



Performance-Based Road Maintenance Contracts for Sub-National Roads: Experience from Latin America

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Executive Summary

The outsourcing of road maintenance to micro- and small enterprises under performance-based contracts has been recognized as an effective approach to rural road maintenance in many developing countries. This sees payments for the management and/or maintenance of pavements linked with the contractor successfully meeting or exceeding certain clearly defined minimum performance standards. If structured correctly, sub-national road maintenance PBC programs can effectively maintain pavements, while at the same time, contributing to improved social welfare and local economic conditions.

This report describes a study aimed at reviewing PBC models for the maintenance of sub-national networks in Latin America. The objective of the report is to disseminate the relevant knowledge to other countries interested in building capacities of small and micro contractors and engage them under small-scale PBCs to maintain sub-national roads. The report focuses on labor-intensive practices (micro-enterprises) but also covers contracts that require the use of more conventional maintenance practices.

The study included (1) a critical literature review of relevant documents and reports, (2) identification of suitable agencies for detailed study, (3) a telephone survey of these agencies, and (4) visits to selected agencies in different countries in Central and South America to identify key lessons from failures and successes to be applied to future applications of performance-based road maintenance contracts. The report compares programs in 10 countries and 12 road agencies and present detailed case studies for a subset of these agencies. In general, the programs implemented include two groups of PBCs, projects with a significant social component in economically depressed areas that use mostly cooperative micro-enterprises, and projects focused almost exclusively on improving the service of the roads that also utilize small, medium, and large contractors. Key differences between the two groups of programs include the technical level of the workers and the type of performance indicators used, which have to be consistent with the technical level of the entrepreneurs.

The report presents key lessons learned, associated challenges, opportunities, and achieved results and provides a summary of key recommendations pertinent to performance-based contracting of micro- and small enterprises for municipalities and local governments. The study found that micro-enterprises are a viable option for providing an effective approach for maintaining roads and creating local contracting capacity, especially in remote areas. This practice: (1) improves road maintenance; (2) generally results in cost of the routine maintenance somewhat lower than that of conducting the work by force account, (3) directly and indirectly generates attractive jobs in the rural areas; (4) help secure maintenance funding; (5) rewards initiative; and (5) creates a sense of ownership of the road in the communities adjacent to the road. Performance-based contracts are a practical mechanism for contracting the maintenance of sub-national rural road networks to micro-enterprises. The type of work performed and the remote location of the road segment under consideration make it difficult to measure and control quantities. Furthermore,

performance-based contracts have also been implemented successfully for the maintenance of urban street networks to enterprises of different sizes. Hybrid contracts are more commonly used in the programs where street rehabilitation is also included. These contracts typically involve medium- to large-sized contractors. The rehabilitation items are paid based on unit prices, and the routine maintenance is based on outcomes or performance.

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1. Introduction

The idea of outsourcing road maintenance to micro- and small enterprises has been successfully implemented in the Latin American region. It has been recognized as an effective approach to road maintenance. Furthermore, several of these contracts have been established as performance-based contracts (PBCs). Under the PBCs, payments for the management and/or maintenance of road assets are linked with the contractor successfully meeting or exceeding certain clearly defined minimum performance standards. The practice provides an effective mechanism for keeping the rehabilitated road in good condition and ensuring the continuation of benefits from improved access. In addition to regularly maintaining roads, the contracting of road maintenance also generates long-term direct and indirect employment at the community level. All costs in the document are expressed in U.S. dollars, unless noted otherwise.

The recently released Transport Note TN-27 (Stankevich et al., 2005)¹ features a PBC model which is more applicable to large-scale networks and which requires outsourcing to large- or at least medium-scale contractors. The present study was aimed at reviewing PBC models for the maintenance of sub-national networks in Latin America. The objective of the report is to disseminate the relevant knowledge from these experiences to other countries, specifically to build capacities of small and micro contractors and engage them under small-scale PBCs to maintain sub-national roads. The report focuses on labor-intensive practices (micro-enterprises) but also covers contracts that require the use of more conventional maintenance practices.

The study started with a thorough literature review to identify relevant documents and reports and by communication with regional experts to identify suitable agencies for detailed study. Agencies that have used this type of contracting for at least five years were contacted and interviewed using a predefined list of questions in telephone or personal interviews. Their experiences were tabulated and summarized. Finally, a few agencies were selected based on the interviews, and their practices were documented as case studies. The consultant also conducted field visits to interview representatives of the national and local governments, micro-entrepreneurs and supervisors in order to identify key lessons from the failures and the successes that should be applied to future PBC applications.

The report presents key concepts and analyzes good practices in outsourcing management and maintenance of sub-national-level roads to micro- and small enterprises under PBCs. It also identifies common patterns and main stages of enterprise development for the execution of the contracts at sub-national levels in various countries. It identifies associated challenges, opportunities, and achieved results and provides a summary of key lessons and recommendations pertinent to performance-based contracting of micro- and small enterprises for municipalities and local governments.

¹ Available at: http://iris37.worldbank.org/domdoc/PRD/Other/PRDDContainer.nsf/WB_ViewAttachments?ReadForm&ID=85256D2400766CC785257212007163A3&

2. Background

Road networks have a significant impact on the economic development, sustainability, and quality of life of nations. Queiroz and Gautam (1992) identified a strong association between economic development, measured as per capita gross national product (GNP), and road infrastructure. The World Bank's (1994) research showed that the economic development of nations correlates with their infrastructure systems. Furthermore, the appropriate management and maintenance of roads has significant economic and social impacts. In addition to the loss in asset value, poorly maintained road networks constrain mobility, increase vehicle operating costs and accident rates, and aggravate isolation, poverty, health access, and illiteracy problems in rural communities (Burningham and Stankevich, 2005)². On the other hand, well maintained roads improve timely and affordable access to hospitals, schools, and needed supplies; enhance the competitiveness of local products and services by facilitating their transport to the consumer markets; and promote economic growth through regional, national, and international trade.

Road maintenance includes all the activities conducted to keep a road segment within an appropriate level of service. Although there is no global uniform terminology for designating the various activities performed to maintain road assets, TRN-4 classifies road maintenance activities in three categories: routine, periodic, and urgent maintenance (Burningham and Stankevich, 2005). Routine maintenance includes localized maintenance activities that allow the maintenance of minimum levels of access and safety and prevent premature deterioration of the road. Periodic maintenance includes scheduled activities that are typically applied at regular, relatively long intervals to retard failure, mitigate non-load related distresses, and preserve the structural integrity of the road. If these activities are applied when the assets are in good condition or before they show signs of deterioration, the activities are referred to as preventive maintenance. There is general agreement that these activities are very cost effective. Urgent or emergency maintenance includes reactive or corrective maintenance activities to repair or remedy obvious damage and critical maintenance to prevent imminent failure, traffic damage, or hazards. These repairs in general cannot be foreseen but require immediate attention.

On the other hand, activities to restore the road to as-built condition or upgrade its structural or functional capacity are not considered maintenance but rather rehabilitation (restoration, resurfacing, or renewal). Typical rehabilitation strategies include the full-length addition of layers to existing surfaces to increase structure and lane-widening (Hudson et al. 1997).

Historically, road maintenance has been one of the business functions that most road agencies have conducted by force account (in-house units). However, since it is not a very visible activity (the user will not usually notice the maintenance unless it is missing), many

² Available at:
[http://iris37.worldbank.org/domdoc/PRD/Other/PRDDContainer.nsf/All+Documents/85256D2400766CC7852572250002B410/\\$File/tr040final008004005.pdf?OpenElement](http://iris37.worldbank.org/domdoc/PRD/Other/PRDDContainer.nsf/All+Documents/85256D2400766CC7852572250002B410/$File/tr040final008004005.pdf?OpenElement) (accessed 03/07)

agencies have neglected to assign the appropriate resources to these types of activities and have placed more emphasis on the construction of new roads that allow them to cut ribbons and gain more visibility. This negligence has led to a real crisis that has prompted some international organizations to launch initiatives to promote road maintenance and educate decision makers on the importance of preserving road infrastructure. Some of these efforts in Latin America include the PROVIAL series of seminars and workshops initiated by the World Bank and the program "Financial and Institutional Reform of Road Maintenance in Latin America and the Caribbean," initiated by the German Development Corporation (GTZ) and the Economic Commission for Latin America and the Caribbean of the United Nations (CEPAL)³.

These efforts, coupled with incentives from international development organizations, have had some degree of success in educating both decision makers and the general public on the importance of road maintenance and promoting accountability. They have also fueled some changes in the way of doing business in many highway agencies. Among other initiatives, contracting road maintenance to private contractors emerged in the 1970's as a practical alternative for assuring that these activities are actually conducted and that the work is done efficiently and effectively (CEDEX 2000)⁴. This practice has been implemented using contractors of various sizes, including lengthworkers, community contractors, petty contractors, micro-enterprises, small-scale contractors, and medium- and large-sized contractors (Burningham and Stankevich, 2005). While some of the agencies have written these contracts using unit prices (admeasure) or lump sum payments, other agencies have adopted more innovative contracting practices, such as PBCs or hybrid contracts that combine quantity-based and performance-based items.

2.1. Performance-Based Contracts for Road Management and Maintenance

One of the most successful road maintenance contracting practices has been the use of PBCs. In the PBCs, payments are linked to the contractor meeting or exceeding certain performance indicators (or results). This type of contracting transfers some of the risks associated with managing and maintaining the road to the contractor. The concept was piloted in British Columbia, Canada, in 1988 (Zietlow, 2004) and it has expanded steadily since then with different names: performance specified maintenance contract (PSMC), performance-based management and maintenance of roads (PMMR), output-based service contract, and performance-based road asset management and maintenance contract (Queiroz, 2005).

The World Bank's "Resource Guide for Performance-based Contracting for Preservation and Improvement of Road Assets" provides detailed information for national and sub-national road agencies in developing and transition countries interested in launching or enhancing a performance-based contracting (PBC) program to manage and maintain their road networks

³ <http://www.performance-based-road-contracts.com/>

⁴ <http://www.cedex.es/ceta/dircaibea/gesmanindice.html>

⁵. The Guide contains information and practical documentation to: identify a PBC approach to fit specific conditions in a given country; design bidding and contract documentation; and develop an efficient PBC implementation strategy.

The scope of a PBC may vary significantly in coverage (e.g., only individual assets or all road assets), number of services included (from one service, e.g., cleaning ditches, to all maintenance activities), and length of the contract (from a few months to many years). The World Bank Transport Note TN-27, "Performance-based Contracting for Preservation and Improvement of Road Assets," provides a very detailed overview of this contracting method. TN-27 reviews the worldwide experience with the PBC approach focusing on large-scale networks that require outsourcing to large- or at least medium-scale contractors. The following are the main reasons identified for road agencies to choose a PBC approach over more traditional approaches: (1) cost savings in managing and maintaining road assets; (2) greater expenditure certainty for road agencies; (3) the ability to manage the road network with fewer agency staff; (4) better customer satisfaction with road service and conditions; and (5) stable, multi-year financing of maintenance (Stankevich et al., 2005).

The report also highlights the main challenges that road agencies face when implementing PBCs and lessons learned from the experiences in developing countries. The main challenges identified include: (1) adequate allocation of risks to the party that is able to manage them best; (2) establishing a true partnering relationship between the contractor and client; (3) the need to acquire a new set of skills and expertise to enable the road agency staff to effectively develop and manage a PBC program; (4) downsizing of the agency triggered by the adoption of the PBCs; (5) choosing a PBC format that is consistent with the contracting industry's capacity in the country; (6) identification and clear definition of appropriate performance specifications; (7) design of an incentive payment mechanism that encourages the contractor to consistently meet or exceed the specified minimum performance indicators; (8) assured long-term funding for multi-year PBCs; and (9) determination of the liability and indemnity of the contractor and client particularly in relation to incidents, accidents, and emergencies (Stankevich et al., 2005).

The following factors were identified as key to the successful implementation of the PBC approach: (1) commitment of higher-level government; (2) adequate skills and expertise within the road agency; (3) appropriate capability of the contracting and consulting industries; (4) enabling contracting and partnering environment; (5) stable, multi-year funding; and (6) adapting the PBC generic principles and format to the specific local context of each country (Stankevich et al., 2005).

2.1.1 Micro-enterprises for Road Management and Maintenance

The generic term micro-enterprise has emerged in Latin America to denote a new type of small enterprise with low capital and emphasis on labor-intensive practices created for the

⁵ <http://www.worldbank.org/transport/roads/resource-guide/>

aintenance of rural roads or urban streets. While most are cooperative endeavors, the term also includes small single- or multiple-owner businesses.

Colombia started using cooperative micro-enterprises for road maintenance in 1984. Since then, many highway agencies have implemented similar programs using two different types of micro-enterprises: cooperatives and single-owner. The types of contracts used to include contracts based on unit prices and PBCs, with the latter becoming more popular. In 2005, micro-enterprises in Bolivia, Colombia, Ecuador, Peru, Honduras, and Nicaragua used PBCs. The experience in Latin America suggests that the cooperative micro-enterprises have several advantages over the single-owner. The main advantages are greater working morale and quality of work because of the sense of ownership by the community. In addition, cooperatives seem to be less vulnerable to corruption than single-owner enterprises. Some of the main lessons identified by Zietlow (2005(b)) from the implementation of these types of contracts in Latin America are the following:

1. Micro-enterprises for road maintenance have proved to be a viable option for creating local contracting capacity. Furthermore, the training to manage a small business has enabled members of the cooperative to start additional business activities, mostly related to their civil works skills, and even has inspired family members to create small family businesses in other fields.
2. The micro-enterprises not only improve road maintenance but help create employment and provide access to basic services, especially in remote areas.
3. Crucial factors to the success of the road maintenance system using micro-enterprises include:
 - Securing sufficient and timely financing for micro-enterprises because the enterprises do not have the ability to survive prolonged delays in payments.
 - Careful selection of the members of the cooperatives and a well-designed and executed training program.
 - Qualification of the road management enterprises and the supervisor and road managers.
4. Anecdotal data suggest that performance-based contracts produce better results than unit price contracts with regard to quality and cost.

2.1.2 Small Enterprises for Road Management and Maintenance

Another practice that has been implemented with mixed success is the contracting of road maintenance to small enterprises created or reorganized to provide these types of services. Some of these enterprises were formed by former employees of highway agencies who took advantage of early-retirement packages aimed at the reduction of the government workforce. They generally invested at least part of the incentives to fund the entrepreneurial endeavor. The National Highway Administration (*Dirección Nacional de Vialidad*, DNV) of Uruguay is one of the agencies that pioneered this practice. The DNV contracted the maintenance of more than 1,700 km of roads through nine contracts. Of

those, two routine maintenance contracts and one maintenance contract for traffic signs and markings have been concluded with enterprises formed by former DNV staff. The contracts have been let directly for four years (two years with a renewal option for an additional two years).

The Uruguayan contracts uses objective and measurable performance indicators, such as maximum International Roughness Index (IRI) values that depend of the type of surface, minimum remaining gravel thickness for unpaved road, no potholes, and clean culverts and ditches, right-of-way, and traffic signs, among other measures. The contract also specifies deadlines for compliance with the various performance indicators (e.g., two months for potholes, six months for other defects on main roads). The contractor is paid a fixed monthly fee per kilometer and type of road surface, and penalties are applied if the performance targets are not met. The inspections include visits for payment that are conducted once a month on a random sample of 10% of the road network in addition to regular inspections of approximately 5% of the network once a week and due to complaint by the public. These are followed up by inspections to verify that the contractor has rectified detected deficiencies. In general the Uruguayan experience has been positive (World Bank 2005⁶, Zietlow, 2005(a)).

2.1.3 Rehabilitation and Maintenance Contracts

The third practice that has been implemented with good success is PBCs with the private sector that include rehabilitation and maintenance. In Latin America this practice was pioneered by the Argentinean government, which used it for creating capacity and incentives for the maintenance of its non-concessioned national road network. This mode has also been imitated in Brazil, Chile, Colombia, Guatemala, Paraguay, and Uruguay. The multiyear, lump sum contracts, funded by Argentinean government and the World Bank, specify required road service outputs and use incentive-based payment schedules to ensure the quality of the work. The main objectives for adopting this approach include: 1) cutting the administrative costs associated with input-based contracts, 2) encouraging innovation and cost effectiveness by giving contractors more responsibility, 3) developing more stable funding for road maintenance, and 4) providing a mechanism to better meet road users' needs. Contractors are paid equal monthly installments for specified services as long as the quality of outputs complies with the technical specifications. If the outputs do not comply with standards, daily penalties are imposed (and subtracted from future payments) until the necessary repairs are carried out. The penalties are based on deficiencies noted during monthly inspections. No penalties are imposed for the first two or three months following the award of a contract, giving the contractor time to repair any preexisting deficiencies (Liataud, 2004⁷).

