



Sub-Saharan Africa Transport Policy Program  
The World Bank and Economic Commission for Africa



SSATP Working Paper N° 22

# ***Expanding Labor-based Methods for Road Works in Africa***

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**October 1996**

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## Foreword

Using labor-based methods for road works has been an important part of the strategy to improve rural transport infrastructure in Sub-Saharan Africa over the past twenty-five years. These methods not only produce gravel roads of equal quality to those produced using equipment-based methods, they also generate rural employment in a cost-effective manner. In addition, labor-based methods save on foreign exchange, inject cash into the local economy, transfer knowledge about road works to the local community—knowledge that will be useful for later maintenance—and reduce damage to the environment. The World Bank has been working with other bilateral donors and African governments to support the use of labor-based methods through the Rural Travel and Transport Program (RTTP). This program is a component of the Sub-Saharan Africa Transport Program (SSATP), which is a collaborative framework set up to improve transport policies and strengthen institutional capacity in Africa. This report is one of a series of approach papers prepared within the framework of the RTTP. Its intent is to firm up the conceptual basis for developing rural transport programs in Sub-Saharan Africa. The other papers in the series address planning systems, institutional arrangements and financing, and intermediate means of transport. The RTTP is now entering its implementation phase and will spearhead country-based strategy processes to develop transport programs.

Labor-based methods have proved to be a cost-effective alternative to equipment-based methods in low-wage countries that have an adequate supply of underemployed labor. But in many developing countries, applying these methods on a large scale has proven difficult. Addressing this difficulty is critical for future rural development in Sub-Saharan Africa. Using local resources to improve rural transport infrastructure is essential for developing strong rural economies, increasing incomes, and facilitating access to markets and social services.

Experience gained from the RTTP suggests that two key reforms have not received the attention they require: improved financial management—to ensure that funds flow adequately and laborers are paid on time—and decentralization—to streamline payment procedures and strengthen the stakeholders favoring labor-based programs. These two reforms, together with government commitment, effective labor laws, appropriate design standards, and training, should facilitate the mainstreaming of labor-based programs in low-wage countries. While addressing these reforms, program designers can begin to establish a delivery mechanism suitable for the country in question. This paper presents a number of models in that regard. The correct choice of delivery mechanism, together with the necessary reforms, can facilitate the expansion and sustainable use of labor-based methods in the road sector.

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## Abstract

Using labor-based methods for road works has been an important part of the strategy to improve rural transport infrastructure in Africa over the past twenty-five years. These methods not only produce gravel roads of equal quality to those produced using equipment-based methods, but they also generate rural employment in a cost-effective manner. Although labor-based methods have proved to be a cost-effective alternative to equipment-based methods in many low-wage Sub-Saharan African countries, these methods have not been applied on a large scale.

The Rural Travel and Transport Program (RTTP)—a component of the Sub-Saharan Africa Transport Policy Program (SSATP)—launched a study to find sustainable solutions to this problem. The RTTP, with the support of a number of bilateral donors, has over the last two years examined experiences in Africa to identify why labor-based programs have not been adopted on a large scale and to develop appropriate reforms.

Experience gained under the RTTP identifies two key reforms that are necessary to mainstream labor-based programs, but which have not received the attention they require. These are improved financial management, to ensure that funds flow adequately and laborers are paid on time, and decentralization, to streamline payment procedures and strengthen stakeholders' support of these programs. These two reforms, together with government commitment, effective labor laws, appropriate design standards, and training, should facilitate the mainstreaming of labor-based programs in countries where such methods are feasible. While addressing these reforms, program designers can begin to establish a suitable delivery mechanism. This paper presents a number of models and assesses them on the basis of payment delays to laborers, the time horizon for start-up and expansion, the government's performance risk, and long-run efficiency. The correct choice of delivery mechanism, together with the necessary reforms, can facilitate the expansion and sustainable use of labor-based methods in the road sector.

## Acknowledgments

This report was prepared by Elisabeth Stock, Rural Transport Specialist, Africa Technical Department, World Bank, and Jan de Veen, Senior Engineering Advisor, Development Policies Branch, International Labour Office (ILO), Geneva.<sup>1</sup> The report was prepared under the overall direction of Jean H. Doyen (Division Chief) and Snorri Hallgrímsson (Infrastructure Advisor), Environmentally Sustainable Development Division. The report is based on work carried out under the Rural Travel and Transport Program (RTTP), a regional initiative to improve rural transport services. The RTTP is financed by the Governments of Norway, Sweden, Switzerland, and by the World Bank.

Substantive inputs to this paper were made by Ernesto Henriod (Director of Headquarters Construction Department, World Bank), Peter Morris (Principal Transport Engineer, World Bank), Larry Schroeder (Professor, Indiana University), Howard Stock, Evelyn Stock, Gary Taylor (Director, IT Transport, UK), and Ron Watermeyer (Director, Sonderlund & Schutte, South Africa). Substantive inputs were also made by current RTTP staff: Snorri Hallgrímsson and Christina Malmberg Calvo.

Other important contributions to the report were made by Claus Andersson (ILO, Geneva), Ed Connerley (Expert in Public Administration, Consultant), Goeffrey H. Mwangi (Provincial Works Officer, Government of Kenya), Margaret Grieco (Social Scientist), Ian Heggie (Principal Highway Specialist), Jean-Marie Lantran (Senior Construction Engineer), Stefano Pagiola (Economist), and Thor Wetteland (Transport Engineer), all of the World Bank.

The paper was reviewed during the Tenth Road Maintenance Initiative (RMI)/RTTP Annual Coordinating Committee meeting, which took place in Yaoundé, Cameroon in October 1995, and subsequently during an expert workshop on Labor-based Small-scale Contracting for the Roads Sector held in Mazvikadei, Zimbabwe in December 1995. Reviewers at these meetings included government officials from Cameroon, Central African Republic, Ghana, Kenya, Lesotho, Namibia, Uganda, and Zimbabwe. Representatives from bilateral agencies included Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), British Overseas Development Assistance (ODA), Swedish International Development Authority (SIDA), and Norconsult. Representatives from the ILO, from international consulting firms including Intech, and Scott Wilson Kirkpatrick, academicians from universities including Wits (South Africa) and Loughborough (UK), and small-scale contractors from Ghana, Kenya, South Africa, and Zimbabwe also participated in the review process.

Comments on sections related to labor legislation and conditions of work were provided by David Tajgman (ILO, Harare). A list of technical manuals on labor-based road works was compiled by Angela Kabiru (ILO, Nairobi).

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<sup>1</sup> Responsibility for opinions expressed in signed articles, studies, and other contributions rests solely with their authors, and publication does not constitute an endorsement by the International Labour Office of the opinions expressed in them. Reference to names of firms and commercial products and processes does not imply their endorsement by the International Labour Office, and any failure to mention a particular firm, commercial product, or processes is not a sign of disapproval.

## Executive Summary

The use of labor-based methods for road works has been an important part of the strategy to improve rural transport infrastructure in Africa over the past twenty-five years. These methods not only produce gravel roads of equal quality to those produced using equipment-based methods, but they also generate rural employment in a cost-effective manner. In the late-1970s and 1980s, pilot projects were set up in low-wage countries to demonstrate the technical and economic feasibility of labor-based methods. These efforts have proved insufficient for expanding labor-based methods—their use often collapsed soon after the pilot ended. This report, based upon extensive field work in Sub-Saharan Africa and a review of previous experience, identifies the key reforms and interventions that can facilitate the expansion of labor-based methods in the road sector. These include increased government commitment, effective labor laws, appropriate design standards, training, a reliable flow of funds, and a decentralized administrative structure. These last two reforms have not received the attention they require. While addressing these reforms, program designers can begin to establish a delivery mechanism for initiating and later expanding labor-based programs. This paper presents a framework for selecting the delivery mechanism most suitable to a country's particular circumstances.

In the 1970s, international organizations and donors focused their attention on determining the feasibility of labor-based methods. In terms of quality, the World Bank and International Labour Office (ILO) identified those activities for which labor-based methods produced better, equivalent, and worse quality output than equipment-based methods. They found that there was a broad scope for the use of labor-based methods in the road sector. This report argues that the relative cost of labor-based compared with equipment-based methods depends on three factors: the wage level for unskilled labor, the supply of equipment and spare parts, and the type, design, and packaging of works. The lower the wage level, the smaller the supply of equipment, the shorter the haulage distance, the smaller the project size, and the more remote and dispersed the work, the more likely are labor-based methods to be more cost-effective than equipment-based methods. In terms of completion time, theoretically, labor-based methods can deploy enough labor to finish a project in the same amount of time as equipment-based methods. Practically, however, the completion time when using labor-based methods is constrained by the availability of labor, the willingness of labor to work, and the size of the works to be completed.

The pilot projects initiated in the late-1970s and 1980s—in those African countries where they appeared to be feasible—created an artificial environment to test the feasibility of labor-based methods. For example, pilot schemes would circumvent labor regulations to enable employers to pay wages below the legislated minimum wage, or would alter the definition of casual labor so that laborers could be fired after a few months without severance pay. In addition, pilot schemes used design standards that were more appropriate for labor-based methods than those used by the road agency, they provided training, and they created financial mechanisms that circumvented normal procedures to ensure that labor was paid on time. Although these pilot schemes were effective in demonstrating the technical and economic feasibility of labor-based methods, their artificial structures often collapsed soon after the projects ended. There is a need, therefore, to institute the reforms initiated during the pilot scheme nationwide. Such reforms should facilitate a sustainable expansion of the use of labor-based methods.

## **Reforms and Interventions for Expanding Labor-based Methods**

Reforms that have received the most attention include generating government commitment to the labor-based technology, altering labor laws to make them conducive to labor-based methods, adapting design standards to make them appropriate for labor-based methods, and providing training so that quality can be ensured. The reforms that have been overlooked in the past or have not received the attention they require are related to ensuring a reliable flow of funds and decentralizing the administrative structure by delegating authority and financing to the appropriate level. Both of these reforms are aspects of financial management.

An unreliable flow of funds makes equipment-based methods more attractive than labor-based methods. Cash flow problems affect labor-based operations more quickly than they do equipment-based operations, because material and equipment suppliers will often accept delays in payment, while casual laborers will not. At best, delays in paying wages reduce productivity and increase costs. At worst, delays result in strikes and riots. Small firms, currently thought to be the most attractive candidates to implement labor-based methods, are particularly vulnerable to cash flow problems, since they often lack sufficient collateral to obtain overdrafts. In addition, a centralized road management structure, present in most countries, hinders the expansion of labor-based methods. Highly bureaucratic payment procedures often delay payments. Interim payment certificates or payroll receipts may have to pass through twenty-five to forty-five checkpoints before being paid. A centralized management structure may also be insensitive to the demands of the domestic constituency who favor labor-based methods. Often, the only stakeholders favoring labor-based methods are small farmers in rural areas who are employed on the road sites. Although in some countries this constituency may be strong at the local level, it is often incapable of pressing its demands on a centralized management structure.

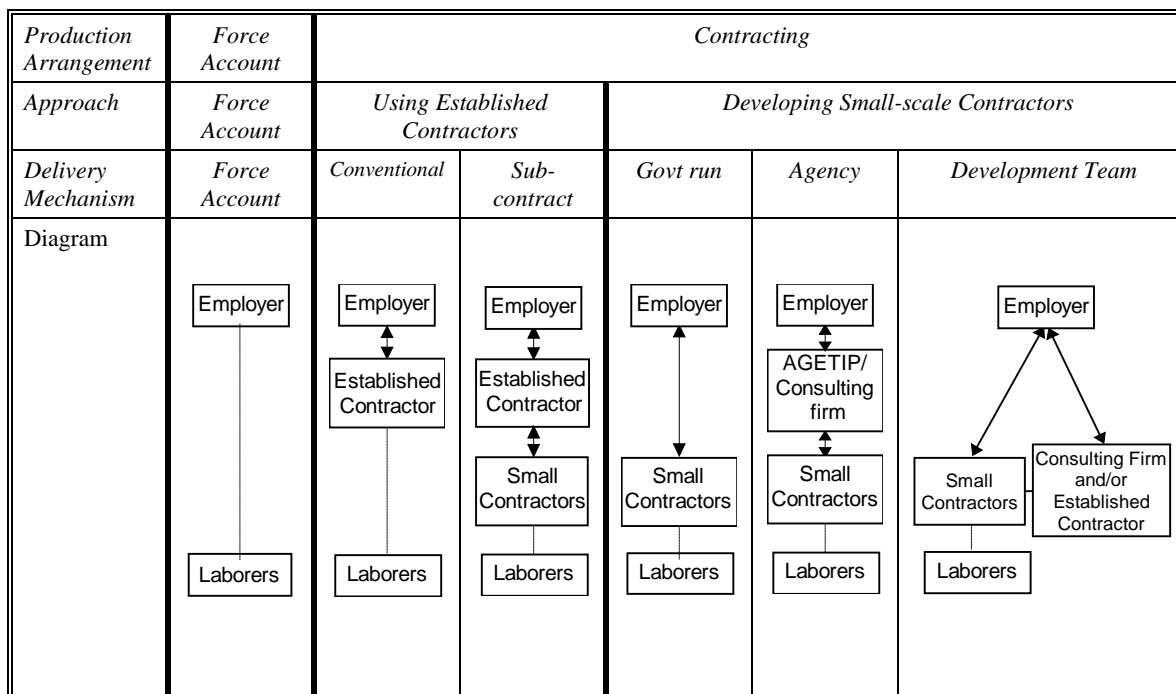
### **Two Reforms Requiring More Attention**

The successful mainstreaming of labor-based methods, therefore, requires both reliable, safeguarded funding over an extended period, and decentralized project administration. Reliable funding might be attained by imposing an interim surcharge on fuel that is held separately from the road fund for maintenance, or by securing programmatic donor funding. Funding can be made secure by placing it in a properly managed special account. Project administration can be decentralized by delegating authority and finances to local levels and undertaking financial and technical audits ex-post.

While working to put these reforms in place, program designers can begin to compare the various models for expanding labor-based programs. These models can be divided according to their production arrangement, which is either force account or contracting. Within the contracting arrangement there are two different approaches: using established contractors and developing small-scale contractors. The models, depicted in the following table, can be distinguished by the degree of private sector involvement in execution and administration and the size of the firm measured by its acquired assets. Program designers must understand each model's relative strengths in order to choose the most suitable model or succession of models for a particular country, given the characteristics of its public and private sector.



## The Production Arrangements, Approaches, and Basic Delivery Mechanisms for Expanding Labor-based Methods



\* In the above models, arrows represent contractual relationships, broken lines represent employment relationships and regular lines represent “other” relationships.

The force account model has been the most widely used (for example, in Benin, Ethiopia, and Kenya). Like many other government-directed activities, it has inherent inefficiencies and is unlikely to ever reach the efficiency of the private sector.

Using established contractors may appear to be the most attractive approach for introducing labor-based methods since they can pay laborers on time, few institutional changes are required, and there is low performance risk. This model is currently being used in South Africa. But it has inherent weaknesses. Established contractors resist substituting labor for equipment that they already own. It may be possible to force established contractors to use labor, but this will often result in increased costs. Instead of substituting labor for equipment, they may hire a large number of nonproductive laborers merely to meet employment requirements.

An alternative approach to using established contractors is to develop small-scale contractors (as in Ghana, Tanzania, and Zambia). In this case, program designers have three models to choose from, which differ in the degree and type of private sector involvement. In the government-run model, contractor development is the responsibility of a government road agency; in the agency model, it is the responsibility of a nonprofit nongovernmental organization (NGO) or a for-profit consulting firm; and in the development team model, the responsibility is shared amongst the government agency, an established contractor, and a for-profit consulting firm. The selection of a model depends primarily on the current contracting environment in the country being considered and the resistance to reform. If the road agency is functioning well and reform can be facilitated, the direct road agency model or development team model may be most suitable. If a road agency is unable to undergo the required reforms within a reasonable time

or would prefer to pass a portion of the risk of contractor development to the private sector, a development team model may be the most suitable. If the road agency is nearly defunct or unacceptably corrupt, an agency model may be more suitable and can be used until the road agency has undergone the necessary institutional reforms. In the end, the choice of technology and production arrangement should be consonant with the reform needed in the government's structure and its work practices.

# 1. BACKGROUND

Civil works programs that deliberately use unskilled labor fall into four major categories:

- Relief programs, which respond to emergencies created by natural or man-made catastrophes. Their objective is to provide income to the workforce; any assets created are of secondary importance.
- Self-help programs, in which the government appeals to communities to help themselves rather than pay community laborers. These programs are a form of regressive taxation.
- Employment-generation programs, which attempt to assuage political unrest by providing jobs. Their objective is to keep people busy rather than to improve productivity.
- Asset generation programs, which supplement beneficiaries' usual incomes by employing them in projects that improve infrastructure facilities at the lowest possible cost. In these programs laborers are paid. This paper addresses only this last category of civil works programs—specifically, those that generate assets using labor-based methods. Here, labor-based methods refers to the use of labor and light equipment (such as, tractor-trailers and vibratory pedestrian rollers) as the predominate mode of production.

## Historic Perspective

Since 1971 the World Bank and the International Labour Organization (ILO), in collaboration with several governments and other agencies, have been investigating the use of appropriate technologies for civil construction. The initial phase of the World Bank study conducted in 1971 examined the technical feasibility of substituting labor for equipment in low-wage countries. It found that making this substitution for a wide range of construction activities was technically feasible and generally produced the same quality of product. The second phase of the study conducted over the period 1971 - 1973, examined the economic feasibility of labor-based methods by observing construction activities in India and Indonesia, where these methods had traditionally been used. Based on this evidence, the study concluded that traditional labor-based methods of construction were not economically competitive with modern equipment-based methods even at low wage rates.<sup>2</sup> The third phase of the study conducted over the period 1973 - 1976, reversed the earlier conclusions. It found that in low-wage countries, labor-based methods could be fully competitive with equipment-based methods, as long as workers were provided with adequate tools, good incentives, and effective management.

In 1975, the World Bank began to finance projects in countries where the lessons from this study were being applied: Benin, Burkina Faso, Cameroon, Chad, Colombia, Dominican Republic, Honduras, Kenya, Lesotho, Malawi, the Philippines, Senegal, and Togo. The ILO began to provide technical assistance to other countries that were starting labor-based works, including Ethiopia, Guatemala, and Mozambique. In both set of these countries labor-based works were carried out by “force account” units. Force account (departmental force) units are public agencies that carry out all aspects of construction “in house.” They supervise, manage, and control their machines and labor directly. By 1978, the focus began

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<sup>2</sup> These conclusions, however, were based in part on equipment productivity figures that were later found to be too optimistic for developing country conditions.

to shift from force account to contracting. The World Bank's *Guide to Competitive Bidding on Construction Projects in Labor-Abundant Economies* (World Bank 1978a) argued that administrative procedures (such as designs, contract documents, project packaging, and methods of finance) were often biased toward equipment-based methods even when a more labor-based technology could be justified. The guide stated that by "neutralizing" the contract and administrative procedures, bidders would naturally select a more appropriate technology mix.

## **Benefits**

Labor-based programs have many benefits. First, they provide a cost-effective alternative to equipment-based methods for both road rehabilitation and maintenance (under certain circumstances, which are described in Chapter 2). Second, they generate temporary employment for both men and women. The ILO estimates that the labor-based program in Kenya generated at least 24 million worker-days between 1974 and 1996, or more than one million worker-days annually. The Moroccan National Promotion, created in 1961, generated about 7 million worker-days, or 4,000 new jobs annually (World Bank 1971). The percentage of women hired on these construction sites ranged from 10 percent to 25 percent.

Third, labor-based methods save foreign exchange. In Rwanda, they reduced foreign exchange expenditures by more than 60 percent. Fourth, they inject cash into the local economy. In Ghana, from April 1987 to July 1989, \$368,000<sup>3</sup> were paid as wages to workers. Fifth, labor-based construction methods facilitate the use of labor-based maintenance since, for example, it is much easier to maintain a hand-dug trapezoidal ditch by hand than to maintain a grader-dug V-ditch by hand. Sixth, they transfer knowledge of labor-based road works to local communities—knowledge that will be useful for later maintenance. Seventh, they have environmental advantages—labor-based works use less fuel, emit less exhaust, raise less dust, and are less likely to seriously damage the terrain bordering a construction site. Labor-based methods require less maneuvering space, especially when doing hill cuts and excavation work. Finally, they encourage the development of local industry for manufacturing hand tools and light road construction equipment.

Earlier studies concluded that labor-based methods are a cost-effective alternative to equipment-based methods in low-wage countries that have an adequate supply of underemployed labor that is motivated, can be supervised, and is equipped with appropriate tools. Yet in many of the developing countries that meet these conditions, labor-based methods have not been applied on a large scale. This paper will determine the reasons why by re-examining the experiences of labor-based programs executed by the public sector (that is, force account) and the recent experiences of labor-based programs executed by the private sector (that is, contracting).

This paper has four aims.

- To enable program designers to identify countries and projects in which labor-based methods may be technically and economically feasible in terms of quality, cost, and completion time (Chapter 2).
- To identify and discuss the reforms required to expand labor-based pilots into nation-wide programs (Chapters 3 and 4).

