

Rural road planning in developing countries

by

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INTRODUCTION

In an age of uncertainty one thing is certain: the poor of the world are getting poorer while the rich are getting richer. It is now seen that in the last 25 years of national and international effort the pattern of development has often resulted in growing disparities between the living standards of countries and also in many developing countries between classes in the same country. In an age that has seen massive economic growth for the world as a whole there are still about 40 developing countries where the annual income per head is less than \$200. Thirty per cent of the world's population, 1200 million people, live in these countries. Even in those countries of the Third World which are above this poverty line it is often the case that the benefit of over half the national income goes to less than one quarter of the population. The poor countries are those that rely almost entirely on agricultural production and where 80-90 per cent of the population live in rural areas by subsistence or near subsistence farming. It is these facts that have led to new thinking nationally and internationally about directions for development and new policies of aid to developing countries. Indeed "a widespread current view among analysts of the development process is that, unless specific action is taken to assist the poorest groups directly, relative poverty will increase and any reduction in the numbers of people living in a state of absolute poverty will be painfully slow". This view implies that more should be done to ensure that a higher proportion of aid should directly benefit not only the poorest countries but the poorest people in these countries. As most of these people live in rural areas, any new aid strategy should not only put new emphasis on programmes oriented towards the relief of poverty within countries but should give specific emphasis to rural development.

This emphasis, present in much international thinking about development, highlights the need for improved transport in rural areas and requires a re-appraisal of conventional methods of rural transport planning. Following a recommendation adopted by the OECD Steering Committee for Road Research a Joint Working Group was formed with the OECD Development Centre to consider the problems of planning roads and other transport facilities in rural areas of developing countries. It is the object of this paper to discuss the wider issues involved in the light of the conclusions of this Joint Working Group.

TRANSPORT PLANNING METHODS

In the ideal situation a transport planner sets out to devise transport facilities to help a society to achieve the wider economic and social goals it has set itself. He cannot properly begin his task before these goals are

described in sufficient detail for him to translate them into the needs for moving goods and people. Far too often, however, the planner's task has been seen only in terms of improving an existing facility for the benefit of those who will use it.

Transport planning techniques have been substantially developed only in industrialised countries and where there was in existence an extensive and largely unplanned transport system. Inadequate track standards and traffic congestion was already leading to costly delays to users and to pollution of the environment. The problems first appeared in extreme form in cities. The main techniques which were devised were oriented to the alleviation of these urban problems and were developed for application within the constraints of the urban scene.

The beneficiaries of improvements could be closely identified as present and future users of the system. There was considerable experience of the past growth and characteristics of traffic which could be used with some confidence to predict future growth. Since high levels and already been reached growth was relatively small and prediction that much more certain.

In developing countries the role of transport has often been seen in the past as "catalytic" to development in the sense that provision of a transport facility has been assumed to be sufficient in itself to open up a region and so stimulate economic growth and improve social conditions within its area of influence. Roads were needed in rural areas where no vehicle yet moved. It is paradoxical therefore that the techniques adopted for planning transport intended to stimulate growth in rural areas were derived very largely from the existing complex methods devised to alleviate the urban congestion in industrialised countries. This is paradoxical but not surprising. Some success had been claimed for the application of existing transport planning techniques, mainly in cities in North America. No tested alternative existed for a developing country to use. Foreign experts commissioned to help with transport planning tended to use the techniques with which they were familiar in their own country.

In most recent years the deficiencies of the 'transferred technology' approach to transport planning in developing countries were clearly seen and several attempts to broaden the basis for planning were made. In particular research workers have attempted to clarify the relationship between transport investment and increased agricultural production. These broadened approaches have been reviewed by the OECD Working Party in their report. The conclusion was that there was no tried and tested method of allocating finance for transport that could achieve optimum development impact.

RURAL ROAD TRANSPORT APPRAISAL

It is probably true to say that the broader issues of transport planning have received less attention than the appraisal of discrete transport projects. Developing countries, international lending agencies and aid donor countries have concentrated their efforts in finding answers to two main questions:

Is the project to construct a transport facility justifiable in economic terms?

How can competing projects be ranked in priority order?

The urgency with which these questions have been posed, often occasioned by the conviction that transport was a seminal requirement for development, have tended to deflect thinking into the confines of sectoral planning and away from comprehensive development planning and the need to reconcile physical, economic and social aspects.