⁶ Available at: <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTTRANSPORT/EXTROADSHIGHWAYS/0,,contentMDK:20706624~pagePK:148956~piPK:216618~theSitePK:338661,00.html>

⁷ Available at: <http://rru.worldbank.org/Documents/Other/09ch4.pdf>

The Argentinean National Highway Agency conducted a nationwide road survey to define the minimum (rather than optimum) road standards, determine required rehabilitation and maintenance, and identify the size and shape of the sub-networks for contracting. Roads with traffic in the range of 300–3,000 vehicles per day were identified as eligible for output- or result-based contracting.

The initial phase of the program started in 1995 and covered maintenance of approximately 3,600 km of paved roads that were in good to fair condition. The contracts were issued for four years with payout schedules based on kilometers per month or kilometer-month (*Kilómetro-mes*). Contractors are paid equal monthly installments for specified services as long as the performance indicators are met. Daily penalties are imposed for substandard performance of each indicator until the necessary repairs are carried out. For example, a pothole left un-repaired beyond the authorized time limit will cost the contractor \$400 per day until it is patched. The cost of the routine maintenance is approximately \$2,000/km/year, and the contracts are working well.

The next stage covered rehabilitation and maintenance for roads that were rated in poor condition, with contracts requiring lump-sum, up-front payments for the rehabilitation tasks. The combined rehabilitation and maintenance contracts (*Contratos de Recuperación y Mantenimiento*, CREMA) required the contractors to rehabilitate and then maintain a network (100 to 300 km) of roads for five years for a lump-sum amount. The contract specifies the sections that need rehabilitation and the minimum solution required to ensure a positive net present value for the investment. The rehabilitation works must be carried out during the first year and the routine maintenance activities throughout the five-year contract period.

Technical details and specifications for these contracts are available at the World Bank's Toolkit for Public Private Partnerships in Highways web site ([PPP](#), 2006⁸). The evaluation of the program has shown that the approach offers an effective means to reduce the cost of maintenance and improve its quality. By holding contractors accountable for the future quality of the roads, output-based contracts keep them more alert to quality during the execution of road works, and passing some monitoring functions on to contractors guarantees efficient monitoring of pavement and traffic conditions, leading to more timely corrective actions (Liataud, 2004).

2.2. PBCs for Road Management and Maintenance in Latin America

In the 1990s the Board of Highway Directors of Ibero-America (*Consejo de Directores de Carreteras de Iberia e Iberoamérica*) conducted an investigation of three methodologies for road management in the region. The study was coordinated by the National Highway Directorate (*Dirección Nacional de Vialidad*, DNV) of Chile. This project analyzed the following approaches used at the national level: contracts using unit prices, PBCs, and

⁸ <http://rru.worldbank.org/Documents/Toolkits/Highways/>

contracts with micro-enterprises. Table 1 summarizes the findings of the study, which represents a good overview of the maintenance contracting practices in the 1970–90s.

Table 1. State of the Practice in Road Maintenance Contracting in Latin America in the 1990s (after CEDEX 2000).

Country	Contracted Maintenance				Used Micro-enterprises
	Using Unit Prices		PBCs		
	Used	Since	Used	Since	
Argentina			X	1993	
Brazil	X	1970			
Chile	X	1992	Allowed in 1996		X
Colombia	X	1996	X	1996	X
Costa Rica					
Ecuador					X
Guatemala	X	1994	X	1997	
Honduras	X	1990			
Nicaragua	X	1980's			X
Panama			Pilot only		
Peru	Emergency only		X	1996	X
Uruguay			X	1997	X

Table 1 shows that PBCs have been used by several countries in the region and in several cases using micro-enterprises. The first reported experience is the implementation of the kilometer-month contracts piloted in Argentina in 1993. By the late 1990s the practice had expanded to other countries including Chile, Colombia, Guatemala, Panama, Peru, and Uruguay (CEDEX 2000).

3. Types of Sub-national Road Maintenance PBC Programs in Latin America

The implementation of PBCs at the sub-national level has been slower than at the national level, but it seems to be gaining momentum thanks to successful efforts at the city and county level. For example, the city of Montevideo, Uruguay, has used PBCs for managing their streets since 1998, and several local governments in Peru and Ecuador use road maintenance PBCs with micro-enterprises for managing rural and access roads. Furthermore, the distinction between national and local jurisdictions may be irrelevant since the denomination of the various road networks often changes due to many decentralization (or centralization) efforts occurring in the region.

With a few exceptions, there are significant differences between the typical PBC programs for national road networks and those used by the local programs. Some of the main differences are summarized in Table 2. On the other hand, it must be noted that some national agencies use models similar to those for the local networks and vice-versa.

Table 2. Comparison of Typical National and Local Routine Maintenance PBC Programs.

Type of Program	National	Urban Local	Rural Local
Types of roads	Mostly high-traffic routes with good (or reasonable) geometrical standards	Paved and unpaved urban streets	Access roads, many of which built over ancient walking paths with poor geometric standards
Main network function	Connectivity	Mobility	Access
Main objective(s) of the program	Reduce transportation costs Promote development Increase efficiency	Improve service Enhance mobility Provide employment	Provide access to basic services and markets Provide employment Promote development
Type of performance indicators	Objective, measurable performance parameters	Variable and dependent on the type of network	Subjective, fairly general road condition indicators (e.g., passable road, no potholes)
Type of contractors	Medium or large contractor	Small to large contractors	Micro- and small enterprises
Type of work included under the PBC	Routine and emergency maintenance (and often rehabilitation) using heavy construction equipment when required	Routine maintenance (and often rehabilitation) combining labor-intensive with equipment-based techniques	Routine maintenance only using mostly labor-intensive methods

The state of the practice at the sub-national level was determined based on a comprehensive review of published and unpublished resources and a survey of road agencies in the region. The survey was sent to all the countries that were identified as using PBCs and/or micro-enterprises for maintaining their road infrastructure. The survey

questionnaire is provided in Appendix I. The results of the survey and literature review are discussed in this report. It is important to note that not all the agencies responded to all the questions.

3.1. Implementation Rationale

The development of the road maintenance PBC programs in general have been promoted and encouraged by international organizations such as the World Bank, International Labor Organization (ILO), Inter-American Development Bank (IDB), German Agency for Technical Cooperation (GTZ), Danish International Development Agency (DANIDA), and Andean Foment Corporation (*Comision Andina de Fomento, CAF*). In the case of the rural road maintenance programs using micro-enterprises, the international agencies have provided support and partial funding for the initial development of the program, pilot implementation, and for the first cycle of operation (three to five years). This support has been instrumental because it provides a commitment to the program, helps demonstrate its effectiveness, and creates a culture of maintenance. In general, the programs have a double objective of improving road maintenance to preserve the value of the road infrastructure and providing employment to alleviate poverty. In several cases, the practice has also been accompanied by the establishment of Road Funds (*Fondos Viales*) that also help secure the resources for financing the activities. On the other hand, the urban road maintenance programs studied were started by the cities with their own resources.

The flow chart presented in Figure 1 summarizes the criteria that can be considered to decide if the use of labor-intensive routine maintenance PBC with micro or small enterprises is the best approach for a particular and organizes the decision-making process. The various questions are expanded following:

- Does the road agency have the necessary personnel to conduct the road maintenance through force account? If the agency does not have the needed personnel, then the use of contracts is a practical and effective way performing maintenance. If the agency does have enough manpower, then the decision makers should consider what would happen with these workers when the road maintenance is contracted out. Some agencies have developed early retirement programs for their employees to leave and form parts of such enterprises.
- Is there a culture of maintenance within the agency, or is road maintenance typically neglected? If the latter is the case, then the use of road maintenance contracts may help create the needed culture of maintenance.
- Are there enough unemployed (or sub-employed) people living in the vicinity of the road to form the micro-enterprises?
- Is the road in a maintainable condition? If the road is in very bad condition, it may need to be rehabilitated first because routine maintenance may not be practical or effective.

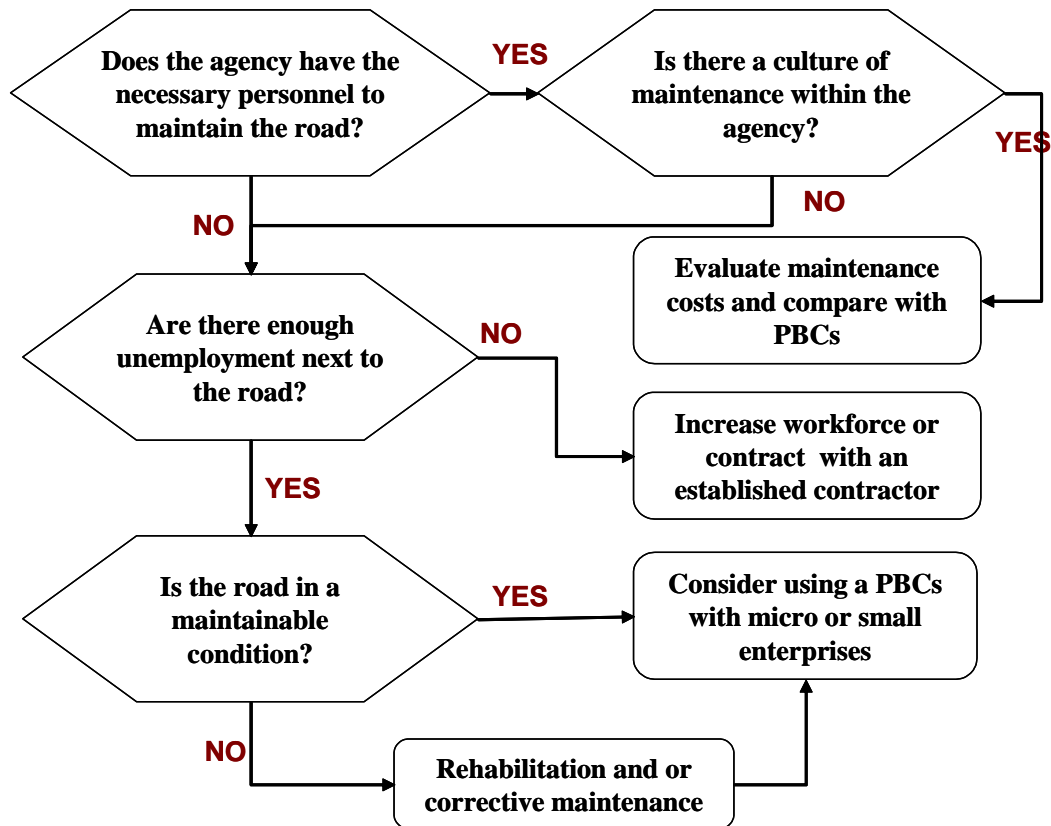


Figure 1. Flow chart for deciding whether or not to use PBCs with micro or small enterprises.

3.2. Scope of the Programs

Table 3 summarizes the main programs identified as part of the study. It can be observed that it includes a wide range of approaches, types of road networks, and geographic distributions. In general the sub-national road maintenance PBCs can be grouped in two main realms:

1. Projects with a significant social component in economically depressed areas that use mostly cooperative micro-enterprises, and
2. Projects focused almost exclusively on improving the service of the roads that also utilize small, medium, and large contractors.

While the first group relied heavily on external funding for the initial development, the second group included several examples of programs funded exclusively with municipal resources as is the case for those implemented by the cities of Buenos Aires, Guatemala, and Montevideo.

Key differences between the two groups of programs, as shown in the next sections of the report, are the technical level of the enterprise personnel and the type of performance

indicators used. While the projects in the latter group include objective and measurable performance indicators, such as a minimum Pavement Condition Index (PCI) or International Roughness Index (IRI), the first group of PBCs utilizes very general and often subjective indicators, such as a clean or passable road. It is noted that the responses received cover more than 45,000 km of roads that are being maintained through PBCs. In some cases, such as in Peru, the programs have evolved over the years and the experiences are treated separately in the survey because there have been significant operational and organizational changes. The following three sections discuss the main organizational, technical, and social aspects of the various programs compared.

Table 3. General Description of the Sub-national PBC Programs Identified.

Country	Program Name	Period	Network under PBC				No. of Cont.	Financing (%)			
			Km Pav.	% ⁽¹⁾	Km Unp.	% ⁽¹⁾		Nac. Gov.	Loc. Gov.	Intl.	Road Fund
Argentina (Buenos Aires)	Contrato de Gestion Vial	2001-	2,800	100	-		12		100		
Bolivia	Programa de Conservacion Vial con Microempresas	2001-05	N/A		N/A		1402			100	
Colombia	Instituto Nacional de Vias (INVIAS)	1984-	7,744		4,979		3,000 -4,000	100			
Ecuador	Programa de Infraestructura Rural de Transporte (PIRT)	2002-06	-		520	1	N/A	30		70	
Guatemala	Programa Limpia y Verde (Guatemala City)	2002-	720	20	-		46		100		
	Programa de Emergencia (Tropical Storm Stan)	2005-06	N/A		N/A		40				
Honduras	Fondo Vial	2000-	2,763	92	-		70				100 ⁽³⁾
Nicaragua	Programa de Mantenimiento de Microempresas Asociativas	1997-	-		19,032		33 (+4)	20			
Peru	Prog. De Caminos Rurales	1995-00	-		7,866		295	30	10	60	
	PROVIAS Rural	2001-06	-		13,526		439	60 ⁽²⁾	40		
Salvador	Fondo Vial (FOVIAL)	2001-	3,284	100	3,169	100	39				100
Uruguay (Montevideo rural)	Mantenimiento por Estándares zona Oeste de Montevideo	1999-03	-		112	30	1		100		
Uruguay (Montevideo urban)	Mantenimiento por Estándares de la Red Vial Departamental	1998-	150	100	-		1		100		

⁽¹⁾ Percentage of the corresponding network under PBCs.

⁽²⁾ Since 2006 100% of routine maintenance is paid by local governments

⁽³⁾ Originally 36 micro-enterprises were funded by the World Bank

4. Organizational Aspects

Table 4 summarizes the main organizational aspects of the various programs evaluated. The two types of processes previously discussed are reflected in the type of enterprise used. The rural programs in Bolivia, Colombia, Ecuador, Nicaragua, and Peru utilize associative micro-enterprises because they incorporate a significant social component. On the other hand, the maintenance programs in El Salvador and the cities of Buenos Aires, Guatemala, and Montevideo have used a more traditional scheme of contracting with established small to large enterprises. It must be noted that the number of enterprises are listed only to give an idea of the magnitude of the size of programs because they represent only those created under the programs listed in Table 3 and not all those created in the country under consideration. Most of the programs needed to create an office to manage the road maintenance contracts. The remaining part of the section focuses on the organization and creation of the micro-enterprises because most of the small, medium, and large enterprises were already established contractors with different degrees of road construction and maintenance experience.

Table 4. Type of Enterprise Used and Contracting Practices.

Country	Started	Type of Enterprise ⁽¹⁾	Number	Legislation Needed? ⁽²⁾	New Office Needed? ⁽³⁾	Procurement Process ⁽⁴⁾
Argentina (Buenos Aires)	2004	S / ML	12	Administrative changes	Local	Bid
Bolivia	2001	ME	1402	No	National	Direct
Colombia	1984	ME	~350	N/A	N/A	Direct or Bid
Ecuador	2002	ME	36	No	National	Direct
Guatemala (City)	2002	S	46	N/A	Local	Public Bid
Guatemala (Emergency)	2006	ME	40	N/A	Local	Direct
Honduras	1999	ME	70	N/A	N/A	Direct
Nicaragua	1997	ME	37	N/A	N/A	Direct
Peru (1 st phase: 1995-01)	1995	ME	295-428	N/A	National	Direct
Peru (2 nd phase: 2002-)	2002		363-439	N/A		Direct or Bid
Salvador	2001	S / ML	39 (+15 for insp.)	Yes, national and local	National	Bid
Uruguay (Mont. rural)	1999	ML	1	No	N/A	Bid
Uruguay (Mont. urban)	1998	ML	1	No	N/A	Bid

⁽¹⁾ ME = Micro-enterprises (cooperatives); S = Small size contractors; ML = Medium to Large Contractors

⁽²⁾ The program in Buenos Aires, Argentina required legislative administrative changes that allowed the type of reception required for performance-based contracts. Salvador required new laws that allowed the use of performance-based contracts.

