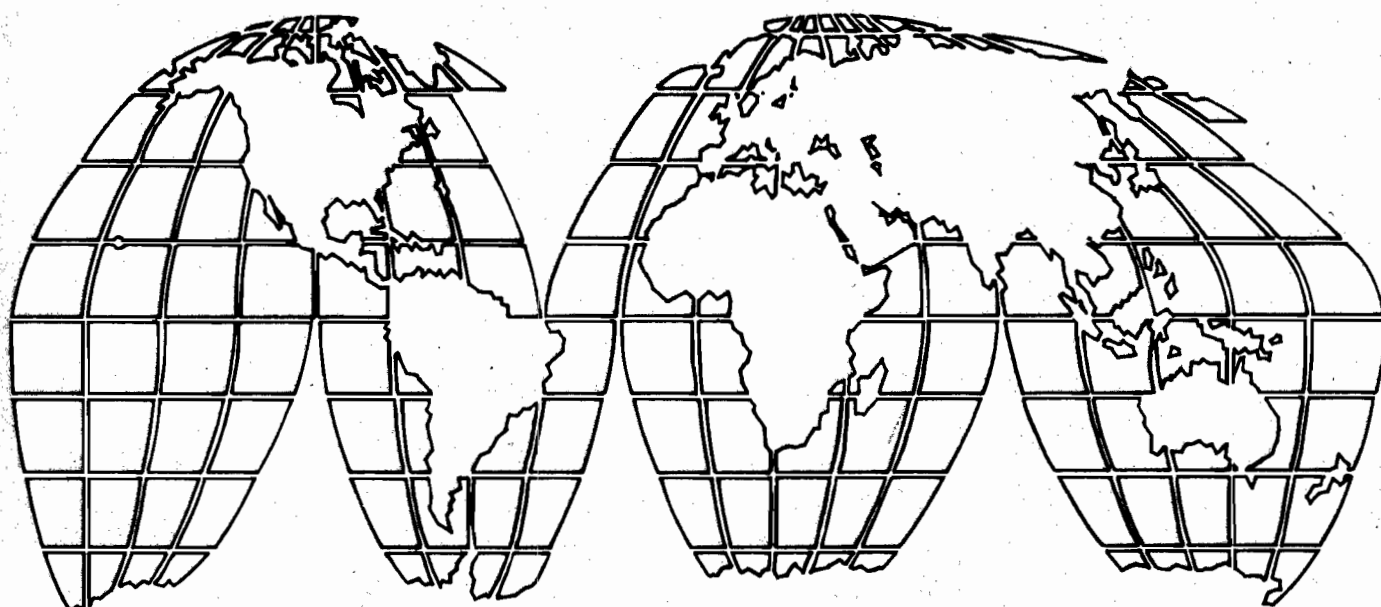


A.I.D. Program Evaluation Discussion Paper No. 2

New Directions Rural Roads



March 1979

Office of Evaluation
Bureau for Program and Policy Coordination
Agency for International Development

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NEW DIRECTIONS RURAL ROADS

by
Judith Tendler

A.I.D. Program Evaluation
Discussion Paper No. 2

The Studies Division
Office of Evaluation
Bureau for Program and Policy Coordination
U.S. Agency for International Development
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PREFACE

The A.I.D. Program Evaluation Discussion Paper Series: Office of Evaluation Approach

This is one of a series of discussion papers issued by the Agency for International Development. This paper is sponsored by the Office of Evaluation.

The purpose of the A.I.D. Program Evaluation Discussion Paper Series is to stimulate thought and dialogue on development problems and to encourage experimentation. The authors of the papers are instructed to be critical in a constructive sense and to examine explicit or implicit assumptions that are usually taken as given, to look for unrecognized and often cross-sectoral linkages, to examine host country institutional factors, to examine how AID's organization, staffing and procedures affect its effectiveness, and to identify alternative approaches and policy options. Two key factors characterize the series: actual development experience is sought as a basis for opinion and opinion is directed towards policy issues. The papers are a mix of what is known (from experience and evaluation evidence) and what needs to be known from further evaluative studies.

Because the discussion papers are exploratory, they are not intended to be comprehensive in coverage, conclusive in their argument, or primarily technical in orientation. They are intended to help formulate additional hypotheses for testing and to assess what additional work needs to be done on the problem. We hope that the discussion papers will help stimulate innovative and more effective programming and project design in our overseas missions and that they will also be of interest to scholars carrying out research on development.

Most importantly, however, we hope that the papers will elicit responses from our readers--responses that will confirm or refute assertions, refine or add issues to be analyzed, and suggest case studies necessary to resolve issues.

The primary objective of the Office of Evaluation is to provide AID management with analyses of the intended and unintended impact of projects, programs, policies, and procedures. It is our intent that lessons gleaned from AID's past be made readily available to improve present planning.

The Office tailors its approach to suit the nature of a problem, its urgency, and the type of data available. After identifying a problem and ascertaining management interest in it, the Office's staff normally links up with or establishes a network of AID and non-AID experts. The staff also reviews information from the Agency's automated data base systems and assembles documents including project papers, project evaluations, and special studies sponsored by other parts of the Agency. In conjunction with this, the Office commissions discussion papers by experts who are familiar with development problems. It may also hold workshops and conferences and, if necessary, carry out field studies of past projects and programs. The Office does not sponsor basic research on development but concentrates on analyzing available information.

Findings are issued in discussion papers, workshop and conference reports, circular airgrams, action memoranda, sector and subsector studies and case studies. These do not constitute formal guidance unless they are explicitly cleared and issued as such.

About the Author

Judith Tendler has a Ph.D. in economics from Columbia University. Her doctoral dissertation--Electric Power in Brazil: Entrepreneurship in the Public Sector--was published by Harvard University Press. Dr. Tendler worked for the Agency from 1967 to 1970--first in the Brazil Mission in Rio de Janeiro, and then in the Office of Development Resources of the Latin America Bureau. During that period, she did several evaluations of electric-power, highway-construction, and highway-maintenance projects. Since leaving the Agency, Dr. Tendler has worked as a consultant for the World Bank, the Inter-American Development Bank, the Organization of American States, and the Agency--mainly in the area of agricultural and rural development projects. Dr. Tendler was a Fellow at the Center for Advanced Studies in the Behavioral Sciences at Stanford in 1973-1974, during which time she completed a book on project decisionmaking in foreign assistance organizations. Her book, Inside Foreign Aid, was published by the Johns Hopkins University Press in 1975.

Author's Note

This paper, together with a companion paper on rural electrification, is based on 40 interviews conducted in Washington over the period of a month in the spring of 1978. Valuable additions to the interviews were provided by the comments of AID staffers at my preliminary presentation in May, by the literature cited at the end of the paper, and by discussions at a three-day seminar on labor-based road construction in Washington, sponsored by AID and IBRD.

The reader will find little citation of sources in the text. Most of the lessons to be learned from AID's projects are not written down, and come from my interviews. Out of consideration for those who talked with me, I have preferred to not cite interview sources at all. I have referred where possible to written analyses and descriptions of projects and points discussed in the text. A list of the documents collected during this period follows the text.

A draft of this paper was distributed within AID in late 1978, followed by a seminar held at AID in January of 1979. The seminar provoked lively discussion on various sides of the issues, and many valuable contributions were made to the ideas presented in the paper. In the interests of facilitating an immediate wider distribution of the paper within the Agency, and because the paper is preliminary to a series of field studies of rural-roads projects to be undertaken by the Studies Division, I chose not to revise the paper at this point. The seminar resulted in the formation of an Agency-wide study group on rural-roads evaluations, which will attempt to see that the issues raised by the paper and the seminar receive attention in subsequent project evaluations sponsored by the various bureaus of the Agency.

I am most grateful to the many persons who spent time telling their project stories in response to my questions, to those who took time to write down their reactions to my paper, and to those who attended the seminar and made it a vigorous exchange of ideas. I very much appreciated the support and the challenges provided by the Studies Division of PPC.

—Judith Tendler

Summary and Recommendations

The search for New-Directions impacts of road projects has focused on labor-based methods of construction. In recent years, the donor world has supported considerable research investigating the competitiveness of labor-based techniques of roadbuilding as opposed to equipment-based ones. Donors have also started to finance labor-based road construction, mostly pilot projects. After years of tutelage in equipment-based construction, recipient governments or their highway departments are often reluctant to adopt labor-based techniques. Equipment-intensive projects are in many ways "neater" than labor-based ones: there is only one large contract to let and monitor, the pace of work is easier to plan, and the exact nature of the task and the expenditures required to do it are more easily predicted and described in a bid document.