Again, methods of transport project appraisals in developing countries have in the past relied heavily on these familiar methods established in industrialized countries for projects to relieve traffic congestion. Some form of conventional cost-benefit analysis was used. At its simplest this implied first assessing the cost of constructing or improving the facility, in most cases a road. The benefits were then identified as cost savings accruing to the vehicle operators using the road. Existing traffic was measured in volume and weight. It is crucial both to the calculation of cost and of benefit that an accurate estimate is made of future volumes, weights and speeds of traffic which will use the facility. The structural standards to which the road is designed begin with consideration of the load it will bear in terms of repetitions of application of axle-weights; the geometric standard to considerations of volume dimensions and speed of traffic. The standards adopted determine the cost of construction or improvements.

The aim of the project was normally envisaged as relief of congestion and thus benefits could be uniquely identified as road user cost saving in time, vehicle operating costs, accident cost savings and the like. Again the estimate of cost savings is directly related to future traffic volumes.

Future increases in traffic are usually predicted in three categories, normal, diverted and generated. Normal traffic is defined as the traffic that will materialize whether the road investment is made or not. Forecasts are made from a knowledge of past trends in traffic growth, sometimes by linear extrapolation but more usually by sophisticated methods using relationships between income and vehicle ownership and usage or between land-uses and trip making. Diverted traffic is that which switched from use of another road or another mode because of a perceived cost saving if the new facility is used. Generated traffic is defined as that traffic other than diverted traffic which is induced to use the projected road by the reduction in transport costs.

Those traffic estimates used in conventional cost-benefit analyses of road transport projects encounter difficulties and inadequacies when applied to roads in rural areas in developing countries. In these areas of low traffic and low economic activity it is obviously inadequate to use past traffic trends as a basis for future forecasting. When the aim is to increase economic activity rapidly and perhaps to modify drastically the mode of agricultural production, it is unlikely that a study of the present situation will give any useful guide to the planned future. It is indeed very unlikely that improved transport will be the sole input needed to stimulate the changes although it may be essential. Thus in the conventional analysis benefits are measured too specifically and attributed too narrowly.

In these circumstances it is surprising how much reliance was placed on appraisal methods for road projects in developing countries that were only a slight modification of those conventionally used in developed countries. These necessarily favoured projects for inter-urban roads, highways in which traffic was already appreciable and often growing rapidly. It is arguable that such infrastructure was, in any case, a prerequisite framework into which future development of feeder roads could be fitted. On the other hand application of conventional appraisal technique was inappropriate for the myriad of low-volume, low-cost roads needed for a strategy of regional development of agriculture and small scale industry. Investment in these roads was difficult to appraise and they were neglected.

A BROADENED APPROACH TO RURAL ROAD APPRAISAL

Case-studies of road planning in rural areas in developing countries were critically reviewed by the OECD Working Group. Many of these measured an increase in agricultural production that occurred when roads were built. They pointed to one fairly obvious method of improving road project appraisal. The benefits derived from this increased producer surplus could be added to those derived from road user savings. This is a sensible approach but in application has shown many deficiencies. For increased agricultural production investments in fertilisers, irrigation, agricultural extension services may be equally necessary and may be large. Thus those analyses that attribute the total increase in production to road investment alone are clearly inadequate. Even those that go further and deduct the cost of other investments from the cost side of the equation perpetuate the fallacy by assuming that these other investments have no net benefit.

The World Bank, aware of the deficiencies in project appraisal for the sharpened emphasis it was giving to policies to benefit the small farmer in rural areas, have developed a broadened approach to the economic appraisal of rural roads. [1] The method devised does not represent a sharp break with current practice but by focussing on the analysis of changes in farm income, explicitly orients the evaluation towards the main target beneficiaries of rural road projects. A 'producer surplus' analysis is made which quantifies the developmental impact of transport cost savings and complementary investments within the area of influence of a road. This area is estimated as extending as far as the transport cost savings of the road project have an effect on agricultural production.

The forecast of developmental impact is based on a careful evaluation of the rural economy that is influenced. Three essential issues are examined: [2]

Producer Response

How will producers respond to higher farmgate prices, lower input costs and improved quality of service? Will the likely increase in farmgate prices be of sufficient magnitude to stimulate increased production?