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<sup>3</sup> All dollar values are in US dollars, unless otherwise indicated.

- To discuss various delivery mechanisms (models) that can expand the use of labor-based methods for each of three approaches: force account operations, established large contractors, and small-scale contractors (Chapter 5).
- To compare the various delivery mechanisms so that program designers can select the one best suited for the circumstances in a particular country (Chapter 6).

This paper limits itself to examining the expansion of labor-based methods where these methods can provide a cost-effective alternative to equipment-based methods. It does not address the use of labor-based methods as an employment-generating tool where they are significantly more expensive. If a program designer's principal objective is employment generation, he or she should also consider other sectors of the economy for their ability to create employment (such as the housing sector and the agriculture sector).

## 2. THE TECHNICAL AND ECONOMIC FEASIBILITY OF LABOR-BASED METHODS

Labor-based methods depend mostly on human muscle, and little on equipment, differentiating them from equipment-based methods. In theory, the potential mix of labor and equipment spans the full spectrum, with no clear boundary between the two methods. For developing as well as industrial countries, the appropriate construction methods are found somewhere between the two extremes—100 percent labor-intensive and 100 percent equipment-intensive—and depend on the socio-economic environment and the task. In practice, the combinations of labor and machinery that are used depend on whether the technology is labor-centered, in which labor is the central resource and equipment plays a supporting role, or equipment-centered, in which the opposite holds true.<sup>4</sup> In this paper, labor-based methods refer to those that use labor and light equipment as the predominant mode of production and equipment-based methods refers to using heavy equipment and a few laborers (that is, machinery operators) as the predominant mode of production (technical manuals on labor-based road works can be found in Appendix 1).

### Quality and Suitability

Labor-based methods can produce satisfactory results as amply demonstrated by the Upper Ganges Canal, the first German Autobahns, the Trans-American Railway, and the Sarda Sahayak Canal. Basic road construction activities can be categorized as either: (a) equipment-based, in which labor substitution is not technically feasible; (b) labor-based, in which equipment substitution is not technically feasible; or (c) an activity that can be carried out with either equipment or labor (see Appendix 2).

Activities for which labor-based methods produce better quality results than equipment-based include: creating embankments on very soft ground, producing drainage systems, undertaking shallow excavations with a high water table, selecting materials when excavating, exploiting small quarries, and performing routine maintenance on gravel and earth roads. In terms of suitability or ease of production, labor is better suited to produce the longer-lasting trapezoidal drains than is equipment, which can often produce only V-shaped drains. In addition, labor-based methods are more suitable for rehabilitating and maintaining narrow, winding roads in densely-populated urban areas, because bulldozers cannot maneuver well in such situations. Contractors in South Africa, for example, use labor when constructing side roads on site-and-service projects, because beneficiaries purposefully design these roads to be winding and narrow (3.5 m in width) to discourage taxi drivers from speeding. Initially, beneficiaries designed roads with speed bumps but the taxi drivers found ways to remove them. Also, in Kenya's highland region, labor may be more suitable for gravel road rehabilitation, because high population pressure forces farmers to till the soil up to the road's edge. Unlike graders, which deposit material excavated from the drains on to farmers' land holdings, laborers deposit this material on to the road surface to build up the road profile.<sup>5</sup> Activities for which labor-based methods cannot produce the same quality results as equipment-based include: underwater excavating, producing aggregates less than 15-20 mm in nominal size, piling, achieving certain surface tolerances, and compacting material (World Bank 1978b). In addition,

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<sup>4</sup> This framework for viewing labor- and equipment-based technology was suggested by Gary Taylor of IT Transport Ltd. and reflects what is found in the field.

<sup>5</sup> The material that cannot be used to build up the road profile can be deposited neatly on farmers' land.

equipment-based methods are more suitable than labor-based methods for projects that require moving large volumes of earth longitudinally over several hundred meters.

Compaction is an important activity in road works, and is one of the few activities for which equipment can achieve higher and more uniform standards than can labor. In Honduras, where compaction was carried out by hand with tampers (wood, steel, concrete) or hand rollers, the results were unsatisfactory. Although larger mechanical compactors offer one alternative, they may have very low utilization on small, scattered labor-based jobs (that is, feeder roads) because of the small amount of work involved. It may, therefore, be more economical to use pedestrian vibrating rollers, which can be used more efficiently for small works. For example, in Lesotho pedestrian-operated rollers were more economical and better suited for compaction than large rollers. Animal- or tractor-towed rollers can also be used if the reduction in compaction standards is acceptable. Although compaction often represents only a small proportion of the total cost of works, proper compaction is a prerequisite to minimizing future maintenance costs.

## Cost

Financial considerations are crucial in determining the feasibility of labor substitution. The financial feasibility of labor-based methods is a function of many factors, including: the availability of labor, the wage rate for unskilled labor, the supply of equipment and spare parts, the productivity of labor, and the nature of the works to be executed (including the type of works, its location, the way in which it is packaged, and way in which it is designed). This section discusses the first three of these factors. The issue of labor availability is discussed under the section “Completion Time” and that of labor productivity is discussed in the sections on “Labor Laws” and “Training” both in Chapter 3.

### *The Wage Rate for Unskilled Labor*

Wage rates have a decisive impact on the scope of labor substitution. A labor-based program in Mexico exemplifies this point. From 1971 to 1979, rural access roads were built using labor-based technology, with labor inputs averaging about 50 percent of total costs. From 1979 to 1982, however, the Mexican economy was buoyant and rural real incomes soared. Thus, labor participation in the rural roads program dropped steadily, reaching about 15 percent in 1982. Then, a financial crisis in 1982 reduced the real wage levels of agricultural labor. This factor, combined with the poor harvest in 1982, prompted the government to re-embark on labor-based construction, especially in the poorer areas of the country (World Bank 1986).

Even though the wage rate is only one of many factors determining the feasibility of labor-based methods, one can determine a loose estimate of the cut-off wage below which labor-based methods are feasible. In the mid-1970s, the World Bank and the ILO estimated the cut-off wage to be around \$2 per day in most labor-based operations.<sup>6</sup> Two decades later, in 1996, equipment and transport prices have more than doubled in US dollar terms for most developing countries, while labor wages have generally fallen in real terms. Thus, the ILO has increased the loose estimate of the cut-off wage to \$4 per day. (See

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<sup>6</sup> In the Kenya Tea Roads analysis, the actual cost of building tea roads by contract using equipment-based methods was compared with the probable cost of doing the same work using the Kenyan Rural Access Roads (RAR) organization. At the time of the analysis (1977) the rural unskilled wage was \$0.9 per day, and an overhead factor of 53 percent was applicable to the RAR program. As the program expanded, this overhead decreased, and was 35 percent in 1978. Using this latter figure, the 1978 wage rate must be above \$1.3 per day before labor-based methods become more expensive than equipment-based methods.

Table 2.1 for a comparison of wage rates in different African countries.) In countries where the wage rate fluctuates between \$4 and \$8 per day, serious consideration should still be given to labor-based construction and maintenance alternatives. Program designers must also be wary of how seasonal variations affect wage rates (Box 2.1).

**Table 2.1 Examples of Salary Schemes for Casual Labor (US dollars per day)**

Tanzania, Nigeria	0.3 - 0.5
Uganda	0.4 - 0.5
Zaire	0.5 - 0.8
Mozambique	0.8 - 0.9
Rwanda	0.9 - 1.5
Eritrea	2.0 - 3.0
Namibia	4.0 - 7.0

*Source:* Rausch 1994, p. 25.

**Box 2.1 The Importance of Seasonal Variations in Agriculture on the Labor Wage Rate**

The importance of seasonal variations in agriculture should not be underestimated. In India, for example, agricultural wages typically increase by 30 percent to 80 percent or more during peak seasons, which are four months out of the year in rain-fed areas, and as much as eight months out of the year in irrigated areas (World Bank 1976). In Kenya, seasonal opportunities in coffee- and tea-producing areas make labor scarce at certain times of the year. Thus, unless wage rates can be revised in response to changing site conditions or seasonal considerations, there may be wide fluctuation in labor availability. When labor availability fluctuates so that labor-based programs face a greater supply of workers than is needed for the jobs available, site managers can use a lottery system to minimize recruitment problems and eliminate the risks of favoritism and nepotism. Such a system is used in the Kenya program (World Bank 1986). For more information on labor variations, see Vaidya (1983).

*The Supply of Equipment and Spare Parts*

A large supply of used equipment and spare parts limits the scope of work for which labor-based methods will be cost-effective. This factor is often overlooked because in most Sub-Saharan African (SSA) countries, exchange rate reforms have made equipment imports relatively more expensive than labor. The exchange rate, however, is not the only factor determining the cost of equipment. Cost is also determined by the abundance of equipment grants and the supply of used equipment already in the country. For force account units, frequent equipment grants enable road agencies to ignore the capitalization or recapitalization components of their operating costs, thus making equipment-based methods appear cheaper. For example, in Zimbabwe a Japanese grant for heavy machinery in the early 1980s encouraged the District Development Fund to use equipment-based methods to rehabilitate gravel roads as part of the Rural Road Program funded by the Federal Republic of Germany. In Morocco, the government's policies to promote employment in public works (including a duty of 30 percent on imported equipment) did not slow mechanization in road construction, because the investment budgets were almost exclusively financed out of foreign loans. In 1970, the World Bank granted Morocco a loan to purchase road construction equipment (bulldozers, graders, and loaders), on which no taxes were levied (World Bank 1971).

For contracting firms, it is often the supply of used equipment already in the market that affects the scope of works for which labor-based methods will be cost-effective. A large supply of used equipment not only decreases the purchasing price for such equipment, but also lowers the maintenance costs since old, broken-down equipment can be cannibalized for parts. An abundant supply is usually the result of:



bilateral or multilateral lending for equipment at concessionary rates,<sup>7</sup> industrial country grants for heavy machinery built in their country, foreign contracting firms selling fully depreciated equipment at the completion of a project, overcapitalization during periods in which the exchange rate was overvalued, and the ad hoc nature of scheduling works that increases the supply of equipment during a large donor-funded project and then leaves this equipment languishing once the program ends. Program designers operating in low-wage countries with a large supply of equipment can still create a cost-effective labor-based program by carefully selecting the type, design, and packaging of works.

### *The Type, Location, Packaging, and Design of Works*

The comparative cost of labor-based versus equipment-based methods will depend in part on the type of work that is being executed, its location, how it is packaged, and its design. Theoretically, labor-based methods are more cost-effective than equipment-based methods for those works that are small—the smaller the work, the higher the equipment-mobilization cost as a share of total project cost. The comparative cost of labor-based methods also depends in part on the location of the work being executed. In general, the more scattered an activity or remote a project, the lower is the relative cost of labor-based versus equipment-based methods. For activities that are inherently small and scattered (such as spot improvement, culvert cleaning and scour-control construction), labor-based methods will tend to be more cost-effective. For projects that are small and remote (such as rehabilitating 10 km of gravel road far from any city), labor-based methods may also tend to be more cost effective. Another type of road works that often lends itself to labor-based methods is constructing or rehabilitating gravel roads that connect certain localities to existing secondary roads since these roads tend to be short, scattered and remote. In general, the smaller the work, the more scattered the activity, or the more remote the project, the lower is the relative cost of labor-based versus equipment-based methods.

For those works that traditionally require large and lumpy investments (such as road construction and rehabilitation), program designers can favor the use of labor-based methods by packaging the works into smaller projects. In Kenya, for example, the Rural Access Roads Program packaged road construction and gravelling works into small projects of 5-15 km each. Dividing the work this way discouraged the use of equipment-based methods. Using heavy equipment on short roads is often not cost-effective because the cost of mobilizing equipment becomes a large share of total project cost. In general, the smaller the projects into which lumpier activities are divided, the lower will be the relative cost of labor-based versus equipment-based methods.

In terms of design, the principal consideration is the longitudinal movement of earth. Projects that minimize earthmoving decrease the relative cost of labor-based methods versus equipment-based methods since they avoid the cost of mobilizing heavy earthmoving equipment. Projects that entail moving large volumes of earth longitudinally over several hundred meters, in contrast, favor the use of bulldozers or scrapers and are less suited to the use of labor-based methods. Using heavy equipment (such as bulldozers) alongside labor on a road site deters the use of labor for two reasons. First, once contractors or force account units have paid to move a bulldozer to their site, they then will want to use it for as many activities as possible—including those that replace labor, such as excavation, spreading, and removal of top soil. There is evidence that site managers tend to use heavy equipment also for those activities labor can do more efficiently, such as moving earth and aggregates over short distances. Second, laborers often feel unmotivated working alongside heavy equipment that can execute with ease the work they find

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<sup>7</sup> In 1973, the World Bank's Board of Executive Directors set a framework for assisting domestic construction industries in developing countries. This included financial assistance by on-lending through a development finance company for equipment purchase, as in Ethiopia, Ghana, and Pakistan (Henriod 1984).

difficult. The ways in which designers can minimize moving earth longitudinally in road construction are discussed in the section on “Designs” in Chapter 3.

Gravel haulage is not as much of a concern as earthmoving. Although combining labor with certain equipment (such as bulldozers and graders) often results in the inefficient use of both resources, combining labor with trucks for hauling gravel does not. Trucks are generally used for haulage when gravel quarries are located a far distance from the road site. If the quarry is located between 100 m to 10,000 m, animal carts or tractor/trailer combinations are more appropriate. If the haulage distance is less than 100 m, wheelbarrows can be used effectively. Site managers can combine the use of labor and trucks (even of 6m<sup>3</sup> capacity) efficiently so long as the truck’s loading height is kept as low as possible, and labor is well-organized at the quarry (where the gravel is excavated and loaded) and at the site (where the gravel is off-loaded, spread and compacted). For example, if managers at the gravel quarry prepare a loading bay, a large group of laborers will be able to load the truck in about fifteen minutes. Once at the road site, trucks and trailers can dump the gravel while slowly moving forward, thereby assisting the laborers in spreading the gravel quickly and making sure it is ready for compaction. Work studies have shown that one laborer is capable of spreading 12-15 m<sup>3</sup> per day on well organized sites (Coukis 1983).

In countries with a low wage rate and small supply of used equipment, the scope of activities for which labor-based methods are cost-effective may range all the way from routine maintenance to gravel road rehabilitation. In countries with unfavorable conditions, the cost-effectiveness of labor-based methods for gravel road construction and rehabilitation will depend upon the remoteness and dispersion of the work-sites, the packaging of the works and the design.

In conclusion, whether one method is cheaper than another depends on all the factors discussed in this section: labor availability, the wage rate for unskilled labor, the supply of equipment and spare parts, labor productivity and the nature of the works to be executed. For a given individual factor, there is no universal break-even point at which labor-based methods become cheaper than equipment-based methods—one can only discern how that individual factor affects the *relative* cost of labor-based versus equipment-based methods (See Table 2.2).

For a program designer, it is important to identify which of these factors can be altered within a road program. In most cases, a program designer will be unable to alter the availability of labor, the real wage rate for unskilled labor, and the supply of equipment and spare parts, since these factors relate to settlement patterns and national market conditions, both of which are outside the scope of a road program. Labor productivity and the nature of the works to be executed, however, can be directly altered within a road program since they relate to the organization of the work site, the training of site managers, the choice of works to be undertaken and how they are designed and packaged.

Program designers should note that in the private sector the relative cost of using different work methods does not necessarily dictate which method a firm will use. When the sector is very competitive, equipment-based firms may temporarily underbid labor-based firms in order to keep their equipment employed. These firms can tender low prices because their higher fixed costs and lower variable costs gives them more flexibility in bidding. Although equipped firms would be able to underbid labor-based firms for only a short time (or they will be unable to replace their equipment stock), this behavior is not unusual when there is a shortage of work available in the sector (see the section on “The Conventional Model” in Chapter 5). In such situations, program designers can either: protect labor-based contractors from competing with equipment-based contractors, design works so that they can be feasibly executed only using labor-based methods (see the section on “Designs” in Chapter 3), or select the type, design, and packaging of works to make them unattractive to equipped firms.

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**Table 2.2 The Effects of Various Factors on the Relative Cost of Labor-based Versus Equipment-based Methods**

<i>Factors</i>	<i>Cost of Labor-based Methods</i>	<i>Cost of Equipment-based Methods</i>	<i>Relative Cost of Labor-based vs. Equipment-based methods</i>
(1) Labor scarcity	++	0	+
(2) Low unskilled labor wage rate	--	-	-
(3) Abundant supply of equipment and spare parts	-	--	+
(4) High labor productivity	--	-	-
(5) Nature of works			
Type of works			
inherently small size	+	++	-
Location of works			
scattered	+	++	-
remote	+	++	-
Packaged into small projects	+	++	-
Design			
abundance of longitudinal earthmoving	++	+	+

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## **Completion Time**

Theoretically, one could deploy enough labor on a project to finish it in the same time that equipment-based methods would require. Practically, however, when using labor-based methods, the completion time is constrained by the availability of labor and the size of the works.

The availability of labor depends on the settlement patterns in the area where the works are being executed and on the willingness of labor to work. In general, it is more desirable to recruit labor from local areas. Although laborers have been known to walk up to 20 km to the road sites, such exertion reduces their work efficiency. The willingness of labor to work in civil construction depends on: earning differentials relative to alternative employment; the wealth of the individual (such as the extent of landholdings); any additional work-related costs of food, housing, and transport; the disutility of work in terms of leisure forgone; the method of payment (that is, check or food); and the regularity of payment (the method of payment is discussed in Appendix 3). The regularity of payment depends on cash flow—which is critical for the survival and expansion of a labor-based program. In the Dominican Republic, delays in paying workers spurred distrust and created difficulties in recruiting and retaining labor (Henriod 1984). This issue is discussed in more detail in Chapter 4.

Even in the best cases (that is, those with an adequate supply of underemployed workers who are willing to work and are paid regularly for doing so), contractors and force account units will come up against practical constraints in executing large labor-based projects. Small-scale contractors will be constrained by the quantity of light equipment that they own. And as they grow, they are likely to invest in heavy equipment (to become eligible for more profitable, technologically advanced projects) rather than in more light equipment, which would assist a growing labor force. Established contractors are not well-suited for executing large labor-based projects. Once contractors purchase heavy equipment, the marginal costs of using that equipment are often lower than the marginal costs of using labor-based methods (see the section on “The Conventional Model” in Chapter 5). Finally, force account units will also face constraints as labor-based methods begin to display diseconomies of scale: the supply price of labor is likely to rise with the larger labor forces needed to speed construction, the physical limitations of the site may restrict the amount of labor that can be employed, and the practical difficulties involved in housing and feeding large numbers of laborers will increase.<sup>8</sup> In contrast, equipment-based methods display economies of scale (one can achieve higher output by using larger units on larger projects).

In general, in areas where labor is readily available and is willing to work, labor-based methods can have the same completion time as equipment-based methods for smaller projects, or where the size of equipment is restricted. This implies that a labor-based program working on many dispersed sites has the potential to have the same or faster completion time as an equipment-based program. This potential can be realized if the reforms facilitating the expansion of labor-based road programs are met.

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<sup>8</sup> This is probably not the case for India, where population density is high and labor is extremely mobile. For example, in the construction of a large dam in Mysore on which as many as 20,000 people worked, workers were recruited from up to 1,000 km away (World Bank 1971).

### **3. EXPANDING LABOR-BASED ROAD PROGRAMS: REFORMS AND INTERVENTIONS**

In the past, program designers set up pilot schemes to assess whether labor-based methods were feasible in a particular country. These pilots often created an artificial working environment for force account units or contractors to assess the feasibility of the technology. This environment usually enabled employers to circumvent labor regulations in paying wages below the legislated minimum wage or in hiring casual laborers for a few months and firing them without severance pay. In addition, the pilots often adapted the design standards to make them more appropriate, provided training and created financial mechanisms conducive to timely payments.

Although this environment enabled governments and donors to demonstrate the technical and economic feasibility of labor-based methods, the pilot environment has been difficult to mainstream. The next two chapters describe reforms and interventions that are necessary to replicate the pilot environment nationwide and expand labor-based methods in the road sector. This chapter focuses on the reforms and interventions that have received the most attention: generating government commitment to labor-based technology, making labor laws more conducive to labor-based methods, creating appropriate designs, and providing training. Chapter 4 describes reforms that have either been overlooked or have not received adequate attention: improving financial management to ensure that timely payments are made to laborers and decentralizing the program to streamline payment procedures and make them more efficient.

#### **Government Commitment to the Labor-based Technology**

Government commitment is crucial because expanding labor-based methods requires that the government make significant changes in institutions, attitudes, and work habits, and that the government provide a steady flow of funds. Thus, ideally, support for the use of labor-based methods should be built among the most senior government officials.

##### *The National Level*

It is often argued that government officials will be eager to adopt labor-based methods when faced with growing unemployment. But very few countries have initiated labor-based programs to address their unemployment problems without external prompting. When confronted with growing unemployment in the late 1960s and early 1970s, the Kenyan Ministry of Works was initially reluctant to adopt labor-based methods, claiming that they were too difficult to implement, were too slow to execute, required too much supervision, resulted in poor quality roads, and were not cost-effective. This view shifted as a result of a 1975 study in which the ILO and the Norwegian aid agency collected productivity data on existing methods of road construction. The Kenyan government then became more committed to labor-based methods and initiated the Rural Access Road Program, followed by the Minor Road Program. Now, 85 percent of the total roads under the Ministry of Public Works (53,000 km paved and unpaved) are to be maintained using labor-based methods, and a substantial portion of the unpaved network is to be brought up to maintainable condition using labor- and tractor-based methods (Kenya 1993).