Ironically, the appeal of equipment-based construction is in some ways greater to donor organizations than to recipient countries--notwithstanding the genuine concern of the donors for getting away from equipment-based techniques. Under current AID procedures, equipment-based projects take less staff time than would labor-based projects--at least for an initial period of transition to such techniques. AID procedures contribute,

inadvertently, to the greater attraction of equipment-based construction; for example, AID loans do not provide operating capital to contractors for the large and frequent wage expenditures necessary under labor-intensive construction. Also, AID often supplies equipment to the same road-construction agencies with which it has labor-intensive projects, thereby increasing even more the lure and the relative cheapness of equipment-based techniques.

Given the reluctance to adopt labor-based techniques, AID training and persuasion will not be enough to induce the transition to such techniques. Similarly, the power of cost-benefit analysis to show that labor-based techniques can be competitive with equipment-based ones, even at market prices, will also not be sufficient. In order to facilitate the adoption of labor-based construction, AID should pursue a strategy that seeks to lessen the relative costs of such techniques. This can be done partly by refraining from actions that decrease the real costs of equipment-based construction, and partly by seeking out institutional environments in the recipient country where labor-based construction is more desired, more familiar, and more functional. In these latter environments, correspondingly, equipment-based construction will be less attractive, less available, and less professionally respectable.

AID should avoid financing labor-based projects in agencies receiving parallel AID or other donor funding for equipment-based construction programs. The resulting easy availability of equipment makes the introduction and acceptance of labor-based techniques into these agencies more difficult than it normally would be. Though this suggestion may seem an obvious one, many donor attempts to initiate labor-based programs take place exactly in these kinds of agencies--i.e., highway departments receiving simultaneous injections of equipment and funds for equipment-based construction, often together in the same loan with the labor-intensive project. To stay away from such highway departments, one might think, would result in proscribing AID financing for many of the world's highway departments, thereby severely limiting AID's possibilities for financing labor-based projects. But the suggestion actually points the way to placing such projects in government agencies outside the highway departments--for example, regional development authorities or integrated development programs. Such agencies are somewhat removed from the influence of fleets of construction equipment and of engineers trained in equipment-based techniques. In addition, labor-based construction is likely to be more in the interest of these agencies than of highway departments. The principal objectives of such agencies, that is, often include

employment of the rural poor, local organization for community construction projects, and construction of rural roads as opposed to arterials. This contrasts with highway departments, for whom construction in itself is most important--particularly of arterial roads. For the professionals of the highway departments, moreover, only certain design standards are considered technically acceptable; these standards are often incompatible, or more costly to execute, with labor-based techniques. Unfortunately, the rural roads found in AID's rural-development projects have so far been neglected as institutional opportunities for labor-based construction.

Another way to place labor-based programs away from the undermining influence of equipment-based techniques is to seek more decentralized decisionmaking settings and financing, if possible, for such projects. Regional development authorities are also an example of an entity more decentralized than a highway department. Decentralizing road-construction decisionmaking not only takes decisions away from where the equipment is. Roadbuilding decisions at more local levels will also produce a higher ratio of unpaved to paved roads and a higher ratio of maintenance to construction efforts. The decisions will be characterized by a higher affinity for labor-based construction, if only because such techniques are more in use at local levels. Projects

at such levels, then, involve more of a continuation of existing techniques than a weaning away of roadbuilders from other, desired techniques. The difficulties that donors are having in winning over recipient governments to labor-based roadbuilding, then, may be more a result of the fact that donors are not working at the level of design and implementation where labor-based techniques are more accepted.

Decentralization of roadbuilding can elicit local financial contributions to road construction and maintenance in a way that centralized decisionmaking does not. Decentralization, moreover, is more likely to result in a piecemeal approach to road construction. Such a division of traditionally lumpy roadbuilding investments into smaller parts--strung out through time and built with more rustic materials and techniques--is in keeping with the relative capital scarcities and labor abundances of recipient countries.

The approaches to labor-based projects suggested here can be beneficial for the rural poor not only because of the employment they generate. They can also result in more rural roads and maintenance per dollar spent on road construction, and a more balanced development of rural and arterial roads in any particular region. In the search for New-Directions impacts of rural roads,

the impact of such alternative patterns of road-system growth has been somewhat neglected--because of the exclusive focus on labor-based construction techniques.

Introduction

The subject of roads is unique among infrastructure projects in having had its construction technology subject to intense scrutiny for labor-using opportunities. This scrutiny has concentrated almost exclusively on alternative approaches to construction. It has not yet evaluated the impact on the poor of alternative patterns of road-system growth.

Labor-based construction techniques, previously shunned by donor agencies as less efficient than equipment, have now been given a more serious analytical look as a result of research efforts of the World Bank and the International Labour Organization. Concern with rural poverty and more equitable growth patterns stimulated this research in the early 1970s because of the great potential of road construction programs to generate employment in the countryside, if labor-intensively done. The result of this research effort is a rich and detailed literature on the possibilities of using such techniques, and on their costs when compared to equipment-based construction.¹ IBRD, AID, and other donors have

¹ See bibliography item numbers 8, 10, 12, 14, 15, 16, 17, 18 19, 25, 30, 58, 60 and 61.

also made a serious effort to experiment with labor-based projects in their operational programs. The results of the IBRD research effort and the country experiences so far are now being disseminated by AID and the IBRD through a series of seminars in various parts of the world.²

The findings of the IBRD research and the pilot-project experiences are that labor-based construction techniques are indeed competitive with capital-intensive techniques over a range of wages, and in many cases are distinctly cheaper.³ These results

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The findings presented at the seminar in Washington D.C. are summarized in International Bank for Reconstruction and Development (IBRD), "Seminar on Labor Based Construction Methods," 15 May 1978.

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IBRD researchers have been reluctant to enunciate a "cutoff" wage because they feel the outcome of the cost comparison is so dependent on local conditions. A cutoff, they feel, allows decisionmakers to make hasty decisions, in line with their prejudices, without analyzing the costs of the situation at hand. When pressed to provide a cutoff wage, the IBRD cites a wage of up to US\$2.50 a day as compatible with highly labor-intensive techniques; a range of \$2.50 to \$4.50 as compatible with a mix of labor and equipment; and over \$4.50 as requiring the more traditional equipment-based approaches. I return to the question of the "cutoff" wage later.

are the more significant in that they are based on strictly financial, rather than economic analyses; they were obtained, that is, without giving the benefit to the labor-based alternative of a lower shadow-price for labor and/or a higher shadow price for the foreign-exchange costs of imported equipment or of foreign contractors.

Labor-based construction

As part of its research effort, the IBRD re-did the financial analysis of a past road construction project in Kenya, which had already been completed with the prevailing equipment-intensive technology. The re-analysis showed that the road could have been built more cheaply if labor-based techniques had been used. Why hadn't this alternative been analyzed when the project was being designed? Because nobody thought of it. If it was cheaper, then why didn't anybody think of it?

Labor-based (LB) construction techniques have not been used in most IBRD- and AID-financed road projects for various reasons. In order to assess the potential for their use, it is important to understand why these techniques are not in more widespread use in donor-financed projects today, especially in cases where they are obviously cheaper. To a considerable extent, equipment-intensive methods of road construction are preferred to

labor-based ones simply because that is the way developing countries and donor organizations have been accustomed to working. The more that countries and donors become entrenched in this mode of construction, the greater become the costs--both real and expected--of making the transition to another mode.

Over the many years that donor organizations have been financing road construction, their ways of operating have inadvertently contributed to the predominance of equipment-intensive methods. During the days of the Development Loan Fund in the 1950s, as told by an AID administrator, Third-World countries frequently presented proposals for financing of roads that were criticized by the DLF as being unrealistic. "How are you going to construct the road?" the DLF would ask upon receiving a proposal. "We parcel out the road construction by stretches to the various localities," they would reply, "and each one works on its own piece simultaneously." "That's no way to build a road!" the DLF would respond. One had to hire only one contractor to build the road, the DLF would explain, who would be responsible for the whole task. That was the only way to know, it was said, what one was getting into, how much it was going to cost, when it would be completed. It was also the only way to get outside financing for a project.

Though the DLF story may not be representative, it reminds us that labor-based ways of building roads did exist in many countries prior to the involvement of donor organizations in road construction--and continue to exist today, parallel to donor involvement, at local levels. If a country insisted on using labor-based techniques, the probability of achieving scarce donor financing was much less than if it agreed to use equipment-intensive techniques. Thus the evolution of roadbuilding techniques may well have taken a more capital-intensive direction than would have normally occurred in some countries, because of external financing.