Distribution of benefits

To whom do the transport cost savings accrue? How are they distributed among producers, truckers, traders, consumers and others affected by the road? What is the relation between the distribution of benefits and the structure of the economy reflected, for instance by land tenure patterns and the structure of the trucking industry?

Non-transport constraints

What constraints exist which might prevent the produ-

cer from responding to the incentive provided by the road project? Does the producer have the required resources, attitudes and risk preferences? And if he does not, what else needs to be done, by whom and when, to get the maximum impact from the road investment?

The net income (producer surplus) of farmers and transporters prior to the proposed investment is determined from an analysis of baseline data on crop areas and yields, production costs, ex-farm prices, marketed output and local consumption together with transport costs and prices. Changes in these data are then forecast if the proposed investment is made and subtracted from those changes that would have occurred without the investment. By these means a benefit can be summed year by year and compared with costs of the project. A calculation is then made of a rate of return of the package of investments in transport combined with other complementary investments.

It is not suggested by the IBRD that this complex analysis is needed for all road projects in rural areas. It is accepted that there are cases in which the level of economic activity is high and the traffic demand sufficient to allow the traditional methods of road project appraisal to be used with confidence. As a guide the World Bank method suggests that roads with traffic levels of greater than 20-50 vehicles per day fall into this category. However, it is strongly recommended that estimated transport cost savings measured on the basis of predicted traffic levels should be supplemented by consideration of the distribution of their benefits. It may also be necessary to consider whether complementary investments are needed before the road project will produce the calculated benefit.

A second case applies to areas where the need for development is greatest, where economic activity is low and where the market economy is very weak. There may be no motorable roads or those that there are carry less than 20-50 vehicles per day. In most areas the considerably extended investigation of agricultural production, distribution and marketing systems required in the 'producer surplus' analysis outlined above is vital. Without it the justification of a transport investment is pure guess work.

After examination of the concepts and methods described by the World Bank in this broadened appraisal procedure the OECD Working Group concluded that it represented the best approach currently available - and strongly recommended its adoption. The Group and the World Bank recognise that no 'universal' method of project appraisal is conceivable and recognise also that the recommended approach has deficiencies. In basic concept it still relies very heavily on the assumption that an analysis in economic terms is sufficient. Consideration of stimulus to development from non-transport investments and from social, non-economic influences are treated as secondary. In practice the recommended method would require a massive data collection that may make the analysis of a project unacceptably high compared with its cost. Further research, some of it already under way, and experience from application of the method is still required. Never-the-less it is advocated in the interim to OECD member countries as a basis for a harmonised approach to investment studies of rural road transport.

TRANSPORT IN PLANNED RURAL DEVELOPMENT

For a truly fresh look at the problems of transport planning and transport project appraisal it is best to return to considering planning for rural development in a wide sense. Given that in the great majority of developing countries the basic infrastructure of main roads

exists, even in rural areas, it is necessary to drop completely the concept that transport has any unique role: it is no more an initiator of growth than many other forms of investment. Successful rural development must be based on increased agricultural production of all kinds but it is probable that in the vast majority of cases this increase will not be stimulated by a separate sectoral investment. It seems probable that emphasis on planning for economic returns will not achieve alleviation of the poverty of the rural masses, nor stimulate the changes in rural society that will be necessary. Social factors that hinder progress should be analysed: for example provision of schools and hospitals may be equally necessary. Although literacy and health of the rural population may be goals in themselves they may also be indispensable steps for increased agricultural production. This argues that planning must integrate elements of economic and social advance with planned improvement of the physical infrastructure in a comprehensive policy for development. It should be made appropriate for the particular region at the particular time. In short there should be, in a fashionable phrase, integrated rural development.

Transport projects should now be seen as one element in a planned package of investments identified as needed for development. There can be little doubt that improved transport will be an urgent need in rural areas where there is emphasis on increasing agricultural production above subsistence levels. Crops must be grown for sale in the market. They must be carried to the market. The means of carriage is almost everywhere in these regions so inefficient and expensive that over very short distances the returns to farmer are negated. [3] Improved transport is vitally necessary although not of itself sufficient to effect the change to the market economy.