⁽³⁾ This column summarized the responses regarding whether it was necessary to create a new office for managing the road maintenance PBC program

⁽⁴⁾ Bid = the contracts are awarded through an open bidding process; Direct = the contracts are tendered directly to the micro-enterprises

4.1. Micro-enterprise Promotion and Creation

In general there are two schemes for the constitution of micro-enterprises. These differ mostly in the degree of participation from the community in the selection of members. The two modalities, as discussed in detail as part of the case studies presented later in the document, are the following:

- Micro-enterprises generated with significant input from the community: In general, these enterprises work better internally because the members know each other. In some cases there is a core group and then the other positions are rotated among other members of the community. This latter practice generally appears to have some detrimental effect on the quality of the work and has a higher risk of political favoritism but allows the spread of program benefits to a larger sector of the population.
- Micro-enterprises generated with minimum input from the community: In this case the community helps identify people in need, but a promotion group selects the micro-entrepreneurs based on pre-established criteria. This methodology ensures more transparency in the process but in many cases has resulted in heterogeneous groups that do not work very well together.

In addition, there are also different types of micro-enterprises based on the type of juridical framework used for their creation. The models used include non-profit cooperatives, associate work cooperatives, associate work enterprises, multi-active cooperatives, and small single- or multiple-owner businesses among others. In general, true corporate models or enterprises appear to work better. These are discussed in detail by Yeng and Van Dissel (2003). In general, the agencies visited recommended creation of true enterprises or businesses instead of non-profit entities to allow for the capitalization of the micro-enterprises and the development of additional productive endeavors. Tailor-made laws or administrative dispositions have been required in some countries to allow more flexible mechanisms that facilitate fair treatment of micro-enterprises that have limited technical, administrative, and finance capabilities.

4.1.1 Micro-enterprise Promotion

A significant component of implementing a micro-enterprise based road maintenance program focuses on the creation and formalization of the micro-enterprises themselves. This is usually done through a process of promotion. This phase for the generation of the micro-enterprises has been identified as a critical step by most of the programs studied. Salomon and Gonzalez (2003) identified the following principal actors in the micro-enterprise promotion process:

- Agency responsibly of the maintenance of the road.
- Promotion team.
- Community (population affected by the road).

- Community authority (legal authority that directs social life of the community, e.g., mayor).
- Social actors (social or religious organizations that have representation and moral authority in the community).
- Moral leaders of the community (people with credibility and reputation, such as teachers or doctors).
- Selection committee.
- Micro-enterprise.
- Users.

While the actors involved in the activities are common to all the programs, different approaches have been selected for the promotion process. Some programs use consultants, others internal promotion teams, and others the local authorities. Table 5 presents an example of the various phases included in the promotion process. The promotion team is usually formed by members with experience in social, legal, and technical aspects and who understand the rural situation in general and the specific community in particular. A very detailed discussion of the promotion process in various countries is provided elsewhere in Salomon (2003).

Table 5. Example of micro-enterprise promotion process.

Phases		Activities
Phase 1	Preparatory Activities	Initial coordination
Phase 2	Institutional Support	Agreement with provincial and municipal governments Coordination with Non-Governmental Organizations (NGOs, churches, etc.)
Phase 3	Work Team	Provincial and municipal coordinators and supervisors
Phase 4	Candidate Selection	Call for candidates Pre-selection
Phase 5	Micro-enterprise Formation	Management workshop Legal registration Technical and financial training
Phase 6	Contract	Direct invitation Signature of the contract Credit for equipment

Programa de Infraestructura Rural de Transporte (PIRT) Ministerio de Obras Publicas del Ecuador-BID Unidad de Caminos Vecinales
Guía N6 Promoción, Formación y Contratación de Microempresas de Mantenimiento Vial. Quito, Octubre 2002.

4.1.2 Requirements for the Selection of the Micro-entrepreneurs

The requirements for the micro-entrepreneurs that would constitute the enterprises are variable; however, following are some of the most important factors:

- Economic need, because the program has the dual objective of improving the conditions of the roads and combating poverty. This is easier to assess in the programs with high community involvement in the selection process because the communities are small and the members know each other well whereas in programs with low community involvement, external promoters have to verify the economic situation of each candidate.
- Gender equity has been another important selection factor since it is in line with the goals of several of the organizations that have promoted this approach.
- No educational requirements are included in most of the micro-enterprise programs; however, some programs include adult education programs that have allowed the workers to finish primary school and learn how to read and write.

The minimum number of workers per kilometer is usually specified. While some agencies use the same number for the entire network, some of the more mature programs (e.g., Colombia and Peru) have established different work loads based on the geographic and climatic factors. For example, the program for the national roads in Colombia uses a differential scale that ranges from 5 km/worker in flat land with low vegetation to 2.5 km/worker in mountainous terrain. In addition, some agencies require that the enterprise have some minimal financial capital for its constitution. This requirement has been particularly difficult for some of the micro-enterprises to meet; such is the case of the Ecuador, which requires a minimum capital of \$400. For this reason, the new programs are investigating innovative procedures for securing capital.

4.2. Contracting Practices

Most of the programs studied contracted the work directly with the micro-enterprises formed under their sponsorship. Most countries did not require new laws to allow for the use of PBC for road maintenance with micro-enterprises and were allowed to contract directly because it was specified in the contract with the international lending organizations. However, agencies such as the *Provias Decentralizado* in Peru are facing serious administrative challenges to the continued hiring of the micro-enterprises amid the transference of the responsibility to the local governments. The contracting laws in Peru require the local governments to use public bidding once the programs are taken out of the umbrella of the international agreements. In addition, laws and dispositions governing contracting practices often limit the financial amount of the contracts that can be awarded directly. This has forced some agencies to limit the duration of contracts to keep them within the allowed amounts. Almost all agencies had to create an office to manage the program.

In the case of contracts issued as a result of public tendering processes, the requirements are similar to those used for normal construction and rehabilitation projects. The main

qualifications required include financial capital, equipment, educational level of personnel (e.g., to have at least a registered civil engineer), and road maintenance experience.

Key Findings of this Section: *The micro-enterprises differ in the degree of participation from the community in member selection and type of juridical entity used for their creation. In general, the agencies visited recommended creation of true enterprises or businesses instead of non-profit entities. The members are selected based mainly on economic need and gender equity. Typically the contracts are awarded directly without a public tendering process; however, some agencies have used public bidding.*

5. Technical Aspects

The technical aspects of the various programs studied provide a good picture of the state-of-the-practice, covering a wide range of contract types and sizes, scopes of works, and maintenance techniques. Table 6 presents the basic characteristics of typical contracts within each of the programs studied. A typical micro-enterprise PBC for maintenance of rural roads includes between 15 and 50 km maintained by 10 to 15 workers at a cost of roughly \$1,000/km. The cost per kilometer of maintaining the urban roads is considerably higher and requires more employees.

Table 6. Basic Information for Typical Road Maintenance Contracts.

Country	Number of Employees	Length of Road Covered (km)	Amount of the Contract (US\$)	Length of the Contract (months)	Approximate Cost (\$/km-yr)
Argentina (Buenos Aires)	N/A	28	8,000,000	48-60	28,000
Bolivia	6-10	25-50	20,000	10-12	800
Colombia	10	41	60,000	12-21	1,000
Ecuador	8	15	15,000	12	800-1,200
Guatemala (City)	18	15	256,000	24	7,000
Guatemala (Emergency)	N/A	1-5	variable	1.5	N/A
Honduras	14	46	38,000	12-18	1,192
Nicaragua	14	65	N/A	N/A	N/A
Peru (1 st phase 1995-01)	15	20-50	24,000-28,000	12	1,200
Peru (2 nd phase 2002-)				12	600-1,275
Salvador	68	150-300	800,000-1,400,000	12	4,000
Uruguay (Mont. rural)	11+	112	4,000,000	48	4,000
Uruguay (Mont. urban)	120	150	10,000,000	36	20,000

NOTE: The contracts in Argentina include rehabilitation of street blocks below a threshold condition value and construction of curbs and gutters on parts of the network.

5.1. Contract Characteristics

Most of the micro-enterprise contracts are result- or outcome-based and include only routine and, occasionally, minor emergency maintenance (Table 7). On the other hand, rehabilitation, periodic, and large emergency maintenance items are typically included in the contracts with the larger contractors (small to large enterprises), and these items are usually paid based on unit prices. All the larger contracts studied are hybrid because they contain a routine maintenance component with payments based on performance and some

rehabilitation, periodic, or emergency items paid based on the executed quantities. In the case of Salvador (FOVIAL), only the drain cleaning, sign maintenance, and right-of-way mowing are contracted with performance standards.

Table 7. Main Characteristics for Typical Road Maintenance Contracts.

Country	Type of Maintenance ⁽¹⁾	Maintenance Technique ⁽²⁾	Type of Contract	Strategy Identification ⁽³⁾	Agency Provides ⁽⁴⁾
Argentina (Buenos Aires)	R E H	SE HE	Hybrid	Contract / Inspector	--
Bolivia	R	L	PBC	Contract / Inspector	Tools
Colombia	R	L	PBC	N/A	--
Ecuador	R	L	PBC	Contract	Tools
Guatemala (City)	R E P	L SE	PBC	Contract / Inspector	--
Guatemala (Emergency)	R E	L	Hybrid	N/A	Tools mats.
Honduras	R	L	PBC	N/A	--
Nicaragua	R E	L SE	PBC	N/A	--
Peru (1995-01)	R	L	PBC	N/A	--
Peru (2002-)	R	L	PBC	N/A	--
Salvador	R E P	L HE	Hybrid	Contract / Inspector	--
Uruguay (Mont. rural)	R E P H	L HE	Hybrid	Contractor	--
Uruguay (Mont. urban)	R E P H	HE	Hybrid	Contractor	--

⁽¹⁾ R = Routine maintenance, E = Emergency maintenance, P = Preventive maintenance ; H = Rehabilitation

⁽²⁾ L = Labor-intensive manual work, SE = Activities requiring small equipment, HE = Activities requiring heavy equipment

⁽³⁾ Contract = The maintenance work is determined in the contract; Inspector = the inspectors or road administrators indicate what type of maintenance work should be conducted on a regular basis, e.g., weekly or monthly.

⁽⁴⁾ Tools = Tools and safety gear, mats. = Materials

Most of the programs control work through government inspectors, administrators, or road managers who work in close cooperation with the local authorities. One exception is Peru, which worked first with consultants and more recently with road monitors. These are junior professionals who spend one year supervising the micro-enterprises as part of their professional practice. These monitors work under the supervision of a regional (provincial) engineer from the *Provias Descentralizado* program. Colombia and Honduras also conduct the supervision through consultants.

In some cases the government provides tools, materials, safety gear, or uniforms. This appears to be a good practice because it ensures that the micro-enterprises have access to appropriate tools in good condition, which helps improve productivity. In cases where the micro-enterprise had to buy the tools themselves, it was noticed that some of the tools were in very bad condition because it is hard for the workers to invest part of the already small payment to replace the tools. The same problem was observed with the safety gear and uniforms; these items are very important to improving the safety of the workers and the visibility of the program, but they may not be considered a priority by the micro-entrepreneurs who generally face severe economic difficulties.

It is also important to note that most of the PBCs with micro-enterprises are not strictly fully performance-based because the decision of which tasks to conduct each week (or month) is taken by the inspectors, monitors, or supervisors who indicate what must be done and then check that the work has been done. However, the contracts are output-based because the inspectors do not in fact measure any quantities but rather look that the assets selected for cleaning are clean, that the section of road that he or she requested to be maintained is in good condition, etc. and the contracts decide how to do it and when to do it within the specified timeframe.

5.2. Types of Asset and Performance Indicators

Most of the contracts studied include the maintenance or control of following assets: pavement surface, shoulders, ditches, culverts, right-of-way vegetation, and slopes. Other contracts include signs (60% of the programs surveyed), bridges and other structures (50%), and pavement markings (30%).

As mentioned in the Background section, the performance indicators used for the different type of contracts vary widely. The supervision effort, and thus the complexity of the performance indicators, should be commensurable with the cost and scope of the contract. In the case of the rural road maintenance contracts with micro-enterprises, the standards are very general, simple, and often somewhat subjective. For a work force with very limited technical training, a requirement of "clean surface," is more meaningful than "no more than 10% of length in any 1000 m road section should have a rut depth more than 20 mm." The National Road Service (*Servicio Nacional de Caminos*) of the Ministry of Economic Development of Bolivia has developed a detailed Technical Manual for Road Preservation with Micro-enterprises that includes a description of the various components of the road and a list of 26 maintenance activities with the corresponding simple quality control assurance indicators for their outcomes (SNC, 2002).

On the other hand, the larger contracts for the maintenance of national, urban, or sub-urban networks are typically set using specific objective performance indicators. Their measurement parameters often require relatively expensive and sophisticated equipment. As an example, Table 8 presents the performance indicators used by the city of Montevideo.

Table 8. Performance Indicators Used for the Urban Streets in Montevideo, Uruguay.

Indicator	Required value
Pothole	None
Patching	Squared and leveled
Cracking	Controlled
Portland Cement pavement joints	Totally sealed
Raveling, breeding, drainage, and cleaning	Controlled
Faulting or depressions in Portland cement concrete (PCC) pavements	< 15 mm
Rutting or depressions in asphalt concrete (AC) pavements	< 20 mm
Manhole depressions	< 15 mm PCC, 20 mm HMA
PCC slab cracks (longitudinal/diagonal/corner)	None
Transversal cracks in PCC slabs	< 30 %
Smoothness – new AC surfaces	IRI < 2.0 m/km
Smoothness – new surface treatments	IRI < 3.0 m/km
Smoothness – new PCC surfaces	IRI < 3.8 m/km

NOTE: The smoothness of pavements receiving only routine maintenance cannot increase. The IRI values are used for reference only, not to apply penalties.

5.3. Costs and Payments

As expected, the cost of the routine maintenance contracts (as shown in Table 5) varies significantly depending on the type of road being maintained, traffic, geographical region, etc. Since the contracts with the small to large contractors follow normal tendering processes used by highway agencies, this section focuses on the practices for computing the cost and making the payments used in the contracts with micro-enterprises.

In general, the costs of maintenance PBCs with micro-enterprises are computed based on typical wages (and need), defined productivity rates (workers/km), and estimates of the various indirect costs. As an example, Table 9 presents the calculation of costs for a micro-enterprise in the province of Chimborazo in Ecuador. Several agencies use differential costs based on the geography, usage of the road, and vegetation. The payments are generally done monthly (quarterly in the case of the new program in Ecuador) in a lump-sum that is linked to the accomplishment of the defined outcomes or performance standards.

Most contracts include a penalty for substandard maintenance (normally 5–20% of the monthly payment), and some use warranty clauses. However, various agencies indicated that these penalties are seldom applied; instead, the inspectors usually indicate the problems and the micro-enterprises correct them before the next visit. The enforcement of the penalties when appropriate could help maintain the quality of the work and production.

Similarly, the use of incentives for exceeding the minimum standards, which are not currently used, could provide an extra motivation for improving performance.

Examples of terms of reference (TOR) and contracts are provided in Appendix II. It is important to note that most micro-entrepreneurs in the most depressed and remote areas have limited educational backgrounds and many of them cannot read and write. Therefore, it is important that the TOR and contracts (as well as the manuals and guides) are simple so the micro-entrepreneurs do not get intimidated by complicated technical or legal jargon.

Table 9. Example of Cost Worksheet for a Micro-enterprise in the province of Chimborazo, Ecuador.