The donor policy of financing foreign-exchange costs of infrastructure projects made it desirable for project designers in both recipient and donor agencies to maximize the import component of the project--either through the importation of equipment by a highway department or the contracting of international contractors from industrialized countries; who normally use equipment-based construction techniques. Costs with high labor components would be local rather than foreign-exchange, and thus not financeable. Together with the concessional interest rate of donor lending, these methods of operating gave a distinct cost advantage to equipment-intensive construction.

There is now a more widespread understanding in the donor world of the distorting effects of these methods of operation. Deliberate attempts have been made to finance greater shares of local costs with their usually greater labor-using impacts. But the results of the past neglect of labor-based techniques still exert a strong influence today: equipment lasts many years, a contracting industry has grown up around this type of business, many engineers have been trained in these techniques, and donors still finance many equipment-purchasing or equipment-intensive construction projects.

AID policies with respect to the imported components of projects also continue to exercise their bias against labor-based methods. An IBRD consultant, working on a pilot LB-road project in Honduras, reported at the AID/IBRD road seminar⁴ that he was forced to buy picks and shovels in the United States, at three times the local cost; AID had provided the funding for these implements, and required U.S. procurement. Similar complaints were registered in an evaluation of a PVO village water project in Africa. Though local procurement was possible under the AID grant,

⁴In Washington, D.C., May 1978.

waivers had to be sought from AID/Washington for each local purchase. This imposed considerable costs on the program in terms of waiting time and extra paperwork.⁵

AID and IBRD loans to highway and public-works departments for the acquisition of equipment have also tended to work against the adoption of labor-based techniques. Because such loans are usually repaid by the government's central bank, and not by the department owning the equipment, the capital costs of the equipment are often not taken into account when these departments make cost-benefit analyses of proposed roads or of alternative construction techniques--or when charges are computed for renting out the equipment. From a financial point of view, the reasoning behind this practice is perfectly sound: the department does not have to pay for the equipment out of its budget, and often does not expect to have to do so for future equipment. At the AID/IBRD road seminar, one highway official was reported to have justified his exclusion of equipment costs in the labor-equipment cost comparison with the question, "Why should we include equipment costs? We got the equipment from AID, and we don't have to pay for it out of our budget."

⁵ U.S. Agency for International Development/Kenya, "An Evaluation of Care-assisted Village Water Development Activities in Kenya," by Huntley Biggs and John R. Schott, Work Order No. 8 of AID/otr-C-1379, 28 August 1976.

It would be useful to explore methods by which AID could change its procedures so that it would not contribute to decreasing the financial cost of capital to road-building entities, thus prejudicing the case further against labor-based techniques. Highway departments might be required to amortize AID equipment loans out of their own budgets. If this is not feasible, then equipment loans of this nature should perhaps no longer be made, for they build a pro-equipment bias into highway departments that lasts for many years.

Interestingly, an equipment-intensive road project constructed by a foreign contractor leaves almost as strong a legacy of equipment-purchasing choices in the local economy as does an equipment-purchasing project. Foreign contractors, that is, fully depreciate the costs of their equipment over the life of the construction project. When the project is terminated, they dispose of the equipment on the local market--often with the local highway department itself. Even when the AID loan finances construction rather than equipment acquisition, then, the net result is more construction equipment available on the local market.

AID's equipment and import biases are often imposed from outside the Agency, or are meant to serve purposes unrelated to choice of technique. AID should conduct a cataloging of these

procedures and their present status, in order to bring attention to the obstacles they pose for carrying out the New-Directions mandate. If real increases in the relative cost of equipment vs. labor can be brought about by changes in donor policies and procedures, these changes will be more powerful in effecting the transition than AID persuasion, training and good intentions with respect to labor-based techniques.

The prevalence of equipment-intensive techniques is to a certain extent the result of the international diffusion of industrialized-country technology rather than of donor influence. In this sense, might not AID and other donors be tilting at windmills in trying to bring about a change to labor-based techniques? It is difficult to determine the extent to which the preference for equipment-intensive techniques is a result of donor practices and, therefore, how responsive this preference will be to a change in these practices. One can not ignore the fact, however, that there are long-standing traditions of labor-based construction prevalent in some countries today--not all of which are in Asia.

⁶ A common criticism of labor-intensive techniques--particularly by Latin Americans--is that they apply only to Asia which, it is said, is unique in its abundance of labor and low wages.

Mexico, for example, is an interesting example of a country whose central government initiated a labor-based road construction program at a point in its history when it had already become a medium-wage, middle-income country.⁷ Labor-based construction, moreover, coexists in many countries today with equipment-intensive construction--one at the local level, the other at central government levels. This point is discussed further below.

⁷ This program is described in Mexico, Secretaria de Obras Publicas, Caminos y Mano de Obra.

The Move Toward Rural Roads

The new interest of donors in labor-intensive construction represents not only a change of heart about which technologies are best for road construction, but a change in the type of roads being financed. During the time when equipment-intensive techniques reigned unquestioned, most of the road-construction projects financed by the donors were primary and paved roads. More recently, and independently of the question of construction techniques, donors have moved more and more toward rural and unpaved roads. In 1965, 62% of the mileage built with IBRD road-construction financing went toward primary roads; that share fell to 48% in the 1969-1971 period; by 1975-1977 the share had fallen to very little, with rural roads now taking the majority (93%).⁸

The change in donor road portfolios is partly a result of the new concern with rural unemployment and poverty, and the search for projects with direct rather than indirect impacts on the rural poor. This meant replacing infrastructure projects with projects in the field of rural water supply, health, agricultural

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Figures are for the fiscal year. IBRD, Transport Research Division, "Note on Rural Road Lending," 13 December 1977, p. 2.

Similar data for AID are not available. They could be partially compiled by going through all project papers for roads and for projects with road components.

extension, etc. The so-called integrated rural-development projects come under this latter rubric, and rural roads often show up as one of the features of these integrated projects. Unlike primary roads, then, rural roads were able to partially escape the anti-infrastructure bias of New Directions--particularly if they were embedded in larger rural-development projects.⁹

Donor organizations have turned away from primary roads also because the primary-road network has largely been built in some areas, such as Latin America. Or, at least, the case for primary-road construction is no longer as pressing as it used to be, and it is easier to turn one's back on it in favor of rural roads. Rural roads, in turn, are more conducive to labor-based construction than paved roads. To a certain extent, then, the interest in labor-based technologies results from the fact that the donors are now spending more of their road monies on rural roads than they were in the past. This may explain the fact that even

⁹ There is no logical reason, of course, that a primary road might not also be construed as contributing to the development of a rural region, along with other project components like potable water and health. But one usually does not find primary roads in rural-development projects.

though Latin America is considered higher-wage and higher-income than most of the Third-World, it has some interesting labor-based road-construction programs.¹⁰

The styles of paved vs. unpaved roads

As the opportunities for primary-road construction get "used up", what's left for roadbuilders and road-financiers is a new kind of construction activity. The ways of doing primary-road construction--its technology, its administrative organization, its spatial layout--are not necessarily apt for rural-road construction. There are ways of going about rural-road construction that offer significant competition to the organization and technology of road construction when it is dominated by primary roads. The lower the design standard of a road, in general, the more conducive it is to labor-based construction techniques. Mainly, the activities associated with road-paving and compaction show less flexibility than others for competitive substitution of labor for equipment. Rural roads are not paved and can often dispense

¹⁰ E.g., Mexico, Colombia, Haiti, Honduras. These programs are described in part in bibliography item numbers 3, 4, 6, 20, 24, 34, 36.

with compaction.¹¹

The design standard of rural roads is not the only reason that they are more amenable to labor-based techniques. In that rural roads are often short roads--connecting certain localities to existing secondary and primary roads--they are more suited to a piecemeal construction style. Several fronts or several short roads, that is, may be worked on at once. Equipment-intensive construction of a set of such roads bears the additional costs of moving the equipment frequently from one site to the other, after each short road is finished. Because many such road sites are of difficult access, moreover, it can be particularly costly to use equipment for such roadbuilding programs.

The dispersed, piecemeal nature of a rural-road construction program--in contrast to the same number of kilometers of construction of a single primary road--lends itself to a more decentralized organization of the construction task. Though one might not think of having several contractors or public-works gangs on different stretches of a single primary road, that kind of

¹¹ When compaction is not done at the time of construction, it is usually left to occur through vehicle use combined with subsequent grading activity. The Mexican labor-intensive road program does compaction this way. One further justification for "natural" compaction is that the first rainy season after equipment-based compaction may well wipe out the investment in it.

breaking up of the task in organizational terms fits the dispersed nature of rural-road construction well. Hence the community-based labor approach of many of the new donor-financed labor-based construction projects.