It is this ambiguity about the role of transport in development that has hidden what should come first. If development is to improve the level of living of the rural poor then development plans start with benefits to this group through increases in production and income, better health and literacy. Better transport is not a primary goal, it is a service to the achievement of the more basic goals. The benefits of better transport should not be relied on to 'trickle-down' to the poorer groups. Improved means of moving people and goods, improved transport infrastructure should be provided in a development programme only to the extent necessary to match the specific need for movement if the other basic goals are to be met. Where resources are scarce over-emphasis on transport can be counter-productive.

There are two important consequences for the appraisal and justification of road projects in an integrated approach to rural development if the view of the 'service' role of transport as expressed above is accepted. Provision of improved transport will in most cases be vital to the success of the development programme but no attempts will be made to attribute benefits to transport alone. In the economic analysis made to justify the investment package, benefits will be quantified in terms of achievement of economic and social goals. For example, in terms of the value of increased agricultural production or of improved health and education of the target group. The costs of transport provision, which include expenditure on road construction and maintenance will be added to the costs of the other inputs.

The second consequence affects the role of the transport planner in the multi-disciplined team necessary for pre-investment studies. In feasibility studies for ad-hoc transport projects the transport planner has normally been required to estimate the numbers of vehicles of various types which will use the proposed new or improved facility in the years after installation, in other words to assess accurately transport demand. But transport has

an influence on nearly every aspect of integrated planning. An iterative approach showing how different levels of transport provision affect levels, spacing and timing of other inputs is an essential part of the process. The transport planner should, therefore, be a member of the planning team from the outset so that his particular expertise can be fed into the overall conceived in more fundamental terms than in terms of vehicle flows. The assessment of the nature, quantity and timing of goods movements and the requirements for personal mobility should properly be the role of those concerned with development of the natural resources of the region and of the planners of social advance, of improvements in health and education. It is the agricultural planner who should estimate how much tonnage of product should be moved and the marketing planner where it should be moved. The education planner should determine the need for children to move to the schools he plans; the medical planner how many people require access to the health centre.

The main role of the transport planner in the team will be to devise cost-effective ways of meeting this fundamental transport demand, not of assessing it. He should then adopt a 'system' approach in which there is an evaluation of the interaction between costs of track construction and maintenance on one hand and the cost of vehicle operation on the other. He should look into the important but neglected field of provision of vehicles that are more appropriate to the transport needs of specific developments and to the primitive tracks on which they may have to travel. He will also be freer than at present to consider using other transport modes and their co-ordination with road transport.

There is one particular area of transport improvement that may be of main importance in increasing the productivity of the farmer. It has been largely neglected by transport planners. This is in the movement of goods off the road or track. At present loads of produce are carried to the road by human portage. Materials needed on the cultivated land such as fertilisers or anti-pest sprays are similarly loaded on heads or backs. Since the possible distances are low the area of cultivation and the penetration of improved agricultural practices are similarly limited. A careful examination is required of the needs for this kind of transport. An economic analysis, which takes into account social constraints and physical conditions of the terrain, should be made of ways of improving the efficiency of human muscle power by using bicycles, carts or barrows. Consideration of vehicles pulled by animals or moved by engines should follow. Where disposable income is very low even individual ownership of an imported bicycle may be impossible - so that questions of organisation of use and local manufacture of appropriate vehicles may be crucial.

FUTURE RESEARCH

Evaluation of transport projects

In the critical analysis made by the OECD Working Group of current methods of planning and appraising road projects in developing countries one of the notable features was the shortage of well-documented follow-up studies to ascertain the efficiency of evaluation procedures. Although the Group put forward the view that the broadened approach recommended by the World Bank is sufficiently developed to enable it to be used now as the basis for a common approach to transport investment appraisal in developing countries, it was concluded that there was need for more research.

The main emphasis should be to validate and improve the methods of transport planning and project evaluation for use in integrated rural development. The best approach will be to monitor socio-economic changes

induced by a planned transport project. Beginning with the active cooperation of developing countries a number of rural development projects should be implemented on the basis of the integrated investment approach. It was recommended that there should be international cooperation to coordinate the research so that maximum impact could be rapidly obtained.

The studies envisaged are similar to and could complement those being carried out by the World Bank in Brazil, Ethiopia, Kenya, Madagascar and the Yemen. These studies use extensive and comprehensive collection of socio-economic data to describe the post-evaluation situation and the post-implementation situation as it develops. This data collection is likely to be an expensive exercise but it should be designed to provide information that will be of value for monitoring the total investment package and not solely the transport element.