Province: Chimborazo		Route: RioBamba Guaranda	
Section: Calpi-El Arenal		Length: 42 km	
Total Cost of the Micro-enterprise (\$U.S.)		29,498.36	
Number of workers		11	
Basic salary / person-month		160.00	
Transportation / person-month		22.00	
Meals / person-month		33.00	
Fringe benefits / person-month		50.69	
Subtotal Labor / person (7 months)		1,859.33	
Total Labor		20,458.12	
Tools, equipment and uniforms		2,329.51	
Office rental (to storage the tools)		140.00	
Vacation compensation		513.32	
Legal representation		70.00	
Accident insurance		286.77	
Financial advisor		280.00	
Training		70.00	
Profit		1,931.82	
Administration and unforeseen expenses		258.27	
SUBTOTAL		26,337.82	
Taxes 12 %		3,160.54	
SUBTOTAL + Taxes		29,498.36	
TOTAL COST		29,498.36	
COST/KM		702,34	

5.4. Key Implementation Issues

Table 10 summarizes the various aspects that were considered important for the successful implementation and operation of the road maintenance PBCs by the respondents who answered this question in the state-of-the-practice survey. All respondents agreed that the payment reliability is an important factor; the micro-entrepreneurs selected are among the poorest in very impoverished areas, so they depend heavily on these payments for their subsistence. Delays on the payments rapidly result in conflicts, bad morale, and poor work quality. Other very important factors identified by most respondents are enterprise personnel selection, training, and qualifications of the inspectors, followed closely by selection of the performance indicators and then the possibility of renewal of the contracts (labor stability); which was considered important by only about half of the respondents.

Table 10. Important Factors for the Implementation and Operation of the PBCs.

Country (agency)	Personnel Selection	Training	Reliability of Payments	Indicators' Selection	Inspectors' Qualifications	Possibility of Renewal
Argentina (Buenos Aires)	Important	Important	Important	Important	Somewhat Important	Somewhat Important
Bolivia	Important	Important	Important	Important	Important	Important
Ecuador	Important	Important	Important	Important	Important	Somewhat Important
Guatemala (City)	Important	Somewhat Important	Important	Important	Important	Somewhat Important
Salvador	Important	Important	Important	Important	Important	Important
Uruguay (Mont. rural)	Important	Important	Important	N/A	Important	N/A
Uruguay (Mont. urban)	Somewhat Important	Important	Important	Important	Important	Important

Key Findings of this Section: A typical PBC for rural roads includes routine maintenance of 15 to 50 km, that are maintained by micro-enterprises with 10 to 15 workers at a cost of roughly \$1,000/km. Most of the micro-enterprise contracts use simple performance indicators and include only routine and, occasionally, minor emergency maintenance. The TOR, contracts, manuals, and guides for these contracts should be simple to avoid intimidating the micro-entrepreneurs with complicated technical or legal jargon.

Typical road management and maintenance contracts for urban roads in metropolitan areas are hybrid and also include rehabilitation, periodic, and emergency maintenance items. The cost per kilometer of maintaining the urban roads is considerably higher, the technical level of the contractor staff is higher, and these contracts include more elaborate performance indicators than in the rural contracts.

6. Social Aspects

Most (if not all) road maintenance programs that use labor-intensive practices have a dual objective: improve the conditions of the road and provide employment. Therefore, social aspects play a significant role in the design, development, implementation, and operation of these programs. This section provides insight on the issues of economic development as a result of creating access, jobs, education and training, and gender equity from the perspective of program formulation. The actual impact of the various implemented programs is discussed later as part of the case studies and in the evaluation section of the report. It must be noted that the positive social impacts are probably applicable to micro-enterprise contracts under either PBCs or admeasure contracts.

6.1. Jobs and Development

Employment generation and income increase are two of the major impacts of the micro-enterprise programs. While most of the workers receive basically the minimum salary, an study conducted under the umbrella of the International Labor Organization identified the following benefits from the micro-enterprise program for road maintenance:

- The workers receive a regular salary and thus know how much money they will receive and that they have the possibility of asking for credits and making short-term investments.
- The improved road conditions allow generation of new business, such as public transportation, freight transportation, and cattle and produce trading.
- The workers and their families recognize that they have the chance to increase the family savings and improve their nutrition and education.
- Indirect labor opportunities have been generated by personal savings, positions left behind by members of the micro-enterprises, and business created as a result of the road improvements.

As an example, Figure 3 shows a quantitative assessment of the various uses of the family savings as a result of the *PROVIAS Rural* program in Peru.

6.2. Education and Training

The education and training efforts that have been established as part of the micro-enterprise programs for road maintenance have also had a positive impact on the education level of the micro-entrepreneurs. Many of them have been able to complete primary education, learn to read and write, and in many cases understand business practices. The improved skills have facilitated the development of other complementary, productive endeavors.

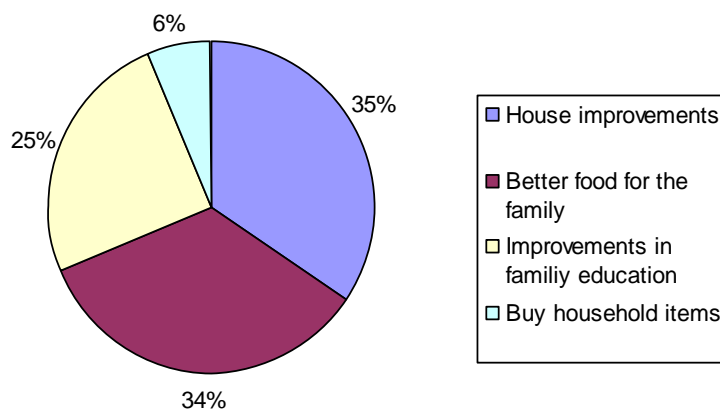


Figure 3. Example of investments permitted by the micro-entrepreneurs' savings.

Some programs have explicitly provided support to the micro-enterprises to develop these other productive activities that contribute to the economic development of the region. For example, in Honduras the program provides training in agriculture and fish farming. Similarly, in Colombia the monthly training program includes technical, environmental, administrative, cooperative, and personal aspects such as teamwork, sexually transmitted diseases, and first aid, and it promotes the development of parallel entrepreneurial activities (small stores, nurseries, small flower farms, etc.) involving family members. In Peru, as a consequence of a fixed, relatively elevated tariff per kilometer used in the initial phase, the micro-enterprises were able to save some capital that allowed them to capitalize the micro-enterprises and to develop productive endeavors that have generated work for family members and other community members.

6.3. Gender Equity

Gender discrimination is a severe problem in most of Latin America, where women often have different responsibilities and do not have the same access to jobs as men. Contreras (2003) found that in Ecuador women's participation in rural road micro-enterprises was practically non-existent. The participation of women in micro-enterprises generated in Honduras and the first phase of the Peruvian rural roads program was also very low—between 2% and 3%.

This low participation of women in roads maintenance tasks is attributed to stereotypes and social prejudices about women's ability to conduct physically demanding work. Road work is perceived by many in local communities as not being appropriate for women. For example, Contreras (2003) attributed the low percentage of women to the popular beliefs that road maintenance works requires physical strength, the presence of women makes the wives of the other associates jealous, and women are putting themselves at risk on the road because of their feminine condition. Taborga and Ruiz-Abril (2002) also found that women's lack of knowledge about the project, women's assumption that the maintenance work and therefore micro-enterprise membership is only open to males, and unfavorable criteria for selecting

the members of micro-enterprises also contribute to the low participation of women in the micro-enterprises.

However, experience shows that micro-enterprises comprised entirely of women carry out maintenance works with high quality standards. For example, during the field visits to one of the micro-enterprises in Ecuador, there were five women working in the micro-enterprises as surrogates for their spouses, who were the formal members of the enterprise (Figure 4). These women appeared to be working hand-in-hand with their male counterparts.



Figure 4. Women working in a micro-enterprise in the province of Tungurahua, Ecuador.

To correct the gender disparity, many of the most recent road maintenance programs have explicitly incorporated provisions to ensure gender equity in job opportunities. One of the successful examples is in Peru, where thanks to changes in the promotion process, affirmative action, and guideline improvements, women's participation increased to 23% of the micro-entrepreneurs in the second phase of the rural roads program. Table 11 summarizes the specific targets established for increasing women's participation in Peru.

Instead of requiring previous experience in road maintenance, the modified TOR required experience in specific tasks. This increased women's participation, as women in the Sierra are actively engaged in agriculture and many of the road maintenance tasks are similar to some agricultural tasks. Similarly, the new guidelines consider women's experience as household managers as managerial experience, and leadership positions in women's organizations for the entrepreneurship attitude requirements. Other activities to improve women's participation include advertising the project among local women's organizations, including a description of maintenance tasks to be carried out, and explicitly encouraging women to participate.

Table 11. Gender Matrix Defining Specific Targets for the Second Phase of the Peru Project (Taborga and Ruiz-Abril, 2002).

Area	What do we want to achieve in the next five years?	What do we need?	What resources do we have?
Family	Contribute to decreasing alcohol consumption and domestic violence in the communities where we work	Information	Gender impact study Gender trained staff
Community	Men and women participate equally in local development window projects	Training to LDW staff Indicators	FAO- World Bank gender technical assistance mission Gender training to decentralized unit staff
Micro-enterprises	Men and women have equal opportunities to participate in micro-enterprises	Information campaign promoting women's participation	Design a gender action plan Look for resources to implement it
Other institutions	Raise awareness of gender issues in other institutions dealing with poverty programs	Partnerships with government agencies and NGOs	Inter-institutional agreements

According to the leadership of the *Provias Rural* program in Peru and the various evaluations conducted by consultants and World Bank staff, the increase in women's participation has brought the following developments (Taborga and Ruiz-Abril, 2002):

- Improvements in the condition of the rural roads because of increased productivity, enhanced performance of the enterprises because women act as a moral catalyst while working on controlling or assessment functions (e.g., treasurer), and improved technical performance because of a better distribution of tasks according to the abilities and skills of each member. While men handle heavy tasks such as landslides management, both women and men perform the less labor intensive and more repetitive jobs such as cleaning ditches, filling holes, controlling the vegetation, etc.
- Positive impacts for the women workers as well as for their families' and communities' well-being. Specifically, women have benefited from (1) equality in the access to jobs, (2) capitalization of their family's finances and increased household security, (3) empowerment because the possibility of working helps them access other political and decision-making positions, (4) enhanced family well-being and self-esteem. Women's participation has also contributed to changing traditional gender roles.
- Improving men's social behavior, e.g., reduced alcohol consumption. The codes of conduct established by the micro-enterprise, peer pressure, and high

competition in the communities to be part of the micro-enterprise have led to exemplary behavior from men and women micro-enterprise members.

Finally, it is also important to note that the impact of the improved road is also different on men and women. Rural men and women perform different daily activities involving different types of travel, and therefore the rehabilitation of roads benefits men and women in different ways. While women traveled more frequently to markets, schools, health centers, and to visit acquaintances, men primarily used the roads to go to work and to sort out administrative issues in town. Men and women alike benefited from expanded employment opportunities in nearby towns, but women benefited more from access to health services, from time saved in reproductive work and from increased mobility. Women's use of health services following the road's rehabilitation increased more than that of men.

Key Findings of this Section: *The interviewed agencies agreed that the programs for contracting rural road maintenance to micro-enterprises have contributed to improvements in employment, education, and gender equity, with consequent secondary social and economic benefits. Furthermore, evidence from Peru, Ecuador and Nicaragua suggests that mixed-gender micro-enterprises have at least similar performance to the male-only micro-enterprises and provide positive impacts for the women workers as well as for their families' and their communities' well-being.*

7. Results

In general, there is a consensus that the contracting of road maintenance activities through PBCs is an effective practice. In particular, the practice of using micro-enterprises has proven very useful because of the double direct effect of improving road conditions and providing employment, in addition to many indirect effects that enhance economic development and quality of life. The following sections discuss the main benefits of the program, their impact, and a list of potential roadblocks or challenges that should be considered while developing a similar program.

7.1. Benefits

Based on the responses received, the following are the main benefits of implementing road maintenance PBCs using micro or small enterprises (in order of decreasing importance):

1. Better service to the users.
2. Cost savings.
3. Employment generation.
4. Increased road management efficiency.
5. Secure maintenance funding.

In addition, most of the respondents agreed that the approach has also: (1) helped meet peak demands, (2) increased flexibility in work programming and execution, (3) enhanced the worker's access to services, (4) helped increase expenditure certainty, (5) enhanced the profits margins of some of the local products, and (6) enhanced general access to services.

These benefits are consistent with those identified by various evaluation studies. For example, the evaluation of the micro-enterprise programs in Peru identified a significant impact in the transportation conditions and access to basic services and a small positive impact on production, employment, and poverty alleviation. The analysis also showed a positive impact on access to schools, administration of justice, and health services. There was also a small increase in the size of agricultural land and land values; a small reduction in the unemployment rate, poverty, and migrations rate; and an increase in average wages. The studies also found a very positive perception by the population of the road conditions (CUANTO, 2000 and 2004).

7.2. Impact

The respondents to the state-of-the-practice survey also agreed that most of the programs for road maintenance studied have resulted in a better level of service to the road users, better level of road maintenance, increased efficacy of the maintenance work, and lower cost of maintenance per kilometer when compared with those before the implementation of the program. Table 12 summarizes the responses of the agencies that answered this question in the state-of-the-practice survey.

Table 12. Summary of the Evaluation of Program Success.

Country	Level of Road Maintenance	Efficacy of the Work	Level of Service Provided	Cost of Maintenance per Kilometer
Argentina (Buenos Aires)	Better	Better	Better	Lower
Bolivia	Better	Better	Better	Lower
Ecuador	Comparable	Comparable	Better	Lower
Guatemala (City)	Better	Better	Better	Lower
Nicaragua	Comparable	N/A	N/A	Lower
Uruguay (Mont. Rural)	Better	Better	Better	Similar
Uruguay (Mont. Urban)	Better	Better	Better	Lower

Consistent with these findings, an evaluation of the Participative Road Preservation Model (*Modelo de Conservación Vial Participativa, CVP*) in Costa Rica identified several benefits of rehabilitating and maintaining 1,000 km of rural roads. Although the program included more than routine maintenance, it is important to review the results because the study quantified specific benefits in the following four areas (MOPT/GTZ, 2001):

- Technical-Economic:
 - Reductions in travel time (40–50%) and vehicle operation cost (from \$0.602/veh-km to \$0.308 /veh-km).
 - Reductions in maintenance (more than 25%) and gravel loss (46%) because of better drainage systems, which resulted in increased road life (from one to five years) and maintenance budget allocation due to the benefits obtained.
 - Increase (27%) in the area of coffee plantations in the area of influence of the roads and reduction (almost 40%) in coffee production losses due to fermentation.
- Institutional:
 - Creation of the Municipal Road Maintenance Units.
- Environmental:
 - Significant emission reduction (27 %).
- Social:
 - Increase in the participation of women in Road Committees (from 5% to 30%) and the time women spent on the committee (from 1.5 years to 2.5 years).
 - Increase in public transportation services (for many places this was the first time that the services were available).
 - Improvement in accessibility (reducing the average time that the roads are not passable from form 30 to 5 days).

7.3. Potential Roadblocks

Although in general the reviewed programs have been very successful, there have been many roadblocks that have required changes and adjustments over the years. Table 13 presents a summary of the main potential problems identified by the respondents to the state-of-the-practice survey.

Table 13. Summary of Potential Problems and Hurdles.

Potential Problem	Argentina (Buenos Aires)	Bolivia	Ecuador	Guatemala (City)	Nicaragua	Uruguay (Mont.)	
						Rural	Urban
Lack of knowledge of the contract	Yes	Yes	Yes	No	No	Yes	No
Lack of technical qualifications of the maintenance personnel	Yes	Yes	Yes	Yes	No	Yes	No
Lack of managerial skills of the enterprise personnel	No	Yes	Yes	No	Yes	Yes	No
High turnover in the enterprise staff	No	Yes	No	Yes	No	No	No
Financial insecurity because of uncertain contract renewal	No	Yes	No	Yes	No	Yes	Yes

Several other challenges faced during the development and operational phases of the particular projects studied are identified in the various case studies presented in the following section and summarized in the Conclusions and Recommendations section that also recommends solutions for the main potential challenges identified.