The rural-road construction that has taken place in countries where most central-government attention was focused on primary-road construction has often taken a decentralized form-- province or county or village projects, sometimes with admixtures of self-help contributions. Maintenance of such roads, even when they are constructed by central highway departments, can usually not be counted upon from these authorities. They tend to concentrate their scarce budget funds on primary-road maintenance, if they do any maintenance at all. Emergency employment programs resulting from calamities like drought and flooding have also been engines of rural-road construction. Since their express purpose is employment-creation, the use of labor-intensive techniques is not questioned; and since there are considerable opportunities for political patronage to be attached to these funds, they are often disbursed through and managed by local or regional authorities-- again, decentralized.¹² Northeast Brazil is a case in point.

¹² A number of these programs from various countries are analyzed in John Thomas et al, "Employment and Development: A Comparative Analysis of the Role of Public Works Programs," Harvard Institute for International Development, April 1975.

To the extent that rural-road construction has been undertaken in the past, then, it has tended to be labor-based and decentralized--for technological, administrative and political reasons.

What is new about donor involvement with rural-road construction is not that the techniques are labor-based. Rather, this is the first time that labor-based rural roadbuilding programs are being financed (1) at such a significant scale in any particular country, (2) as part of ongoing roadbuilding rather than of employment-creation programs, and (3) at the central-government level of highway or public-works departments rather than at local levels. This combination of central-government management of simultaneous and labor-based rural-road construction projects makes such programs more than a marginal change in what donors and recipient countries were doing in road construction in the past. The magnitude of the change relates to the fact that one has to supervise labor instead of equipment.

Whether or not the difficulties of supervising labor are greater than working with equipment, the ways of running labor-based projects have yet to be worked out by many central-government authorities--or, in some countries, are just starting to be. The ways of handling equipment-based construction, in contrast, have already been worked out and are familiar to highway departments and

contractors. It may take considerable cost and effort for central-government authorities to learn the new labor-based ways and to do them well. Though labor-based rural road construction is nothing new, then, its pursuit by centralized state authorities on a significant scale, and its financing by donor organizations, is.

Building the arterials first

The above discussion suggests that countries tend to construct their arterial roads first, and start thinking about rural-road construction only after that--at least at central-government levels. Arterial construction is likely to continue even into the period when the need for rural roads becomes more pressing. The Mexican government, for example, recently realized that it had an extremely high ratio of mileage in arterials to mileage in rural roads--80% to 20%--exactly the opposite to the ratio for the United States.¹³ Partly because of this lack of rural roads, the arterials were not generating the traffic volumes necessary to justify the investment that had been made in them. One of the justifications for the Mexican rural-roads program, then, was to achieve greater utilization of the costly excess capacity in the arterial-highway network. As another example of the chronological sequence of centrally-administered road construction, the Panamanian

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Caminos....

government is said to have "exhausted" the possibilities for arterial highway construction and is closing out that principal activity of its highway department. It will now go into rural-road construction and highway maintenance.

There are some good reasons that countries do the arterials first and exclusively. Arterial-road construction, in a sense, represents a much easier way of running a highway department than a mix of arterial and rural roads, or rural roads only. A highway department can contract out the whole job to a construction firm or can absorb all of its own construction capacity in one arterial project ("force account"). Arterial roads are easier to get financing for, both foreign and domestic, and each project has a distinct beginning and end, and a highly visible and continuous physical location.

An equivalent amount of financing spent on rural roads represents much less of a "clean" project than an arterial road. There are many work fronts instead of one and many contracts instead of one; more supervision is required. To the extent that rural-road construction is labor-intensive, moreover, it will be difficult to describe it in a bid document; much of the design of such roads occurs as construction goes along--adapting to local materials and labor-force availabilities. The lower design standard of the rural road,

compared to arterials, means there is less need for previous design work than in the case of higher-standard roads. With an arterial, one signs a contract and has a better idea of what one will get, when, and how much it will cost.

Another reason that arterial roads are an "easier" activity for a highway department is that they are more politically compelling. They have the same drama as hydroelectric dams. A president or a governor can lavish inaugurations on them and claim credit for them. Rural roads, in contrast, are more like an ongoing program than a discrete project. They are more akin to road maintenance than to road construction. They require ongoing involvement and do not merit celebrations when they are finished--at least at a national level.

To understand why arterial roads are easier activities than rural roads is to also understand why maintenance is such an intractable problem. For a highway department, an arterial roadbuilding program means that one's ongoing activities are involved in moving from one construction project to another. The activities usually associated with operational expenditures--maintenance and supervision--are minimized. In most countries, in turn, it is typically easier to obtain public funding for capital costs than for operating costs--especially for a sector like roads,

where there are so many opportunities for large and politically appealing capital projects. Given these funding dynamics, it is not surprising that a highway department's activities would gravitate to those areas where financing is easier and more likely to be obtained--i.e., to construction rather than maintenance, to arterials rather than rural roads.

The attractiveness of higher-class roads is just as compelling for donor organizations as it is for recipient-country highway departments. Large-scale equipment-intensive road projects are "cleaner" projects for donors than programs of rural-road construction. The point is an important one, because many in AID see rural roads as opportunities for getting New-Directions budgets ~~committed more rapidly and~~ with lesser inputs of staff time--in comparison to projects in water supply, health, and agriculture. The New-Directions-type rural roads will not have this same "efficiency" per dollar of AID money spent that arterial-road projects have. Project money may no longer be able to be taken care of and accounted for in one neat contract to one international contractor. Overhead expenditures will now be concentrated on supervision and training, rather than on equipment. The execution of the program will be dispersed in space and time. Partly because of the disinterest of most large contractors in these kinds of projects,¹⁴ the work will be parceled out piecemeal

¹⁴At the present time, it is difficult for AID to get bids from large contractors on road-construction projects that are less than US\$10 million.

to a series of force-account construction teams, and/or to smallish local contractors, who will do pieces of a road or only certain kinds of structures (e.g., bridges). Small local contractors, if they exist, will often be the only place in the private sector where labor-intensive construction capacity exists. Most contractors switch to equipment-based techniques when they grow big.

Even when rural roads are equipment-intensive in construction, they still are less compact than arterial-road projects. As projects, they become even less compact when one adds labor-based techniques to them--small contractors and many work fronts, village-based recruitment of labor, and construction schedules subordinate to the seasonal availability of labor rather than to the time constraints of costly idle equipment or incumbent politicians. For AID, this almost turns infrastructure projects into institution-building ones, thus blurring the clean hard lines that have made infrastructure projects so desirable.

Mixing rural roads with arterials

Whether countries build their arterials first--and take on their rural roads as a separate and much later activity--is an important question with respect to New-Directions objectives. Certain patterns of road-system development may have a more favorable impact on the rural poor than others, or may result in more equitable

patterns of growth. An arterial road and a certain amount of its rural feeder roads might better be built at the same time, or closer in time, instead of proceeding across the country from one arterial to the next for many years. Also, arterial and rural-road development in one region may have a higher payoff, in terms of equalizing development, than in other areas--owing to differing patterns of existing wealth-holding and economic activity.

The question of alternative road-system development patterns and sequences has received almost no attention in the discussion of roads and New-Directions objectives. The lack of attention to this matter results partly from the fact that roads are justified on a project-by-project basis, giving little occasion to assess how the system is developing--even though donor involvement in many countries' highway budgets is large enough to justify a look at the way the system is growing. Also, the focus on labor-based construction techniques as a way of meeting New-Directions objectives seems to have monopolized most of the concern over these objectives--leaving the implications of alternative road-system patterns neglected.

Arterial- or penetration-road proposals for road-poor countries are usually justified as being necessary because of "a lack of" such roads. Even without taking into account New-Directions

criteria, this kind of decision should be guided by some criteria regarding desirable road mileage per population density, per agricultural production value, or per physical area. With respect to New-Directions objectives, moreover, AID should develop criteria as to what kinds of road-system development patterns are more desirable.

Though AID may be contributing to a more complementary development of rural roads and arterials in some countries by financing only the rural roads, these countries frequently have already undertaken substantial arterial construction--e.g., Kenya, Honduras, Colombia. It is easier for AID to do rural-road construction in these countries; that is, since they themselves are ready to take that step. But in arterial-poor countries, as in the case of many in Africa, AID could have a greater marginal impact by resisting the pressure being put on it to invest mainly in arterials and in exploring instead the possibilities for complementary rural-road development.

