PN-ABA-313

PLANNING AND EVALUATION OF HIGHWAYS AND RURAL ROADS

AFRICAN REGIONAL WORKSHOP ON LOW-VOLUME ROADS

FREETOWN, SIERRA LEONE

8-12 SEPTEMBER 1980

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The purpose of planning for highways and rural roads is to ensure an economical, efficient, and safe transportation system which not only meets defined short-range and long-range service objectives, but aids the country in achieving its socio-economic, and often times political, development goals. Needless to say, the planning process should be a simple, logical, systematic, comprehensive, and - I would emphasize - a continuing exercise which provides the necessary data for decision-makers.

1. Investment Appraisal Methods

Before I elaborate further on what is involved in or constitutes a comprehensive planning process, I would like to briefly review, in the context of this Workshop, the relevancy of existing investment appraisal methods to rural road planning and development.

For many years, appraisal methods for transport investments were based on the "specific-benefit" approach, which still forms the basis for evaluation of most infrastructure projects. Rarely was the proposed investment related to a national development plan based on regional needs. The appraisal presumed that the benefits of road investments could be isolated and largely determined by estimating the direct savings to road users, i.e., in vehicle operating costs, vehicle maintenance costs, and time.

There are two main inter-related reasons why such appraisal methods for rural roads are generally inadequate in developing countries. The first reason lies in the fact that they are simply inappropriate --- the cost-benefit methodology is aimed primarily at alleviating problems due to inadequate standards or congestion in an extensive and largely unplanned transport system. This methodology further favored inter-urban or urban roads on which traffic was already appreciable and growing. Consequently, investment in low-volume, low-cost roads to serve rural areas was largely ignored.

The second and somewhat more argumentive reason for the inadequacy of the specific-benefit approach for rural roads was the assumption that benefits could be solely and directly attributed to the investment in transport. In other words, it was assumed that the provision of an adequate transportation facility was the key to development of a region and by itself would stimulate economic growth and social improvement. This thesis, in my experience, does have some validity, but it has been the exception, not the rule. On the other hand, it is now generally accepted that transport should be planned and provided only to the extent necessary to meet specific needs and to ensure effective use of all investment inputs. Over-emphasis on transport may reduce investment in other basic sectors, and consequently, be counter-productive in the overall development process. An effective rural development plan should consider investments of many kinds to produce the desired economic and social advances. In almost all cases, investment in a rural road system can only be evaluated as a part of a combined appraisal of all individual elements. It cannot be considered independently.

This integrated or often-termed "package" approach to transport investment in rural areas has several important consequences. In the economic analysis of the total plan, benefits should be assessed in terms of the achievement of broader economic and social situations, such as the increased agricultural production and/or improved health, welfare, and education. The costs of transport, including expenditures for road construction and maintenance, should be added to the costs of other capital and services inputs, such as irrigation, fertilizers, and hospital and education programs. The benefits from these activities should be likewise assessed.

Another consequence of the integrated approach is on the role of the transport planner. Instead of strictly confining the assessment of transport needs or demand to the numbers of vehicles and the different types which will use the proposed road, planning objectives and outputs as defined by agriculturalists, economists, and others, should be expressed in terms of the nature, quantity, delivery mode and timing of goods and people movements. The transport planner's principal task should be to devise cost-effective ways of meeting these transport requirements and to indicate how different levels of transport input affect other inputs and outputs. This is essential to good rural development planning which, to be achieved, requires a multi-disciplinary approach.

Both A.I.D. and the World Bank have adopted the integrated appraisal methodology for rural development projects. You will be hearing more about this in the next two sessions.

The appraisal methodology just described may be varied to achieve the desired social and economic objectives, and the planning team, properly composed of the necessary disciplines, can ensure that any plan reflects local resources, characteristics, and desires. In turn, the transport element within the overall plan will be equally adapted to local conditions. Regardless of the techniques employed, the adequacy of any appraisal, or feasibilty study, is entirely dependent on the extentm reliability, and availability of data for the analysis. In a planning process, data must be gathered systematically and continuously.

II The Planning & Evaluation Process

In establishing guidelines for transportation investment, consideration should be given to the stage of development that the country is experiencing. For instance, in a developing country that is well underway towards achieving a viable economy, proposed projects might have benefits that far exceed those that are normally quantified under the present state-of-the-art in conventional economic studies. Many times the need of a project is obvious because the project is necessary for the country to function in a manner that will meet social, economic, and political goals,

On the other hand, a country that is in the early stages of development does not possess a trend of fundamental concepts and attitudes which is necessary for developing and adhering to long-range goals and objectives. Therefore, it is difficult to fit together transportation projects into a proposed infrastructure that will meet growth demands. In this situation, projects must be .....

thought of in a relatively narrow framework and weighed in terms of easily identified consequences to the extent possible.