A rapid international build-up of information will require a number of such post-evaluation studies carefully chosen to reinforce and complement one another. Land classification, a mapping technique involving the identification of natural patterns of landscape (land systems) from aerial photography, satellite imagery and field survey is being increasingly used to assess potential for agricultural development. It can thus be used for selection of research areas for the investment studies that are of similar potential and also for transfer of conclusions from one area to another. It could be used to aid research using cross-sectional as well as time-series analysis on a number of projects in a given region. The use of the imagery involved is well established for monitoring changes in agricultural land-use.

In this research, the need to simplify and cheapen planning and evaluation procedures for the low-cost rural transport required should be kept in the forefront. If good plans for this urgent development need are to be made they should be pragmatic and accommodated to the level of achievement of the developing country in question so that the plans can be implemented.

Research on cost-effective transport systems for rural areas

It is central to the ideas advocated by the Working Group that the provision of rural road transport should be as cost-effective as possible. There are already gaps in the knowledge of rural road construction which research should fill before integrated transport demand can be satisfied as effectively and as cheaply as possible. The Working Group made recommendations for a number of engineering research activities which should provide this essential information. These are concerned with the development of standards of construction and maintenance of extremely low cost roads; the cost effectiveness of simpler, cheaper and more flexible vehicles than those at present imported for use on the rural roads of less developed countries; the better use of indigenous materials for truly low cost roads, and further work on labour-intensive road construction methods which take account of the recent experience of countries which have adopted such methods with considerable success.

A Road Transport Investment Model [4] has been developed through international cooperation and the mathematical relationships from which it is constructed have been calibrated by field work in developing countries. Further development of the model and extension of the relationships are needed before it can be used to help decisions such as choice of road standards for the lowest level of rural road provision. Research is needed on the relationship for instance, of vehicle operating cost to roughness and geometry of earth roads.

The present choice of motorized vehicles for use on

rural roads in developing countries is at present often confined to those imported from industrialized countries. Research is needed on the trade-offs between road design and vehicle design to enable decisions on appropriate transport systems to be made. There is considerable evidence that a potential transport bottle-neck in rural areas in developing countries is lack of suitable vehicles for off-road, field or farm to road movements. Research is required on simple vehicles, motorized or muscle-powered for this purpose.

Roads in rural areas must use the earth materials of the terrain traversed; importation of material from any distance can increase the costs of construction many fold. The information on the occurrence and the basic properties of tropical soils and rock that does exist is inadequate and selection standards for road use borrowed from the practice in industrialized countries are inappropriate both to the materials and to the methods of construction best suited to developing countries. Research is needed to establish cost-effective procedures for using indigenous materials. The first step is to identify the resources of road building materials and to map their occurrence. This should be followed by measurement of basic properties in suitable laboratory tests and by performance testing in scientifically designed full-scale road experiments.

Rural areas in most developing countries have large scale unemployment or under employment. The decision needs to be made as to how far efforts should be made to use labour-intensive methods of building and maintaining roads, so providing jobs for a large workforce and using and developing local skills. The decision needs to take account of more than the strictly economic analysis of comparative costs of transport provision by capital-intensive versus labour-intensive means. In addition the possibility of continuing social effects of the alleviation of under-employment and the local acquisition of managerial and organisational skills of projects are accomplished by successful labour-intensive methods. Much work has recently been carried out by ILO [5] and the World Bank [6] into the comparison between labour and capital intensive methods of road construction. The studies have provided guidelines for the economic use of labour-intensive work but have concluded that in particular further research is needed into methods of work organisation. In this regard the special efforts and experience of countries such as Mexico and India should receive special study to determine how their successful methods can be translated into other environments.

Besides the question as to how far labour can be substituted for machines in transport technology, there is also the question for the Third World of developing and using in a new alternative technology appropriate to the physical environment, social condition and state of development and capable of evolving as development proceeds. Such a technology should embrace both the building and maintenance of roads and eventually the vehicles which use them. It should be characterised by low capitalization costs and almost certainly by high employment of labour but should also embody the latest scientific understanding of the bases of the processes employed. Development of this appropriate technology would seem to be an ideal area for cooperation between transport research institutes in industrialised and less-developed countries.

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