Key Findings of this Section: *The interviewed agencies agreed that the programs for contracting rural road maintenance through PBCs have resulted in improved road conditions and service at a lower cost, with consequent improvement in access to services and reduction in travel time and vehicle operation costs. The programs have also generated employment, increased road management efficiency, helped secure maintenance funding, and many secondary social, economic, and environmental benefits. For example, the improved road conditions have had positive impacts on production, employment, poverty alleviation, land values, and area used for agricultural purposes. The main problems encountered during the implementation of the programs are related to the lack of technical and managerial skill of the maintenance workers and difficulties in securing resources for the program in the long term. These problems can be mitigated through training and strengthening of the local institutions.*

8. Case Studies

Based on the results of the survey and telephone interviews, the consultant identified several programs to highlight as case studies, including rural and urban programs. These cases are described following. In addition to PBCs for the maintenance of sub-national networks, some relevant practices for national roads are also included in this section.

8.1. Rural Programs

8.1.1 Peru

The road network in Peru is divided into four sub-networks: (1) national, (2) departmental, (3) provincial, and (4) horseshoe tracks. Traditionally, the central government was responsible for the national and departmental networks; however, the government is engaged in a decentralization policy to transfer the management of the departmental road to the regional governments. Until recently, the Ministry of Transportation and Communications had three autonomous directorates that focused on national



Source: Torres, 2006

(*Provias Nacional*), departmental (*Provias Departamental*), and rural roads (*Provias Rural*). The departmental and rural directorates have been merged into *Descentralizado*⁹, which is becoming a supporting program for the sub-national governments that are assuming responsibility for the management of most of the roads in their areas. The directorate is transitioning from an agency in charge of the execution of the works to one that is responsible for providing technical, administrative, and financial assistance as well as knowledge management services. Within this framework, approximately 15,000 km of departmental and provincial road are being maintained by 700 micro-enterprises that have provided 7,000 permanent jobs in areas gravely affected by poverty.

The *Provias Rural* program (initially called Rural Road Program) started in 1995 to improve the road condition of rural roads and the social environment of the people of the 12 poorest departments of the country. The first phase (1995 to 2000) covered 401 municipal districts, 108 provinces, and 12 departments. The network maintained included 882 km of access roads, 2,106 km of secondary roads, and 263 km of the national network. The second phase involved the rehabilitation of 3,000 km of rural roads and the routine maintenance of 14,251 km. The effect of the program on the Peruvian rural roads is illustrated by two examples in Figure 5.

⁹ <http://www.pvd.gob.pe/index2.htm> (accessed 03/07)



Figure 5. Examples of the effect of the road maintenance contracts (Torres, 2006).

The second phase (2001 to 2006) focused on promoting the rural integration of low accessibility regions, rehabilitating and maintaining rural roads at reduced costs, creating new employment and acting as a catalyst for employment generation, and strengthening the local institutional capacity to assure a sustainable road maintenance program.

Rural and Departmental Road Programs

The practice of contracting micro-enterprises for road maintenance has been an integral part of the strategy of the Peruvian rural road program. The program started with support of the World Bank and the Inter-American Development Bank (IADB). The program funding breakdown for the second phase was 30% World Bank, 30% IADB, 30% central government, and 10% local governments. The local contribution has been increased to close to 40% in the latest phase of the program. The program rehabilitated rural access roads, most of which were built over ancestral tracks and had poor geometric standards.

For example, many of the roads lay next to rivers and were flooded periodically during the rainy season.

The rehabilitation was very basic, with an average investment of \$10,000–\$15,000/km and used simple specifications that included the addition of a layer of granular material and the construction or repair of small drainage structures. Once the roads were rehabilitated, their routine maintenance was contracted to micro-enterprises at a cost of approximately \$500–\$1,000/km/year. In addition, depending on the traffic and climate, some of the roads received periodic maintenance every three years (average cost \$3,000/km), which included grading and partial re-graveling. These periodic maintenance works were also generally contracted with local road construction companies. Emergency maintenance, to correct damage inflicted by natural disasters such as landslides and earthquakes, is not included in the contract and is generally conducted as a cooperative effort between the local government (equipment), Provias (combustible), and the micro-enterprises (labor). In the near future, the roads in the intermediate (*ex-Provias Departamental*) network will receive mechanical routine maintenance once or twice a year. This will be done with heavy construction equipment (graders and rollers). The plan is for local governments to contract these services at a cost of \$600/km, but the province may opt to execute the work by force account with the funds provided.

Micro-enterprises for Road Maintenance

The use of micro-enterprises for the maintenance of rural roads has been considered very successful. The cost of the approach has been lower than when the Ministry used to rehabilitate and then abandon a road that soon needed to be rehabilitated again. The process has a lot of participation from the local governments and communities. The local communities play an active role in the selection of the roads that will be maintained through road maintenance contracts, selection of the workers who will form the micro-enterprises, and control of the level of service achieved.

The program started with three pilot micro-enterprises. A typical contract covers 20 km and includes 10 workers (approximately 2 km per worker). The mayor (*Alcalde*) of the province periodically assesses that the road is passable, the typical required level of service. Although the evaluation of this level of service is very subjective, there are some items that can be measured; for example, one of the workers has to travel the entire road section at least once a day (usually on a bicycle) to identify any problems that need to be corrected. The regional engineer for the zone was responsible for making the payments in a monthly meeting with each micro-enterprise based on the feedback received by the local authority (this has recently changed as discussed later in the report). The process is supported by monitors, young engineers, *social or business administration specialists* from local universities that work for one year as part of their professional practice. The experience allows them to interact with the rural people and to experience communal life; approximately 5% of the monitors are women. Each regional unit handles approximately 30 micro-enterprises with the help of five to six monitors.

When the program was run by the central government, the micro-enterprises were generated, formed, and trained with support from the National Highway Agency. Most micro-enterprises were constituted as non-profit civil associations because this modality was similar to the communal activities already being conducted in many of the communities and allowed them to avoid paying income tax. It is important to note that, especially in the sierras, there was already a common ancestral practice of organizing groups of volunteers to do community work, such as cleaning or repairing public spaces. The micro-enterprise formation process started with a promotional effort that selected the micro-entrepreneurs. This was followed by a cycle of training and creation of the micro-enterprise. Finally, the work was contracted directly as stipulated by the lending organizations. The contracts were done based on a pre-established fee and a technical manual. Table 14 summarizes a typical promotion process.

With the decentralization efforts, the Provincial Road Institutes (*Institutos Viales Provincial*, IVP) have become responsible for managing the roads. The Provincial Roads Institutes were created after 2000 as decentralized institutions that municipalities can use in order to manage road assets. Institutes work under the authority of a "board" composed of all the mayors in the province. Each institute is composed of a manager (*gerente*), a technical specialist and administrative personnel. The Institutes receive resources from the provinces and municipal districts.

Table 14. Typical Sequence of the Micro-enterprise Promotion Process

Phase	Typical Activities
Preparation	Select promotional team Establish responsibilities and control mechanisms Inventory roads and assess their condition Create selection criteria
Promotion	Present project to local authorities Coordinate with community Meet with community Hold second meeting with interested community parties Train micro-enterprises management
Selection	Interview participants Select candidates
Legal Constitution	Elect management Create micro-enterprises statutes Present statutes to the Ministry of Public Works
Contract	Prepare budget Direct contract
Training	Conduct technical training on rural road routine maintenance Conduct administrative and financial training

The program reached approximately 108 provinces and 200 municipal districts in January 2007. The institutes are responsible for managing the provincial roads and preparing multi-year provincial road programs. There was consensus among the various actors interviewed that these institutes needed significant support, orientation, and training in order to

consolidate themselves institutionally. It is planned that these institutes will eventually expand their responsibilities to manage other assets and become Provincial Infrastructure Institutes.

The payments to the micro-enterprises are now made directly by the Provincial Road Institutes. However, the regional engineer still meets monthly with the micro-entrepreneurs. It is important to note that about 20% of the provinces have expanded the program with their own resources. Direct contracting has been discouraged since the decentralization, and the some contracts are currently being awarded competitively. The agency is attempting to secure some legislative changes that would allow a more flexible contracting mechanism for this type of work at the municipal level.

Impact

There have been several evaluations of the approach of contracting the road maintenance to micro-enterprises using PBCs. Torres (2006) summarized the main results of the *Provias Rural* program (which included rehabilitation of some road in addition to routine maintenance) as the following:

- Provided a wide geographic and social coverage directly benefiting 250 people per kilometer with a low investment of just \$100 per capita.
- Provided permanent (all weather) access to 3.5 million rural inhabitants.
- Provided a financial compromise with the local governments and a presence of the government in rural areas in conflict and facilitated the collaboration between central and municipal governments.
- Generated 7,000 permanent jobs and 50,000 temporary employment opportunities.
- Saved at least \$10,000/km every four years on road rehabilitation and maintenance costs.
- Contributed to poverty alleviation, generation of new economic activities, and development of local engineering and consulting firms.
- Introduced new economic agents, including the road maintenance micro-enterprises, small engineering and consulting enterprises, and other productive initiatives. Estimates indicate that the investment in road maintenance is multiplied by 10 in other productive initiatives.

One unexpected result of the program is that several micro-entrepreneurs have developed significant leadership skills and have been elected municipal board members and even mayors.

Formal Evaluations

The *Provias Rural* has contracted two evaluations in 2000 and 2004 to assess the economic, social, environmental, and institutional impacts of the program for maintenance of rural roads using micro-enterprises to an independent group (CUANTO). Both evaluations

showed that there were important benefits. Many families were interviewed in both evaluations. However, the evaluations were somewhat subjective because there was no detailed baseline evaluation.

The 2000 evaluation quantified and qualified the impact of the Rural Road Program (*Programa de Caminos Rurales*, PCR) that included not only the routine maintenance but also the rehabilitation of the rural roads and improvement of horseshoe tracks. The study compared a sample of the road included in the program to a control sample composed of similar roads but not included in the program through surveys and interviews. The main impact identified was an improvement in the transportation conditions (travel time, passenger and goods transportation cost, and vehicular flow). In addition, the study also found improvements in the access to public services and markets. Improvement to employment, migration, and poverty alleviation were small or nil. Only marginal negative impacts were observed, with a small increase in accidents and crime, more competition for local resources, and changes in local dress (CUANTO, 2000).

The second evaluation (in 2004) also determined a baseline for future evaluations. Consistent with the previous evaluation, this study identified significant impacts on transportation conditions and access to basic services and a small positive impact on production, employment, and poverty alleviation. Travel times were reduced by more than 60%, and there was an increase in traffic and a reduction in the fares of the public transportation services. The analysis also showed a positive impact on the access to schools (8% increase in enrollment) and health services (55% increase in visits) and administration of justice. There was also a small increase in land values and the area used for agricultural purposes; a small reduction in the rates of unemployment, poverty, and migration (which was not stopped); and an increase in the average wage of about 20%. Finally, the study found a very positive perception of the road condition by the population (CUANTO, 2004).

Escobal and Ponce (2002) evaluated the benefits of rehabilitated rural roads by focusing on their impact on key welfare indicators such as income or consumption. The study looked at rural households living in some of the poorest districts of Peru and compared (using propensity score matching techniques) households located near rehabilitated roads to suitable controls. Results showed that rehabilitated road accessibility can be related to changes in income sources, as the rehabilitated road enhances non-agricultural income opportunities, especially from wage-employment sources. However, income expansion was not matched by an equivalent consumption increase, apparently because the additional income is allocated to savings through increases in livestock, most likely because road quality improvement is perceived as transitory.

Another evaluation of the *Provias Rural* and *Provias Nacional* programs was conducted for the International Labor Organization in 2004. The specific objectives of the study were: (1) the analysis and evaluation of the micro-enterprises programs from the transportation and management point of view and (2) the analysis and evaluation of the micro-enterprises programs as employment and income generators. The study also documented lessons learned and developed recommendations to improve the programs. The study was based on

personal interviews with micro-enterprises owners, employees, families and end-benefited users for the municipal program and with supervisor engineers, regional engineers, and micro-enterprise owners for the national program. The study involved seven departments with a total of 297 micro-entrepreneurs from 31 micro-enterprises and 83 micro-entrepreneurs from 8 micro-enterprises for the rural and national programs, respectively. The results are consistent with the previous evaluations: the micro-enterprise system is viable, sustainable, and has significantly impacted the maintenance of rural roads. The report also compares the practices and presents recommendations on how to improve the process (Contreras, 2004).

Contreras (2004) identified two key aspects that have facilitated micro-enterprise sustainability: (1) the work stability provided by the program and (2) the interaction with the monitors and supervisors that allow the micro-entrepreneurs to receive training and technical assistance. The report also identified three phases in the micro-enterprise formation:

1. In the first phase, the community accepts and participates in the selection process, and they help identify and select potential micro-enterprises members.
2. In the second phase, the members improve their economic situation, increasing their buying power capabilities. This phase usually generates resentment by other members of the communities, especially in poor and extremely poor communities.
3. In the third phase, the community requires the municipalities to implement a rotational system that ensures the participation of more people. Although this last phase usually has a small negative impact on the condition of the road and the economic situation of the original micro-entrepreneurs, it opens employment opportunities to other members of the community.

Personal Interviews

The Peruvian Ministry of Economy and Finance provided similar findings. The person responsible for the oversight of the rural road program agreed with the opinion of the *Provias* and the various independent reports that road maintenance through micro-enterprises of the *Provias Rural* has been a successful program. This program has allowed the sustainability of road maintenance and the preservation of the investments in rural roads. It provides an effective mechanism to secure the needed resources and creates an organization responsible for the road maintenance. For this reason, the program has been replicated on the national and departmental networks. In general, approximately one-third of the micro-enterprises have grown and generated other productive projects, another third have been able to support themselves, and only one-third are experiencing problems. He also recommended a rotation mechanism to help alleviate poverty although this is not the direct objective of the program. The external financing has been the catalyst that provided visibility and credibility to the program. The program was able to break some taboos, such as the belief that the maintenance by force account was the only practical way of maintaining rural roads in poor and remote areas and that only the roads paved with an asphalt surface are able to remain in good condition. Furthermore, the application of level

of service was very important because it provided a significant change in the way of doing business.

Finally, the members of the micro-enterprise San Juan de Dios in the province of Cuzco (Figures 6.a and b) recognized that in addition to securing them some income, the program has significantly improved the condition of the roads and provided access to service that did not exist before the program. The maintenance kept the road in reasonable condition nine years after rehabilitation, and they were even able to do some minor geometric improvement correcting dangerous curves, as shown in Figure 6.c and d, respectively. The depicted road is nine years old and has received only routine maintenance. The improved road conditions have also facilitated the creation of public transportation systems (small buses and mototaxis, Figure 6.e) and the access of small commercial trucks with construction materials, allowing the population of the adjacent areas to upgrade their roofs from straw to ceramic shingles (Figure 6.f).

Challenges

There were several issues that made it difficult to develop and implement the program. According to the experts interviewed, the main problems that needed to be resolved include the following:

- Determination of the best juridical and organizational model for the micro-enterprises, which because of their rural and often remote nature require special legislation and treatment. Furthermore, it was important to contemplate the ancestral community practices.
- Securing enough resources for maintenance because maintenance activities lack the visibility of new construction or rehabilitation projects, and consequently they generally do not provide a high political payoff. However, the program has demonstrated its value and most of the provinces have been able to fund the continuation of the program (and some have expanded it), using a model in which the cost is shared between the district and the province.
- Determination of fair differential costs per kilometer because there was not enough experience with this type of contract and therefore no good historical records about production rates in the different areas. The program adopted a flat rate (\$1,200/km) in the first phase and then modified it as more information became available. In the second phase, the roads have been classified in 12 types based on the physical characteristics of the road, geographic region (rainforest or sierra), and level of service (high or low), and a differential cost has been computed for each class (ranging from \$540 to \$1,275). It is also important to consider indirect costs such as social security benefits and insurance.
- Minimizing the potential risk that the placement is used to pay political favors because the local authorities are heavily involved in the selection of the members.



Figure 6. Micro-enterprise work and impact in the province of Cusco.

- After the consolidation of the program, the members of the micro-enterprises were envied by other members in the communities because they had a fixed job with a secure income. In some cases there was high expectation in the communities but

only very few jobs. To correct this, the rural road program implemented a system of rotations in which some of the positions rotate among the communities' members.

- In some regions, there was heavy resistance to the participation of women because of social and cultural prejudices.