The Mexican government's enthusiasm to introduce labor-based methods contrasts sharply with the initial reluctance of the Kenyan government. During the early 1970s, the pressing need to create jobs for unemployed laborers prompted the Mexican government (without the support of an external agency) to apply labor-based methods in its public works program. Initially, laborers replaced equipment to create

work opportunities only in depressed agricultural areas. Later, experience showed that labor could compete favorably with equipment where the terrain lent itself to pick and shovel technology—and the use of labor-based methods expanded. From 1971 to 1983, about 80,000 km of rural access roads were built in Mexico under this program. Local authorities managed this construction and their pay was based on actual progress (World Bank 1986).

Like Mexico, India initiated labor-based methods without external prompting. There, the government set standards and specified the method of construction so as to maximize the use of labor and minimize the use of equipment. This action was a response to the Planning Commission's recommendation in the Fourth Five-Year Plan (1969-74) to place greater emphasis on job creation. The approach document to the Fifth Plan (1973) proposed still greater emphasis on this objective, urging the promotion of labor-based economic activities and job creation in the road sector (World Bank 1974). These policies were supported by labor laws that allowed employers to lay off workers at any time without having to pay them additional compensation. Such firing, however, was reportedly rare (World Bank 1975b).

Why would high-level government officials be reluctant to support labor-based methods? First, some government officials wish to use only the latest technology. Second, the Ministry of Finance may believe that the cost of labor-based methods is higher than that of equipment-based methods. While the direct cost of labor can be easily identified from payrolls, the cost of owning and operating equipment is usually distorted by unrealistic assumptions, omissions, or cost factors. For example, the government does not usually consider equipment donated by external agencies as owners' costs because it is included in the development budget rather than in the recurrent budget. Third, equipment-based projects may command more external finance than labor-based projects. International agencies often base financing of construction projects on the estimated foreign exchange cost to the borrowing country. Projects executed by domestic contractors using labor-based methods require less foreign exchange and warrant a smaller loan than those executed by contractors using heavy equipment.

Fourth, equipment-based methods may appear cheaper to a force account unit because they require less operating capital than labor-based methods. Equipment is a sunk cost whereas labor costs must be paid throughout the duration of the project. In addition, in some countries, cash flow problems in labor-based projects are more politically sensitive than in equipment-based projects. The nonpayment of wages in labor-based programs immediately creates adverse political effects locally, while for equipment-based programs, cash flow problems merely result in reduced output which the public is often willing to accept. Finally, road agency officials who do not favor labor-based programs (for reasons discussed in the next section) may try to discourage higher level officials from introducing such programs.

Attitudes about labor-based methods may be changed in two ways. Pilot projects can help promote acceptance. In general, governments in the developing world doubt the efficiency of labor-based methods, preferring to pass the risk of their initial implementation to aid agencies. Experiences in Chad, Ghana, Honduras, Kenya, and Mozambique prove that once labor-based schemes are shown to produce high quality roads in a cost-effective manner, they become politically attractive to the host government, which thereafter provides counterpart support. This finding implies that counterpart funding should be requested following the demonstration phase. Unfortunately, few agencies are prepared to support completely self-contained projects. Although such projects do not require much money, they require as much work to prepare as large projects, and the benefits are not visible for three or four years. In addition, study tours have been particularly effective at changing attitudes in the Africa region: many policymakers and managers have benefited from visiting large-scale, cost-effective programs in Ghana, Kenya, and Malawi.

### *The Road Agency Level*

Why would SSA road agencies be reluctant to support labor-based methods? All over the world engineers and planners display a striking bias in favor of equipment use in civil construction. Many engineers and planners acquired their education and practical experience in industrial countries. They are familiar with the costs and performance of machines and believe laborers to be undisciplined and unreliable. Also, they believe that the quality of manual work is inferior to that of machines. In sum, for engineers and planners, employing more labor means a reduction in productivity, a product of doubtful quality, and an increase in costs.

Further, for the same rate of output, the supervision requirements of labor-based projects are much greater than those for equipment-based projects. For example, the output of a bulldozer employed in earthworks on a large site can be as high as 700-800 m<sup>3</sup> per day, which may be equivalent to the output of 200-300 laborers working in groups of twenty to thirty. A bulldozer can be operated by one or two skilled workers, but more than a dozen supervisors are needed to oversee laborers doing the equivalent amount of work. In addition, labor is often deployed over a wider geographical area, requiring a dispersal of supervision, which further raises supervision requirements.

Staff members of technical departments who are assigned to labor-based units fear losing status and possibilities for advancement compared with their colleagues in equipment-based units—especially at the beginning of programs, when the chance to make a career in labor-based programs appears doubtful. Limitations on civil service careers may induce complacency and a lack of commitment among the senior staff. In Kenya, where there are already shortages of engineers and staff, local engineers perceived the Rural Access Road Program as being of low status at the beginning of the labor-based program (World Bank 1986).

Finally, engineers and other civil servants will have less contact with established contractors and will lose the benefits of such a relationship. In addition, established contractors may feel that a labor-based program will reduce demand for their services and therefore lobby road agency staff to oppose such a program or keep it to a minimum.

Attitudes about labor-based methods may be changed in three ways. Securing commitment from the highest levels of government will ensure that government officials at the agency level actively support the program (Box 3.1). In Kenya and Ghana, for example, attitudes toward labor-based methods became more favorable once high-level government officials decided to use these methods as the principal means to improve and maintain roads.

Teaching the cost-effective use of labor-based methods in universities and training colleges will also change attitudes. If labor-based methods are not incorporated into tertiary education, graduates will regard labor-based methods as "soft" engineering. The ILO is currently experimenting with this idea in a number of universities and training colleges in Africa, Asia, and Europe.

Finally, designers should build in career development as part of labor-based programs. For example, a special department for labor-based road construction with formalized organizational and staffing structures should be formed within the relevant ministry. It should provide career opportunities for professional staff and formal support for field operations (see Box 3.1). The Kenyan government trains all foremen and overseers in both equipment- and labor-based methods. This policy creates greater uniformity in career paths. Career development in labor-based works can also lead to international opportunities. A number of Kenyan and Ghanaian engineers who became involved in the labor-based program later found employment internationally as labor-based experts. The ability to vie for international opportunities may be further incentive for staff to join a labor-based department.

### **Box 3.1 Mexico: Attracting Civil Servants to the Labor-based Program**

Key to the development of labor-based technology in Mexico was the creation of an institution within government that eventually became permanent. The Directorate-General of Rural Roads and Construction developed a large body of professional and paraprofessional staff with an ingrained, intense esprit de corps. It also provided good visibility for staff promotions within the Secretariat of Communications and Transportation. The engineers, for example, had to be motivated to work with less glamorous technology in poorer and more isolated areas of the country. They were encouraged to use labor-based rural access road construction with the argument that, when building a rural road, engineers' ingenuity and perseverance are strenuously tested, and the results of their efforts are readily visible in the improvement of access to hitherto neglected villages. These results represent immediate professional rewards. In contrast, when building a highway, an individual engineer's efforts are usually engulfed in the activities of a large team, with little perception of the individual's contribution to the overall results.

This approach was supported by the establishment of a career pattern for the staff of the Directorate-General of Rural Roads and Construction and by the permanence of that institution within the structure of the Secretariat. After the initial years, its turnover of engineers settled to levels comparable with those of other offices of the Secretariat.

*Source:* World Bank (1986).

## **Labor Laws**

Labor laws—such as the minimum wage, hiring and firing regulations, and legislation that forbids tying wage rates to productivity—can have a significant impact on the use of labor-based methods. Some developing countries legislate a minimum wage rate above the market wage and compensation payment for employee termination—both of which increase the cost of labor. Sometimes, these factors can adversely affect the cost of labor relative to equipment, making labor-based methods less viable. The legislated minimum wage not only has a decisive impact on the scope of cost-effective labor substitution, but can introduce artificial volatility in the equation comparing the cost of labor- and equipment-based methods. This volatility occurs because although the cost of equipment and materials tends to rise steadily with inflation, governments tend to increase the legislated minimum wage in large steps. For example, in Lesotho there were two separate increases in the minimum wage rate over a five-year period (1978-83), and immediately after each increase, equipment-based methods became comparatively less expensive. But, six to eighteen months later, inflation would raise the cost of equipment relative to labor, and labor-based methods would again become comparatively cheaper (Edmonds, Goppers, and Söderbäck 1986). To remove such artificial volatility from the cost comparison equation, regular six- or twelve-month reviews of the minimum wage legislation should be encouraged.

Hiring and firing legislation can also hinder the administration of labor-based programs. In Honduras, to avoid having to pay laborers one month's severance pay when dismissing them, the road agency had to change its entire labor force every two months and lose all the benefits of skill development and experience, interrupt the activities every two months for at least three days, or constantly attend the labor court (World Bank 1978b).

Regulations tying the wage rate to productivity can also affect labor-based programs significantly. Evidence from India and Indonesia indicate that incentive payment systems, such as task rate or piece rate may raise labor productivity by a factor of three compared to daily wage systems (World Bank 1976). Yet, in some developing countries, instituting a piece- or task-rate system may be unconstitutional or be opposed by labor unions or laborers themselves. In both systems, laborers are paid for completing tasks. In a task-work system, the size of the task is calculated so that a laborer can complete only one task in a day,



while in a piece-rate system the pieces may be small and, hence, many pieces can be completed in one day. During the demonstration project, task rates are calculated based on the average measurements of the person-day output of daily-paid workers. In Mexico, the constitution proscribed piece work by individuals and the differentiation of payments according to productivity (World Bank 1986). To navigate around this decree, the government hired entire communities through community task work and relied on peer pressure to generate high productivity. In South Africa, during the apartheid regime, labor unions opposed tying wages to productivity as one means of protecting black laborers from being overworked. In 1993, with the coming of democratic rule and the need to expand employment, the Congress of South African Trade Unions, the South African Federation of Civil Engineering Contractors, and the South African National Civic Organization agreed to a pilot program, known as the Framework Agreement, in which labor was paid according to a task-rate system.

The impact of labor legislation can vary depending on the size and type of employer. Often, different legislation applies to private and public employers and, sometimes, small employers are exempted from certain provisions. For example, during a pilot in Namibia, force account operations operated under a civil service clause that enabled them to hire and fire casual laborers without abiding by the ordinary regulatory scheme. Contractors, on the other hand, were not allowed to operate under this clause because they were private employers.

Practical application of the laws can also differ—large established firms are more easy to monitor than many smaller firms. Labor-based programs must address this issue because they employ casual laborers, who are rarely represented in workers associations or cognizant of their rights under national labor laws. Experience suggests that if this issue is overlooked, abuses of the laws can lead to labor unrest and threaten a program's prospects for expansion. In order to protect workers' rights, program designers should make sure that workers are made fully aware of the terms of employment. Programs designed to develop small-scale contractors could mandate that the contract be terminated and the license to bid canceled if the contractor does not respect national labor legislation.

## **Designs**

Design engineers can create a bias for or against the use of labor-based methods through the design, selection of materials, and choice of design standards. Designs that support the use of labor-based methods minimize the moving of earth in a longitudinal direction. Designers can reduce earthmoving by following the contours of the terrain where it is feasible (for example, in rural areas with little traffic), by locating smaller borrow pits at more frequent intervals and by achieving earthworks by cross movements rather than by extensive longitudinal movements. On sidelong ground designers can reduce the need for hauling earth long distances by building a cut/fill section, using drystone or masonry retaining walls if necessary. In flat terrain, designers can make side ditches larger than otherwise necessary to provide fill for the embankment.

The type of materials selected for a project often dictates the technology that must be used. For example, choosing graded crushed stone for the base courses in black-top surfaced roads automatically dictates the use of equipment-based methods—graded crushed stone can be readily placed by a grader and only inefficiently placed by hand. The choice of a single-size stone aggregate (railway ballast size), which is used in waterbound macadam base courses, dictates the use of labor-based method. This aggregate cannot be readily worked with machines because the fine material has to be broomed in to lock up the base. But it can be worked efficiently by hand. In addition, choosing concrete and reinforced concrete structures may dictate the use of more equipment-based methods than choosing local materials, such as treated hard wood, masonry, or brick, which may be acceptable alternatives.

In order not to bias designs against labor-based methods, design engineers must specify acceptable (not maximum) standards. For example, designing structures with lower concrete strengths and increased dimensions would allow the use of hand-broken, lower-strength aggregates. Compaction standards should also be specified with care, since these standards can also dictate the choice of technology, particularly on unsurfaced (gravel or earth) roads. Often, design engineers stipulate—unjustifiably—that the high compaction standards necessary for paved roads also be met for unpaved roads. This stipulation creates a bias for equipment-based methods—an equipment-based contractor often already owns a heavy roller, while a labor-based contractor does not. Design engineers should not overspecify compaction and tolerances so that they can only be achieved with heavy equipment.

## **Training**

Employing labor-based methods haphazardly will not make them competitive with equipment-based methods. The productivity rates for labor-based methods have been found to vary by as much as 1,300 percent, ostensibly for identical activities and site conditions (World Bank 1978b). This variation is primarily caused by differences in organization and management, such as the use of incentive schemes, and in the design and quality of handtools and complementary light equipment. In one study, better supervision was associated with substantial increases in labor productivity (Scott Wilson Kirkpatrick 1991). There is a great deal of literature on training site supervisors and contractors, much of which is available through the ILO. (Core training materials are listed in the Bibliography.)

Program designers often make training subcomponents for the private sector supply-driven, even though the striking success stories of firm growth have tended to be demand-driven (Tendler and Amorim 1996). In a supply-driven program, trainers typically provide firms with standardized training, technical assistance, and credit. Success is measured by the number of firms trained and the amount of credit disbursed. In a demand-driven program, the first issue tackled is providing firms with a market, which is then followed by technical help fashioned around the needs of small firms and, possibly finance. Unlike a supply-driven program, success is measured by the quantity and quality of works executed by the trained firms. The benefits of demand-driven training will be described further in Chapter 5.

## **4. EXPANDING LABOR-BASED ROAD PROGRAMS: ENSURING A REGULAR FLOW OF FUNDS AND DECENTRALIZING THE PROGRAM**

It has been difficult to expand labor-based programs, even in countries that have achieved the reforms discussed in Chapter 3. This lack of success is mainly attributable to the inability of governments to ensure a regular flow of adequate funds. This aspect of financial management has received insufficient attention in program design and thus warrants treatment in a separate chapter.

### **Accounting for the Effects of Insufficient Funds**

An inadequate flow of funds can have two effects on a labor-based program. First, it can delay payment to laborers and, thereby, halts or retard the speed of works. In the Dominican Republic, after a devastating hurricane in late 1979, the government's delayed disbursement to the labor-based program caused delays in the payment of wages, reduced productivity, and increased unit costs to above an acceptable level. During the Moroccan National Promotion Program, which provided 20 million worker-days of unskilled labor annually between 1961 and 1971, workers commonly abandoned the site after having worked for one or two months without being paid. Second, and often overlooked, an inadequate flow of funds can make equipment-based methods more attractive than labor-based methods to both force account units and contractors. This crucial issue is explored below.

For force account operations, cash-flow problems affect labor-based force account operations more quickly than they do equipment-based operations. Although cash shortages in equipment-based programs can affect a road agency's ability to buy fuel and spare parts, the effect is not immediate and will be less damaging politically, since laborers will not be left unpaid.

For small firms, delays in the disbursement of funds lead to delays in paying contractors, which in turn lead small firms to favor equipment- over labor-based methods (Stock 1996b). Throughout Africa, small firms have little or no access to credit facilities at local banks and are afraid to demand interest on late government payments for fear of being blacklisted. In Ghana, small firms with limited access to working capital can delay payments to material and equipment suppliers, but cannot delay payments to large numbers of casual laborers without risking work stoppages. Labor-based contractors can try to explain to their laborers why payments are late, but most laborers will not trust this explanation, suspecting that the government has paid the contractors and that they have diverted the money. When equipment-based contractors are paid late, in contrast, they need only explain that payments were late to a few permanent laborers, suppliers and equipment hire firms who either have developed a trusting relationship with the contractor or can verify these statements, unlike casual laborers. Since wages can account for more than 40 percent of overall costs, in those countries where material and equipment suppliers will accept delayed payments, small-scale contractors tend to favor equipment- over labor-based methods.

Large established contractors are also affected by payment delays but less so than force account units and small firms—for two reasons. First, unlike the other employers, large established contractors often have social or political ties to government officials who can use their influence to pressure the treasury to make payments. Second, unlike small-scale contractors and force account units, large

established contractors can borrow from banks to bridge finance gaps and pay laborers. In countries where government payment delays are extremely unpredictable, large established firms, like other employers, may be unable to use public contracts and work certifications for obtaining bank credit. For example, in Colombia, prior to 1980, the government delayed monthly payments to contractors by up to eight months, banks discounted a maximum of 60 percent of the value of the payment certificates, and contractors took recourse to the nonbanking money market that maintained interest rates up to twice the commercial bank rate (Henriod 1984). This situation was eased when the Ministry of Public Works and Transportation improved its payment procedures, bringing down to less than one month the interval between certification and payments.

Although borrowing increases the cost of works, large established contractors can raise their prices to recover the interest payments from the government. It might therefore seem that large contractors are best suited for labor-based work. But this is not the case. Large equipment-based firms prefer to execute large projects that require heavy equipment and little labor. If such projects are unavailable for a time, large firms, with their high fixed costs and low variable costs, will underbid a labor-based firm and keep their equipment employed rather than switch to labor-based methods and leave their equipment idle (Stock 1996b). Although large-scale firms would be able to underbid labor-based firms for only a short time (or they would be unable to replace their equipment), the ability to do so gives them little incentive to learn how to use labor-based methods (see the section on “The Conventional Model” in Chapter 5).

An inadequate flow of funds is often the result of poor budgetary discipline and a centralized, bureaucratic management structure. Poor budgetary discipline is common in much of Sub-Saharan Africa. In many cases, government development programs do not match government finances. Governments overextend their resources, and hence are perennially short of capital. Such a fiscal environment can exacerbate the power struggle among the various ministries for finances. Generally, ministers or permanent secretaries who are in good standing with the treasury will be better able to exact money for their programs. Like other government agencies, road agencies are often placed in a very precarious situation: politicians pressure them to produce quick results to increase citizen support, yet road agencies are often not provided with the necessary funds. In most cases, road agencies meet politicians’ demands by shifting a portion of their capital shortage to their suppliers. Suppliers, in turn, build their financing costs into their bids and pass them back to the road agency. Although a civil works industry has evolved in most countries despite these imperfect financial circumstances, such conditions make the use of labor-based methods difficult or even impossible.

A centralized management structure is also common in much of Sub-Saharan Africa and often leads to excessively bureaucratic payment procedures, which can result in payment delays. Procedures in most developing countries require considerable paperwork, signatures, and vetting, taking weeks to complete. For example, in the Honduras force account program, paying unskilled labor required thirty-five administrative steps, involving many ministries and several departments (World Bank 1986).<sup>9</sup> Also, workers had to present the following personal documents to get their wages: an identity card, a municipal tax record, and income tax liberation proof, for which they had to pay \$0.25 (1978 prices) for a form and tax stamp.

In countries pursuing the contracting route, an interim payment certificate may have to pass through twenty-five to forty-five checkpoints before it is paid—and irregular practices can delay each signature (Lantran 1993). It should be noted that in small-scale contractor programs, streamlining payment

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<sup>9</sup> In Honduras, workers also had to present the following personal documents to get their wages: (a) identity card, (b) municipal tax record, (c) income tax liberation proof for which they have to get a certificate from the Ministry of Finance paying US\$ 0.25 (1978 prices) for a form and tax stamp.

procedures often receives more attention than other aspects of expanding labor-based methods. Although important, bureaucratic payment procedures delay payments by a predictable amount of time and are thus not as serious an impediment to small firms as is an erratic flow of funds.

How can an adequate and timely flow of funds be ensured? This paper proposes two reforms: improve financial management (that is, tap a regular source of funds and protect these funds from being used for other projects), and decentralize management and finances to streamline payment procedures. An additional benefit of decentralizing the program is that it strengthens the constituency in favor of labor-based methods.

### **Improving Financial Management**

Maintaining Sub-Saharan Africa's core network of approximately 610,000 km of main roads requires an annual expenditure on routine and periodic maintenance of between \$1.5 and \$2.0 billion (1 billion = 1,000 million). But, budget allocations for maintenance rarely exceed 30 percent of requirements—because African governments are short of fiscal revenue and donors are reluctant to fund maintenance in perpetuity (Heggie 1995). Thus, the only solution for meeting maintenance requirements is improved domestic revenue mobilization. Several African countries have addressed this issue by introducing an explicit road tariff consisting of vehicle license fees and a fuel levy.<sup>10</sup> The tariff is collected independently from government sales and excise taxes, and is generally set to cover all costs of maintaining main roads and part of the costs of maintaining urban and rural roads. The remaining costs of maintaining urban and rural roads are financed by local taxes.

