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Designing a Rural Basic Access Road Project: The Case of Andhra Pradesh, India

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Conventional road project design and appraisal methodology has some serious limitations when it is applied to rural basic access road projects, particularly those aiming to achieve both social equity and economic efficiency objectives. These limitations can be overcome by the use of participatory approaches and other practical tools.

INTRODUCTION

Reliable access from villages to markets and social services is an essential component of the quality of life for rural population. However, many poor villages in developing countries do not have all-weather road access and are often cut off for long periods during the wet season when access roads become impassable. The provision of basic, all-weather road access can thus serve as a valuable instrument for rural poverty alleviation.

Conventional road project appraisal methodology focuses on the quantification of direct road user benefits. But most rural access roads have very low initial traffic volumes, and expected benefits of improvement come primarily through increased socioeconomic opportunities, which increase traffic, but are difficult to forecast and quantify in monetary terms. A further difficulty is that rural road investment programs often cover large areas where needs include both the improvement of existing all-weather passable roads for the purpose of traffic efficiency and the provision of basic access for poverty reduction. Limited budgets often have to be allocated between poverty-focused and efficiency-oriented road works. Moreover, rural road projects are often screened from a vast road network. To maintain a degree of equity among villages, the spatial balance of the program must be considered as well as economic criteria in selecting individual roads for investment.

Conventional road project appraisal methodology offers little help in these dimensions. Other tools are thus necessary to supplement conventional road project appraisal methodology. The case presented below illustrates the usefulness of participatory approach, rural road network master planning, and the joint application of cost-effectiveness analysis and cost-benefit analysis in the design and appraisal of rural road projects.

RURAL ROAD PROBLEMS IN ANDHRA PRADESH

The project is a stand-alone component of a larger project, the India—Andhra Pradesh Economic Restructuring Project (approved in 1998 and effective in 1999). It was proposed by the Government of Andhra Pradesh (GoAP) as a pilot program, to be implemented in three selected poor rural districts, Adilabad, Karimnagar, and Warangal. The three districts have a total of 6.8 million population; the majority struggle to survive on less than US$1 a day. The area is served by about 15,000 km of rural roads, which are regularly affected by monsoon. Over 80 percent of the roads are in poor condition, and are vulnerable to heavy rains. Thirty percent of rural roads are impassable each year during the rainy season. The objectives of the project are thus set to improve the quality of life of the rural population and to promote rural economic growth through improvement of the rural road network, particularly through provision of basic, reliable all-weather road access to villages which currently are not provided with such access.

There are four main types of rural roads in the area: tracks, earth roads, gravel roads, and water bound macadam (WBM) roads. An earth road is made of only an earth formation. Neither tracks nor earth roads are all-weather passable. A gravel road is made of a layer of gravel on top of an earth formation, and a WBM road has one or two layers of WBM on top of an earth

formation and a gravel layer. If properly maintained, both gravel and WBM roads can be all-weather passable. However, many gravel and WBM roads in the area become impassable during heavy rains due to inadequate or defective cross drainage facilities. When traffic volume (particularly motor vehicle traffic) on a gravel or WBM road reaches a certain level, it is more economical to pave the road than maintain the unpaved road to all-weather condition. Paving (also called black-topping) is done by adding a layer (2 cm) of bituminous mix on three layers of WBM.

The poor condition of rural roads in the area has much to do with institutional weaknesses. The management of rural road is the responsibility of the state level Panjayat Raj Engineering Department, (PRED). As in many parts of the world, rural road maintenance funding in Andhra Pradesh had long been inadequate, resulting in a huge backlog of periodic maintenance. This was changed in recent years when substantial increases in rural road funding provided sufficient total resources for the proper maintenance of the network. However, under-development of the network, weak institutions and political pressure continued to cause diversion of maintenance funds to upgrading projects (mainly black-topping). The design and selection of road works did not follow clear social and economic criteria and was heavily subject to political influence. Due to the lack of technical guidance and weak funding mechanism for road maintenance, black-topping is considered by local politicians and decision makers as the only technical solution to ensure all-weather road accessibility. As a result, PRED is often pressured to allocate more funds for economically unjustifiable road paving. Worse yet, it is a common practice in Andhra Pradesh that as soon as a rural road is paved, it is reclassified as a major district road under the state road system and transferred to the State Roads and Buildings Department (RBD), where the road tends to receive the lowest priority in RBD's maintenance budgeting process and consequently is poorly maintained. Clearly, for the project to achieve its objectives on a sustainable basis, these institutional problems should be addressed along with proper design and implementation of road works.

PARTICIPATORY APPROACH

During the project design and evaluation, a participatory approach was adopted for building consensus on various policy issues. These included setting design standards, agreeing investment priority, and formulating a policy framework for rural road investment and management.