Where to Put the Labor-based Project

The attempts of donor organizations to introduce labor-based road programs have not always been met with interest by recipient countries. Part of this resistance is a result of the disruption that these techniques bring in the ways that highway departments organize their work and maximize their budget receipts. Why take on a new activity that may bring less foreign and domestic financing in the future and will require larger operating budgets--unless one is at a point where, like Panama, all the opportunities to construct arterial roads have been "used up" and only rural roads and maintenance are left to do.

In some cases AID might do better placing its labor-based programs in government entities outside the highway departments--where equipment-intensive construction projects are not such a functional way of doing things. The labor-based projects might have easier going in ministries or departments whose self-interest was better served by labor-based and dispersed road construction. Some of the more successful labor-based rural-roadbuilding programs were housed in agencies for which highway construction was not the main purpose. Employment-creation and integrated regional-development objectives, for example, were the genesis of the Mexican labor-based road program.

Similarly, the labor-intensive road construction program in Northeast Brazil was run by the Ministry of the Interior, in its capacity to oversee all regional programs--and by the National Department of Drought-Prevention Works, a Northeast-specialized agency involved mainly in the construction of dams and reservoirs.

The labor-intensive road program in Colombia also started away from the highway department--as a joint effort of the Ministry of Agriculture and the Federation of Coffeegrowers to cope with employment problems in one particular region. (The program subsequently became part of a semi-autonomous rural-roads agency.) The original purpose of the Accelerated Rural Development program initiated by the Thai government in the 1960s was to counteract insurgency in the northeast area of the country by building penetration roads into the area as rapidly as possible.

Another variation on the theme of the above examples is illustrated by an IDB technical-assistance project in Guatemala involving the designing of a decentralized labor-based roadbuilding program. The equipment in the project, it is planned, will be able to be used by communities for other activities after the road is completed--such as preparing land for irrigation, etc. (The Mexican labor-intensive program offers similar arrangements.) In these cases, the equipment is tied to further activities of a

region, rather than to further construction of a certain type of facility (highways) anywhere in the country.

The programs mentioned above were executed by sponsoring entities with a primary interest in employment-creation and/or regional development rather than road construction. Just as important, they were often operated with considerable decentralization. The regional-development aspect of the program would be better managed that way, it was felt, or decentralized management and/or funding would better fit local and provincial political interests. Both the labor-intensity and the decentralization, in other words, were considered desirable not because of their contribution to highway-construction objectives. Since construction was not the major activity of these sponsoring agencies, moreover, they were often equipment-poor. Thus it was easier for them to engage in labor-based road construction than it was for established highway departments. There was no competing other way of doing construction--no group of professionals and equipment, representing that other way, already inhabiting the agency.

Roadbuilding programs with employment-creation as a primary objective have often been criticized by economists as being non-productive investments. Whether or not this is true, the lesson of the above examples is that it still may be more

feasible to get a labor-based roadbuilding program started in an employment-creating or regional-development agency than in a highway-building one. AID should watch for the possibilities for labor-based roadbuilding programs in these types of entities and at levels of decentralization where equipment-intensive construction is not so firmly entrenched.

Thailand and the bullock trails

The evolution of the Accelerated Rural Development (ARD) program in Thailand provides a good illustration of the pervasive influence of equipment-intensive thinking--and of the way institutional arrangements can provide a program with some protection from that influence. The ARD program was initiated before labor-intensiveness and appropriate technology were in style. The agency and its program were started as a counterinsurgency effort with U.S. assistance. The intention was to connect the northeast of Thailand to the central and southern parts of the country, and to wrest the allegiance of the population from the Communists by providing water and health programs, in addition to roads.¹⁵

¹⁵ This is not an uncommon motive for major rural infrastructure programs. The Philippine rural-electrification program represented an attempt by the Marcos government to win allegiance in the countryside over the Communists.

The roadbuilding aspect of the ARD program might better be described as one of intermediate technology, rather than as labor-intensive. The use of more rustic methods of road construction was forced by the urgency to get the job done fast, the shortage of funds to buy rights of way, and the availability of U.S. bulldozers as a tacit form of rent payment for the use of Thai air bases. The result of all these constraints was that the roads were constructed on the paths of old bullock trails without any major changes in alignment.

The decision of ARD to use the bullock paths as roadbuilding sites was made to the consternation of Thai highway-department engineers. Though not part of the ARD agency, these engineers had considerable influence over the determination of road-construction techniques used throughout the country. The highway department housed the elite of the civil engineers in the public sector, as is often the case, and it was difficult to ignore their technical judgments. As in many countries, it was standard highway-department practice to design and build gravel penetration roads to be upgradable to pavement, if future increases in traffic volumes so warranted. This meant using the alignments, grades, and road widths proper for paved roads from the start. Later on, only the pavement would have to be put in place, without

additional investment in re-alignment, right-of-way purchase and road widening. Thus to simply build the new ARD penetration roads along the old bullock trails, according to the highway-department engineers, was to make it impossible to use appropriate design standards; if the roads were to be upgraded to pavement in the future, they would have to be built almost from scratch.

The cost of now vs. later

The argument against using the bullock trails for penetration-road construction in Thailand is a common one in decisions about road construction. The economic reasoning implicit in the argument is similar to that of the argument one often hears for paving roads sooner rather than later. It is sometimes argued, that is, that a gravel-road project with potential for a future arterial--but with currently low traffic volumes--should be paved now rather than later. It is cheaper to pave when the road is being built, it is said, than as a separate task later on.¹⁶ The paved

¹⁶ This argument was made by the government for paving the Tanzam penetration road at the time of its construction. Government engineers argued that it would cost \$13 million to build a gravel road plus an additional \$3 million to pave it at the time of construction. If the road were paved separately in the future, it would cost an additional \$5 million--making the total cost of construction and paving \$2 million greater (\$18 million) than would be the case if construction and pavement were done all at once (\$16 million). AID engineers felt that predicted traffic volumes did not warrant more than a gravel road at that time. The decision was made, nevertheless, to pave at construction.

road is also easier and less costly to maintain--a point I return to later.

The argument for "doing it right in the first place" has the common-sense appeal of "a stitch in time saves nine." But an economy with the capital-scarcity and uncertainty of most AID recipients will have a high rate of discount of future costs and benefits. Correspondingly, present costs and benefits will be more weighted than in capital-abundant countries. When the appropriate discount rate is applied to the stitch-in-time argument, then, the added real cost of doing it right from the start can be higher than the supposedly higher cost of having to do it right several years hence. Building roads now to upgradable

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In the Tanzam example of the above note, the present value of the cost of paving later as a separate task (\$5 million) would be less than that of paving at the time of construction (\$3 million) if the paving were done three years or more after the original construction (using a conservative rate of discount of 15%). After the third year, that is, the present value of \$5 million discounted at 15% is \$2.86 million. Using a more realistic (25%) rate of discount, the cost of paving later is higher than the cost of paving now only up to the end of the second year after construction. Contrary to what was claimed, then, it was more costly to have paved at the time of construction rather than later, if the later paving were to have taken place two or three years after construction--a not unlikely assumption.

standards for the future also means that one invests in these "future" roads before knowing which ones will actually generate the traffic volumes large enough to justify paving. Even if one is armed with the proper economic reasoning, however, it will still be difficult to influence design choices like those of the bullock trails in an environment where engineers are the most prestigious actors--and where "correct" choices from an economic point of view are seen as professionally inadequate from an engineering point of view.

Lessons of the Thai story

The lessons of the ARD story in Thailand are threefold. One is that outside circumstances played an important role in getting the technological choices made the way they were. The urgency of the task, and the lack of funds to do it "right" from the engineering point of view, elicited intermediate-technology choices of a type that donors are now trying to persuade recipient-country highway departments to make--with only a spotty record of success. It will be easier to get labor-based decisionmaking to take place, then, if the reasons to do it are more compelling than the logic of an economic cost comparison, or even a financial one. AID, in turn, should look for institutional environments and levels of decisionmaking where labor-intensive

choices come more naturally. I return to this point later in the discussion of decentralized programs.

The second lesson of the ARD story is that the decisions to employ rustic and less exacting roadbuilding standards were made in an agency different from that which housed the highway engineers. The ARD had objectives that were different than roadbuilding, objectives to which "good" roadbuilding techniques were subordinate--namely, connecting up to an isolated part of the country, providing the population there with certain services, and asserting sovereignty over that area. Any sacrifice of proper roadbuilding standards to fulfill this mission, given such a set of objectives, would be of secondary concern.