In reaction to the poor state of Sub-Saharan Africa's core road network, most countries and donor agencies have shifted their focus from new investment to rehabilitation. Rehabilitating the core network is estimated to require \$1.5 billion per year over the next ten years (Heggie 1995). Although the general budget can finance a portion of new investment and rehabilitation in many SSA countries, the potential for financing all investment is small: many of these economies are already in debt. The possibility of using a road fund to finance a substantial portion of road rehabilitation may also be limited. In most developing countries, road funds were created to generate a regular flow of funds for maintenance, and the enabling legislation generally attempts to protect them from being diverted and spent on new investment or rehabilitation. In Latin America, this legislation has led to narrowly-defined road conservation funds. The Honduras road fund, for example, mandates that all funds must be used for only conservation of the network. In most of Africa the function of the road fund has not been defined as narrowly. Zambia, for example, is now considering creating an additional, separate interim surcharge on fuel to be used for rehabilitation. Both fuel levies will be held separately, and reviewed and amended annually to match ongoing revenue requirements.

Given the limitations of the general budget and the road fund, SSA countries will probably have to rely on donor funding to support much of their road rehabilitation. Presently, donors contribute \$800 million per year for rehabilitation. Three issues should be addressed if donors are going to provide the principal source of financing. First, they should structure their lending policies so that they do not create a bias toward equipment-based programs. For example, donors should not base their funding on the estimated foreign exchange component cost to the borrowing country. If this is done, labor-based projects, because they require less foreign exchange, would warrant smaller loans than equipment-based projects.

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<sup>10</sup> A road tariff should not be considered a regular tax.

Second, donors must provide sufficient funding over an extended period. For example, the Ghana program was seriously threatened when the source of funding moved from donors to the general budget: payments to contractors were delayed for as long as three months—the time interval between each quarterly disbursement from the Ministry of Finance. Third, donors must demand timely disbursements of counterpart funds. In Kenya, donor funds were disbursed promptly, while counterpart payments were delayed by months. Since many donors require that the Government of Kenya finance 20 percent to 30 percent of a project, counterpart payments represent a significant share of total finance (Stone 1992). One possible solution is to let the government provide counterpart funding from an additional, separate interim surcharge on fuel.

Tapping a regular source of funds is *not* equivalent to generating a regular flow of funds. As the examples presented earlier attest, financing road rehabilitation through the general budget has been fraught with problems. In many SSA countries, the Ministry of Finance commits funds to road rehabilitation and then allows these funds to be diverted and spent on other public programs. Donors have found that their funds often experience the same fate as general tax revenue when routed through the treasury.

Unless funding for road works is protected, a labor-based program will not receive a regular and timely flow of funds. One way to protect this financing is to place it in a special account that is properly managed. Another way to protect funding for road works or to obviate the need for such protection is to increase the budgetary discipline of the treasury. Examining this possibility is beyond the scope of this paper.

The most sustainable type of special account is one that is financed by regular domestic tax revenue or user charges, such as a road fund. A road fund is held separately from the general government budget and receives disbursements directly from road tariff proceeds. These proceeds are not earmarked in the conventional sense of the word (Appendix 4). A road fund requires the oversight of a road board. Without a properly functioning road board, proceeds deposited in a road fund can still be diverted and spent on other public programs. For example, in the Central African Republic, the Ministry of Finance borrowed money from the road fund to pay civil service salaries.

In addition, a road board should represent a wide range of interests, including a core of public sector representatives (from the Ministries of Finance, Works, or Transport and from local government), and should be complemented by members representing road users, farmers, industry and commerce, and the engineering professions. Sierra Leone has one of the most representative board structures. One-third of the board represents government, one-third represents road users (the chamber of commerce, the road transport industry, and the engineering profession), and the final third is nominated by the Ministry of Works (Heggie 1995).

Donors have also established special accounts that are held separately from the general government budget. They are usually set up in a commercial bank in the name of the agency supplying the road services. For example, in 1994 the United States Agency for International Development (USAID) and the Danish International Development Agency (DANIDA) set up a special account for the Department of Feeder Roads in Ghana to pay for labor-based rehabilitation. In 1989, the World Bank set up a special account for Agence d'exécution des travaux d'intérêt public contre le sous-emploi (AGETIP) in Senegal to expedite payments to small firms (see the section "The Agency Model" in Chapter 5). Once donors had set up special accounts, they prevented the Ministry of Finance from usurping funds by having financial audits and through other means of managing the accounts.

## **Decentralizing Labor-based Programs**

Three important problems are left to be solved for expanding labor-based programs: streamlining payment procedures to make payments more efficient, creating incentives to make designs appropriate and package the works into many small contracts, and strengthening the power of the stakeholders supporting these programs. Fortunately, these three problems can be addressed in the same way: by decentralizing management decisions and finances.

## **Management Decisions**

Authority should be delegated to the level most capable of making timely and appropriate management decisions, and should be supervised ex-post. When using force account, a decentralized program enables site staff to respond flexibly to various site conditions. Without such flexibility, an entire program can be shut down while awaiting a decision from the central government, as happened in one project in Asia. There, the project was stopped when labor was no longer willing to work at the specified piece rates and the unit had to await a decision from the central government permitting revised rates (World Bank 1974). In Mexico, the Directorate-General of Rural Roads Construction was able to successfully decentralize its approach to management. It delegated authority to *Residencias Generales* (general residencies) in each of the Mexican states, which managed the planning, design, and execution of rural road construction within their jurisdictions. They also coordinated the work of special programs for the development of rural roads (World Bank 1986).

Delegating authority to local government can also result in designs that favor the use of labor-based methods. Decentralization places decision-making where heavy equipment is often less readily available, where engineers who favor equipment-based techniques are not concentrated, and where equipment-based contractors do not see big stakes (Tendler 1979a). Thus, local government entities are likely to espouse a simpler technology that favors the use of labor rather than equipment. This topic requires further field corroboration.

When contracting out, decentralizing management decisions creates incentives for government officials to package works in ways that favor labor-based methods. In Brazil, for example, the state politicians in Ceará gained political support by packaging purchases into many small contracts. In this way, they were able to purchase from small producers inside the state and disperse the benefits of procurement among many local firms. The politicians went out of their way to advertise that they were “coming to the rescue of local industry,” and reducing problems of unemployment (Tendler and Amorim 1996).

Whether a program uses force account or contracts out, a decentralized management structure has the additional benefit of enlarging and strengthening the domestic constituency in favor of labor-based methods. In centralized programs, often the only stakeholders supporting labor-based methods other than the donors financing the program are the small farmers in rural areas who work on the road sites, and the small-scale contractors who have little access to equipment. In decentralized programs, however, the set of stakeholders grows to include local civil servants. These civil servants support labor-based methods because of their simplicity—they enable civil servants to manage road works that would have been managed at a higher level if carried out with equipment-based methods. In addition, decentralization often makes it easier for the supporters of labor-based methods (the contractors, the local officials, and the small farmers who work as laborers) to press their demands on government, since they may have more power at the local level and are closer to where management decisions are made. Close proximity reduces

beneficiaries' costs of organizing and presenting themselves to the local government unit if payments are delayed. This topic requires further field corroboration.

### *Finances*

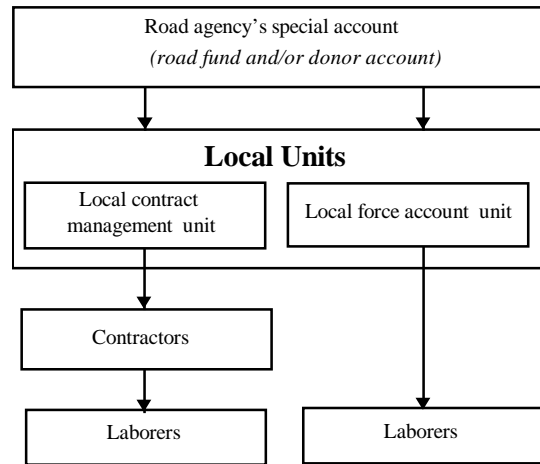
In many cases, finances should also be delegated to the level responsible for making management decisions, herein called "local units" (Figure 4.1). There are three ways to decentralize funds to local units: disburse funds directly, settle bills periodically after approved work has been completed, or disburse funds on a conditional basis and undertake technical and financial audits ex-post.

The first method is the simplest, but it does little to strengthen financial discipline. Funds are simply disbursed directly to each local unit, which then has to account for its spending behavior within the usual government audit framework. Often, this framework is weak and does not promote accountability. The second method requires more oversight by the manager of the special account. This method imposes discipline on each local unit ex-ante in that funds are only disbursed once the local unit provides evidence that the work has been carried out satisfactorily. Although this method creates accountability, it may be unsuitable for labor-based work. If it imposes rigorous procedures requiring many steps and endorsements, it may delay disbursement of funds to pay laborers.

Because in the third method, financial and technical audits take place after works have been completed, this method facilitates rapid and timely payments to local units. Sometimes, as with donor financing, this type of disbursement takes the form of a revolving fund, and any eligible disbursements from this fund are replenished regularly from the special account. For example, in the Mexico Decentralization and Regional Development Project, the Treasury opened a revolving account for each state at a correspondent bank through the Banco de Mexico. After agencies execute their projects, they prepare "Statements of Expenses" and submit them for payment at the designated bank. The funds are then reimbursed from the special account at the Central Bank (Gopal and Marc 1994).



**Figure 4.1: Disbursing Funds**



Ghana has also experimented with disbursing funds and undertaking technical and financial audits ex-post. As part of a new maintenance program, the Department of Feeder Roads transfers money from the road fund to the regions on a quarterly basis and then audits the regions' accounts after road works are completed. This system has expedited payment to contractors because: the money to pay contractors' interim certificates is always available before work is completed, the interim certificates themselves require fewer signatures before funds are released (work needs to be certified only by the regional engineer and regional planning officer), and contractors can pick up their check closer to their office rather than having to travel to the capital. In fact, at the regional level, contractors can have their sites evaluated and be paid on the same day. Zambia also offers an important example of decentralized finance (Box 4.1)

Some difficult challenges to decentralization should be mentioned here. First, program designers must select a level at which to manage and finance road works that has appropriate personnel and experience—or where this capacity can be built. Second, in the case of contracting works, if a local unit creates a development budget that stretches beyond its financial means, it can make up for its financial shortfall by requiring contractors to fund projects through completion using their own money. This measure can inadvertently favor the use of equipment-based methods. One district in Ghana, for example, only pays contractors three months after the project is completed, thereby preventing small firms from participating and favoring the use of equipment-based methods. Third, stakeholders favoring the present system may resist decentralizing finances. For example, in the case of contracting works, government officials in the capital may be using their position to exact gratification payments from contractors and will probably be unwilling to see this additional source of income removed.

**Box. 4.1 Lessons from the Decentralization of Road Fund Finances in Zambia**

The Zambian Road Board has developed an innovative approach to decentralizing finances to the district level. Decentralizing finances is the second phase of a plan to generate district-level capacity. In the first phase the Board appointed one Zambian engineering consultant per province to act on behalf of the district councils and help them plan a maintenance program that the Board could finance. In the second phase, the Board decentralized finances to the district level to encourage the districts to view themselves as the employer and expanded the role of the consultant to include “watching over” these finances. For each district council, the Board opened a local bank account from which money could be drawn only with joint signatures from a council member and the consultant. In this way, the Board used the private sector to monitor the public sector—and increased fiscal accountability.

It should be noted that decentralization is not the only way to streamline payment procedures. Program designers can streamline payment procedures by delegating finances to a single individual or a single department within a central ministry office. Delegating finances to an individual has proved successful in Burkina Faso. There, the Director General of Public Works is able to pay contracts without delay because he has full authority to procure works valued at less than \$176,000 and full access to an advance fund and a bank account at a commercial bank (Lantran 1993). This practice comes under the “one-stop window” principal, which has recently been applied in Africa, for example, to regroup and simplify the procedures governing investment and the creation of companies, and to regroup and simplify the formalities for requests for foreign exchange and import authorizations. Although these methods expedite payments, they do not help strengthen a constituency in favor of labor-based methods.

## **5. DELIVERY MECHANISMS FOR EXPANDING LABOR-BASED METHODS**

Initiating projects is important for achieving needed reforms. If properly designed, projects help demonstrate the technical and economic feasibility of labor-based methods, thereby building support for the technology, and enable program designers to refine specific reform strategies through an iterative process. In order to launch a labor-based program, designers must select a delivery mechanism that is suitable for the country. This choice can affect the program's ability to achieve its defined objectives and expand in the future. This chapter discusses the various delivery mechanisms. Then, Chapter 6 compares their strengths and weaknesses to assist program designers in selecting one that is optimal given a country's environment, resistance to reform, and stated objectives.

### **Three Approaches to Civil Works in Developing Countries**

Since the 1960s, developing countries have used two types of production arrangements to carry out civil works: force account and contracting. Contracting itself has two approaches: using established contractors and developing small-scale contractors. In countries that have used force account, public agencies have supervised, managed and controlled their machines and labor directly. Countries that have used established contractors have either relied solely on foreign firms to execute works or have encouraged the establishment of a domestic contracting industry. Ghana is one of the few African countries that, after independence, began developing a local road contracting industry.

By 1991, 146 contractors were registered for equipment-based paved and unpaved road construction, rehabilitation and maintenance. Of these, ten could tender up to about \$2 million, and four could complete works up to any value. Countries that have traditionally used small-scale or "petty" contractors have tended to support policies that package civil works projects into a large number of small contracts, encourage subcontracting, and limit the importation of heavy equipment. Such countries are predominantly found in Asia. India, for example, supported petty contracting by discouraging small contractors from equipping themselves with heavy machinery and by packaging civil works projects into a large number of small contracts varying in value from \$10,000 to \$100,000 (1976 prices) per year (World Bank 1976). Such small contracts are not only appropriate for small-scale contractors, they also deter large contractors from competing. Unlike the experience in a number of Asian countries, supporting the development of small-scale contracting is relatively new in African and Latin American countries.

In order to expand the use of labor-based methods in the road sector, one must understand the delivery mechanisms within each of the three approaches discussed above. Although there are as many delivery mechanisms as there are designers to conceive them, one can discern general themes or similarities. At the simplest level, understanding a particular delivery mechanism means simply understanding who does what and how that relationship is defined—or, which entity is responsible for each aspect of the project process and how the contractual relationships are drawn up. The responsibilities involved are:

- Selecting and financing works to be executed,
- Designing works and, if contracted out, preparing contract documents,

- Monitoring works including measuring works, conducting inspections to ensure compliance with specification and arranging acceptance tests,
- Executing works, including arranging for specialist work, supplying equipment and labor, and providing superintendence.

This chapter focuses predominantly on assigning responsibility for monitoring and executing works. This paper does not discuss the issues of who designs the works and, in the case of contracting, who prepares contract documentation. These issues generally do not affect the choice of labor-based or equipment-based methods. The entity responsible for selecting and financing road works is herein referred to as “the employer.” An employer can be a public agency, a community, or an individual. Although this paper draws most of its examples from cases in which the employer is the government, the same or similar delivery mechanisms can be used if the employer is a community or an individual. (For further information on procurement with community involvement see Gopal 1995.)

This paper discusses six basic delivery mechanisms (Table 5.1 and 5.2). The force account arrangement provides only one delivery mechanism for expanding labor-based methods: the force account model (next section). There are two delivery mechanisms for expanding the use of labor-based methods among established contractors: the conventional model, whereby an established contractor hires labor directly (section on “The Conventional Model”), and the subcontracting model, whereby an established contractor or firm subcontracts the portions of the projects that are labor-based (section on “The Subcontracting Model”).

There are three delivery mechanisms for expanding labor-based methods among small-scale contractors: the government-run model, whereby the responsibility for all aspects of contractor development (including small contract administration and payment) lies with the government road agency (section on “The Government-run Model”); the agency model, whereby the responsibility for all aspects of contractor development (including small contract administration and payment) lies with an independent nonprofit management agency or with a for-profit consulting firm (section on “The Agency Model”); and the development team model, whereby this responsibility is divided among the employer, a construction manager, and a materials manager (section on “The Development Team Model”).

**Table 5.1 PRODUCTION ARRANGEMENTS, APPROACHES, AND BASIC DELIVERY MECHANISMS FOR EXPANDING LABOR-BASED METHODS**

<i>Production Arrangement</i>	<i>Force Account</i>	<i>Contracting</i>				
<i>Approach</i>	<i>Force Account</i>	<i>Using Established Contractors</i>		<i>Developing Small-scale Contractors</i>		
<i>Delivery Mechanism</i>	<i>Force Account</i>	<i>Conventional</i>	<i>Sub-contract</i>	<i>Govt-run</i>	<i>Agency</i>	<i>Development Team</i>
Diagram						
Countries (examples)	Benin, Botswana, Burundi, Cambodia, Chad, Columbia, Dom. Repub. Ethiopia, Honduras, Indonesia, Kenya, Laos, Lesotho, Malawi, Mozambique Namibia, the Philippines, Rwanda, Tanzania, Thailand, Zambia, Zimbabwe	South Africa	India, South Africa	Benin, Cambodia, Ghana, India, Indonesia, Kenya, Lesotho, Madagascar, Namibia, Nepal, Sierra Leone, South Africa Tanzania, Uganda, Zambia	<b>AGETIP:</b> Benin, Burkina Faso Chad, The Gambia, Guinea-Bissau Madagascar, Mali, Mauritania, Niger, Senegal, Tanzania <b>Consulting Firm:</b> South Africa	South Africa

*Note:* Arrows represent contractual relationships, broken lines represent employment relationships, and unbroken lines represent other relationships.

**Table 5.2 ASSIGNING RESPONSIBILITIES FOR EACH BASIC DELIVERY MECHANISM**

Delivery Mechanism	Selecting & Financing Works	Designing & Monitoring Works	Executing Works		
			Materials Management <sup>b</sup>	Construction Management <sup>c</sup>	the Actual Works <sup>d</sup>
Force Account	Government				
Conventional	Employer	Employer or Consulting Firm <sup>a</sup>	Established Contractor		
Subcontract	Employer	Employer or Consulting Firm <sup>a</sup>	Established Contractor	Small Contractors	
Govt. run	Employer	Employer or Consulting Firm <sup>a</sup>	Small Contractors		
Agency or Consulting Firm	Employer	Consulting Firm	Consulting Firm or AGETIP	Small Contractors	
Development Team	Employer	Employer or Consulting Firm <sup>a</sup>	Consulting Firm and/or Established Contractor	Small Contractors	

- a. For each project, an employer can decide whether or not to pass the responsibilities for designing and monitoring works to an engineering consulting firm.
- b. Includes procuring, storing, issuing, and accounting for materials if required.
- c. Includes arranging for specialist work, arranging for the supply of equipment, providing bridging finance for small contractors' tools and wage payments.
- d. Includes supplying labor and providing superintendence.

### The Force Account Model



In the force account (departmental force) model a public agency carries out all aspects of construction in-house, directly supervising, managing and controlling its machines and labor. Kenya provides an interesting example of force account operations in Sub-Saharan Africa, because it has implemented labor-based methods on a relatively large scale. The Rural Access Road Program constructed 8,120 km of access roads between 1974 and 1992. In 1986 the program was gradually transformed into a labor-based rehabilitation program for classified minor roads, called the Minor Roads Program. Between 1986 and 1994, the Minor Roads Program rehabilitated 3,381 km of minor roads, of which 2,816 km were graveled. Furthermore, in 1993-1994 alone, the program employed 11,125 casual workers and 1,397 permanent staff (Kenya 1994). This program employed primarily low-income residents, more than half of whom earned wages for the first time; created the means for to market surplus food crop and livestock production; increased cash earnings from both farm and nonfarm sources; and contributed to reducing the gap between upper- and lower-income groups.<sup>11</sup>

<sup>11</sup> These are the findings of a monitoring and evaluation study financed by the Government of Kenya and various aid agencies. The findings are based on a two-year study of 828 households in a selected impact area of the Rural Access Road Program.

## *Problems and Challenges*

The problems that program designers face when using a force account model to expand labor-based methods are not necessarily different from those faced when using equipment-based methods. Force account operations tend to be inefficient for a variety of reasons. First, bloated payrolls may mean that more than three-fourths of disbursements to local force account units are spent on government salaries rather than on works. Second, force account units often have ineffective management structures: accounts are kept on a cash basis, investments are written off as cash expenses as soon as they are incurred (that is, road agencies do not depreciate assets or keep a balance sheet), and the accounting system uses very broad cost headings that are highly aggregated. Most road agencies, therefore, cannot tell how much they spend on road works (Heggie 1995). Third, the force model does not introduce an intermediary between the government and the laborers. Consequently, as labor-based programs expand, increasingly more complex administrative structures must be developed to make timely payments to thousands of laborers working at many different road sites.

In the force account model, salary schemes make government employment unattractive for engineers, and regulations require that the supervisory staff have advanced education. Unattractive salary schemes hinder a road agency's ability to work. Often, higher-level employees move into the private sector, where salaries are more attractive, take on other full-time jobs during regular working hours, or enhance their salaries by exacting gratification payments. Regulations that require supervisory staff to have advanced education can also prevent a program from functioning efficiently. In Honduras, for example, the central recruiting agency of the government required that all technical key positions be filled by candidates holding a university engineering degree—even though the best middle-level managers for labor-based works have often had little schooling (World Bank 1986).