The participatory process comprised several workshops at different stages. At the initial stage of the project preparation, a two-day objectives-oriented workshop was held jointly with PRED staff, local government officials, and transport operators. Through the workshop rural road problems were identified and analyzed, project objectives discussed and prioritized, an overall description of the project established, and the rural road policy framework formulated. As project preparation advanced, district-level workshops were held in each of three districts, jointly with district government officials, district politicians and PRED staff, to discuss and formulate the district-level program. During project appraisal, technical workshops were held with PRED staff from both the headquarters and the districts, to define the detailed scope of the project.

The rural road policy framework emphasizes the importance of basic access and the need for economic justification for any road upgrading to blacktop standard. According to the current stage of rural transport development in Andhra Pradesh, the basic road accessibility is defined as basic all-weather motorable access to villages, with brief interruptions during heavy rains permitted. It is also decided that bringing the core network to all-weather standard be given first priority over upgrading of individual links to blacktop standard. Road works related to the provision of basic access will be prioritized according to cost per population served. Any investment beyond the basic accessibility, such as black-topping and construction of new links, will be subject to cost-benefit analysis and must meet the minimum economic rate of return (ERR) of 12%. Moreover, the policy framework emphasizes the allocation of adequate funding for maintenance of the core network through the state-level rural road maintenance budget,[1] and introduces district-based annual maintenance plans and a technical audit to verify the outcome of plan implementation. The participatory process has been initially successful, as the policy framework was passed as a state decree in December 1998 and has been adopted by GoAP throughout the state.

DISTRICT-BASED RURAL ROAD MASTER PLANNING

The central task of the master planning process was to identify from a large number of rural roads in the project area a core network, shown in Figure 1, that would provide the basic minimum road connectivity between

[1] Funding for the maintenance of non-core roads is mostly from the central government and channeled directly to the community level through various poverty alleviation and employment generation programs. The policy framework encourages the creation of community road associations for the management of non-core community roads.

villages and market centers. This involved selecting one road connection from each village to a nearby main road or market center amongst the alternatives available for connecting that village, on the basis of careful consideration of existing road network, location of markets, topography and local travel patterns. Through this process, a core network comprising 700 individual links and totaling 9,000 kilometers was selected in the three districts out of a total rural road network of 15,000 kilometers.

The next step was to determine the type of improvement required for each road on the core network to achieve basic all-weather standard. A detailed road inventory and condition survey was conducted by local engineers for the entire core network to establish a database containing the following data for each road: road name, jurisdiction, length, road type, number of bridges and cross-drainage facilities, overall conditions, passability during rainy season, population served, and current levels of traffic. Traffic data were obtained on road links proposed for upgrading to bituminous standard. Traffic counts were executed for 12 hours from 6:00am to 6:00pm. All commonly used transport modes in the project area were counted, including bus, minibus, car/jeep, truck, tractor trailer, tempo, three-wheeler, two-wheeler, bullock cart, bicycle, and pedestrian. With the road condition data and the PRED cost data, various works required to bring each road to basic all-weather standard were assessed and the least-cost solution was proposed for consideration of project financing. Black-topping works were also proposed for roads with traffic levels above an economically justifiable threshold.

SELECTION OF PROJECT ROADS

As a result of the master planning process, a number of roads were identified for improvement from the 9,000 kilometers of core network. Most of these road works were considered as necessary to achieve the basic access standard, and mainly included spot improvements such as gravelling or placing one layer of WBM on sections of roads with poor surface condition and construction of missing cross-drainage structures at an average per kilometer cost of US$15,000 equivalent. They were ranked for cost-effectiveness according to the number of population served per unit amount of investment required to bring the road up to basic access standard. From the top of the ranked list, a total of 3,000 kilometers road works was selected out of the core network (about 1,000 kilometers in each district) at district-level participatory stakeholder workshops. Based on the available finance, a maximum amount of US$50 per person was identified as the threshold, above which road works would not be financed.

From the 3,000 kilometer roads identified above, the district workshops also produced a wish list for roads with substantial traffic to be upgraded to bituminous standard for economic reasons. These roads were screened by using a simple cost-benefit analysis program,[2] which was devised to quantify road user benefits (including savings in vehicle operating cost and travel time cost) for both motor vehicle and non-motorized vehicle traffic, and to estimate the ERR of the proposed road work. To further facilitate the evaluation process, traffic thresholds (defined as the combinations of motorized and non-motorized traffic sufficient to ensure ERR of 12%) were established. Proposed black-topping on roads with traffic levels below the threshold would not be considered for financing under the project.

Eventually, about 1,700 km of rural roads were selected for financing to basic accessibility standard, with cost-effectiveness ratio ranging from 14 to 50 US dollar equivalent outlay per person served. A further total of 1,300 km of roads were selected for black-topping. Their ERR range from 12 to 90 percent with an overall ERR of 24 percent. A total of two million rural population are expected to benefit from the project.