A. Evaluation of Transportation Projects in Countries That Are Well Underway Towards Achieving a Viable Economy

The concept of working towards a system of transportation should be encouraged in countries where economic growth is fairly well defined and established. The idea should be to develop a logical system of transportation that will serve the movements of persons and goods as efficiently and economically as possible.

The present method of using a benefit-cost analysis to justify each individual project is conducive to a bits-and-pieces type approach rather than an integrated systems approach that combines adequacy with economy. Therefore, in countries that are well underway towards achieving a viable economy, the evaluation of transportation projects should be the logical outcome of a transportation planning process. In this situation, a conventional feasibility study to prove economic and technical soundness for each proposed project is unnecessary, since the ingredients for project justification are obtained in an integrated manner during the planning process. Furthermore, in view of the present costs of feasibility studies, the adoption of the planning process criteria would most likely result in considerably less cost when many projects are proposed.

Through a transportation planning process, present and future needs are determined. This sets the course for making the best use of funds and for factually balanced improvement programs. With the transportation future clearly pictured, definite short-and long-range goals can be established which have the important effects of creating inter-modal cooperation and stimulating further economic growth.

A planning process for transportation is a logical, systematic and continous procedure that is focused towards obtaining the highest overall level of transportation service for the funds that are available. For instance, the highway planning portion of the process would involve the following activities:

- Inventory - The first step in highway planning begins with the collection and organization of data to determine the physical make-up of the highway plant, the use made of the highways, and the land uses which generate the traffic.

- Classification - Using the storehouse of basic knowledge obtained during the inventory, the second step is to group all roadways into distinct systems or classes according to their functional characteristics. For instance, all roads that serve abutting land use might be classified as local. All roads that connect centers of economic activity might be classified as arterial. All roads that collect traffic from local roads and channel it into the arterial road system might be classified as feeders. Then design standards for improvement are related to each road and class, and jurisdictional responsibilities are assigned to each class.

Besides being a necessary step in systematic planning of roads, classification is the first attempt in the planning process to combine adequacy with economy. For instance, parallel facilities that duplicate functional purposes are downgraded and, consequently, many roads can rightfully be improved to lower standards that they would ordinarily be without proper classification, i.e., without considering the traffic split between facilities.

- Needs Analysis - The purpose of this phase is to determine what improvement projects are necessary to bring the roadway system up to some predetermined level of condition and serviceability. This phase not only involves determining present deficiencies but also predicting future deficiencies and the period of years over which the deficiencies are expected to arise.

- Finance Study - The finance study is performed in conjunction with the needs analysis and includes an assessment of all current sources of revenue available for highway purposes and possible additional sources of revenue. Alternative design standards for each class road are considered in light of their respective financing requirements, and a decision is made as to a plan of operations for highway improvements that does not overextend the financing capability of the particular country.

- Priority Analysis - The foregoing phases of the planning process have answered the questions: "How much should we spend and what projects should we spend it on". The next step is to determine the sequence in which we should build the projects. Priority analysis is a methodical and impartial procedure for ranking the needed improvement projects in order of relative urgency. A number of tools are available for this, e.g., sufficiency ratings, rate-of-return or benefit-cost analysis, average daily traffic, etc.

- Program Assembly - Program assembly considers the data on needs, financing, and priorities, seasons it with legitimate practical considerations and converts it to an actual construction timetable. In this phase, estimated project costs are balanced with projected yearly revenues to formulate a master plan comprising both a short- and long - range program. Periodically, the plan must be revised to reflect changing conditions and updated so that it will always cover a constant number of years in the future. Although the gathering of data and the analytical activities have been described for roads, a similar system can be developed for other transport modes. Moreover, the evaluation can be integrated with economic data that is concurrently gathered. Since most of the data usually required for a feasibility study is already stored and up-to-date, only a relatively short-term and much less costly effort would be required to prepare a project for a donor's consideration. In most cases, the Borrower himself could do this.

B. Evaluation of Transportation Projects in Countries that are Experiencing the Early Stages of Development

In countries that are experiencing the early stages of development it may be premature and impractical to set up a transportation planning process. Therefore, the evaluation of a transportation project must be based on an individual study

which computes benefits and costs insofar as practical. This procedure for the justification of a project is necessary for the donor or lending agency to have sufficient information to adequately evaluate the project. However, much too often, the benefits and costs that are considered are reduced to a single numerical answer (B/C ratio or Rate of Return) which is used at face value in determining the worth of the project.

An economic study is not an instrument of precision -- it is necessarily based on forecasts that are subject to error and may sometimes be based on assumptions and arbitrary values that are not valid. Practically, economic studies never consider all benefits and all costs. Therefore, a single numerical answer, as is normally the result of a feasibility study, can be misleading to a lending agency when considering a project for a loan or grant. However, from an operations research point of view, an economic study can assist a donor by supplying him with valuable information thus greatly increasing the chance of making the right decision -- more so than if the decision is made on the basis of someone's intuition or prejudice.