The force account model is also affected by cumbersome government procurement regulations. These can lead to problems procuring high-quality tools and materials close to the road site and problems maintaining light equipment. For example, in Kenya, inferior quality agricultural tools were used because the Supply Branch of the Ministry, in line with government policy, insisted on awarding tenders to the lowest bidders, regardless of the quality of their work (World Bank 1986). In 1978, this problem was corrected by requiring the Supply Branch to purchase handtools that complied with the Kenyan Bureau of Standards quality. Then manufacturers, who were represented on the relevant Kenya Bureau of Standards committee, complained that these standards were unrealistically high and would make the tools too expensive for the majority of the purchasers who were farmers. The Kenya Bureau of Standards therefore agreed to reduce the relevant standards without the knowledge of the Minor Roads Programme.

In Lesotho, government procurement regulations obliged the Labor Construction Unit to procure materials far from the work site even though the same materials were available nearby. In one example a force account unit working in a remote part of the highlands wanted to procure cement from the least expensive store nearby, but the Labor Construction Unit's head office was obliged to advertise and tender the request. Unfortunately, the only cement suppliers who responded to the advertisement were based in Maseru. Thus, the Labor Construction Unit was forced to buy the cement in Maseru and transport it over gravel and earth roads to the remote road site in the highlands.

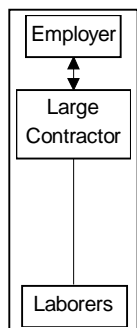
Maintaining equipment has also been a much-discussed problem for government agencies—and labor-based operations have not been excluded from these difficulties. For example, in Kenya, light equipment was so poorly maintained that, according to a 1981 survey, the availability of tractors and trailers was only slightly higher than 50 percent (World Bank 1986). In Lesotho, government procedures require that the Labor Construction Unit repair all of its machines at the Plant and Vehicle Pool Services, which is inefficient. This mandate raises the cost of works for the Labor Construction Unit relative to a contractor, who can rent equipment from the private market.

### *Possible Solutions*

By creating an autonomous road agency, the government can press for the introduction of sound business practices to ensure that it gets value for money. Road boards can also play a role in this reform. When road work is funded by a road tariff, road users will generally support the introduction of sound business practices. Road users expect clear management objectives, competitive terms and conditions of employment, consolidated budgets, commercial costing systems, and effective management information systems. They may also press for the ability to gradually contract out the services that are performed in-house.

An autonomous road agency is also in a better position to introduce the practice of basing promotions on performance rather than length of service and can place less-educated personnel in site management positions. For example, when the Ghana Highways Authority gained its autonomy and was no longer tied to civil service employment regulations, it quickly introduced a new reward and careers systems (Heggie 1995). An autonomous road agency can also free up procurement by enabling force account units to procure appropriate, high-quality tools for labor-based works and repair or rent their own machines within the private sector.

### **The Conventional Model**



In the conventional model—commonly used in most of Sub-Saharan Africa for equipment-based works—an employer makes a unit-rate contract directly with an established contractor to execute works using labor-based methods. If the employer has limited professional and managerial resources, it may choose to contract out various project responsibilities to the private sector. For example, employers often pass to the private sector the responsibilities of the “engineer”: administering the contract, checking the setting-out, measuring the works, conducting inspections to ensure compliance with specifications, and arranging for acceptance tests. Employers also often pass to the private sector the responsibility of designing the works, preparing the contract documents, advising on materials, and coordinating programs. In both cases, the employer passes these responsibilities to the private sector by signing a contract with either one or two civil engineering firms. Although these firms are often involved in the models, they are not focused on in this paper since they do not affect the degree of employment achieved.



## *Problems and Challenges*

Established contractors are averse to adopting labor-based methods, even where low wage rates make them appear more profitable. Recent research has found several explanations. First, labor laws often discourage large firms from switching to labor-based methods (as discussed in the section on “Labor Laws” in Chapter 3). In most countries, large established contractors are bound by minimum wage laws and union agreements on hiring and firing. This obligation generates concerns about excessive dependence on the labor force and about potential unrest resulting in the escalation of wage levels (Henriod 1984). Because the contractual relationship between the established firm and the employer is unit-rate in nature, the established firm must bear a large proportion of the risk of using labor (high absentee rates, unrest, and so on). Second, large firms own equipment that they do not want to leave idle. For established contractors, the essential difference between using labor-based methods and equipment-based methods is the composition of costs. Equipment-based methods have high fixed costs and low variable costs. The reverse is true for labor-based methods: monthly wage payments often make up 40 percent or more of total project costs. Large established contractors prefer to use their equipment and pay lower variable costs rather than substitute labor, even when labor-based methods are less costly than equipment-based methods based on unit-rate buildups (Stock 1996b). Third, labor-based methods require more working capital than equipment-based methods—something that may not be easy to obtain from financial institutions in an environment where payments to contractors are delayed (see the section on “Accounting for the Effects of Insufficient Funds” in Chapter 4).

## *Possible Solutions*

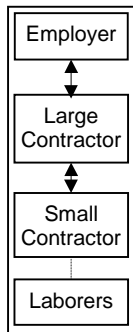
It may be possible to encourage established contractors to use labor-based methods through labor requirements or contract method specifications. These options, however, should only be considered in countries that have sufficient capacity to monitor and regulate contractors. Even in South Africa, which has such capacity, these methods have proven unsuccessful. For example, from 1985 to 1990, through the Special Employment Creation Program, the South African government committed \$314 million for “labor-intensive” construction and maintenance.<sup>12</sup> Although this program was never evaluated systematically, observations suggest that rather than being labor-intensive, this program was labor-extensive. Laborers were hired but were not given the opportunity to be productive (McCutcheon, n.d.). This poor result of the Special Employment Creation Program has been attributed to large contractors being encouraged to use labor-based methods through contract clauses such as “make greater use of labor wherever feasible,” and designs and specifications that were biased toward capital-based construction.

When established contractors use equipment-based methods and then hire laborers for nonproductive activities, there is a danger that these contractors will hire based on nepotism, not skill. For example, in Senegal, large established contractors tended to recruit members of their extended families when forced to meet labor requirements. Rather than narrowing the gap in wealth distribution, this practice does the reverse. Contractors can retain more of their profit if the contract management agency supports their extended families. Method specifications, the other alternative that more or less dictates the extent of using different proportions of labor or equipment, are also not ideal because they transfer some of the risks and responsibilities inherent in civil construction from the contractor to the government and also may discourage the contractor from innovating.

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<sup>12</sup> Disbursement was converted to US dollars by using the average Rand-to-dollar exchange rate over this period (0.44).

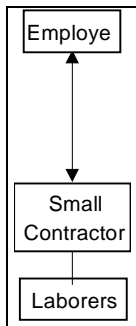
## The Subcontracting Model



In the subcontracting model an employer signs a contract with an established contractor to execute works, and the contractor then subcontracts the labor-based portion of the works to smaller firms. The established contractor often takes responsibility for material acquisition and control, plant hire, setting-out, and administration and quality control. The only responsibility left for the small-scale firms is managing labor. This model is used predominantly in Asia. Although it tends to generate more employment than a model in which an established contractor uses heavy equipment, it has some inherent problems. First, the substitution of labor for equipment will be minimal—established contractors will use their equipment for most activities and hire labor-only contractors for the few activities that do not lend themselves to equipment-based methods. Second, subcontracting is often attractive to established firms only if they can shed responsibility for having to comply with labor laws. Unlike established firms, small-scale contractors are often numerous and difficult to monitor. Thus, the attractiveness of this model depends on the legal environment guiding subcontracting. In countries where established contractors bear a large portion of the risk (that is, they are held responsible for accidents and strikes), this model may not prove very attractive. Tax laws can also affect the desirability of this model. Subcontracting is better facilitated in those countries that have a value added tax compared with countries that levy taxes on each individual contract.

One interesting hybrid of the subcontracting model is the franchise model, in which a large contractor or material producer grants the right or license to market its goods or services to a small-scale contractor. This model has yet to be implemented in a developing country, and its scope for encouraging the use of labor-based methods appears to be small. Although there are many benefits to this model in terms of risk-sharing, it seems to be suitable only for countries with large suppliers of building materials. For example, COLAS, a large international bitumen manufacturer, is interested in using this model in South Africa. The model is beneficial for COLAS because labor laws and regulations will be passed on to the franchisee. COLAS protects itself from future competition by teaching the franchisee only how to use the bitumen product and not how to convert raw bitumen into usable bitumen. This model is beneficial for the small-scale contractor because COLAS will provide the capital, training, and quality control. In general, large firms will only provide technical and financial assistance to a franchisee when the franchiser is one of many suppliers of a particular good or service in a competitive market.

## The Government-run Model



In the government-run model, a government road agency makes a unit-rate contract with small-scale contractors to execute works but retains responsibility for all aspects of contractor development—from preparing contracts, to tendering them, to monitoring and paying contractors. To develop small-scale contractors, the government agency must often undergo substantial reform. First, the agency must generate or expand its access to vehicles and trained personnel for monitoring contracts. Second, the agency must package works into sizes that small-scale contractors can manage. Third, the agency must help small-scale firms to gain access to essential equipment (such as small rollers). This can be done either directly, through plant pool hire, or through leasing arrangements. Hire-purchase arrangements may delay competitive tendering beyond an acceptable point and should be approached cautiously (see Appendix 5).<sup>13</sup>

Many international experts also encourage the introduction of simple contract documents for small-scale contractors. Whether or not this practice should be considered depends, in part, on the objective of the program. If the program is designed to develop small-scale contractors so that those who are successful can eventually compete with larger established contractors, the program may prefer to use internationally recognized documents together with a short and simple commentary to guide small-scale contractors through key provisions. If, on the other hand, the program is targeting very small contractors (that is, routine maintenance contractors), who may never be able to compete with larger, established firms, the program may prefer to introduce documents that use simple language.

In 1986, Ghana became the first SSA country to launch a program introducing labor-based methods in the local road contracting industry. The World Bank and the United Nations Development Program (UNDP) provided financial assistance for the project, and the ILO provided technical assistance. This program was designed to benefit rural casual laborers living within the vicinity of the road works. It paid laborers using a task-rate system and included a training course for contractors and their supervisors. The program also helped to establish a hire-purchase agreement so that contractors could purchase a set of light equipment worth \$160,000. Between 1986 and 1994 the program created about 2.6 million worker-days of employment, paying out \$1.4 million in wages and rehabilitating 1,190 km of gravel roads. In addition, during the pilot, labor-based methods were shown to cost 10 percent to 25 percent less than equipment-based methods.

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### *Managing Many Small Contracts*

The first challenge in implementing this model is monitoring and administering many small contracts. Contracting with small-scale firms is often viewed as a major headache—small-scale contractors are thought to have higher costs, lower quality work, and unreliable completion times. Also, working with them requires preparing small contracts for small amounts, which means more work overall for the government agency (Tendler and Amorim 1996). Road agencies may have difficulty responding to such an increase in workload, because, in many instances, they are under pressure to downsize and are forced to operate with unattractive salary schemes.

One solution to the problem of unattractive salary schemes is to create an autonomous road agency. Such an agency can respond to an increase in workload by improving the terms and conditions of employment (as discussed in the section on “Possible Solutions to the Force Account Model”). A second solution to this problem is to delegate authority and financial management to the appropriate level of government. This can enable local government units to share the burden of administering and monitoring many small contracts.

### *Easing the Impact of Payment Delays*

The second challenge to this model is reducing the effects of payment delays on small-scale contractors. Although the issue of payment delays was discussed in Chapter 4, it requires further discussion here because it affects small-scale contractors so severely. Two additional means of addressing this problem include creating or strengthening contractor associations and providing contractors with working capital.

Within functioning democratic regimes, contractors' associations can pressure the government to make timely payments. In Ghana, for example, the labor-based contractors union successfully argued its case with the government when individual contractors had been unable to do so. In Peru, the Chamber of Construction was powerful enough to add a new contract clause providing contractors with accrual of interest on delayed payments in the standard conditions of contract. This contract clause pressured the contracting agency to pay promptly and by the most expeditious means. In some cases, payment instructions were issued by telex or telegram when, in the past, they had been issued through slow ministerial channels. The Peruvian Chamber of Construction also collaborated with the government and trade unions in running a vocational training institution established for the construction industry (Henriod 1984). Contractors' associations can also facilitate access to insurance bonds and guarantees if an individual firm does not have sufficient collateral.

Contractors will be less sensitive to delays in government payments if they have access to working capital.<sup>14</sup> Governments or donors can help contractors gain access to working capital by creating financial intermediaries or by helping contractors directly. Some countries have established banks dedicated to financing the construction industry. In Mexico, where the government makes timely payments to contractors, the Banco Nacional de Obras y Servicios Públicos (BANOBRAS) has, since its establishment in 1933, supported the Mexican construction industry by providing short-term loans to public works contractors. BANOBRAS advanced funds against the security of an assignment of the contractors' receivables from the government agency sponsoring the project. In other words, each contractor instructed the contracting agency to pay the contractor's advance payment and all monthly certificates to an escrow account with BANOBRAS. BANOBRAS then kept a close watch on the

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<sup>14</sup> Access to working capital is the key issue here, not subsidizing working capital.

contractor's physical progress on site and financial performance, and released funds following schedules and procedures agreed with the contractor. In this way, contractors were freed from the uncertainty and effort of collection. As part of its trust activities, BANOBRAS also operated a special fund that provided up to 25 percent of the full value of a project. This funding was used to finance contractors' start-up costs of construction (Henriod 1984). Donors have also played a role in providing working capital for small firms. For example, the European Union (EU) has set up a facility that allows small and medium-size entrepreneurs to establish direct credit lines (Rausch 1994). One should approach this solution carefully, however—the success of these credit schemes depends on the government making timely payments to contractors which, in turn, reduces the bank's risk.

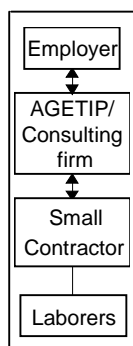
In pilot projects the government or donors often set up mechanisms to directly help contractors access working capital. For example, the government may pay for labor costs on a monthly basis according to certified payrolls submitted by the contractor. These interim payments guarantee regular payments to the workers and can be deducted when the work certificate is paid. But although these systems minimize working capital constraints during the pilot, they are often difficult to mainstream, because they place too large an administrative burden on the government. In addition, government officials may come to see small-scale contractors as being "spoon-fed," and this type of resentment can undermine the labor-based program.

Another mechanism that has been developed and mainstreamed is having the government provide contractors with a mobilization advance—worth a percentage of the contract value—before work actually starts. This advance can then be deducted over time from interim payments. In Tanzania advances can be as high as 30 percent for small contractors, provided not more than 15 percent goes toward equipment purchases.<sup>15</sup> The state of Ceará in Brazil provided small-scale enterprises with a 50 percent cash advance. It then minimized the risk of default by organizing small enterprises into associations. If one enterprise did not deliver the contracted products, the other enterprises in the association would have to make up the difference (Tendler and Amorim 1996). Similarly, a government can include in each certificate an advance covering a proportion of the estimated value of work that will be completed in the period between certification and payment. The amount of such an advance could be made to depend on the contractor's performance and progress.

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<sup>15</sup> The equipment ownership document is then held by the ministry until the advance is recovered.

## The Agency Model



Rather than enabling a government road agency to do business with small-scale contractors through reforms, program designers can set up an independent contract management agency outside the government to handle the burden of administering and monitoring many small contracts. In this model, an employer hires an “agency”—usually on a cost-plus-fee basis—to manage small contracts and train small-scale contractors. These agencies then make contracts directly with small-scale contractors to execute civil works. Also, they often make contracts with local consultants—to prepare designs and bidding documents and to supervise works—in order to keep their own employment to a minimum. In this model, the agency can be either nonprofit or for-profit.

The model for non-profit contract management agencies is the Agence d'exécution des travaux d'intérêt public contre le sous-emploi (AGETIP) in Senegal. AGETIP was established in 1989 as a private non-profit NGO with the following objectives: creating employment, particularly in urban areas; providing vocational training to improve the operational efficiency of the local construction industry and the effectiveness of public institutions; demonstrating the scope for increased application of employment-intensive construction technologies; and executing public works that are worthwhile both economically and socially. AGETIP has been given the mission of "owner's delegate" for a program of small and medium-size labor-based public works and therefore manages every aspect of the project, including inspection. As of January 1993, Senegal's AGETIP had implemented 330 projects for a total of \$54,788,000, and its overhead had amounted to only about 5 percent of its turnover (Péan 1993). To date, donors have channeled a growing share of external funding for infrastructure development in Sub-Saharan Africa through such agencies.

Although AGETIP has been instrumental in increasing employment in Senegal, it has had limited success in the road sector for two reasons. First, AGETIP requires road contractors to own a certain set of heavy equipment. AGETIP therefore predominantly contracts with large established contractors. Second, AGETIP encourages contractors to employ more laborers by stipulating in the contract documents that 8 percent of the total costs of the road project must be spent on labor wages. This percentage is not very high compared with road works in Ghana where wages make up 40 percent of contractors' total project costs. In addition, requiring contractors to spend a percentage of total costs on labor wages does not encourage them to use labor productively—they can begin to meet the labor obligation by “hiring ten watchmen instead of two.” It should be noted here that AGETIP's limited success in expanding labor-based methods in the road sector is not a function of weaknesses in the model itself, but rather a function of the way in which AGETIP set about to increase employment. An agency model that contracts with small firms, rather than large ones, can be an important tool for expanding labor-based methods in the road sector.

A for-profit engineering consultant can be hired on a fee basis to play the same role as an organization such as AGETIP. One example of a consulting firm that manages contracts comes from South Africa, where, in 1986, an engineering consulting firm managed municipal public works contracts for small-scale contractors in Ilinge, Transkei. There, an engineering consulting firm acted as an agency for urban service upgrading. The agency signed contracts with forty-two small contractors and created approximately 600 jobs (NEF 1994).

The agency model teaches an important lesson for small-scale contractor development. Unlike most assistance programs that have a supply-driven approach—that is, they provide technical assistance or credit to small firms—the agency model has a demand-driven approach—it creates a market for small

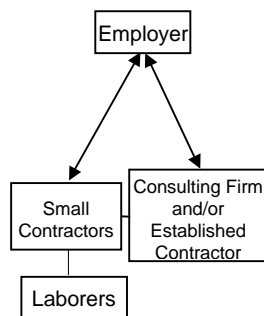
firms by “freeing up” procurement. The agency model does so by dividing up works into many small contracts and providing prompt payments for works completed. Firms gain access to training based on successful tendering. Once firms win a contract, they become eligible for training, which is provided by the contract management agency either in-house or through contracting with a training firm.

The private agency model has been deemed more efficient than government agencies—success that can be attributed to two factors. First, private agencies can avoid many of the problems faced by government agencies. Unlike a government road agency, a private agency can pay its employees high salaries and therefore attract well-motivated, high-caliber staff and streamline procedures for payment and procurement. Second, donors can have private agencies externally monitored (for example, the World Bank’s arrangement is for AGETIP to have bimonthly management audits, biannual financial audits, and annual technical audits), a power they do not have over government agencies.

A key difference between a for-profit consulting firm and a nonprofit NGO is the former’s ability to provide bridging finance for contractor payments when disbursements from the employer are delayed. For example, it appears unlikely that AGETIP would be able to function efficiently if it were financed from Senegal’s general budget—its nonprofit status might prevent it from borrowing money in financial markets to bridge any financing gaps caused by erratic disbursements from the general budget. A for-profit consultant, on the other hand, may be better able to handle delayed disbursements (up to a point), because it can raise funds from financial markets more easily. The consultant can then pass this cost back to the government through the fee mechanism. Of course, if employer disbursements are so erratic that consultants do not feel that they will be able to service any loans, they will not provide bridging finance.

Program designers must be careful when using the agency model. First, when establishing a private nonprofit NGO, a program designer must be careful not to create a monopoly situation. If the NGO never faces competition from other NGOs it will be difficult for the employer to ascertain whether the NGO is managing contracts efficiently. Second, program designers must also carefully generate the type of contractual arrangement it makes with an agency. Consultants and organizations like AGETIP are commonly contracted on a cost-plus basis, and experience from South Africa illustrates some pitfalls with this contractual arrangement. For example, one project was marred by extensive cost overruns, and workers and contractors pressured the consulting firm to prolong the project for as long as possible in order to retain a source of income. Finally, program designers must be careful not to overlook the need for training for both contractors and consultants in labor-based work methods and to provide the necessary guidance for appropriate light equipment and tools.

### The Development Team Model



The development team model recognizes that civil works comprise four functional areas: construction management, materials management, materials supply, and the works (labor and equipment). The employer assigns different functional responsibilities to different actors: the work is contracted out to a small-scale contractor, materials management and supply is contracted out on a fee-basis to a material manager, and construction management is contracted out on a fee-basis to a construction manager. The contractual relationships between the various actors dictate the incentive structure. Contractors enter into a contract directly with the employer and are therefore motivated by profit to successfully complete their contracts. The construction manager and materials manager, in contrast, are separately appointed by the employer on a fee basis and are

therefore motivated by their interest to secure another appointment.

