement between the parties and requires technical and financial oversight to ensure proper use of funds.

Planning Community Roads and Paths

The first step in helping communities to plan access improvements should be a horizontal process that allows them to mobilize funds for the investment of their choice. Hence, funding agencies, including local governments and communities themselves, must develop communication skills and methodologies for identifying local priorities. Trained outreach workers can ensure that information on local needs and priorities are presented to local road agency staff and that agency plans and proposals are in turn communicated to villagers in terms they understand.

Conclusions and Summary

The framework described here requires that central government devolve planning of local government roads to local governments and their constituents and that it create an environment that encourages communities and other private or non-government entities to become owners of community roads and paths. Devolving ownership to small-scale farmers, the largest private sector group in most developing countries, will increase efficiency and bring more roads under regular maintenance.

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