C. Conducting Feasibility Studies in Countries that are Experiencing the Early Stages of Development

General practice by some donor and lending agencies has been to request a detailed feasibility study in one package that includes economic evaluation, the completion of preliminary engineering plans and financial and other plans necessary to construct the project, and the determination of a reasobably firm estimate of cost. Historically, these studies have been expensive, and extravagant costs have sometimes been incurred in cases where the study indicated that the project was not worthwhile.

In order to avoid extravagant costs, consideration should be given to performing the feasibility study in two phases: Phase I would include a thorough economic study and would derive all quantifiable benefits. However, the engineering analysis should be limited to obtaining magnitude-of-cost estimates through careful reconnaissance surveys and study of maps and aerial photographs. Cost indices for construction over various types of terrain could be developed from experience and knowledge of local conditions. The results of Phase I would show, by a benefit-cost or rate of return analysis, or some other approporate tool, whether or not the project is economically justified and the best alternative from the considered alternatives.

Phase II would include a financial analysis and the necessary preliminary engineering to assure that the project is capable of paying for itself and is technically sound. This would involve the more expensive work in a feasibility study such as soils and materials survey, engineering survey, maintenance study and the development of preliminary plans, designs, specifications, construction procedures and schedules. Also, Phase II would show a reasonably firm estimate of cost and a more accurate benefit-cost analysis than Phase I. Consequently, according to existing criteria, the study would be acceptable to lenders for loan purposes.

Should Phase I show that the project is not justified, Phase II

would be cancelled, thus avoiding a wasteful expenditure in preliminary engineering. Implementation of the work could be by seperate contracts for Phase I and Phase II, or by a single contract making Phase II execution contingent on the findings in Phase I.

III The "Rural Highway Planning System" - By the U.S. Federal Highway Administration, Department of Transportation

Several years ago, the U.S. Federal Highway Administration (FHWA) developed a basic "Rural Highway Planning System" for use by developing countries. This program is designed using the concept of collecting the minimum basic information needed to plan and operate an efficient highway and rural road transportation program. It minimizes the manual effort and maximizes the use of the computer. The system is flexible so other types of data can be added at a later date as management may desire. Therefore, the total planning program is designed as a coordinated information system which may also form the basis for a total management system.

This system was designed so that all types of roadway oriented data are located using the same reference base of route and mile-point. The information is stored in such a manner that any combination of analyses of these data can be readily accomplished. For example, accident rates by design features or maintenance costs by design or location considerations may be easily determined provided accident statistics and maintenance cost data have been added to the system. However, the initial objective of this project was to include only those basic data needed to evaluate the highway and bridge improvements that were presently needed, consistent with the countries' goals, objectives and financial capabilities. It was also important to develop a means for establishing a priority for constructing these needed improvements.

The programm was designed to be as simple, yet as functional as possible during both the data collection and analysis phases. For example, all field forms are self-coding to permit punching the information from the field sheets directly on computer cards. This eliminated any necessity to manually transcribe the data. This program resulted in the development of a series of manuals of instructions and computer programs for the collection and analysis of data needed to accomplish this basic rural highway planning process. The basic data that were collected as a result of the field surveys included:

1. An inventory of the physical features and dimensions of roadway, structures, railroad crossings, tunnels, ferries etc.

2. A detailed evaluation of the condition of these roadways and structures.

3. An inventory of the characteristics of the motor vehicle traffic using the highways, which includes the traffic volume, distribution of vehicles by type, and weight characteristics.

The above information was then used to evaluate highway needs and deficiencies. The analysis also includes a method which arrays these needs into a priority for improvement.

The original publication includes seven manuals whose titles are as follows:

1. Outline of the Highway Planning Process.
2. Guide for a Manual of Instructions for Road Inventory
3. Guide for a Manual of Instructions for Traffic Surveys.
4. Guide for a Functional Classiffication of Highways.
5. Guide for a Manual for Highway Adequacy Rating.
6. Measuring Highway Improvement Needs and Priority Analysis.
7. Computer Programm Users Manual.

The first six manuals have been published in the English and Spanish languages. The last manual is published in three (3) volumes. Volume I includes the documentation for nineteen computer programs used for analyzing the highway inventory data. Volume " includes the documentation for the seven computer programs needed to analyze the adequacy or sufficiency rating data and the two computer programs that are needed for updating the highway inventory data. The last volume documents the computer programs needed to analyze the highway traffic data, i,e., volume, classification, and weight.

The computer programs and test data have been copied onto five computer tapes. Also available is a "Computer Program Installation Guide".

Anyone desiring additional information on the "Rural Highway Planning System" developed by FHWA, should submit their request through their Chief Highway Engineer, or higher authority, upon their organizational stationery, to:

Mr Kevorkian Alganian
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