In addition, there have been problems associated with the decentralization of the already mature program. It has been difficult to transfer the program to the local municipalities mainly because of the following reasons:

- The provinces often do not have the technical, administrative, and financial resources to properly administer the program. This has resulted in delays on the payments and other problems.
- The transfer created a significant institutional challenge because the contracts can no longer be awarded directly but must be subjected to the general contracting laws that are not designed for these types of contracts and require competitive tendering. For example, the number of micro-enterprises selected to continue working in their respective areas in competitive tendering processes has been steadily decreasing from 75% in 2004, to only 25 %in 2006.

The main recommendation to overcome these challenges is for the program to provide technology transfer activities that allow the transfer of the know-how to the municipalities. The decentralization efforts should have the following: (1) clear objectives, (2) mechanisms for strengthening the municipal planning process and promoting the development of a road management plan, (3) a sound financing scheme that allows the sustainability of the program, and (4) a gradual implementation plan that starts with a pilot and grows one step at a time.

Lessons Learned

According to the authorities interviewed, the following are some of the main aspects that have to be considered when establishing road maintenance program with micro-enterprises:

1. Political: political support for road maintenance.
2. Technical and economic: need to preserve the road assets and employment generation.
3. Financial: sound scheme that guarantees the sustainability of the program.
4. Social: poverty alleviation and participation of the local population that live next to the road and the local actors.
5. Environmental: preservation of the environment and mitigation of the impact of the works.

The main lessons learned from the experience in Peru can be summarized as follows:

- The use of micro-enterprises for the maintenance of rural roads has been considered very successful.

- The use of performance- or results-based schemes appears to be the most practical way of controlling the type of work conducted by the micro-enterprises. Some of the road sections are located in very remote areas that are hard to access to control quantities.
- Training of micro-entrepreneurs, members of the road institutes, and monitors is needed for the consolidation and sustainability of the program.
- It is important that the organizational units are constituted as enterprises instead of non-profit organizations to allow them to engage in sound business practices and be able to embark in other productive endeavors that complement their road maintenance activities.
- It is necessary to develop an efficient rotation mechanism of the micro-enterprise members to ensure long-term acceptance by the community. However, this creates some challenges in terms of continuity of the program and quality of the maintenance work.
- There has to be some enforcement, including penalties when appropriate, to avoid workers getting used to relaxing their responsibilities.
- Tailor-made laws or administrative dispositions are needed to allow a more flexible mechanism that facilitates fair treatment of the micro-enterprises that have limited technical, administrative, and financial capabilities.
- If the responsibility of managing the road is transferred to the local governments, it is very important that there is a national agency that provides technical, administrative, and financial management training and support to the regional institutions.

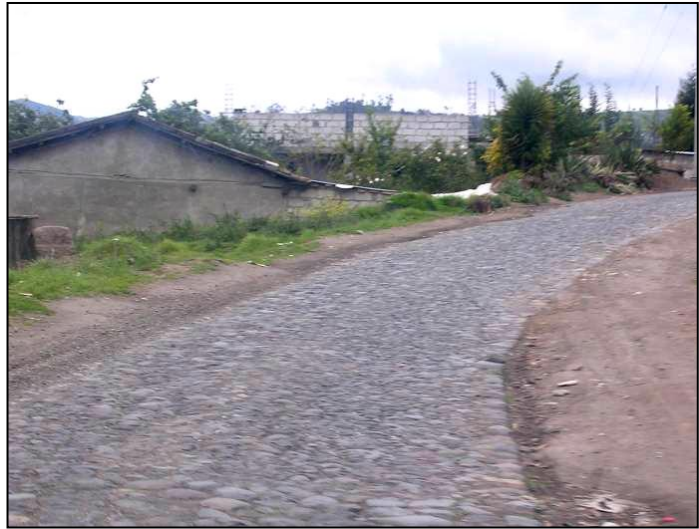
Key Findings of this Section: *The Peruvian rural road program has evolved over the years into a mature and well-established program with quantified and documented technical, social, and economical benefits. The contracting of road maintenance micro-enterprises through PBCs is one of the cornerstones of the process, which has had a significant effect on the sustainability of the process. The program actively involves the community in the formation and control of the micro-enterprises and uses monitors or junior engineers to inspect the work and train and support the micro-enterprises. Both of these practices have proven to be effective. A key measure of the success of the Peruvian program approach is that most of the provinces have maintained the PBC for road maintenance with micro-enterprises after the external and national funding ended.*

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8.1.2 Ecuador

The road network in Ecuador is composed of approximately 43,000 km of road, of which approximately 7,800 km are national roads (primary and secondary networks) maintained by the Ministry of Public Works (MOP); the rest are the tertiary network, access roads, and urban roads and streets.

Most (approximately 90%) of the road network is maintained through contracts with micro, small, medium, and large contractors. The modality of cooperative micro-enterprises is being used extensively for the routine maintenance of both the national and sub-national networks. There are three slightly different contracting models (Contreras, 2003). The first model was used in the first micro-enterprises that have operated since 2000 in Azuay with support from the International Labor Organization (ILO). The other two correspond to the maintenance of selected sections of the national (primary) and provincial (secondary) road systems. Although the same general principles apply to all programs, there are some differences among them. For example, in the program for the national roads the workers that constitute the micro-enterprises are selected by the agency that is contracting the work through a pre-selection process, but in the municipal program there is significant community involvement in the selection of the members and supervision of the work executed. Yeng and Van Dissel (2003) provide details about the modalities used for forming the micro-enterprises in the two models.



In all cases, there is consensus that the micro-enterprises are an effective way of maintaining the roads that would be otherwise neglected. Some of the benefits identified are listed as follows:

- The micro-enterprises take ownership of the road and are able to maintain a satisfactory level of service at very reasonable cost and productivity levels. The micro-entrepreneurs have a vested interest in keeping the road in the best possible condition.
- Since most of the members of the micro-enterprises also have a small agricultural production, they receive a double benefit. They not only get their income increased because of the payments for the road maintenance, but they also get their product to the market more efficiently and at a lower cost; increasing their competitiveness and profits.
- The micro-enterprises provide some marketing for the MOP because the road users see the uniformed crews and signs and realize that the MOP is providing a service.

- The training and practice received while creating and integrating the micro-enterprises allow the members to improve their social and entrepreneurial skills.

Micro-enterprises for Road Maintenance on the National Network

Although the focus of this report is on the road maintenance at the sub-national level, the practices on the national road network are discussed for comparison purposes. The national network consists mostly of roads with good (or at least reasonable) geometric standards, paved with asphalt, and with appropriate drainage systems (bridges, culverts, and ditches). As of 2006, there were 84 maintenance contracts on national roads with micro-enterprises in 18 provinces. Typically, a micro-enterprise is formed by 5 to 14 workers selected from people living in the vicinity of the road, and it maintains between 17 and 40 km of roads with an average of 3 to 5 km per person. The average duration for the contract is 7 to 12 months and is controlled by the cap placed on direct contracts. There are plans to reach all provinces in 2007.

Ideally, road segments subject to these types of contracts are those that have been recently rehabilitated and are returned by the contractors to the agency following rehabilitation. However, in some cases the maintenance of the road is contracted long after the maintenance period for the rehabilitation contracts has ended and the lack of maintenance has started to degrade the road integrity. In these cases, the first three months are used to bring the road to a maintainable condition. Additionally, the road segments included in the program should be located in regions where the MOP has no personnel to maintain the roads.

The monthly payment planned for 2007 is \$1,320/km if the workers work full-time. The cost includes a basic salary (minimum wage) of \$160/month, food, transportation within the maintained section, two trips per month by the manager of the micro-enterprise to the provincial capital, office expenses, accident insurance, accounting services, and fringe benefits. The principal activities included in the contract are cleaning of the road, signs, and right-of-way; cleaning and repair of culverts, ditches, and other drainages; tree trimming, removal, and replacement; grass mowing; and removal of small landslides. Examples of the work conducted are presented in Figure 7, which shows pictures of the before and after conditions for several road assets. In some cases the micro-enterprises collaborate with the MOP to do patching. In these cases it is common that the MOP provides the equipment and materials and the micro-enterprise contribute the labor. All the activities are guided by a Maintenance Manual, but often the recommended procedures are not followed.

The micro-enterprises are permanent (*personeria juridica de derecho privado*), and members do not rotate. The promotion was carried out by consultants that identified potential members with help from teachers, religious leaders, and other communal committees. The promoters organized workshops for all the interested parties and demonstrations of the type of work required. The members were then selected based on need for employment, desire to work, and lack of fixed income, with preference to women or

mixed groups. The input from the community is very limited, and this has created a lack of cohesion within the groups and desertion problems.



Figure 7. Example of drainage conditions before and after maintenance in the province of Manabi, Ecuador.

The supervision of the work is carried out by the MOP regional engineers, called road administrators (*Administrador Vial*), who also control the rehabilitation and new construction

contracts. The administrators organize the work and assign tasks on a weekly basis. He or she also assumes the responsibility of training the micro-entrepreneurs. A work plan is developed for the preparation of the contract, but it is adjusted weekly. In general, the first three months are used to update the contracted road segment to bring it to a satisfactory condition. During that period, the inspections are often more frequent and the level of service standards are relaxed because often the road is given to the micro-enterprises in less than ideal condition. The administrators keep track of the unit quantities executed within each item but only for the agency's records. The payments are based on a monthly assessment of the level of service of the asset maintained (as programmed by the administrator).

Impact

The consultant visited the province of Riobamba, where there were micro-enterprises of seven to eight workers in charge of approximately 40 km of road. The workers in these micro-enterprises work only part-time and are paid between \$600–700/km/year. Both the person in charge of the creation of the micro-enterprise and the supervising engineer agreed that, besides some difficulties, the program has been successful. It has provided employment in an otherwise depressed region, limiting emigration, and it has changed the overall condition of the rural roads where it has been implemented.

Challenges

The main challenge for the initialization of the program by the province of Riobamba was that it was hard to get enough workers because the excessive paperwork frightened them, a fact that was made worse because there were several delays in the initiation of the program (almost four years). In addition, it was difficult to make the workers understand that they were not government employees but rather their own bosses, and it was necessary to rotate the position of general secretary (or president) every two years because the rest of the group tended to think that only the secretary was responsible for getting the job done. The road administrators or supervisors work closely with the micro-enterprise, conduct training, and prepare the monthly plan in cooperation with the micro-enterprise.

The main problem the program during its current operational phase is low reliability in the payments due to a lack of resources or excessive bureaucracy. Some of the payment schedules are five months behind, making it impossible for the inspector to enforce the required work. The programs that have their own funding sources work better. The MOP is trying to create a Road Fund to reduce funding uncertainty and improve the cash flow. Another smaller problem has been staff turnaround. Some of the members have left the cooperative and have been replaced by family members or friends of other members who often do not meet the necessary requirements. This creates internal friction within the cooperative organizations.

Micro-enterprises for Road Maintenance on the Sub-National Network

The micro-enterprises contracted for the maintenance of municipal roads under the Unit of Neighborhood Roads (*Unidad de Caminos Vecinales, UCV*¹⁰) were modeled after the Peruvian experience. Most of the roads in the municipal networks are gravel, earth, or stabilized with stone. They connect the producers with the markets and as such, they have a significant impact on regional development. Therefore, the members of the micro-enterprises have two important benefits: (1) they have a stable job and (2) their production can reach the markets more easily and be more competitive because their work is helping keep the road they use in good condition. The main differences between the programs for the national roads and the sub-national roads are that traffic is in general lower on the latter roads, patching is generally included as part of the required activities, and there is significant participation of the community in the constitution creation and control of the micro-enterprises.

The first phase of the program covered the period from 2002 to 2006 and created 36 micro-enterprises. A second phase is ready to begin at the time of this report. This phase will invest \$55,000,000 over four years; however, the government is trying to secure funding to increase it to \$300,000,000 over 10 years. This new phase will be more decentralized and include a component for institutional strengthening in the provinces and municipalities. Each Province will create Road Management Teams (*Equipos de Gestión Vial*) that will develop maintenance and rehabilitation plans for each municipality. The plan will include an inventory for each included municipality and sections prioritized by visual condition, traffic, and strategic importance. The plan identifies the roads that require rehabilitation or periodic maintenance (partial re-graveling) as well as those that need only routine maintenance. The sections that require rehabilitation or periodic maintenance are designed in a small project that defines the scope of the work required. The teams are composed of three representatives of the Province (ideally with technical, financial, and administrative backgrounds), one representative from the MOP, and one representative from the corresponding local municipality (*Municipio*) where the road is located. The provinces are composed of several municipalities or parishes.

As in the program for the national road network, roads that have been rehabilitated are the best candidate for road maintenance PBCs. According to a recent study contracted by the MOP, the ideal micro-enterprise would be composed of eight members and would maintain approximately 15 km of road. The estimated fair cost is \$1,000/km-year if the traffic is low (5 to 15 vehicles per day). The workers work only part-time (about 10 hours per week). The program hires promoters to help create, constitute, and consolidate the micro-enterprises and develop the contracts with the municipal agencies. The members are selected with significant input from the community following a process very similar to the one described in the Peruvian experience. They have to live next to the section of road being maintained. Initially, no power equipment would be provided, and thus all work

¹⁰ <http://www.ucv.gov.ec/> (accessed 03/07)

would be done manually. However, the micro-enterprise may buy equipment if they find it cost-effective.

There is an initial payment before starting the work, and then the payments are made every three months. The modality of control through level of service is believed to be the only possible approach for this type of work because it would be impractical to measure any type of quantities. The supervisor controls the level of service monthly; if the level of service is inappropriate, the administrator lets the micro-enterprise know and allows them time to improve before applying penalties, which are seldom necessary. The supervisors conduct informal user surveys to evaluate the level of service that the road is provided.

The province of Tungurahua has 34 micro-enterprises constituted by the province mostly with their own funds. They were implemented gradually over a period of five years. The first six enterprises were established with the funds provided by the UCV, but the province then created 28 more micro-enterprises with provincial and municipal resources. These micro-enterprises work on gravel, stone, and asphalt roads. They employ an average of five workers and receive approximately \$450/km on paved roads (Figures 8.a and b) and \$636/km on stone roads (Figure 8.c and d). The cost of maintaining paved roads is lower because the municipality patches them. The workers receive \$50 to \$80 per month for working approximately 10 days per month. These levels of commitment are insufficient, but the province does not have enough resources to increase them.

The process to form the micro-enterprise starts with a request from the municipality. The province then evaluates if the contract is necessary, what the condition of the road is, and how the road maintenance contract will affect vehicular flow. If the project is deemed feasible, then the province authorizes the project and conducts a meeting with the parish. The community then selects the micro-enterprise members based on need, among other factors. Finally the MOP lawyers help to consolidate the micro-enterprise. The parish council helps control the performance of the micro-enterprise and achievement of the required level of service, which is checked once or twice a month. The provincial engineer who supervises the program helps the micro-enterprise plan the works on a monthly basis.

Impact

The provincial authorities in Tungurahua have observed a significant reduction in travel time on the stone roads, approximately 30% on average from the condition before the contracted maintenance was implemented; a reduction of vehicle maintenance cost; and even the creation of public transportation services on some of the roads. Maintenance cost savings cannot be quantified because the maintenance was inexistent before the program.

Some micro-enterprises have been able to produce small savings that, combined with their improved entrepreneurial skills, have allowed them to embark on additional commercial ventures, breeding small animals, for example. Three micro-enterprises have formed small cooperative communal banks that loan money at very low interest, helping other potential entrepreneurs. The province has also expanded the model to other areas and is creating

micro-enterprises to help mitigate some of the environmental impacts by planting trees and other activities.



Figure 8. Examples of roads maintained through PBCs in the province of Tungurahua, Ecuador.

Like what happened in Peru, the program has continued after the external funding provided by the UCV ended. Five of the six provinces that were included in the first phase of the program continued the program with their own funding with minor modifications, and many of them expanded the number of micro-enterprises in existence.

Challenges

A problem faced by the province of Tungurahua during the implementation phase included the program's lack of credibility; however, once the first four micro-enterprises were created, the demand for them grew rapidly. In general, the first few months are difficult

because most of the roads have been abandoned. Thus, the local government helps with equipment and materials to bring the road to a maintainable condition.