LESSONS LEARNED

1. The participatory process for setting investment priority and developing a policy framework was crucial to achieve a systematic approach to the investment and management of rural roads.

2. Comprehensive master plans for rural road network planning developed on local government level are an ideal tool to increase the effectiveness of rural road investment.

3. Cost-effectiveness method combined with least-cost engineering solution is a useful tool for the design, assessment, and selection of basic accessibility road works.

4. The availability of able engineers and the existence of district level statistics and road data inventory in Andhra Pradesh were important factors for the success of the data-intensive rural road master planning and economic analysis.

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[2] See a separate note (Infrastructure Notes, Transport No. RT-5, January 2000) for more details on the economic analysis exercise for this project.

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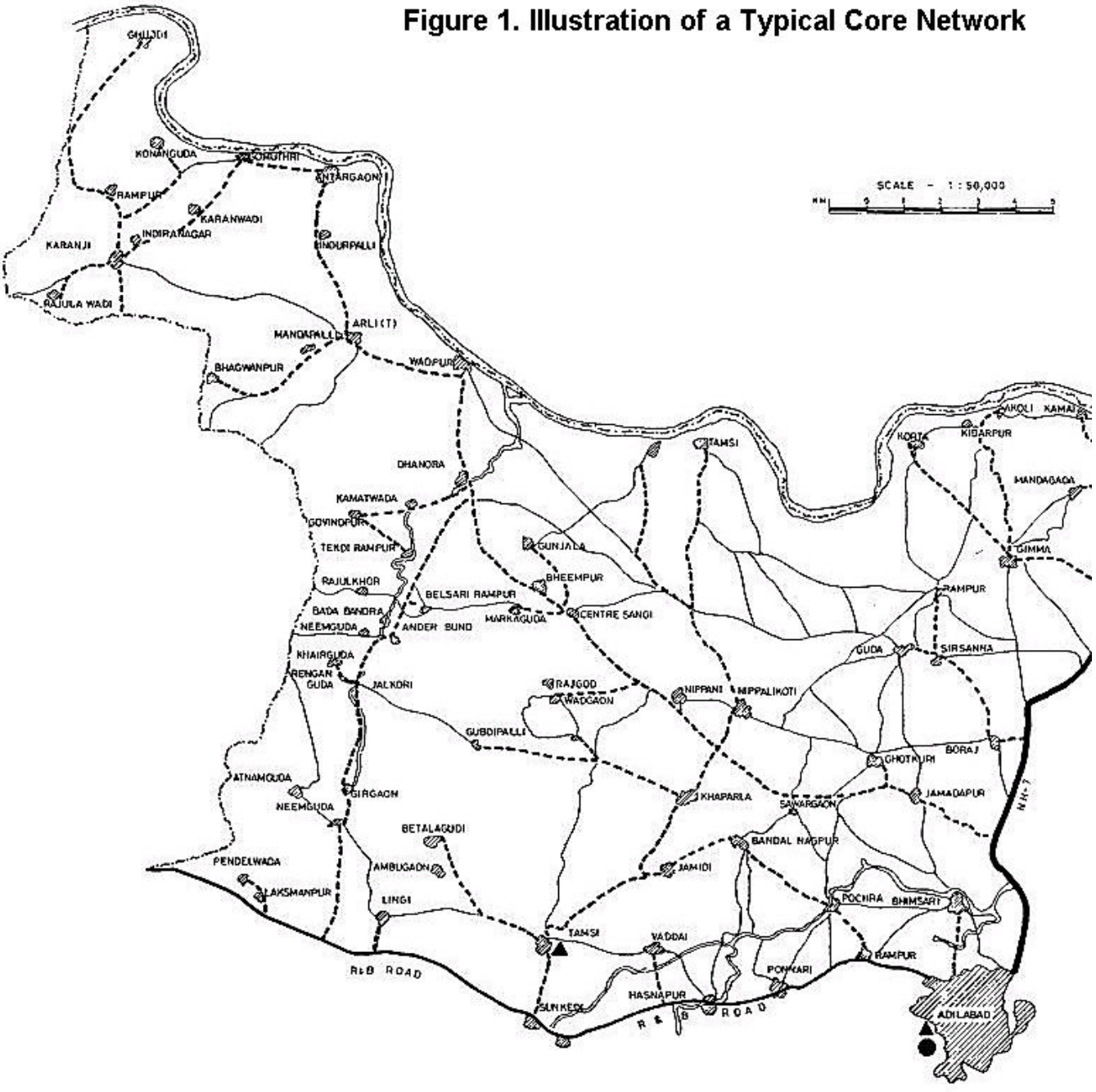
Figure 1. Illustration of a Typical Core Network



Source: Ashok Kumar and Praveen Kumar. "User-Friendly Model for Planning Rural Roads," in Transportation Research Record 1652, Volume 1. Transportation Research Board, National Research Council, Washington, DC, 1999.