What kept the highway-department engineers from having more sway over the design standards of the ARD program is that they were occupied with traditional roadbuilding programs more to their taste in central and southern Thailand. The third lesson of the ARD story, then, is that the equipment-intensive influence could be kept at a safe distance from the more rustic program because the latter was working in an area outside the highway department's geographic turf. Any regional development program, limited to a particular area and interested in more than roadbuilding, is likely to fulfill this qualification more than a country-wide rural

roadbuilding program. Intermediate-technology choices were made in the ARD program, in sum, not because they emerged from a cost-benefit analysis. Rather, the choices were forced by circumstances, and the organizational site of the choices was away from the influence of equipment-intensive road designers.

As the ARD program grew and branched out into other activities, like village water supply, some of its architects continued to search for organizational arrangements that would evoke more intermediate-technology thinking from its engineers. Decentralization to the provinces was carried out, but that was not sufficient to extricate the engineers from the shared professional culture and prestige of building things in certain ways. In time, it was found that the engineers who had strong ties to the provinces they worked in, and who were not able to speak English, were the ones who responded best to the intermediate-technology style of the program. Without English, they were not part of the elite of their profession, and could not aspire to the professional prestige available in the capital city. Their prestige derived instead from their position in the provinces vis-a-vis the people they worked with there. Thus a decentralized system, with professionals whose aspirations could not be met in the capital city, turned out to facilitate a desirable separation from the influence of equipment-intensive thinking.

Roads embedded in rural-development projects

Given the difficulty of interesting countries or their highway departments in labor-based road construction, AID should look for opportunities to house such programs where they will find greater receptivity and protection. As suggested above, regional-development programs or integrated rural-development programs are likely candidates.

It is interesting that the integrated rural-development programs of AID and IBRD are precisely those where one does not find labor-based road projects. Rather, the road components of such projects usually involve standard road projects done with highway departments. In AID, this happens partly because it is difficult to get a plain road project past Congress, in that infrastructure projects are said not to have a direct impact on the poor. One can get by with a road project, however, if it is embedded in a larger "rural-development project"—regardless of whether the roads are to be constructed with traditional equipment-intensive techniques. Ironically, then, AID's equipment-intensive road projects are most likely to be found in its New-Directions rural-development projects.

In the IBRD and in AID, to a certain extent, rural development projects are designed by agricultural-project technicians.

Nobody pays much attention to the details of the road component. Compared to components like health, education or agricultural extension, the road component is usually the least difficult one in the preparation and execution of such projects. It can be counted on to take up a good part of the funding and work fairly well on its own--in comparison to the difficulties of providing agricultural credit to small farmers along with technical assistance, for example, or of setting up a system of local health clinics. In the IBRD, moreover, the interest in labor-based road construction techniques has developed in the transport department. This department oversees the road components of rural-development projects much less closely than it does road projects themselves. In AID, similarly, the engineers can exercise more control over road projects than over the road components of rural-development projects. Up to now, then, the interest of the donors in labor-based techniques has had more of a chance to express itself through road projects than through the road components of rural-development projects.

The difficulty of introducing labor-based roadbuilding where it does not exist probably biases donors toward starting such projects in a way that seems generalizable eventually to the roadbuilding sector. In this way, the learning and start-up costs of such a transition can be spread over a program of labor-based roadbuilding in the future. Generalizability is important,

moreover, to the extent that labor-based programs can have significant impacts on the development of the local equipment and contracting industries. Without the expectation of being able to generalize a labor-based roadbuilding capacity across the country, one would have to forego these substantial linkage benefits. Hence the importance of working with highway departments and of viewing the initial projects as pilots, whose overhead costs will be spread over similar projects in the future. (The gains to be made from linkages to equipment and contracting industries seem to be of greater interest to IBRD than to AID.)

The donors are not unaware of the importance of organizational arrangements that give more prestige and clout to labor-based methods. As part of the IBRD's labor-based pilot project in Honduras, which is now being expanded with an AID loan, a Feeder Road Unit was created in the central government's highway department. The IBRD desired this separate unit so as to provide a career ladder and possibilities for promotion to engineers working exclusively with labor-based techniques. In proposing rural-development projects as a good setting for the growth of labor-based roadbuilding, I am suggesting that there are also other ways of providing these opportunities. Such projects, in fact, are further away from the equipment-intensive world than

is a feeder-road unit in a highway department. Because the objectives of rural-development projects are broader than roadbuilding, moreover, these projects can draw upon professionals for whom labor-based techniques are looked at as a way of fulfilling program objectives, rather than of thwarting them.

If roadbuilding programs are started at the periphery of the roadbuilding sector instead of within it, in sum, the costs of initiating them may be lower and the probabilities of their eventual integration into the roadbuilding economy higher. AID should take advantage of the opportunity offered by its rural-development projects to introduce labor-based roadbuilding-- instead of treating the road components of these projects as a way of getting away with traditional roadbuilding. AID engineers responsible for labor-based road projects should have control over these road components as well.

Mixing equipment with labor-based projects

Another way to protect labor-based programs from equipment-intensive influences is to try to avoid initiating the former programs in agencies that are at the same time receiving donor-funded infusions of equipment. The case of Haiti is a typical example. A labor-intensive pilot project has been initiated by AID in that country's highway department, at the same

time that AID is financing that department's acquisition of a fleet of highway-construction equipment for its own use and for rental to private contractors. In addition, AID is also financing an equipment-based feeder-road construction project with the same department--of which the pilot project is a part. On top of all this, the IBRD is financing the acquisition of maintenance equipment. The U.S. contractor in charge of the equipment-based AID construction project has also been entrusted with the labor-intensive project.¹⁸

These Haitian arrangements seem to make the task of introducing labor-based construction techniques more difficult than it already is. The labor-based effort is virtually surrounded on all sides with equipment-based techniques, professionals, and organizations. Actually AID may not have had that much choice in Haiti with respect to organizational arrangements. Shortly before the project was approved, the labor-intensive project was added onto the equipment-based feeder-road project because of New-Directions objections from Congress to the traditional road project. Such a last-minute creation is not unique, in fact, for AID's labor-based projects. If the labor-based project must be added on at the last minute, there is probably even more reason

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A description of AID's road program in Haiti can be found in USAID, "Haiti: Agricultural Feeder Roads," Project Paper AID-DLC/P-2148, 23 March 1976.

to place it outside the highway department.

The Haiti-type situation may be about to be repeated, on a larger scale, in the African Sahel. Several donor organizations, including AID, have committed themselves in principle to finance large investments in infrastructure, including road construction.¹⁹ In the multidonor discussions of how these projects might be divided up, AID had expressed an interest in the "softer", more decentralized, or "downstream" parts of these projects--e.g., the rural roads rather than the paved ones, the irrigation works rather than the dams. If AID becomes involved in labor-based road construction in the Sahel, this will occur at the same time that considerable equipment, technical assistance, and engineers will be arriving on the scene for equipment-based construction. Arrangements for the institutional separation between AID's and the other road projects will therefore be crucial to the success of the labor-based projects.

The case of the labor-intensive road program in Colombia is another example of the problems of housing labor- and equipment-based programs under the same roof. The Pico y Pala (pick and shovel) program, set up and financed by AID for several years, is now housed in the National Fund for Feeder Roads, a semi-autonomous

¹⁹ See USAID, "Options for AID Policy in the Sahel Region Transport Sector," November 1977; and USAID, "Sahel Development Program, U.S. and Other Donor Support of Priority Sectors," n.d.

government agency. Pico y Pala now accounts for about 20% of the Fund's expenditures for rural roads; the remaining 80% are for equipment-based rural-road construction. At the same time that AID was funding the labor-intensive program, it was also providing equipment to the feeder-road fund for equipment-based road construction.

AID started its funding of Pico y Pala in 1971 and will terminate, after successful completion, in 1980. Unfortunately, however, the attractiveness of the road fund's equipment, partly provided by AID, was too much for the labor-intensive program. When the AID funding runs out in 1980, the road fund plans to terminate the program and use equipment-based techniques of rural-road construction exclusively. Ironically, the Pico y Pala is cited by AID and the Congress as one of the more successful and innovative attempts to organize road-construction work in a labor-based way--an attempt that was started before the current interest in appropriate technology.