One of the operational problems identified is that the program requires TORs that are several pages long, which intimidate the potential micro-entrepreneurs. The program is trying to simplify them. In addition, the program is planning training in several areas including first aid, accounting, and appropriate techniques for using the tools (e.g., machetes). The latest phase of the program includes an approximately 20% increase in the budget for strengthening the agencies' road management capabilities.

Lessons Learned

The main lessons learned from the experience in Ecuador can be summarized as follows:

- The use of micro-enterprises for road maintenance has resulted in a successful practice for the maintenance of both national and sub-national networks. The practice has provided employment in otherwise very depressed regions, helped control emigration, and has changed the face of the rural roads where it has been implemented.
- One key factor that contributed to the successes of the practice is that the micro-entrepreneurs have a double benefit from the contracts: they not only receive a secure job, but they also contribute to bettering the road that they use to get their product to the market and thus, increase their competitiveness and profits.
- The UCV authorities concurred that the measurement of the work performed using results seems to be the most practical way to control the execution of the works, since it is difficult, if not impossible, to measure executed quantities for the type of work conducted by the micro-enterprises.

Key Findings of this Section: *Important issues identified as critical to the sustainability of the Ecuadorian rural road program include: (1) a fair salary to avoid exploiting the workers, (2) a system that has equal gender opportunities, (3) adequate training, (4) support to create the micro-enterprises, and (5) significant buy-in from the local communities.*

Contacts: Eng. Tomás Espin, Unidad de Caminos Vecinales, Eng. Mercedes Lligüin, Ministerio de Obras Públicas, Eng. Ramón Caiza, Province of Tungurahua, eng Wilson Horna and Dr. Nely Ramirez, Province of Riobamba.

8.1.3 Colombia

Colombia pioneered micro-enterprise road maintenance and has a long history of maintaining roads using micro-enterprises. The Ministry of Transportation and Public Works (*Ministerio de Trabajo y Obras Públicas*, MTOP) began experimenting with associative micro-enterprises in 1984. The program began as a joint program with the United Nations and the ILO. The practice has undergone several transformations and is currently used by the National Institute of Highways (*Instituto Nacional de Vías*, INVIAS¹¹), which has 318 micro-enterprises with 11,823 members. The micro-enterprises can be contracted directly or through a bidding process.



The routine maintenance activities included in the contract are the following: (1) cleaning of the roads, right-of-way, culverts, inlets, ditches, channels, signs, road markers, and guardrails; (2) repairing signs, road markers, and guardrails; (3) patching and sealing cracks and joints (INVIAS provides the necessary materials); (4) removing landslides; (5) mowing grass and brushes; (6) trimming, cutting, and removing trees; (7) planting trees and shrubs and seeding grass; (8) painting road markers; and (9) any other activities indicated by the administrator.

INVIAS uses a differential cost scale. A road classification model with four distinctive region characteristics is used to define the cost per kilometer per year as shown in Table 15. The costs are calculated to include salaries (minimum wage), meal and transportation allowances, tool acquisition and maintenance, uniforms, and social security. The micro-enterprise is paid a fixed monthly fee. Usually, there is an advance payment up to 25% and the rest is distributed equally in monthly payments spread over the duration of the contract.

The micro-enterprise is paid after the administration receives the supervisor's report stating that all works were performed satisfactorily. If the work is unsatisfactory, the monthly payment is reduced by 5% the first time, 10% the second time, and 15% the third time. If a micro-enterprise fails to maintain the required performance standards more than three times, the contract is terminated.

The micro-enterprise receives monthly technical, environmental, administrative, and cooperative training. In addition, INVIAS also provides training in other areas such as teamwork, sexually transmitted diseases, and first-aid. The agency launched an education campaign in 2003 that has allowed several micro-entrepreneurs to learn to read and write or obtain a primary education degree. Some have even advanced in their technical training.

¹¹ <http://www.invias.gov.co/invias/index.php> (accessed 03/07)

Table 15. Regions and Estimated Work Loads.

Region	Characteristics	Km/worker
I	Flat terrain Scarce vegetation 5 culverts/km (average)	5
II	Hilly terrain Medium vegetation Between 6 and 9 culverts/km	4
III	Mountain region Medium vegetation More than 10 culverts/km	3
IV	Steep terrain	2.5

Challenges

According to government authorities contacted, the major challenges in the implementation phase were the opposition from the MTOP maintenance employees, the lack of antecedents of similar experiences, and legal issues related to the formation and constitution of the micro-enterprises.

In contrast with what is happening in most of the other countries studied, since 2006, 27,000 km of municipal roads have been transferred to the National Institute of Highways. The national government has made several attempts to sign special agreements with the municipalities to expand the use micro-enterprises for municipal roads, but it often faced obstacles because of lack of resources of the municipalities and political barriers (that make collaboration between municipalities very difficult). However, there have been some successful experiences as in the city of Popayan, discussed with the urban case studies.

Lessons Learned

The authorities interviewed agreed that the program has had significant positive technical, social, economic, and political results. The main issues identified as key for the success of the program were the following:

1. Government support.
2. An assigned (and secure) budget.
3. A competent team for the planning and implementation of the program.
4. Good support documents (manuals, guidelines, etc.).
5. Adequate training of the micro-enterprise personnel.

Contacts: Engs. Carmen Cecilia Morales and Orlando Ortiz, Instituto Nacional de Vías,.

8.1.4 Nicaragua

Nicaragua has several programs that use micro-enterprises for the maintenance of rural roads. These include a national program and two municipal programs for emergency work and routine maintenance of rural roads in impoverished areas, respectively.

National Program

The Routine Maintenance Program by Micro-enterprises (*Programa de Mantenimiento Rutinario por Microempresas*) of the Ministry of Transportation and Infrastructure (*Ministerio de Transporte e Infraestructura, MTI*) started in 1997. The program was structured to cover routine maintenance activities while providing labor to Nicaraguan communities. It has been co-financed by the World Bank and the national government. There are 33 micro-enterprises already formed and 4 in development. The micro-entrepreneurs are people who live on or very near the road to be maintained. Each micro-enterprise employs an average of 14 workers and maintains 60 to 65 kilometers. Women's participation has been encouraged. The Nicaraguan National Highway Administration is in charge of the supervision and inspections. The program has been successful because, in general, the cost per kilometer has been lower than and the quality of the maintenance comparable to that of former maintenance done by direct administration. In addition, according to Dahl-Østergaard et al.(2003) "...If community groups can be taught how to negotiate effectively with outside private and public agencies, how to prepare proposals, how to manage feasibility studies, and how to leverage financing, they can be empowered to become autonomous agents of change." The main challenges identified were the competence with rural activities and lack of knowledge of accounting practices by the micro-enterprise. Better planning is also needed to assure that there is not employment competition during crop time.



Emergency Program

Specific short-term micro-enterprise programs have also been developed to cover emergency situations like the severe tropical storm Alma that caused flooding and severely damaged many roads. With the required approval of the national government, the contracts were made directly to micro-enterprises by the municipal governments. The micro-enterprises had an average of 40 members and attended 30 kilometers for a period of three months. The method of payment was a fixed sum per kilometer for the duration of the contract. The maintenance activities involved cleaning of culverts, ditches, and slopes and removing landslide material. The program only included patching if the gravel material was provided by the municipality. Figure 9 shows an example of the micro-enterprise work.



Figure 9. Examples of emergency micro-enterprise work in Nicaragua.

Local Program

Probably the most interesting experience in Nicaragua is that of the Transport Sector Program Support (*Programa de Apoyo al Sector Transporte*, PAST) funded by DANIDA. The agency has financed municipal transport infrastructure improvements in Nicaragua since the mid-1980s. It finances the rehabilitation of roads if the municipalities or the neighbors (community) agree to secure enough resources for the routine maintenance. The first phase of PAST covered from 1999 to 2004 and the second phase from 2005 to 2009. The program has benefited 14 municipalities and has attended 320 km of roads. It supports the improvement of tertiary transport infrastructure and localized improvement of the secondary transport infrastructure to address bottlenecks in the transport network in the Northern Autonomous Atlantic Region (RAAN), Southern Autonomous Atlantic Region (RAAS), and Las Segovias. These three areas together cover more than half of the national territory.

In addition to improving the transportation infrastructure, the program promotes three cross-cutting, overarching goals: (1) achieve gender equality in the workplace and in the decision-making process; (2) good governance, democracy, and human rights with special emphasis on the inclusion of indigenous groups and respect for indigenous people; and (3) establishment of and adherence to environmental protection principles and guidelines.

The program funds the road improvement with the condition that the municipality and the community take responsibility for the routine maintenance activities afterward. This approach allows the regions to take a network approach to their transport planning and gives them the responsibility for identifying and prioritizing projects within the available funding limits. The municipalities assume responsibility for the maintenance and must provide a five-year maintenance plan (which includes a budget and a financial proposal) and secure the corresponding funding. One of the characteristics of the project is that rehabilitation and improvement are only undertaken after the approval of the maintenance plans, and new project cannot be approved until existing projects have been maintained successfully according to the plans. The program emphasizes the sustainability of the road

maintenance, that is, the preservation of the existing infrastructure that is already in maintainable condition. If the municipality does not secure enough funds for the maintenance of their entire transport network, any investment in new spot improvements for the municipality will be postponed until the situation improves. The program has been successful in that 85% of the rehabilitated roads are receiving routine maintenance.

The first step for a municipality to get funding for a project is to obtain approval by the Regional Transport Councils (RTC). The RTCs were created to assist in the planning and prioritization of the regional transport networks and monitor the maintenance commitments with staff drawn from the municipal councils and regional governments. These councils annually evaluate the financial capacity and the fulfillment of previous maintenance commitments of each municipality. If the municipality receives an unsatisfactory evaluation, it becomes ineligible for new projects until the situation has been resolved because new projects should not endanger the sustainability of already existing maintainable infrastructure. In addition, all projects must receive the relevant environmental clearance in accordance with the checklist shown in Figure 10.

B: Environmental Issues Checklist		
Will the SPS and/or SPS Component		
- Irreversible use of natural resources in ways that will preempt the use, or potential future use, of those resources for any other purpose?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
- Emission and degradation: Cause soil, water and air pollution and are the potential direct and indirect impacts likely to be	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
- Local people and environment: Displace significant number of people, indigenous ethnic minorities or other communities? Change the way of life of indigenous peoples and other communities in such a way that it may lead to increased pressure on natural resources?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
- Occupational health and safety: Lead to occupational health and safety risks?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
- Environmental health: Are there health problems or opportunities from linking environmental opportunities and health?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
- Policies: Result in policy initiatives, which may affect the environment such as changes in agricultural, water, energy and transport pricing policies?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
- Location: Be located in, and (potentially) affect, any environmentally sensitive areas such as National Parks and other protected areas, important archeological, cultural and scientific sites, species of plants and animals worthy of protection and other vulnerable environments such as arid and semi-arid lands, wetlands or coastal areas?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
- Tenure and Access: Lead to conflicts and/or changes in tenure rights and rights of access of rights of access or right of use of natural resources?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
<i>All issues with 'yes' will have to be addressed separately in an ELA or separately in the ToR for the formulation of the sector program support.</i>		

Figure 10. Environmental checklist for the PAST DANIDA projects.

The second step consists of a census of all the families that will benefit from the project to determine the economic capacity of each family. Based on the number and type of families that benefit from the road, a quote is established for each family (e.g., U.S. \$3 or 50 Cordobas for an average family, U.S. \$55 or 1,000 Cordobas for medium-size producers, and U.S. \$110 or 2,000 Cordobas for big producers).

A project is approved only if there are enough people near the road to perform the routine maintenance activities after the rehabilitation is finished. When the project is approved by the RTC, a Project Committee is established to control the routine maintenance under the responsibility and supervision of the municipality. The cost of maintenance is U.S. \$400/km/year and requires one worker per kilometer.

Once the project is approved, the municipal authorities or the beneficiary communities must provide a written Maintenance Commitment (*Compromiso de Mantenimiento*) to maintain the infrastructure, and a Maintenance Committee (*Comité de Mantenimiento*) is created. The community is responsible for selecting the workers, who receive special training.

The routine maintenance work is controlled by an assigned foreman based on simple performance indicators. The foremen routinely check the condition of the road, determine the work needed, and present a request to the Maintenance Committee, which provides the necessary manpower. The participation of women is encouraged in the project committees and in the execution of the projects both as foremen and workers, depending on the local customs and experience. The main results of the program have been well-preserved roads and a high approval rating by a community that realizes the benefits of a well-maintained road and as a result is ready to help the municipality with the maintenance activities. According to the interviewed authorities, the maintained roads are generally in very good condition for at least three or four years.

Lesson Learned

The PAST program has some interesting contributions particular to this program:

- Promotes a culture of maintenance within the local communities served by the roads by requiring that the communities provide routine maintenance of the already rehabilitated roads as a condition for additional rehabilitation funds.
- Promotes good governance by requiring careful planning of the road works and human rights by placing special emphasis on the inclusion of indigenous groups and respect for indigenous people.
- Establishes and requires adherence to environmental protection principles and guidelines.

In addition, experience from the first phase of PAST indicates that the participation of women in the non-traditional roles of decision making and execution of transport infrastructure projects can result in general empowerment and increased participation of women at the local level.

Contacts: Eng. Karen Molina, Fondo Vial and Eng. Santiago Mendoza, PAST Danida

8.2. Urban Programs

8.2.1 Buenos Aires, Argentina

In 2001 the city of Buenos Aires, Argentina, started an ambitious program for developing a pavement management system for the city's collector and local roads¹². One of the main problems were utility cuts, which amounted to about 600 cuts per day and the cuts stayed open an average of 3 days. The city hired a consultant to conduct an inventory and condition evaluation of 30,000 blocks of city streets (each approximately 1,000 m²) and develop a pavement rehabilitation program for



the period 2001–2004 for 12 zones that in general coincide with the communal Centers of Participative Management (*Centros de Gestión de Participación*). The consultant developed a pavement evaluation procedure based on the PAVER Pavement Condition Index (PCI) and established a Geographic Information System (GIS) with all the considered road segments. Each block and intersection was considered a section, and the sections were divided in sample units. The procedure required the evaluation of approximately half of the sample units. The blocks that had a PCI of less than 40 (2,932 blocks) were rehabilitated by force account and then transferred to the contracted maintenance program. Blocks with a PCI between 40 and 60 received partial rehabilitation, and the rest (with a PCI greater than 60) were considered in good condition.

The routine maintenance tasks included in the contract were: patching of different pavement surfaces and gutters, sealing of cracks and joints in concrete and cracks in asphalt pavements, clearing and repositioning metallic fences, maintenance of the pavement painting, replacement of raised pavement markings, and replacement of concrete slabs.

The road management contracts require the contractor to evaluate the surface condition of the entire network every four months. The Pavement Management System group checks 10% of the evaluated segments. The contract includes items that are paid based on unit prices (rehabilitation and emergencies) and others that are paid based on performance. The performance indicators used are PCI, no potholes, curb and gutter in good condition, patching in good condition, horizontal markings in good condition, and smoothness only for the avenues. In addition, the contracts require the contractor to measure traffic volumes

¹² http://www.buenosaires.gov.ar/areas/espacio_publico/gestion_vial/?menu_id=8417 (accessed 03/07)

twice a year and loads (using WIMs) once a year. There are a total of 144 stations in the city.

The contracts were subjected to a tendering process and were won by medium- to large-sized contractors with experience in road maintenance work. The contractors are responsible for the design, rehabilitation (initial and deferred), and preservation of the streets within their zones. Several companies were able to secure more than one zone. The first contracts were awarded in 2004. Only one of the contracts was given to a small enterprise, created by a civil engineer with road maintenance experience, and this is probably the one that works best. All the contractors sub-contract the pavement condition evaluations, traffic counts, and weighing to a consulting company.

The development group has identified the following main challenges: (1) difficulties controlling how long it takes the contractor to fix the potholes once detected and the order of service is issued and (2) difficulties with the development of pavement deterioration models because of lack of historical data.

Lessons Learned

The consultant's evaluation of the project is that the program works properly and that it has helped maintain the streets at a reasonable level of service. In addition, the following were the main recommendation for similar new programs:

- Conduct a complete condition evaluation of the network before starting the contracting process to establish a good baseline and then be able to apply appropriate standards or level of service.
- Communicate with the potential contractors the objectives, basic concepts, and philosophy of the program through pre-binding conferences. This would increase the acceptance of and participation in the program.
- Conduct quality assurance and control tests on the evaluation teams and procedures to assure that the criteria are uniform. Use recognized standards to avoid litigation.