The materials manager and construction manager may be either consulting firms or established contractors. They make up the development team and provide the necessary support to emerging contractors. The construction manager is required by the terms of its agreement, to ensure that the contractor makes satisfactory progress, shows technical competence in the execution of all aspects of the works, and generally fulfills the contractual obligations to the employer. The materials manager is required by the terms of the agreement, to procure, store, and issue to the contractor, on behalf of the employer, materials for the construction of the works and to account for the quantities of materials used.

The development team model is flexible and permits the successive introduction of responsibility for labor, materials, equipment, and finance to small-scale contractors as they develop. For example, once a small-scale contractor is capable of supplying its own materials, the employer no longer needs to appoint a materials manager. And once a contractor can perform all four functions, the employer no longer needs the service of the development team.

This model was developed in South Africa with the Soweto City Engineers Department acting as the employer. Its objective was to create employment opportunities for Soweto residents, stimulate the development of competent contractors among the Soweto population, and retain as much of the expenditure within Soweto as possible (Watermeyer and Band 1994). At the outset of the program, no Sowetan owned or operated a civil engineering construction company. Between 1988 and 1994, about thirty contractors successfully completed contracts on time, delivering products of the required quality. The peak aggregate employment was about 900 people. More than \$15.8 million was spent upgrading the water supply system and constructing the residential roads (which is a sum comparable with conventional construction).<sup>16</sup> In addition, between 30 percent and 65 percent of expenditures was retained within the community, depending on the type of works being executed.

The Soweto City Engineers Department has reduced its risk of contracting with small entrepreneurs by carefully structuring the program. At the first level, the department tenders small contracts of short duration, signs labor-only contracts with the new contractors, pays these contractors fortnightly and only for completed works, retains 10 percent of each invoice, hires a development team to support the contractors, and requires that the developmental team members carry professional indemnity insurance (Watermeyer and Band 1994). Thus, if a new contractor walks off the job, the employer holds 10 percent retention and will lose less than fourteen days of wages. If the employer determines that the quality of works is unsatisfactory, it can sue the construction manager or, if poor quality materials were used, the materials manager. At each successive level, the contractor's responsibility and risk-bearing increases while the management function of and risk borne by the professional team falls (Soweto Project Team 1992).

This model has a number of salient features. First, like the agency model, the initial mentorship and technical training period commences once prospective entrepreneurs win a bid. In the Soweto program, prospective entrepreneurs may attend pre-tender classes, where tender procedures are explained. Second, the performance of the construction manager is not measured according to the number of contractors trained but according to the number of contracts executed successfully.<sup>17</sup> Based upon its terms of

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<sup>16</sup> Disbursement was converted to US dollars by using the average Rand-to-dollar exchange rate over this period (0.35).

<sup>17</sup> A government can also create such an arrangement in government procurement programs that favor small-enterprises, as was the case in Ceará, Brazil. There, the government purchasing agency, which was separate from the assistance providing agency, had to convince the purchasing agency that it was worth its while to purchase the products of the assisting agency's clients. The government set up a relationship with a semipublic technical-assistance agency (SEBRAE). SEBRAE's income was partly dependent on its clients' successful completion of their contracts—namely, delivering on time, producing to specified standards,



agreement, the construction manager advises, assists, and provides on-the-job training for contractors so that they can fulfill their contractual obligations to the employer. To this end, the construction manager visits the site as often as deemed appropriate during the various stages of construction. Third, at the initial stages of the program, the materials manager, not the small-scale contractor, is responsible for procuring materials. In South Africa, the employer often passes the responsibility of paying contractors fortnightly to the construction manager. In such cases, the employer will provide the construction manager with a float account or make alternative financing arrangements.

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and producing at a competitive price. If these criteria were not met, the state purchasing agency would not renew the contract with this particular producer and hence the SEBRAE would lose this source of contract commission (Tendler and Amorim 1996).

## 6. CHOOSING A DELIVERY MECHANISM

This section of the paper attempts to help program designers choose the appropriate delivery mechanism to introduce or expand labor-based methods in a particular country. It does so by comparing the models with respect to payment delays to laborers, the time horizon for development and institutional reform, employers' performance risk, and long-run efficiency.

### Payment Delays to Laborers

One of the principal lessons learned from past and ongoing labor-based programs is that making timely payments to laborers is crucial for success. Yet, in most of Sub-Saharan Africa, it is common for many government projects to receive an inadequate and erratic flow of domestic funds. Four of the delivery mechanisms presented in this paper address this problem: the conventional model, the subcontractor model, the for-profit engineering consultant model, and the development team model. In each of these models, at least one of the intermediaries between the government and the laborers is an established for-profit firm capable of raising funds in financial markets and passing this cost back to the government through its fee-mechanisms. The feasibility of having an intermediary provide bridging finance in this manner depends on the certainty and regularity of employers' payments. If government budgetary discipline has dissolved and payments are too uncertain or erratic, the intermediaries may conclude that providing bridging finance is too risky. If government budgetary discipline is weak and payments are only somewhat uncertain and erratic, the intermediary may be willing to provide bridging finance as long as the employer accepts a provision in the standard forms of agreement enabling the intermediary to recover finance charges from the employer. If government budgetary discipline is strong, the employer may wish to provide the intermediary with a float to simplify payments to small-scale contractors and to avoid the situation of having the intermediary recover finance charges from the employer, thereby increasing the cost of the project.

Although the AGETIP model is also considered a success with regard to timely payments, this success is not due to any inherent institutional quality but to guaranteed donor funding. When the government delays in its counterpart funding, as it often does, AGETIP does not bridge this gap by turning to financial markets. Rather, if an employer does not disburse funds to AGETIP on time, AGETIP will not make payments to contractors on time.

The two models that have experienced the most difficulty with timely payments are the force account model and the government-run model. In the force account model, there is no intermediary between the government and the laborers, and thus laborers are at the mercy of erratic government financing. In the government-run model, small-scale contractors are the only intermediaries between the government and laborers, and these firms, because of their size, often have little or no access to formal sources of bridging finance—they are themselves at the mercy of erratic government financing and, thus, their laborers are equally unprotected.

Common sense suggests that, with secure funding, both of these models should be able to make timely payments to laborers or contractors. In the Mexican force account program, the treasury opened a revolving account for each state at a correspondent bank so that force account units could receive timely disbursements to pay laborers. In the Ghanaian government-run model, DANIDA opened a special account for the Department of Feeder Roads in 1994, and the time between certificate preparation and payment was reduced to two weeks or less. Also, the road fund has also played a role in securing funding

for labor-based methods in Ghana. When the road fund was fiscally decentralized to the regions, the regional administration paid maintenance contractors within one working day.

### **The Time Horizon for Starting-up and Expanding Each Model**

In most SSA countries, the force account model will entail a long time horizon for start up and expansion. Start-up will require the creation and staffing of force account units within the road ministry—an institutional shift that can be time-consuming to achieve. In addition, force account operations will have to navigate within government labor and procurement regulations (discussed in the section on “Problems and Challenges of the Force Account Model” in Chapter 5). In order to facilitate an expansion of labor-based methods, the road agency will probably have to be reformed—requiring commitment over a protracted period. Appropriate reforms include making the road agency more autonomous—to enable force account units to simplify procurement procedures and provide remuneration that is competitive with the private sector—and delegating funds and authority to the qualified local level.

In countries emerging from war, the force account model may be the best option. Often, after war, a country has no road contractors and no institutional arrangements in place to manage force account operations. In such situations, the force account model may be the only means to get quick results on the ground in terms of road rehabilitation and cash injection into poor communities. For example, in Mozambique a multidonor-funded project helped create twenty-two force account brigades, which built 1,783 km of feeder roads over the period 1990-1996. This solution is not necessarily sustainable, however. Mozambique is now initiating programs to develop private contractors.

In countries that have a developed contracting industry, the conventional model and the subcontracting model will likely have the shortest time horizon for start up. Unlike the small-scale contractor approach, the conventional model may already be commonly used for equipment-based works and will therefore be familiar to government agencies. In addition, these models require the fewest institutional changes. Established contractors can complete contracts that are packaged into large sizes, have experience with complex tender documents, are easier to monitor both in terms of their work and labor policies because only a few are required to complete a large quantity of work, and can purchase or rent equipment because of their financial standing. Both the conventional and subcontracting model can facilitate quick expansion if the government is willing to pay the premium that established contractors charge for using labor-based methods and leaving their equipment idle. However, as a program expands, this premium may become unacceptable.

For the small-scale contractor models, the time horizon for start-up will depend upon two variables: the sophistication of the domestic contracting and consulting industries, and the amount of government reform that is required. The agency and development team models may be the most attractive, because a program designer is able to avoid the immediate need to reform the road agency by passing responsibilities on to supporting entities. The models will only be suitable, however, if the country in question has domestic consulting firms, contractors, or NGOs that are sophisticated enough to play the role of the agency, the materials manager, or the construction manager. If a country does not have domestic firms and NGOs capable of playing these supporting roles, a program designer can hire foreign firms, create domestic ones (as was the case with AGETIP), or make the commitment to reform the road agency and increase the efficiency of the government-run model.

The time horizon for expanding each of these three models will depend on the contract administration unit’s capacity to grow and on its ability to protect small-scale contractors from the vagaries of erratic government payments (section on “Payment Delays to Laborers”). The agency and

development team models are best suited for quick expansion. For example, the development team model can be expanded by increasing the number of development teams active in the field. A single development team can comfortably support only between eight and ten contracts running simultaneously (Watermeyer and Band 1994).

Expanding the government-run model, in contrast, may require a longer time horizon. In many countries, the pressures to downsize can prevent a road agency from hiring more staff, which will be needed to administer the increase in small contracts. Although this problem can be addressed by creating an autonomous road authority, such an endeavor may require a considerable amount of time and effort.

It should be mentioned that models can also be used in phases, as is being done in Mozambique. For example, a government can choose to use an agency or development team model to initiate the contracting out process and the training of small firms, and later pass these responsibilities on to the road agency. This option would give the road agency time to undergo the necessary institutional reforms.

### **The Government's Performance Risk**

The government can minimize its own risk by passing it on to the private sector. In its simplest form, the government passes risk on to the private sector through the terms of contract, and the private sector, in turn, accounts for this risk by increasing its tendered fee. If the private sector is better at costing and handling risk, the government may view this increase in fee as worthwhile. In general, established contractors are willing and able to bear the risk associated with construction better than consulting firms and NGOs.

The force account model exposes the government to the greatest degree of risk, since it cannot pass risk on to any other entity. In addition, labor regulations and cumbersome government procurement can affect a force account unit's ability to complete a given project and can increase the likelihood of delay or nonperformance. It is not uncommon for a force account unit to spend its entire disbursement on salaries rather than on actual work or to be inoperable because government procurement rules slow their purchase of equipment and materials.

The conventional model, in contrast, offers the government the least exposure to risk, since established contractors are capable of bearing the risk associated with construction. In addition, these contractors are formally skilled in construction management, thus decreasing the likelihood of delay or nonperformance. The government-run model, unlike the conventional one, does not enable the government to pass as much risk on to the private sector, since small-scale contractors often lack the collateral necessary to secure performance bonds or guarantees. Similarly, in the agency model, NGOs and consulting firms are not well-suited to bear the risks associated with construction. In both of these cases, rather than passing risk on to the private sector, the employer can minimize risk by maintaining competent supervisors on site who are capable of monitoring work and providing technical assistance. The entity responsible for contract management can also make deductions from a contractor's regular payment certificates in lieu of bonds or guarantees.

The development team model offers the most innovative arrangement for sharing risk. In this model, the employer holds the construction manager liable for ensuring that the small-scale contractor fulfills its contractual obligation and holds the materials manager liable for issuing materials so that the works can be executed on time. Both of these "managers" are required to carry professional indemnity insurance, which can be called on in the event of negligence. Although this model exposes the government

to a bit more risk compared with the conventional model, the cost savings of using small-scale contractors rather than established contractors may make the extra exposure worthwhile.

### **Efficiency in the Long Run: Value for Money**

It is unlikely that a government can get value for money using the force account model. Force account operations have inherent inefficiencies. First, they tend to lack financial discipline because they are not driven by profit motives. Unlike a private firm that has a rigid budget constraint, a force account unit will often receive additional budget allocations when it generates cost overruns. In addition, unlike a private firm that must produce a product before it is paid, allocations to force account units are often not tied to output. In general, contracting facilitates better control over the disbursement of public funds and reduces the administrative burden of having to pay hundreds of workers at remote sites.

But using established contractors can also be inefficient because it is not cost-effective for these contractors to substitute labor for equipment that they already own. Requiring established contractors to employ labor may have unwanted consequences. Established contractors will likely: hire laborers and use them unproductively, thereby increasing the costs of the works, and/or use their equipment as they normally would and convince the government monitor at the site to report otherwise. The subcontracting model does not avoid these problems. As with direct contracting, subcontracting is unlikely to encourage a technology switch among established contractors, at least in the short run. In the long run, established contractors may shift to using labor subcontractors as their equipment reaches the end of its economic life. But whether they find this option attractive or not depends on the comparative cost of labor- and equipment-based methods, whether the established contractor can pass the cost of managing labor and the responsibility for labor strikes on to small-scale local contractors, and whether the established contractor trusts that the small-scale contractors can deliver.

In many ways, the small-scale contractor models provide the only long-term answer to getting value for money. Although this approach may appear to be less efficient initially, programs that develop small-scale contractors will eventually achieve longer-term economies from increasing the competitiveness of the industry (Henriod 1984). Although successful small-scale firms will probably amass equipment and enter into equipment-based contracting, they can still use their acquired labor-based knowledge on their sites. For example, some contractors in Ghana who have begun equipment-based road works have resorted to labor-based techniques when their equipment has broken down. These contractors argue that their training in labor-based methods has given them a competitive advantage in the equipment-based sector, because their sites are rarely idle.

The comparative efficiency of the small-scale contractor development models will depend upon a variety of factors. For the government-run model, efficiency will depend on the amount of reform that is required before the road agency can operate with sound business practices. For the agency and development team models, efficiency will depend on the structure of the contract between the employer and the agency. Often, consultants and organizations such as AGETIP are contracted on a cost-plus basis. This arrangement can have negative repercussions if the contractual relationships are not constructed well. For example, a poorly-designed contract will not force the agency or development team to bear the consequences of extensive cost overruns and thus may encourage them to prolong the project for as long as possible in order to retain a source of income. But a cost-plus contractual relationship can also have positive repercussions. For example, an employer can obligate the agency or development team to supply plant and materials at cost. Thus, in effect, the profit on materials, and plant and equipment that the employer would pay if using an established contractor are traded for development support costs for the small-scale contractors.

## Conclusions

The benefits that can be derived from substituting labor for equipment are even more relevant today than when they first began to be studied in the 1970s. Unemployment and underemployment levels have been rising in developing countries at a significant rate, and experience shows that, where the conditions are right, labor-based programs can be a successful device for building assets and generating employment in a cost-effective manner.

In the past, labor-based methods were introduced in SSA countries on a pilot basis. Often, these pilots created an artificial working environment so that the pilot team could assess technically and economically the methods in a particular country. Although this was an effective means of demonstrating the feasibility of labor-based methods, the artificial structures often collapsed soon after the pilots ended. There is a need, therefore, to institute the necessary reforms initiated in the pilot scheme nationwide. Such reforms, if achieved, should facilitate a sustainable expansion in the use of labor-based methods.

This paper has argued that the principal reforms and interventions needed to expand labor-based methods are: increased government commitment to the labor-based technology, modified labor laws that facilitate the use of labor-based methods, appropriate designs, the provision of training, secure funding provided over an extended period of time, and program decentralization achieved by delegating authority and financing to the appropriate level. These last two reforms have not received required attention in the past. The issue of securing funding is crucial because it is the key to sustainability: not only do works need to be funded, but the flow of funds must be regular to ensure that force account units or contractors can make timely payments to laborers. The issue of decentralizing the program is crucial because decentralization can streamline payment procedures and can create incentives for local officials to use appropriate designs and package the works into many small contracts. In addition, decentralization can strengthen the stakeholders supporting labor-based methods.

Once program designers are made aware of the necessary reforms, they can begin to compare the three approaches for expanding labor-based methods. The comparison presented in this report reveals that, although using established contractors may appear to be the most attractive approach for expanding labor-based methods—established contractors can pay laborers on time, do not require a long development horizon, require few institutional changes, and have low performance risk—these contractors will charge the employer a premium for having to substitute labor for equipment. In addition, established contractors are likely to hire a large number of nonproductive laborers, that is, hire “ten watchmen instead of one.” The force account approach may not be much better. Although its efficiency can be increased through reform, it is unlikely to ever reach the efficiency achieved by contracting out to the private sector.

These two analyses may lead to the conclusion that the small-scale contractor approach is the only viable option for expanding labor-based methods in the road sector. If this is the case, program designers have three basic models to choose from. Whether they should select a government-run model, an agency model, or a development team model depends primarily on the country’s contracting environment and the resistance to reform. If the road agency is functioning well and reform can be facilitated, the government-run or development team model may be most suitable. If the road agency is unable to undergo the required reforms within a reasonable time or would prefer to pass a portion of the risk of contractor development to the private sector, a development team model may be the most suitable. If the road agency is nearly defunct or unacceptably corrupt, an agency model may be most suitable—and can be used until the road agency has undergone the necessary institutional reforms.

In the end, the model or hybrid selected should be structured to provide value for money, create useful and appropriate assets, be auditable, and clearly assign accountability. These features can be developed only by carefully designing and redesigning the contractual relationship among the various

actors and continually assessing each actor's risks and rewards. With these goals in mind, the choice of technology and approach should be consonant with whatever reform is needed in the government's structure and work practices.

## Bibliography

- Argyle, M., G. Gardner, and F. Cioffi. 1958. "Supervisory Methods Relating to Productivity, Absenteeism and Labor Turnover." In V.H. Vroom and E.L. Deci, eds., 1970. *Management and Motivation: Selected Readings*. Harmondsworth: Penguin Books.
- Ashong, K. 1993. "The Use of Small-scale Contractors in Labour-based Road Rehabilitation and Maintenance in Ghana: Evolution from 1986 to Date." Ministry of Roads and Highways, Department of Feeder Roads. Accra.
- \_\_\_\_\_. 1994. "Labour Based Road Construction Projects, Summary of Activities and Progress." Ministry of Roads and Highways, Department of Feeder Roads. Accra.
- Bentall, Peter. 1992. "Aspects and Background for Labour-based Contracting—the Ghana Experience." In Gerrit Bosma and Bjorn Johannessen, eds., "Labour-Based Technology: A Review of Current Practice. Report of Proceedings." March 2-6. Geneva: International Labour Organization.
- Bruton, Henry, J. 1974. "Economic Development and Labor Use: A Review." In Edgar Edwards, ed., *Employment in Developing Nations*. New York: Columbia University Press.
- Clay, Edward J. 1986. "Rural Public Works and Food-for-Work: A Survey." *World Development* 14(10/11):1,237-52.
- Cook, Cynthia C., Henri L. Beenhakker, and Richard E. Hartwig. 1985. *Institutional Considerations in Rural Road Projects*. Staff Working Paper 748. Washington, D.C.: World Bank.
- Coukis, Basil. 1983. *Labor-based Construction Programs: A Practical Guide for Planning and Management*. New York: Oxford University Press.
- Damachi, Ukandi G., and Hans Deiter Seibel, eds. 1986. *Management Problems in Africa*. New York: St. Martin's Press.
- Davison, E. 1967. *Why Growth Rates Differ*. Washington, D.C.: Brookings Institution.
- Department of Feeder Roads (DFR). 1989. "Feeder Roads Improvement in Ghana: Contractors Use Labour-based Technology." Accra.
- \_\_\_\_\_. 1994. "Feeder Road Inventory and Condition Survey." Accra.
- de Veen, Jan. 1980. "The Rural Access Roads Programme." Technology and Employment Branch, Employment and Development Department. Geneva: International Labour Organization.
- \_\_\_\_\_. 1988. "The Rational Utilization of Available Resources for Road Improvement and Maintenance; Alternative Approaches to Road Maintenance." Construction Technology Programme 81. Infrastructure and Rural Works Branch, Employment and Development Department. Geneva: International Labour Organization.
- \_\_\_\_\_. 1994. "Guidelines on the Introduction of Employment Intensive Technologies in Large Scale Road Sector Programs." Processed. Development and Policies Branch, Development and Technical Cooperation Department. Geneva: International Labour Organization.