In explanation of the Colombian agency's decision to terminate Pico y Pala, the management said that the labor-based method created "too many cash-flow problems." It is not clear whether this was a serious enough problem, or without possible resolution, to warrant discontinuing a successful program. It is

true, however, that the problem of having the cash to pay workers every two or four weeks, and of finding a graft-proof way of doing so, has been a serious one in other projects of this nature.

The cash-flow problem of labor-based projects results in part from donor and recipient-country financing procedures, which have grown up around equipment-based construction contracting. Since the contractor provides the cash for wage payments, which are considerably less than in a labor-based program, there is no need for the donor to provide operating capital. AID should work on alternative payment procedures and loan disbursement arrangements that take care of this problem, if it is not already doing so. In future cases like Colombia, moreover, AID's technical assistance should advise on a system of domestic public financing that can continue to function after AID leaves.

Rural Roads and Decentralized Management

The political appeal of equipment-based arterial roads has been important, as noted above, in helping to get financing for these projects and in seeing them through. Rural roads don't have that same appeal. Is there anything in rural roadbuilding that can substitute for the political attraction of arterial roads? Here is where decentralized decisionmaking, management and financing can play an important role.

Rural roads give the political payoff at the local level that arterial roads do at the national level. There is almost no other road construction activity possible at the local level that is more compelling than rural roads; there is almost no other activity that can divert funds and attention the way arterial roads displace rural roads at the national level. Decentralized management of labor-based road construction is desirable, therefore, not only because it fits better the labor-intensive operating style. It also takes the decisionmaking and implementation away from an environment where rural roads are less important and rewarding than other types of construction--and places it where rural roads, or a rural road, are considered to be of supreme importance. Decentralization places decisionmaking where large pools of equipment are less readily available, where engineering professionals wedded to "modern"

construction techniques are not concentrated, and where equipment-based contractors do not see big stakes. Decentralization puts decisionmaking where people are more accustomed to making labor-intensive choices, where they will "settle for less." Decentralization, in other words, is one way of achieving the institutional separation between equipment-based and labor-based programs discussed above.

The discussion of decentralization in the preceding section suggests that highway departments and other central-government agencies normally dealt with by donor organizations may not provide the most auspicious beginning for a labor-based road program. They are organizations within which the equipment-based solution comes too naturally. All the persuasion and technical assistance of donor organizations dedicated toward the adoption of labor-based techniques will count for little if there are no forces in the institutional environment which also dictate that approach. Decentralization is simply one way of finding and exploiting the forces that tend naturally toward the labor-based approach.

Another way of changing the power constellation between labor- and equipment-intensive tendencies would be for donors to stop financing all equipment-based construction, while making available the same easy money for labor-based construction. This would abruptly increase the relative cost of equipment-based construction. The donor world is not likely to agree on such a

drastic move, and the effectiveness of such an action taken unilaterally by AID might be limited—though the taking of such a stance by AID might have a significant impact in countries where other donors are not financing roads. The suggestion illustrates, however, the kinds of possibilities that exist for giving the labor-based approach a helpful hand.

The no-maintenance model

Decentralization of road construction could also help with the problem of inadequate maintenance, which has plagued all road programs, both arterial and rural. One of the reasons that highway departments are bad at maintenance is that they have better, more interesting things to do—building new roads, that is, rather than maintaining old ones. Most of the road-construction and maintenance projects financed by AID and the IBRD will, on close inspection, reveal equipment or maintenance funds being diverted to construction—loan covenants to the contrary notwithstanding. Or, promised local maintenance funds will not materialize in the budget at all.

Road construction wins out over maintenance for the same reason that arterial roads are more compelling than rural ones. From an engineering point of view, construction is more interesting than maintenance. The capital budgets for construction, moreover, are politically easier to obtain than the operating budgets for maintenance. Construction also has a high political exchange value that maintenance does not: a legislator can trade

support of a road-construction project for votes desired for another project. Nobody thinks of porkbarreling, in contrast, with a road-maintenance budget.

A highway department in charge of road construction for a developing country can look forward to a long future of doing nothing but highway construction--moving from one project to the next. With a low operating budget and no maintenance activity, that is, it can still expect a continuous flow of budgetary funds and a steady level of activity doing only construction. But how can maintenance be so blithely neglected? It can be neglected by (1) paving roads whose traffic volume does not justify it, thus minimizing maintenance requirements and, (2) as a corollary of the latter, by letting roads fall apart to the point that their repair qualifies as a major improvement--a capital project, that is, like road construction. Many AID projects, for example, include funds for improvement of such run-down roads. Even though the project paper will deplore the state of maintenance, the availability of concessional donor financing for capital and not operating costs shows the recipient that inadequate maintenance pays off. In that domestic funds for capital projects are also relatively easy to come by, it will pay not to maintain to the point of having to reconstruct in the future. If a road is successful in creating

traffic, moreover, then its deteriorated state will generate cries for improvement from disgruntled and important users. Again, political support will help bring about the funding for an improvement project.

Pave now and save later. The no-maintenance model helps explain why donor organizations have recently found themselves arguing for design standards on proposed road projects that are lower than those desired by the highway departments of recipient countries. The divergence of opinion often centers around whether or not to pave the road, as in the Tanzam highway example above. The road should be paved at the time of roadbuilding, it is argued, in order to save the "higher" future costs of paving separately. This disagreement is similar to ones regarding other choices in roadbuilding, as in the case of the bullock trails discussed above. Existing trails should not be used as the base for new rural roads, it is argued, because the width, alignment and grade will be inadequate for upgrading to accommodate higher traffic volumes in the future.

If appropriate discount rates are applied to the "saved" additional cost of future paving--rates that reflect the scarcity of capital in the economy--then most such arguments will not stand muster. With appropriate discounting of the cost of capital, that is, the

additional cost of doing something like paving now will weigh much more heavily than the "saved" higher cost of doing it later.²⁰ Thus the cost argument used by the proponents of spending now in order to save later will in many cases justify the opposite side of the argument.

If one adds to the argument for paving now some of the institutional factors mentioned in the preceding section, then the argument makes more sense. One reason for a country to pave a new low-density arterial road at the time of construction is that maintenance activities and funding are not expected to be forthcoming. A paved road is better suited to this state of affairs because it will give more maintenance-free years of service than an unpaved one. The additional cost of paving now, moreover, will not come out of one's own budget, whereas the costs of maintenance will; the paving cost will simply be tacked onto the capital cost of the project.

In reality, premature paving is not actually associated with a saving of expenditure in the future--as its proponents argue. To the contrary, the lack of maintenance on the new paved road will result in the need for a major investment in reconstruction in the

²⁰ See the example in note 17 above.

future--again, a project financed out of the capital budget rather than the operating budget. It is perfectly logical, then, for highway departments to want pavement now. It is not so much that they will avoid additional pavement costs later, but rather that they will avoid the maintenance costs of an unpaved road and will acquire a facility that, unlike a gravel road, will be able to give service for some time without adequate maintenance.

Living with the lack of maintenance. It is difficult to deal with the no-maintenance construction model. It is important, of course, for AID to reveal the spurious logic of spending now to save later, with straightforward economic analysis. But stripping the argument of its formal justification does not do away with the environment that brings about the choices. Part of the problem is that the donors have not been able to acknowledge the no-maintenance model. They recognize and emphasize the lack of maintenance, but proceed as if maintenance will be forthcoming the next time around--with sufficient prodding, technical assistance, and perhaps even funding. Recipients understand that they must make commitments to maintenance in order to get construction financing, thus helping the donors to preserve their inaccurate perception of what will happen.

It is important to acknowledge the no-maintenance model because if one assumes that maintenance will not be forthcoming, then the choice of road standards and the analysis of costs and benefits will be quite different than if one assumes, as now is the case, that maintenance will be forthcoming. The spend-now-and-save-later choices, as in the paving example above, are one such possible difference. It is not that one should routinely go along with decisions to overbuild, out of resignation to the no-maintenance model. One can, instead, look for institutional arrangements that are more likely to elicit maintenance activities and funding--in contrast to the present practice of relying on written agreements that the recipient will come up with the maintenance. One such maintenance-eliciting institutional agreement is suggested momentarily.

Accepting the fact that maintenance funds and equipment routinely get diverted to construction, one can look for approaches that minimize that divertibility. Labor-based methods can be used for maintenance, for example, rather than the equipment-based methods financed with AID loans. With labor-based maintenance, there's no equipment worth diverting. Another approach to the diversion problem is to be wary about putting equipment for maintenance into equipment-poor regions. The more a region is

without construction equipment, the more vulnerable the equipment will be to diversion to other tasks in both the public and private sector. In Northeast Brazil, it was not uncommon for AID maintenance equipment to be diverted at gunpoint from regional maintenance facilities by a neighboring landowner wanting some grading done at his ranch.