- Edmonds, G.A., and J.J. de Veen. 1982. "Road Maintenance: Options for Improvement." Construction Technology Programme 13. Technology and Employment Branch, Employment and Development Department. Geneva: International Labour Organization.
- \_\_\_\_\_. 1991. "Technology Choice for the Construction and Maintenance of Roads in Developing Countries—Developments and Guidelines." Construction Technology Programme 128. Infrastructure and Rural Works Branch, Employment and Development Department. Geneva: International Labour Organization.
- \_\_\_\_\_. 1992. "Labour-based Approach to Roads and Rural Transport in Developing Countries." *International Labour Review* 131(1):95-110.
- Edmonds, G.A., Karlis Goppers, and Mikael Söderbäck. 1986. "Men or Machines?" SIDA Evaluation Report, Industry, Lesotho.
- Edmonds, G.A., and J.D.G.F. Howe. 1980. *Roads and Resources: Appropriate Technology in Road Construction in Developing Countries*. London: Intermediate Technology Publications Ltd.
- Edmonds, G.A., and D.W.J. Miles. 1984. *Foundations for Change: Aspects of the Construction Industry in Developing Countries*. London: Intermediate Technology Publications Ltd.
- Edwards, Edgar O. 1974. "Employment in Developing Countries." In Edgar Edwards, ed., *Employment in Developing Nations*. New York: Columbia University Press.
- Emery, S.J., N. Alli, and B.H.W. Veldman. 1994. "Labour Based Construction of Bitumen Surfacing by Small Contractors." Paper presented at conference on Asphalt Pavements in Southern Africa. Cape Town.
- Garnier, P., and M. van Imschoot. 1993. "The Administration of Labour-intensive Works Done by Contract: Practical Guide." Geneva: International Labour Organization.
- Gaude J. and H. Watzlawick. 1992. "Employment Creation and Poverty Alleviation through Labor-intensive Public Works in Least Developed Countries." *International Labour Review* 131(1):3-18.
- Gaviria, Juan, Vishva Bindlish, and Uma Lele. 1989. *The Rural Road Question and Nigeria's Agriculture Development*. Managing Agriculture Development in Africa Discussion Paper 10. Agricultural Policy, Africa Technical Department. Washington, D.C.: World Bank.
- Gopal, Gita. 1995. *Procurement and Disbursement Manual for Projects with Community Participation*. Discussion Paper 312. Washington, D.C.: World Bank.
- Gopal, Gita and Alexandre Marc. 1994. *World Bank-Financed Projects with Community Participation: Procurement and Disbursement Issues*. Discussion Paper 265. Washington, D.C.: World Bank.
- Graham, Carol. 1991. "From Emergency Employment to Social Investment: Alleviating Poverty in Chile." Brookings Occasional Papers. Washington, D.C.: The Brookings Institute
- Hagen, Steiner. 1985. "Rural Access Roads Program, Kenya: An Analysis of Costs and Productivities." Construction Technology Programme 84. Technology and Employment Branch, Employment and Development Department. Geneva: International Labour Organization.

- Heggie, Ian G. 1995. *Management and Financing of Roads: An Agenda for Reform*. Technical Paper 275. Washington, D.C.: World Bank.
- Henriod, Ernesto. 1984. *The Construction Industry: Issues and Strategies in Developing Countries*. Washington, D.C.: World Bank.
- Hirschman, A.O. 1958. *The Strategy of Economic Development*. New Haven: Yale University Press.
- Horton, Susan, and Timothy King. 1991. *Labor Productivity: Un Tour d'Horizon*. Staff Working Paper 497. Washington, D.C.: World Bank.
- Howe, John, and Deborah Fahy Bryceson. 1993. "Women and Labour-based Roadworks in Sub-Saharan Africa." In Bjorn Johannessen, ed., "Labour-Based Technology: A Review of Current Practice. Report of Proceedings." September 27 - October 1. Geneva: International Labour Organization.
- Hyden, Goran. 1983. *No Shortcuts to Progress*. Berkeley and Los Angeles: University of California Press.
- Hussain, M. I. 1993. "Rehabilitation and Maintenance of Roads in Nigeria—Choice of Technology and Implementation Issues." Paper prepared for Road Maintenance Initiative Seminar, Federal Ministry of Works and Housing, International Labour Organization, Nigeria.
- Jimenez, Emmanuel. 1993. "Human and Physical Infrastructure: Public Investment and Pricing Policies in Developing Countries." Policy Research Working Paper 1281. Poverty and Human Resources Division, Policy Research Department. Washington, D.C.: World Bank.
- Kenya, Ministry of Public Works and Housing. 1993. "Roads 2000, Pilot Project Final Report, Volume 1." Nairobi. December.
- \_\_\_\_\_. 1994. "Unpaved Roads Branch Progress Report 1." Nairobi. November.
- Kilby, P. 1961. "African Labour Productivity Reconsidered." *Economic Journal* 71(282):278-93.
- Lantran, Jean-Marie. 1990. "Developing Domestic Contractors for Road Maintenance in Africa (Contracting Out of Road Maintenance Activities: Volume I)." Africa Technical and Sahelian Departments, Infrastructure Division. Washington, D.C.: World Bank.
- \_\_\_\_\_. 1991. "Contracts for Road Maintenance Works Agreements for Works by Direct Labor (Contracting Out of Road Maintenance Activities: Volume II)." Africa Technical and Sahelian Departments, Infrastructure Division. Washington, D.C.: World Bank.
- \_\_\_\_\_. 1993. "Managing Small Contracts (Contracting Out of Road Maintenance Activities: Volume IV)." Africa Technical and Sahelian Departments, Infrastructure Division. Washington, D.C.: World Bank.
- McCutcheon, R.T. ND. "Employment Creation in Public Works. Labour-intensive Construction in Sub-Saharan Africa: The Implications for South Africa." Department of Civil and Environmental Engineering. Johannesburg: University of the Witwatersrand.
- Marriott, R. 1971. *Incentive Payment Systems: A Review of Research and Opinions*. Fourth Edition. London: London Staples Press.

- Miles, Derek, and John Ward. 1991. "Small-scale Construction Enterprises in Ghana: Practices, Problems and Needs." Geneva: International Labour Organization.
- Moavenzadeh, Fred. 1985. "The Building Materials Industry in Developing Countries: An Analytical Appraisal." Cambridge, Massachusetts: MIT Technology and Development Program.
- National Economic Forum (NEF). 1994. "Initial Overview Report." Prepared by the Technical Committee on a Public Works Programme. South Africa.
- Nilsson, Curt. 1993. "Labour-based Contracting." ASIST Bulletin 2. Geneva: International Labour Organization. December.
- Ofori, George. 1991. "Programmes for Improving the Performance of Contracting Firms in Developing Countries: A Review of Approaches and Appropriate Options." *Construction Management and Economics* 9(1):19-38.
- Onyemelukwe, C.C. 1973. *Men and Management in Contemporary Africa*. London: Longman Group Limited.
- Osei-Bonsu, Kwaku. 1992. "Labour-based Roads Rehabilitation: The Use of Private Contractors." In Gerrit Bosma and Bjorn Johannessen, eds., "Labour-Based Technology: A Review of Current Practice. Report of Proceedings." March 2-6. Geneva: International Labour Organization.
- Péan, Leslie. 1993. "Agetip: A new Resource to Meet the Urban Challenge." Infrastructure Notes. Urban No. OU-8. Infrastructure and Urban Development Department, Urban Development Division. Washington, D.C.: World Bank.
- Rausch, Eugene. 1994. *Road Contractor Promotion and Employment Generation in Africa*. Eschborn, Germany: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ).
- Riverson, John, Juan Gaviria, and Sydney Thriscutt. 1991. *Rural Roads in Sub-Saharan Africa: Lessons from World Bank Experience*. Technical Paper 141. Washington, D.C.: World Bank.
- Sadli, Mohammad. 1974. "Application of Technology and its Employment Effects: The Experience of Indonesia." In Edgar Edwards, ed., *Employment in Developing Nations*. New York: Columbia University Press.
- Schmitz, Hubert. 1985. *Technology and Employment Practices in Developing Countries*. London: Croom Helm.
- Scott Wilson Kirkpatrick and Partners. 1991. "Maintenance Study II, Phase 2 Development of Routine Maintenance Requirements Final Report." Study conducted for the Kenyan Ministry of Public Works, Nairobi. October.
- Sen, Amartya. 1981. "Public Action and the Quality of Life in Developing Countries." *Oxford Bulletin of Economics and Statistics* 43(4):287-316.
- Soweto Project Team. 1992. "Contractor Development in Labour-based Construction." In R.B. Watermeyer, ed., and Soweto Engineer's Department. Soweto: The Contractor Development Team.

- Stock, Elisabeth. 1995. "Labor-based Road Rehabilitation: Can Employment Generation be Combined with Private Sector Delivery? The Ghana Experience." *Newsletter of the Sub-Saharan Africa Transport Policy Program*, No. 11. World Bank: Washington, D.C.
- \_\_\_\_\_. 1996a. "Developing Successful Labor-based Contractor Programs: Lessons from Ghana." Infrastructure Notes. Transport No. RD-21. Transport Division, Transportation, Water and Urban Development Department. Washington, D.C.: World Bank.
- \_\_\_\_\_. 1996b. "The Problems Facing Labor-Based Road Programs and What to Do About Them: Evidence from Ghana." SSATP Working Paper No. 24. Environmentally Sustainable Development Division, Africa Technical Department. Washington, D.C.: World Bank.
- Stone, Andrew. 1992. "Public Procurement and Private Sector Development in Kenya." Background paper prepared for the Kenya Private Sector Assessment. Division on Public Sector Management and Private Sector Development, Country Economics Department. Washington, D.C.: World Bank.
- Tajgman, David. 1995. "Labour Standards and Employment Creation through Labour-based Activities: A Developmental Perspective." International Labour Organization, Harare.
- Tendler, Judith. 1979a. "New Directions in Rural Roads." A.I.D. Program Evaluation Discussion Paper 2. Office of Evaluation, Bureau for Program and Policy Coordination. Washington, D.C.
- \_\_\_\_\_. 1979b. "Rural Works Programs in Bangladesh: Community, Technology and Graft." Transportation Department. Washington, D.C.: World Bank.
- \_\_\_\_\_. 1993. *New Lessons from Old Projects: The Workings of Rural Development in Northeast Brazil*. Operations Evaluation Department. Washington, D.C.: World Bank.
- Tendler, Judith, and Mônica Alves Amorim. 1996. "Small Firms and Their Helpers: Lessons on Demand." *World Development* 24(3)407-426.
- Thomas, John W. 1968. "Food for Work: An Analysis of Current Experience and Recommendations for Future Performance." Development Discussion Paper No. 213. Cambridge, Massachusetts: Harvard Institute for International Development.
- \_\_\_\_\_. 1974. "Employment Creating Public Works Programs: Observations on Policy and Social Dimensions in Employment in Developing Nations." In Edgar O. Edwards, ed., *Employment in Developing Nations*. New York: Columbia University Press.
- Vaidya, K.B. 1983. "Guide to the Assessment of Rural Labour Supply for Labour-based Construction Projects." Construction Technology Programme 21. Technology and Employment Branch, Employment and Development Department. Geneva: International Labour Organization.
- \_\_\_\_\_. 1988. "Supplement to the Labour Supply Guide: Wage Rates on Labour-based Construction Projects in the Presence of High Rates of Inflation and Overvalued Exchange Rates." Construction Technology Programme 93. Infrastructure and Rural Works Branch, Employment and Development Department. Geneva: International Labour Organization.
- von Braun, Joachim, Tesfaye Teklu, and Patrick Webb. 1992. "Labour-Intensive Public Works For Food Security in Africa: Past Experience and Future Potential." *International Labour Review* 131(1):19-33.

- Watermeyer, R.B. and N.G. Band. 1994. "National Housing Forum: The Development of Small Scale Enterprises, Skills, Entrepreneurship and Employment Opportunities through the Provision of Housing." Working Group 3. A study prepared for the Coordinating Committee of the National Housing Forum, South Africa.
- Watson, Gabrielle. 1995. "Good Sewers Cheap? Agency-Customer Interactions in Low-cost Urban Sanitation in Brazil." *Water and Sanitation Currents*, UNDP-World Bank Water and Sanitation Program. Washington, D.C.: World Bank.
- Wells, Jill. 1986. *The Construction Industry in Developing Countries: Alternative Strategies for Development*. London: Croom Helm.
- World Bank. 1971. "Study of the Substitution of Labor and Equipment in Civil Construction: Phase I Final Report." Staff Working Paper 172, Volume 1. Washington, D.C.
- \_\_\_\_\_. 1974. "Study of the Substitution of Labor and Equipment in Civil Construction: Phase II Final Report." Staff Working Paper 172, Volume 2. Washington, D.C.
- \_\_\_\_\_. 1975a. "Increasing Output of Manual Excavation by Work Reorganization: An Example of a Passing Place Construction on a Mountain Road." Technical Memorandum 12. Transport Research Division, Transportation and Urban Projects Department. Washington, D.C.
- \_\_\_\_\_. 1975b. "Some Aspects of Unskilled Labor Markets for Civil Construction in India: Observations Based on Field Investigation." Staff Working Paper 223. Transport Research Division, Transportation and Urban Projects Department. Washington, D.C.
- \_\_\_\_\_. 1976. "Scope for the Substitution of Labor and Equipment in Civil Construction: A Progress Report." Transport Research Division, Transportation Department. Washington, D.C.
- \_\_\_\_\_. 1978a. "Guide to Competitive Bidding on Construction Projects in Labor-Abundant Economies." Report prepared jointly by the World Bank and Scott Wilson Kirkpatrick & Partners. Washington, D.C.
- \_\_\_\_\_. 1978b. "The Study of Labor and Capital Substitution in Civil Engineering Construction." Report on the Bank-Sponsored Seminars in Washington, Cologne, Copenhagen, London, and Tokyo. Transportation Department. Washington, D.C.
- \_\_\_\_\_. 1986. "Scope for the Substitution of Labor and Equipment in Civil Construction: A Research and Implementation Project." World Bank Project Completion Report. Operations Policy Staff, Transportation Department. Washington, D.C.
- \_\_\_\_\_. 1992. *International Financial Statistics*. Washington, D.C.
- \_\_\_\_\_. 1994a. "Country Briefs as of June 30, 1994." Volume 1. Africa Region, Europe and Central Asia Regions. Washington, D.C.
- \_\_\_\_\_. 1994b. *World Development Report 1994: Infrastructure for Development*. New York: Oxford University Press.

## Documents for Training

Andersson, Claes-Axel, Derek Miles, Richard Neale, and John Ward. 1994. *Improve Your Construction Business Handbook 1 and Workbook 1: Pricing and Bidding*. Geneva: International Labour Organization.

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\_\_\_\_\_. 1994. *Improve Your Construction Business Handbook 2 and Workbook 2: Site Management*. Geneva: International Labour Organization.

Andersson, Claes-Axel, Derek Miles, and John Ward. 1994. *Improve Your Construction Business Handbook 3 and Workbook 3: Business Management*. Geneva: International Labour Organization.

Austen, A.D., and R.H. Neale, eds., 1984. *Managing Construction Projects: A Guide to Processes and Procedures*. Geneva: International Labour Organization.

Beusch, A., and J.J. de Veen. 1992. *International Course for Engineers and Managers of Labour-based Road Construction and Maintenance Programmes*. Geneva: International Labour Organization.

Edmonds, G.A., and J.J. de Veen. 1981. "The Application of Appropriate Technology in Road Construction and Maintenance: A Learning Methodology." Geneva: International Labour Organization.

Hernes, Tor. 1987. *Interactive Contractor Training - Module 1: Estimating and Tendering, Module 2: Project Planning, Module 3: Site Productivity*. Geneva: International Labour Organization.

\_\_\_\_\_. 1988 *Training Contractors for Results: A Guide for Trainers and Training Managers*. Geneva: International Labour Organization.

International Labour Organization. 1987. *Guidelines for the Development of Small-scale Construction Enterprises*. Geneva.

---

\_\_\_\_\_. 1991. *Video Series Completing the Guide to the Training of Supervisors for Labour-based Road Construction and Maintenance*. Geneva.

Karlsson, L.S., and J.J. de Veen. 1992. *Guide to the Training of Supervisors for Labour-based Road Construction and Maintenance: Instructor's Manual and 2 Volumes Trainees' Manual*. Geneva: International Labour Organization.

Kirmani, Syed S. 1988. *The Construction Industry in Development: Issues and Options*. Policy and Planning Research Staff Discussion Paper INU 10, Urban Development Department. Washington, D.C.: World Bank.

World Bank. 1973. *Promotion of Domestic Construction Industries in Developing Countries*. Board paper R73-177. Washington, D.C.

## Appendix 1: Technical Manuals on Labor-based Road Works

*This list was compiled by Angela Kabiru (Advisory Support Information Services and Training for Labour-based Road Programmes (ASIST)/Nairobi). For each item, ASIST has included the authors (where applicable), date of publication, title, publisher, price (where known), a reference number for sales address in parenthesis and an abstract. The list of full addresses is appended.*

Allal, M., Edmonds, G.A. and Bhalla, A.A. 1977. *Manual on planning of Labour-intensive road construction*. ILO, Geneva. Sw. frs. 40.00 (1,2).

For people engaged in planning, implementation, evaluation and design of road construction projects. Provides a basis for incorporating the assessment of alternative technologies and a means of evaluating them. Has chapters on road planning, design, productivity, labor-intensive techniques, cost-benefit analysis and organization and management of labor-intensive techniques.

Antoniou, J., P. Guthrie, and J.J. de Veen. 1990. *Building Roads by Hand: An Introduction to Labour-based Road Construction*. Longman Group (UK) Ltd., Longman House. US\$11.50 (1,2).

Presents the broad technical, organizational, and managerial principals of labor-based road construction works. Aimed at supervisory staff but is also valuable to civil engineers embarking on labor-based works for the first time and to students who need a general introduction to the subject.

*Design guidelines for low volume roads suitable for labor-based construction methods in Lesotho*. 1992. Ministry of Works, Lesotho. (5)

Edmonds, G. and J.J. de Veen. 1991. *Technology choice for the construction and maintenance of roads in developing countries: Developments and guidelines*. ILO, Geneva. US\$4.00 (1,2)

A brief introduction to the use of local resources for the construction and maintenance of rural roads. Looks at private sector involvement, contractor development, the development of intermediate equipment for labor-based roadworks, the factors affecting technology choice and the issues in the establishment of labor-based programs.

*Guide to tools and equipment for Labour-based road construction and maintenance*. 1981. ILO, Geneva. Sw. frs. 60.00 (1,2)

A practical guide providing specifications of hand tools, methods for testing various tools, design and manufacturing instruction and information on correct tool handling and maintenance.

*Headman's handbook for maintenance of minor and rural access roads/Kitabu cha utunzaji ya barabara kwa wmayapara* (English/Kiswahili). 1991. Ministry of Public Works, Roads Department, Kenya. (9)

A simple well-illustrated booklet providing instructions for headmen performing annual routine maintenance.

Hindson, J. 1993. *Earth roads: Their construction and maintenance*. Intermediate Technology Publishers. UK\$16.00 (2,4)

A technical manual providing a simple description of road planning and construction for non-engineers. Deals with drainage, road planning, the actual construction and subsequent maintenance operations.

*International road maintenance handbook. Practical guidelines for rural road maintenance: Volume I of IV. Maintenance of roadside areas and drainage*. 1994. Permanent International Association of Road Congresses (PIARC); Transport Research Laboratory (TRL). United Kingdom. (3)

*International road maintenance handbook. Practical guidelines for rural road maintenance: Volume II of IV. Unpaved roads.* 1994. Permanent International Association of Road Congresses (PIARC); Transport Research Laboratory (TRL), United Kingdom. (3)

*International road maintenance handbook. Practical guidelines for rural road maintenance: Volume III of IV. Maintenance of paved roads.* 1994. Permanent International Association of Road Congresses (PIARC); Transport Research Laboratory (TRL), United Kingdom. (3)

*International road maintenance handbook. Practical guidelines for rural road maintenance: Volume IV of IV. Maintenance of structures and traffic control devices.* 1994. Permanent International Association of Road Congresses (PIARC); Transport Research Laboratory (TRL), United Kingdom. (3)

*Labour-enhanced construction for bituminous surfacings.* 1993. Manual 11. South Africa Bitumen and Tar Association. (6)

Provides recommendations on bituminous surfacings for labor-enhanced construction for first-time practitioners. Covers the choice of bituminous surfacings for labor-enhanced construction, with information on the limitation of the construction technique to be used. Covers criteria which would be useful in choosing the surfacing to suit objectives of job creation, maximization of labor or skills transfer.

*Labour-enhanced construction for bituminous surfacings. Methods and procedures.* 1994. Manual 12. South Africa Bitumen and Tar Association. (6)

A companion publication of manual 11. Presents methods and procedures for labor-enhanced construction of bituminous surfacings and gives guidelines for appropriate techniques. For use by contractors' staff in planning labor-enhanced construction of surfacings and in the training of workers. Could also be included in the contract document as a method specification.

Marshall, J. 1987. *Technical manual.* District Council Road Unit. Ministry of Local Government and Lands, Gaborone, Botswana. (7)

Intended as a field reference book. Defines the technical status of the Botswana labor-intensive district road construction and maintenance program. Describes standard setting out and construction procedures, including sections on drainage structures. For use by the supervisory field staff of the program.

Mason, D.J., and J. Hamper. 1996. *Design and specifications for a standard trailer and hitch for labour-based works.* Second revised edition. ILO/ASIST, Kenya. US\$10.00 (2)

Contains technical specifications and drawings for the standard design of a three cubic meter trailer and hitch developed under the Kenya Minor Roads Program. Describes the key features of the trailer and provides a sample of details that should be included in a contract document for manufacturing trailers. Recommendations for the type of tractor that should be used with the trailer are also included.

Minor Roads Programme. 1992. *Technical manual: Volume I.* Ministry of Public Works, Roads Department, Kenya. (9)

Minor Roads Programme. 1995. *Technical manual: Volume II.* Drawings and specifications. Ministry of Public Works, Roads Department, Kenya. (9)

Minor Roads Programme. 1992. *Road Maintenance Manual.* Kenyan Ministry of Public Works, Roads Department, Kenya. (9)

Describes the organization and techniques used for the improvement of roads under the Minor Roads Program. Sets out the policy and standards on technical issues, describes technical procedures used in the program and gives guidance on



planning, organizing and controlling road improvement works. Modules each cover one of the aspects of the program. Volume II contains the drawing and specifications for technical manual I.

Minor Roads Programme. 1993. *Structures manual. Volume I*. Ministry of Public Works, Roads Department, Kenya. (9)

Minor Roads Programme. 1993. *Structures manual. Volume II*. Ministry of Public Works, Roads Department, Kenya. (9)

Gives guidance on the design and construction of small structures commonly encountered on minor roads of a span up to 10 meters. Covers the planning and design process, site investigation and soil testing, river hydraulics and climatological data, as well as modules on materials and types of structures. Volume II contains construction drawings.

*Overseas road note 1: Maintenance management for district engineers*. 2nd edition. 1987. Transport and Road Research Laboratory, Department of Transport, Overseas Development Administration, United Kingdom. (2,3)

*Overseas road note 2: Maintenance techniques for district engineers*. 2nd edition. 1985. Transport and Road Research Laboratory, Department of Transport, Overseas Development Administration, United Kingdom. Second Edition. (2,3)

A practical guide to management of maintenance operations. Outlines a rational approach that will help maintenance engineers organize and control the activities for which they are responsible, and for improving the efficient use of maintenance resources.

*Rehabilitation of Feeder Roads Using Labour-based Methods*. 1993. Technical manual. United Nations Development Programme, Office for Project Services, Afghanistan Projects Office. (8)

Provides practical guidance to various levels of site supervisors engaged in rehabilitation of Afghan feeder roads using labor-based methods.

*Roads 2000 Works manual*. 1996. Ministry of Public Works & Housing, Roads Department, Kenya. (9)

Sets out the techniques and procedures developed from a pilot project for the Roads 2000 program. Describes in detail the organization and techniques used for the preparation, maintenance and spot improvement of roads in the program. Sets out the Road Department policy and standards on technical matters, describes procedures used in the program and gives guidance on planning and organizing road maintenance and spot improvement work. Each module covers one aspect of the program. For engineers and other technical personnel.

*Technical manual for low volume roads upgraded and constructed using labor-based methods in Lesotho*. 1992. Ministry of Public Works, Lesotho. (5)

Covers the geometric design standards of low-volume roads and all associated drainage structures. Details the setting out techniques that will enable supervisory staff to establish a measure quantity of work (or task), how to check the quality of work done, and report on it. Describes all road construction, upgrading and maintenance activities.

## **Sales Addresses:**

(1) ILO Publications, International Labour Office, CH-1211 Geneva 22, Switzerland.

(2) ILO/ASIST Project, Information Services, P.O. Box 60598, Nairobi, Kenya.

(3) Transport Research Laboratory, Crowthorne, Berkshire RG11 6AU, UK.

- (4) Intermediate Technology Publications, 103-105 Southhampton Row, London, WC1B 4HH, UK.
- (5) Ministry of Works, Roads Branch, P.O. Box 330, Maseru, Lesotho.
- (6) Southern Africa Bitumen and Tar Association (SABITA), P.O. Box 6946, Roggebaai 8012, South Africa.
- (7) Ministry of Local Government and Lands, Private Bag 006, Gaborone, Botswana.
- (8) United Nations Development Programme, Office for Project Services (UNDP/OPS), Afghanistan Projects Office, P.O. Box 776, 4th floor Gul Maji Plaza, Jamrud Road, Peshawar, Pakistan.
- (9) Chief Engineer (Roads), Ministry of Public Works & Housing, P.O. Box 30260, Nairobi, Kenya.

## Appendix 2: Labor and Equipment Use for Selected Road Construction Activities

1. Site Preparation	Category
1.1 Clearing and grubbing	
• light vegetation	EL <sup>a</sup>
• medium vegetation	EL
• dense vegetation	EL
1.2 Stripping topsoil	EL
<b>2. Excavating Small Quantities</b> (from ditches, trenches, foundations and so on)	
2.1 In soft material <sup>b</sup>	EL
2.2 In hard material <sup>c</sup>	EL
2.3 In rock <sup>d</sup>	EL
<b>3. Excavating in Bulk</b> (in cuttings and borrow pits)	
3.1 In soft material <sup>b</sup>	EL
3.2 In hard material <sup>c</sup>	EL
3.3 In rock <sup>d</sup>	EL
<b>4. Loading</b> (including the waiting time of any transport equipment)	
4.1 Homogeneous loose material <sup>e</sup>	EL
4.2 Other solid and packaged materials <sup>f</sup>	EL
<b>5. Hauling</b>	
5.1 Up to 50 m	L
5.2 From 50 to 300 m	EL
5.3 Over 300 m	E
<b>6. Unloading</b> (including the waiting time of any transport equipment)	
6.1 Homogenous loose materials	EL
6.2 Other solid and packaged materials	EL
6.3 Water	EL
6.4 Other bulk liquids	EL
<b>7. Spreading</b>	
7.1 Material soils (for earthworks)	EL
7.2 Unstabilized base and sub-based materials, quality factor:	
• high <sup>g</sup>	E
• intermediate <sup>h</sup>	EL
• low <sup>i</sup>	EL

- |   |   |
|---|---|
| 7.3 Stabilized base and sub-base materials, quality factor: |   |
| • high <sup>g</sup>   | E |
| • intermediate <sup>h</sup>                                 | E |

## 8. Mixing

- |  |    |
|--|----|
| 8.1 Natural soils in situ (for mechanical stabilization, aeration, etc.), quality factor |    |
| • high <sup>j</sup>  | E  |
| • intermediate <sup>k</sup>  | EL |
| • low <sup>l</sup>   | EL |
| 8.2 Cement/lime with soils in situ, quality factor:                                      |    |
| • high <sup>m</sup>  | E  |
| • intermediate <sup>n</sup>  | E  |
| • low <sup>o</sup>   | EL |
| 8.3 P.C. concrete, quality factor  |    |
| • high <sup>n</sup>  | E  |
| • intermediate <sup>o</sup>  | EL |
| • low <sup>p</sup>   | EL |

## 9. Compacting and Finishing

- |   |    |
|---|----|
| 9.1 Bulk materials in earthworks, quality factor:   |    |
| • high<br>(>95 percent B.S. (Proctor) compaction; control by frequent testing)  | E  |
| • intermediate<br>(90-95 percent B.S. (Proctor) compaction; control by method specification such as a certain number of passes of a specified roller at a specified moisture content) | EL |
| • low<br>(85-90 percent B.S. (Proctor) compaction; control by visual inspection and moisture content testing)   | EL |
| 9.2 Unstabilized bases and sub-bases, quality factor:   |    |
| • high<br>(Greater than 98 percent B.S. (Proctor) compaction; control by frequent testing)  | E  |
| • intermediate<br>(95-98 percent B.S. (Proctor) compaction; control by method specification)  | EL |
| • low<br>(90-95 percent B.S. (Proctor) compaction; control by visual inspection and moisture content testing)   | EL |
| 9.3 Surface dressings, quality factor:  |    |
| • high<br>(Rolling by heavy pneumatic-tired rollers which facilitates the penetration of the chippings into the underlying material without crushing)                                 | E  |
| • intermediate<br>(Rolling by other equipment with causes some crushing of the chipping or lack of penetration into the underlying material)  | EL |

- 9.4 P.C. concrete for pavements, quality factor:
  - high (Compacted by mechanically operated vibrating beams) E
  - intermediate (Compacted by hand tamping supplemented by vibrators) EL

## 10. Laying

- 10.1 Stone pitching L
- 10.2 Brick soling L
- 10.3 P.C. concrete linings (including compacting and finishing) L
- 10.4 Masonry walling L
- 10.5 Brick walling L
- 10.6 Precast concrete products EL
- 10.7 Steel pipe culverts EL
- 10.8 P.C. concrete in foundations, headwalls, etc.<sup>q</sup>
  - high<sup>r</sup> EL
  - intermediate<sup>s</sup> EL
  - low<sup>t</sup> EL

## 11. Production of Local Materials

- 11.1 Rock for pitching/masonry (crushing operation) EL
- 11.2 Coarse aggregate for waterbound macadam (crushing operation) EL
- 11.3 Crushed rock for bases and sub-bases (for example, Crusher run) E
- 11.4 Course aggregate (chippings) for surface dressing (crushing operation) E
- 11.5 Fine aggregate, (crushing, washing, blending and grading) quality factor:
  - high (washed with precisely defined grading characteristics) E
  - intermediate (washed, but with no grading requirements) E
  - low (unwashed, with no grading requirements) EL
- 11.6 Making bricks (forming and burning of the bricks) EL
- 11.7 Breaking bricks EL
- 11.8 Precast concrete units, (erection and stripping of molds and placing, compacting and finishing the concrete) quality factor:
  - high (spun or hydraulically pressed units) E
  - intermediate (with concrete compacted by tamping or vibration) EL

## 12. Miscellaneous

- 12.1 Cutting, bending and fixing reinforcement L
- 12.2 Formwork (including stripping) quality factor:
  - high (wrought) L
  - intermediate (rough) L
- 12.3 Laying, trimming and compacting topsoil EL
- 12.4 Sprigging with grass, and so on L
- 12.5 Seeding with grass, and so on EL
- 12.6 Brooming and cleaning surfaces EL

- a. E=equipment, L=labor
- b. Capable of being excavated by a spade or similar handtool; or capable of being loaded by a tracked scrapper without push assistance but becoming uneconomic to do so; or capable of being loaded by a scraper with push assistance.
- c. Requiring loosening by a pickax or crowbar before excavating by spade can take place; or capable of being loaded by scrapers with pre-ripping and push assistance.
- d. Requiring the use of drills, plugs, feathers or wedges if excavated by hand, or unrippable by earthmoving machines and requiring the use of pneumatic tools or blasting.
- e. For example. soil, crushed rock, stabilized materials, asphaltic concrete, and so on.
- f. For example, bagged cement, drummed bitumen and petrol, lump rock, reinforcement, and so on.
- g. Courses laid to precise levels with a substantial degree of compaction incorporated in the spreading process. Tight control of thickness of layer on basis of direct measurement after compaction. Surfaces true to line and level with little or no reshaping required during or after compaction.
- h. As above with no pre-compaction required during the spreading process and reshaping permitted during and after compaction.
- i. Thickness of layers controlled by average rates of spread of loose materials (for example, measure by truck load). Surface tolerance achieved primarily by shaping during compaction process.
- j. Involving pulverization and intimate, uniform mixing of the soils and uniform moisture content; high degree of control by frequent testing of gradation and moisture contents.
- k. As above but without pulverization of the soils; a high degree of control but slightly lower standards of uniformity acceptable.
- l. A blending or “turning over” of soils rather than mixing; control exercised mainly by visual inspection. Aeration of soils would fall into this category.
- m. Involving pulverization and intimate, uniform mixing of the material with the soils and uniform moisture content; high degree of control by frequent testing of material and water content.
- n. As above but without pulverization of the soils; a high degree of control but slightly lower standards of uniformity acceptable.
- o. Blending of the cement/lime with the soil by “turning over” rather than mixing; control exercised mainly by visual inspection.
- n. Weigh batching of all ingredients with precise control of moisture content of aggregates, proportions of ingredients, mixing time, workability and strength; normally required to produce high strength (above 30 MN/m<sup>2</sup>) concrete.
- o. Volumetric batching of all ingredients with slightly lower standards of control; to produce concrete strengths within the range 15-30MN/m<sup>2</sup>.
- p. Volumetric batching of solid ingredients with control of workability, water content and workability mainly by visual inspection; low concrete strengths (less than 15-30MN/m<sup>2</sup>).
- q. Including compacting and finishing quality factor.
- r. Thin reinforced concrete sections requiring close tolerances of finish and trowelled/floated surfaces.
- s. Mass concrete sections requiring close tolerances of finish and trowelled/floated surfaces.
- t. Mass concrete with serrated surfaces.

### **Appendix 3: Effects of Method of Payment and Migrant Labor**

The method of payment (that is, check or food) can affect the ability of contractors, or force account departments to attract labor. In terms of methods of payment, employers can have difficulty attracting labor if payments are made by check rather than by cash. One example comes from Honduras where, in 1978, the Ministry of Finance began to pay workers with checks. Because laborers often worked and lived in areas with no banks, a market developed for discounting pay-checks “on the spot” for a discount amounting to an average of one to two days’ work—or about 5 percent to 10 percent of their monthly cash-income. If workers instead went to the nearest bank in the next town, they lost about 30 percent of their monthly cash income in time off and transport costs.

Employers may also have difficulty attracting labor if payments are made with food rather than cash. The ILO has established policy guidelines on the use of food rations as wage payment based on provisions of the ILO’s Protection of Wages Convention (No. 95), which set the international standard for wage payment in-kind. The ILO has also made a policy agreement with the World Food Program on this issue. The agreement makes a basic distinction between local works of direct interest to the community concerned and works of general public interest. If the works meet specific needs of the local community and directly benefit community workers, the workers may be deemed to be contributing their labor outside of an employment relationship, and execution on a communal basis with food as the sole incentive can be justified. The situation is different for public works, which benefit the community in a general context. In that case, labor contributions cannot be expected from an identifiable group of community members who benefit exclusively, and wage employment must be relied on for the labor input. The agreement says that the program should then pay in cash at least 50 percent of the official minimum wage for the type of work and category of workers concerned, and the remainder of the payment may then be made in food.

Whether or not food aid is a necessary component of a labor-based road program has been debated time and again. Under certain circumstances, for example in areas with a supply shortage of basic consumer goods and high inflation rates, the use of payment in-kind can be a powerful incentive for laborers. Yet for projects involving the use of food as (partial) remuneration of workers, a number of issues should be considered. Provision of food to a large work force may depress agricultural production and marketing in the area involved, distract workers from remunerated agricultural jobs, and develop relief and social welfare features. In addition, the logistic, storage and administrative arrangements to be made are usually both complicated and costly.

The success of projects with food aid components is highly dependent on regularity in food supply and distribution, and needs a certain degree of administrative capacity to handle transportation, storage, and distribution. Provision of food rations also requires careful monitoring of the local food supply and the content of the food rations must accommodate the needs and demands of workers. A tested and recommended approach to food aid is to integrate food in the remuneration system on a noncompulsory basis. The workers receive their entire wages in cash and decide themselves whether or not to buy food rations at officially fixed prices (usually below the going market prices because of the supply situation) up to a predetermined proportion of their wages.

A final issue that should be raised is that of consistency, without which it is difficult to build trust. If food aid is used initially in an area to attract labor and then later taken away, the laborers in that area will think the contractor is selling and profiting from their food. Thus, changes in payments such as these, can hurt the trust between laborers and contractors.

Migrant laborers also play a role in labor-based programs and should be separated into two classes: those who are less skilled and come to find employment at the road site out of desperation, and those who tend to specialize in particular activities, developing skills and often much higher productivity than casual laborers recruited locally. The first class of migrant laborers plays a role in labor-based programs in that contractors can import them when they anticipate a rise in the price of local labor. The second class of migrant laborers plays a role in labor-based programs in that contractors consider them more productive, reliable, and disciplined. In Ghana, these migrant laborers are called “old hands” and represent 10 percent to 30 percent of a contractor’s labor force. Contractors see two advantages in using “old hands.” First, they are willing to accept late payments because they have developed a relationship of trust with the contractor. In Ghana, when government payments are delayed, the total number of laborers drops, yet the number of migrant laborers who have worked with the contractor on earlier projects increases.\* Second, they transfer skills to the local laborers. For example, in Nepal, on the Dhankuta to Hile road, skilled masons from the plains built all the initial walls and culverts. When winter came they left the site. But by that time, some of the local laborers were able to take over the masons’ work.

Program designers should also be aware of the disadvantages of employing migrant laborers. First, if the labor force predominantly consists of migrant laborers, the local community will not have as much opportunity to build up technical know-how for later road maintenance. Second, large numbers of migrant laborers may reduce the amount of cash spent in the local economy. Third, migrant laborers may require temporary accommodation. Fourth, migrants can have adverse effects on the health of the local community. This is most dramatic, for example, when migrants are infected with HIV.

The use of migrant laborers among contractors and force account units can be kept at a minimum as long as wages are set at a level that attracts the local laborers and government payments to these employers is timely. Contractors and force account units will often continue to employ a small percentage of “old hands” to help train new laborers. These employers are often not interested in hiring large numbers of migrant laborers, since their lodging is often the responsibility of the employer.

\*Although migrants may fill the vacancies of local laborers, they do not do so in numbers great enough to keep the site progress at the same level.



## Appendix 4: Earmarking Versus Commercialization: Tanzania and Zambia\*

Earmarking is the practice of setting aside revenues raised from certain taxes to cover specified public expenditures. Some economists argue that earmarking imposes undesirable rigidity on government expenditure decisions and should be discouraged. For example, it is inefficient to set aside, say, 20 percent of overall fuel tax revenues to finance national roads, since not all fuel consumption is related to road use. The required expenditures will generally be larger or smaller than this amount, and it may be desirable to use fuel tax revenues for other purposes. However, others argue that earmarking taxes under certain circumstances can improve allocative efficiency in that they act as surrogate prices when the taxes are levied on those who benefit from the expenditures. For example, in both the United States and Japan, part of the gasoline tax and other motor vehicle tax proceeds are earmarked for the road fund, and the income from the fund is used to meet the costs of operating, maintaining, improving, and extending designated parts of the road network. It is argued that such earmarking is a helpful device for approximating benefit taxation and will promote more efficient expenditure decisions.

What is being proposed in the road fund in Tanzania and Zambia is not the above type of earmarking. Earmarking generally applies to revenues that: form part of the government's overall tax system and flow into the government's general revenue account. What is proposed here is a system of user charges that do not form part of the overall tax system (that is, like the landing fees at an airport, they do not form part of the government's sales taxes, excise taxes, and import duties) and are kept in the accounts of the agency supplying road services. This institutional distinction has important implications for efficiency. The charges create a constituency for the agency supplying the service (that is, they create a specific market), make the agency more accountable to its users and, by clearly linking revenues and expenditures, can impose a hard budget constraint on the road agency. Specifically, what is different about the proposed financing arrangements is that the road tariff:

- is not set within the government's overall tax framework;
- is set to achieve specific objectives: demand management and cost recovery for a particular service;
- is added to pre-existing standard sales and excise taxes or, when fuel is highly taxed, partly replaces and partly adds to pre-existing taxes; and
- is used to impose a hard budget constraint on the agency supplying road services.

These road funds should therefore not be classified as conventional earmarking since: the road tariff is set by the roads board outside the government's tax framework, it is set to ensure that all vehicles cover the costs they impose on the road network and collectively cover the entire cost of operating and maintaining the road network, the fuel levies are added to pre-existing standard sales and excise taxes, the charges are related to road usage, and the proceeds from the road tariff are used to impose a hard budget constraint on the agencies entitled to draw from the road fund.

*\*Source: Heggie (1995)*

## Appendix 5: Pitfalls of Hire-purchase Arrangements

Many local commercial banks are often reluctant to administer a hire-purchase agreement for small-scale contractors—they do not trust the government to provide the contractors with a steady work load throughout the repayment schedule, and they do not feel the contractors have enough collateral to cover the risk of the loan.

In Ghana, the Bank for Housing and Construction agreed to administer a hire-purchase agreement as part of the World Bank's Fourth Highway Project equipment hire-purchase scheme. The Bank for Housing and Construction received dollars at 8 percent interest and then hire-purchased equipment to labor-based contractors in dollars at 20 percent interest. The reason for this was that the equipment was amortized in dollars, since a contractor would need dollars to purchase new equipment. Unfortunately for domestic Ghanaian contractors, the cedi depreciated substantially over the years 1987-1992. When contractors received equipment in 1987-1988, one US dollar was worth 175 cedis. In December 1992 one US dollar was worth 519 cedis.\*

In the case of hire-purchase agreements, contractors need a steady workload during the loan period to enable them to meet their commitments. Although competitive bidding is the final goal of a sustainable labor-based program, one must be careful to introduce it at the correct time. Ghana is one country where competitive bidding was introduced too soon. Contracts were tendered under the following conditions: there were the same number of jobs as contractors because the governments had promised the local banks and the contractors a steady work load and there were an insufficient number of competitors (for example, in most regions there were about six contractors competing). This resulted in collusion in some regions—the contractors agreed among themselves who would tender for each job. Such collusion can jeopardize a whole program.

\* The impact of the foreign exchange risk was expected to be reduced by the price adjustment formula (PAF) which adjusts contracts for inflation. The PAF adjusts for changes in the price of materials, labor costs (only if the minimum wage rate changes) and equipment rental rates on a monthly basis. Unfortunately, when there is a rapid devaluation, changes in the inflation rate lag behind. Thus, in the Ghana case, the devaluation was not significantly offset by the PAF.