Underbuilding. In many cases, interestingly enough, the no-maintenance model puts recipient-country engineers on the side of underbuilding in comparison to what is being proposed by donor-country engineers. Underbuilding or "shoddy" construction techniques seem to represent a combination of the no-maintenance model and a desire to get as many kilometers of road constructed per unit of financing--i.e., a sacrifice of quality for quantity. You underbuild not only because you know the facility will fall apart, for lack of maintenance, and have to be reconstructed. You also do not know for sure, in the developing-country setting, which roads are going to generate the high traffic densities and which regions are going to experience traffic-creating growth. In this setting, the road can be seen as an attempt to find out what kind of demand will develop, and not only an effort to service an already-known demand. Construction standards can be "shoddy", then, in accordance with the possible temporary life of the road.

Underbuilding seems contradictory to the overbuilding bias said to result from the no-maintenance model. One can get both types of disagreements, however, depending on the country and the type of road. Donor-engineer complaints of overbuilding, moreover, seem to be of more recent vintage and thus may be more a result of the influence of intermediate-technology thinking than anything else. Ten years ago, the disagreements between donors and recipients seemed to be mostly on the other side--recipient-country engineers complaining that donors were over-designing their roads. That donor engineers are now making the same complaint of recipients may also reflect a lag in the transmission of the intermediate-technology fad from donor to recipient. The recipients, that is, are now reflecting the "modern" design standards that were drilled into them until recently by the donors.

In order to make better decisions about roads, AID needs to recognize the no-maintenance model and the rationale for sacrificing quality for quantity in road-system growth. This will require drawing up criteria about road systems, rather than just for individual roads. The individual-project approach to road analysis has contributed to the exclusion of these important factors from consideration and to the perpetuation of inaccurate assumptions about how road sectors operate.

Maintenance and community-based decisions. One way of approaching the no-maintenance model and its problems is to decentralize decisionmaking about the design and construction of rural roads. At a decentralized level of decisionmaking, there is less tendency for construction to shoulder out maintenance. At the extreme of the village level, the community has no other roadbuilding activity to occupy it once its feeder road is built. Maintenance of the road will therefore not have to compete for attention and funds with another more desirable activity. Indeed, it will be very much in the community's self-interest to maintain its road, for it will suffer directly the costs of inadequate maintenance. At the village level, moreover, there can be no certainty that an improvement project will be obtained from the authorities once a road has been allowed to run down.²¹ At the level of paved-road

²¹ Villages often show considerable ingenuity at getting what is necessary to maintain their road. One Liberian village invited the president of the country to inaugurate its bush school. The road to the village was badly in need of grading and the village was not able to obtain the services of the highway-department grader to do the job. It knew, however, that if the president came to inaugurate the school, the road would be graded first.

construction, in contrast, the road users are geographically dispersed and cannot form a group to do anything about the state of the road. There are no penalties to the highway department, moreover, for inadequate maintenance; indeed, there are rewards, to the extent that capital-budget appropriations are obtained for improvements of roads that are badly run down.

Community-based construction of roads is more conducive to future maintenance also because the local persons involved in construction learn how to maintain the road in the process and how work can be organized for such tasks. The Mexican labor-based road program cites as one of its benefits the learning and organization for future maintenance that takes place during the construction period.

AID's labor-intensive community-based construction programs should try to forge the link between construction and maintenance, and make sure it is functioning well when the project is finished. Organizing and providing for maintenance at the time of construction is desirable because one thereby takes advantage of the existing mobilization of the community around the road project. Neglect of this link occurred in the Colombian Pico y Pala project discussed above. Maintenance was entrusted to a separate organization--the public works department of each state--whereas the construction program was run by a central-government

entity, the semi-autonomous fund for rural roads. This kind of institutional separation of construction and maintenance may actually produce good results at a national level.²² It is one way of dealing with the difficulty that a construction organization has in diverting its attention from construction to maintenance. But this division of labor in Colombia between the national road-construction and the state public-works departments represents the traditional relegation of low-class roads to states and counties--rather than a division of the construction and maintenance tasks for all roads between two task-specific agencies.

The labor-based road projects in Kenya (multidonor) represent an attempt to leave the newly constructed roads with a local maintenance procedure.²³ Upon completion of road construction,

²²The IBRD is trying this approach with its maintenance loan in Haiti.

²³A discussion of this program can be found in Kenya, Ministry of Works, Rural Access Road Program, "Review and Evaluation Report of the Rural Access Roads System," May 1978.

a "line-man" is selected to be in charge of maintenance, a person who lives along the road. He is given simple tools and is paid a monthly fee to keep the road maintained; the fee is paid after verification that the work is done. This concept, which was used in the United States on county roads some time ago and in Europe, is one example of how a local maintenance system can be left in place when the construction team leaves.

Piecemeal construction

Because road budget monies are much less accessible to local- than to national-government entities, decentralized decisionmaking about roads operates at a level where people will settle for less. This means that roads and other infrastructure projects will be built in a more piecemeal way than they are when conceived and financed at central-government levels. At the local level, funding will often be inadequate to finish the facility, or will be available only for a scaled-down version of what was hoped for. At national levels, one does not plan to build only part of a road, or a road without a crucial bridge connection. At local levels, in contrast, people will settle for partial constructions if the only other choice is doing nothing at all.

Part of the dynamic of piecemeal construction is that the very existence of a partially constructed road will help

mobilize local efforts to put the missing parts in place. In the Kenya rural roads program, for example, a community was told that it could have two three-kilometer road segments built, each connected to a different primary road. A bridge also proposed by the community, which would connect the two road segments and provide through access, was considered too costly by the regional planning committee and turned down. Though the community wanted the bridge very much, it chose to have the two segments rather than nothing at all. When the two road segments are in place, it is likely that the community will be able to mobilize its own funding for the bridge itself.

AID's post-hoc evaluations of decentralized road programs should chronicle the types of decisions illustrated in the Kenya case, and follow through on what happens with respect to the unfinished piece later on. This would help to identify the sequences by which things get built in a piecemeal way, and what types of pieces are the best for AID to install first. It is important to become familiar with such sequences because we are used to looking at roads as indivisible, and at piecemeal approaches as inefficient and bad technical form. It is not completely obvious, then, what are the best ways to divide up the construction process--both in terms of what is a technically

viable segment, which can stand on its own without the rest of the structure, and what segments are more likely to bring about their own completion than others.

The reasoning of the above discussion is reminiscent of the evolution of thinking about how to do low-cost housing projects in developing countries. Originally, one simply went and built complete housing projects for the poor. These turned out to be expensive and disliked by their beneficiaries for various reasons. It was then decided to imitate in a project what poor people actually did to provide themselves with housing in squatter settlements: the project would put in a basic package of land, water and sewerage, and welcome in the "squatters" to do what they were usually evicted for. In both housing and roads, then, it had been learned that the way people tend to do things in an environment of capital scarcity can be the best guide to the way they should be done as projects. In both situations, a major self-help contribution to a seemingly indivisible investment project can be elicited if it is designed in a piecemeal way.

Why is piecemeal road development desirable? Mainly, it may give more of a chance to rural communities to get roads in the first place. Piecemeal construction allows rural communities to compete for scarce public funds in a way that does not pit them

so directly against the interests of arterial-road construction. As noted above, moreover, the piecemeal approach seems capable of generating more roads per unit of national or foreign financing, because of the local contribution that can be elicited. Finally, piecemeal construction is desirable because it is more compatible with labor-intensive techniques than is equipment-based construction.

Decentralization of funding can be important to achieving decentralized decisionmaking. The possibilities for the raising of funds at the village and district levels, and the difficulties of doing so where these units do not have taxing power, are issues that are now being raised in AID. A research project on the topic is under way in the Development Services Bureau.²⁴ The decentralization of decisionmaking as discussed here, however, should not be seen as possible only if preceded by such an increase in local taxing power.

The above discussion of decentralization is different from the argument for popular participation. Proponents of labor-intensive projects sometimes assume that the two go together automatically. Popular participation may or may not result from the

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USAID, "Local Revenue Management/Tax Policy for RD," Project Identification Document (PID), 28 April 1978.

decentralized organization of roadbuilding. I am arguing for decentralization on the grounds that it will result in more desired allocations of funds between rural and arterial roads and in better solutions to the maintenance problem than have been found thus far.

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