Contacts: Eng. Fabián Schvartzter, Consultant in charge of developing and implementing the Road Management Program

8.2.2 Guatemala City, Guatemala

The City of Guatemala has implemented a successful program called "Clean and Green" (*Limpia y Verde*) for the cleaning and maintenance of the city streets under the Urban Maintenance Program since 2002. The work performed through 46 contracts with small enterprises involves sign maintenance; cleaning of streets, ditches, and culverts; vegetation control; removal of debris; and curb painting for 720 km of the city streets. The contracts are subjected to a public bid and are given to small



contractors. The contractor is required to have a financial capital of \$20,000, one employee for every kilometer, and maintenance equipment; no special requirements are established regarding experience. An average small contractor employs 18 workers and manages 15 km. The contracts are awarded for a period of 24 months. The contractor is responsible for providing the needed tools, materials and light equipment. Table 18 presents examples of performance indicators used by the program.

Table 16. Performance Indicators Used by Guatemala City.

Indicators	Required Standard
Traffic signal cleaning	All signals must be visible and in working conditions at all times
Curb painting	The curbs must always be visible
Street sweeping	100% of the surface must be free of debris
Trimming, cutting, and removal of trees	No trees should obstruct traffic or pose a safety hazard
Elimination of clandestine dumpsters	All clandestine dumpsters must be eliminated

The maintenance activities are planned by the contractor, who receives input from the supervisor. To meet the contract requirements, the contractor has people working 24 hours a day in some areas, such as the historic city center. The cost of the contract is offered as part of the bidding process, and emergency works are paid extra. The work is supervised by municipality inspectors and penalties are applied if a contractor does not meet the required performance indicators in accordance to a Penalty Manual. The municipal authorities interviewed identified two main challenges in the program: (1) high turnover of personnel in the small enterprises and (2) lack of technical experience of the personnel.

Lessons Learned

According to the municipality, the program has resulted in significant benefits in terms of cost reductions, better services to the community, employment generation, and promotion of better road management. The success of the program is partially due to a strict control of public rights, elimination of adverse selection, and balance of the moral risk. A key aspect essential for the continuity of the program is the regularity of the payment schedule.

Contacts: Eng. Daniel Tello, Infrastructure Directorate, Municipality of Guatemala; Prof. Juan Roberto Brenes, Director of the Centro de Investigaciones Municipales; Henry Lopez, Director, Fondo Vial.

8.2.3 Popayan, Colombia

The municipality of Popayan in the province of Cauca, Colombia, has undergone major institutional restructuring to reduce the personnel of the municipality. The changes included the contracting of the street maintenance and cleaning to cooperatives. The cooperatives' only requirement is that they must be recognized by the Chamber of Commerce (*Cámara de Comercio*). The municipality holds public biddings for the contracts every year and sometimes every six months. The cooperatives use a rotation system (not all members work at the same time), but all the members have the same privileges. Though the government encourages female participation, the percentages vary widely. There is one cooperative formed mostly by women heads of households.



The cooperatives must designate a manager, who is in charge of the administration of the contract and must take a course at the National Learning Service (*Servicio Nacional de Aprendizaje, SENA*). The training covers administration, accounting, and public relations. The qualifications required for the rest of the members varies with the type of activity. While street and signal cleaning and waste collection require no special qualifications, the road maintenance workers are required to have more experience. Some cooperatives include engineers and people with construction and maintenance experience. The cooperatives are required "to perform routine maintenance tasks for an optimum level of service, following the performance indicators established by the municipalities in the Micro-enterprise Activities List" (*Lista de Actividades de Microempresas*). Table 19 illustrates the activities covered and the required performance indicators for each activity.

Municipal employees supervise the works. The designated supervisor must conduct random inspections and review the monthly report submitted by the micro-enterprises within five days of submittal. The micro-enterprises are paid a fixed monthly fee, and there is usually an advance payment of up to 20%. The micro-enterprise is only paid after the administration receives the supervisor's report stating that all works were performed satisfactorily. The penalty system is the same used for the national roads previously discussed in the report.

Lessons Learned

The program has been rated as very successful by the authorities interviewed; the main benefits identified include cost reduction, better quality, and more work opportunities for the population. Ideally, road segments subject to this type of contract are those that have been recently rehabilitated and are returned by the contractors to the agency after rehabilitation.

Table 17. Activities and Performance Indicators used by the Municipality of Popayan.

Activities	Performance Indicators
Cleaning and sweeping of the streets and public places	<p>The streets must be free of paper, leaves, dust, or sand accumulated near the curb and any other object that can be removed manually</p> <p>In the case of unpaved roads, the micro-enterprise is responsible for collecting paper, plastics, and other items from the roads and their immediate zones</p> <p>The micro-enterprise needs to clean as necessary curbs, bridge railings, and other elements, which need to be always free of dust</p> <p>The micro enterprise must support the "Good Neighbor" (<i>buen vecino</i>) campaign to avoid allowing the streets to become a dump</p>
Drainage systems	<p>Ditches, culverts, bridges, and other drainage elements must be always clean so that the water can flow freely. These activities include the removal of dirt, sediments, or any other object that has been swept away due to nature, human, or animal causes.</p>
Sign and traffic control devices	<p>Every sign or traffic control device must be perfectly visible and technically functional at all times</p>
Pavement markers	<p>All markers must be free of dust and debris at all times</p>

Contacts: Eng. Cecilia Guzman, Municipality of Popayan.

8.2.4 Montevideo, Uruguay

The municipality of Montevideo has one of the highest road densities in the world: 5,660 km/km². The city began using road maintenance PBCs in 1997 to improve the quality of the urban network and to reduce maintenance costs. The initial contract was issued for a three-year term, and the contractor received a fix monthly payment. In addition to the routine maintenance and rehabilitation activities, the contracts require the contractor to measure traffic volumes twice a year and loads once a year. Table 8 presented the performance indicators used in these contracts. In addition to the performance indicators shown in the table, the rehabilitated roads must maintain the following IRI values: 2.0 m/km for asphalt concrete, 3.8 m/km for concrete, 3.0 m/km for surface treatment, and 6.0 m/km for gravel surfaces. The contractor has a maximum time to correct the problems once they have been identified; Table 20 summarizes the allowable times.



Table 18. Time Available to Correct Identified Defects.

Surface Type and Defect	Concrete	Asphalt Concrete	Surface Treatment	Blocks	Gravel
Pavement					
Cracking	7 days	7 days	7 days	-----	-----
Patches	96 hrs	24 hrs	24 hrs	-----	-----
Potholes	96 hrs	24 hrs	24 hrs	-----	48 hrs
Manholes	7 days	7 days	7 days	7 days	7 days
Edges and corners	96 hs	-----	-----	-----	-----
Rutting	-----	24 hrs	24 hrs	24 hrs	-----
Bleeding	-----	7 days	7 days	-----	-----
Peeling	-----	7 days	7 days	-----	-----
Sealing joints	3 mos	-----	-----	-----	-----
Fracture slab	7 days	-----	-----	-----	-----
Drainage	7 days	7 days	7 days	7 days	7 days
Shoulders					
Batches, potholes, rutting and peeling	-----	7 days	7 days	7 days	-----
Drainage Systems and Right-of-Way					
Inlets	48 hrs				
Culverts	72 hrs				
Road right-of-way	7 days				

A special municipal control office was created to supervise the program and control the achievement of the required performance indicators. The supervisors inspect random samples of 50 meters of pavement for every 500 meters of contract and one culvert every 10 culverts. The municipality maintains the right to inspect the quality of the works any time and any place that they consider convenient.

The program recognized that the condition of the pavement must at least be regular to be maintainable. For this reason the methodology included two phases: (1) a first phase focused on upgrading pavements in condition below regular to good or very good and (2) a second phase that included the routine, and occasionally preventive, maintenance of all the roads in regular, good, or very good condition. The rehabilitation work is paid based on unit quantities. The contractor is responsible for one year of routine maintenance after completing the rehabilitation while the road is under guarantee. The contractor receives the first monthly maintenance payment for these rehabilitated roads on the thirteenth month after the rehabilitation is completed. The routine maintenance activities on the roads in regular condition or better begin on the first month of the contract.

The program also recognized that when the pavement is not rehabilitated, the performance standards may not be reached immediately. Thus, the contractor has a grace period by the end of which it must submit a plan that details how they are planning to improve the performance. The contracts give the contractors four months to patch all the batches and potholes, nine month to repair unlevelled public manholes, and 6 and 12 months to correct all other defects on primary and secondary roads, respectively.

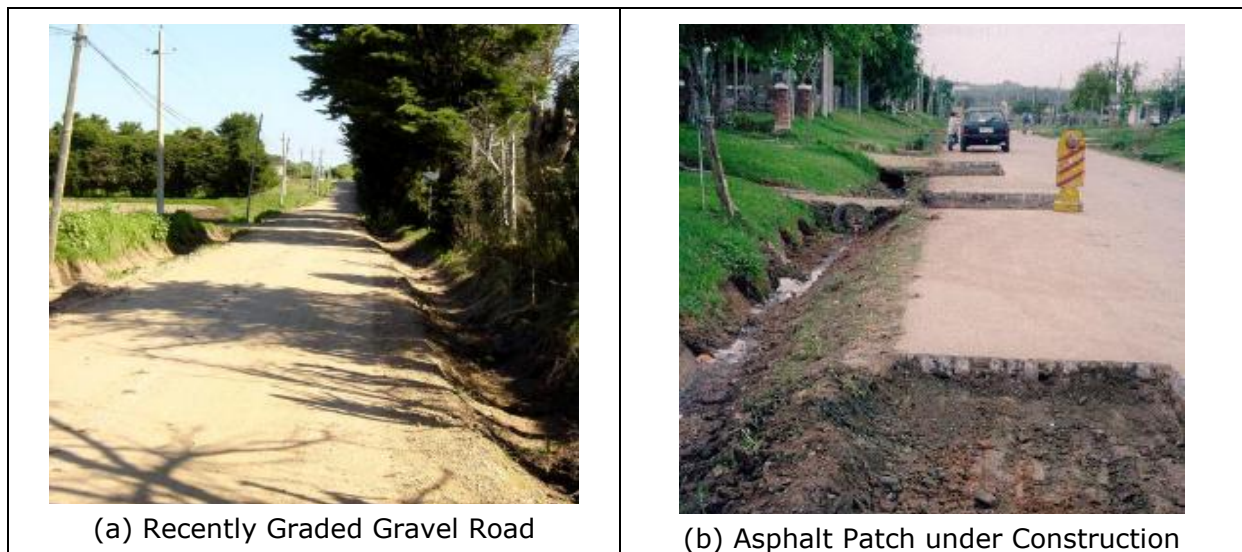


Figure 11. Examples of maintenance activities in the City of Montevideo, Uruguay.

Lesson Learned

The lessons are similar to the ones listed for the program in the neighboring city of Buenos Aires. Implementation of the program required the evaluation of the condition of the entire network and meetings with members of the private sector to get their perceptions, which held the risk of private sector rejection. As a result of these meetings, it was pointed out that the rehabilitation works needed more manpower capacity than is necessary for the maintenance works, and as a consequence the use of subcontractors was authorized. If the equivalent single-axle load (ESALs) increased more than 6%, the contractor was allowed to ask for a revision of the prices. Regular audits of the contractor and the supervisors were also identified as important factors for maintaining a sound program.

Contacts: Eng. Enrique Medina, technical manager, Hernandez y Gonzalez, contractor for the Gravel Road contract; Mario Cammarota, Consultant and former director of the section that contracted the maintenance.

9. Conclusions and Recommendations

This final section of the report summarizes the main lessons learned, challenges, conclusions, and recommendations for developing PBC programs for maintenance of sub-national level road networks using micro- and small enterprises. It must be noted that it was difficult to discern between the effects of each individual practice, contracting the maintenance, using micro-enterprises, and using PBCs, because they are confounded in the evaluations conducted. The benefits, impacts, and challenges are discussed in general with specific references in cases where one of the practices can be identified as the main source of a particular effect.

9.1. Lessons Learned

The study showed that performance-based contracts are a common practice for contracting the maintenance of sub-national road networks in Latin America. The following list summarizes the lessons learned from the experiences reviewed:

- There are significant differences between the scope, objectives, and performance standards of PBCs aimed at the contractors with a relative basic training typically used for the maintenance of local rural networks and those used for the principal national roads.
- The use of micro- and small enterprises for road maintenance has resulted in a successful practice for the maintenance of both national and sub-national networks. The practice provides employment in impoverished regions, helps control emigration, and has often changed the face of rural roads where it has been implemented.
- One key factor that contributed to the success of the practice is that the entrepreneurs get a double benefit from the contracts: they not only receive a secure job but also contribute to bettering the road that they use to get their product to the market and thus increase their competitiveness and profits.
- The measurement of the work performed using results, outcomes, or performance appears to be the most practical way to control the execution of the works because it is difficult to measure executed quantities. This is consistent with previous studies (e.g., Zietlow, 2005) that have also suggested that performance-based measures produce better results than unit price measures contracts.
- The sub-national road maintenance PBCs can be grouped in two main realms: (1) projects with a significant social component in economically depressed areas that use mostly micro-enterprises, and (2) projects focused more on improving the service of the roads that also utilize small, medium, and large contractors.
- Key differences between the two groups of programs include the technical level of the workers and the type of performance indicators used. While the projects in the latter group include objective and measurable performance indicators, such a

minimum Pavement Condition Index (PCI), the first group of PBCs utilizes more general and often subjective indicators, such as a clean or passable road.

- Most of the PBCs with micro-enterprises are not strictly fully performance-based because the decision of which tasks to conduct each week (or month) is taken by the inspectors, monitors, or supervisors who indicate what must be done and then check that the work has been done. However, the contracts are output-based because the inspectors do not in fact measure any quantities but rather look that the assets selected for cleaning are clean, that the section of road that he or she requested to be maintained is in good condition, etc. and the contracts decide how to do it and when to do it within the specified timeframe.
- Securing sufficient and timely financing is crucial, especially in the case of micro-enterprises. Maintaining a regular and timely pay schedule is very important since the workers cannot afford delays in the payments. The micro-entrepreneurs are selected among the neediest in very impoverished areas and thus they depend heavily on these payments for their subsistence. Furthermore, long-term funding is essential for program sustainability.
- It is important to determine the most appropriate juridical and organizational framework for the micro- and small enterprises. In general, it was found that the use of true business or enterprise entities (e.g., limited liability companies) instead of non-profit organizations are preferred because it forces the micro-enterprises to engage in sound business practices and allows them to embark in other productive endeavors that complement their road maintenance activities.
- Tailor-made laws or administrative dispositions are often needed to allow a more flexible mechanism that facilitates fair treatment of the micro-enterprises that have limited technical, administrative, and finance capabilities.
- The process of promotion, formation, and legalization of the enterprises is critical for the process. Careful selection and proper training of the micro-entrepreneurs to develop their technical, financial, and managerial skills is important.
- There has to be appropriate enforcement of the required performance standards, including penalties when appropriate, to prevent workers from becoming used to relaxed responsibilities. A gradual program in which the inspector first issues a warning and then starts using increasingly higher penalties appears to be working in many countries.
- Training of micro-entrepreneurs, members of the local road management institutes or offices, and monitors or supervisors is needed for the consolidation and sustainability of the program. If the responsibility of managing the road is transferred to the local communities, it is particularly important that there is an agency that provides technical, administrative, and financial management training and support to the local governments. Local governments typically lack the necessary expertise and institutional resources to effectively implement and manage

these types of programs. The resulting institutional strengthening should also help improve the overall performance of the local governments and positively impact other business functions of the local governments.

- Micro-enterprises have provided good opportunities for road agencies' staff to start businesses and for the local population to improve their business knowledge and entrepreneurial skill. In many of the countries studied, the creation of the road maintenance enterprises has initiated a new spirit of entrepreneurship, which goes beyond the scope of work originally contracted and has allowed the micro-entrepreneurs to engage in parallel productive endeavors.
- If the programs focus on the use of established contractors it is important to involve these contractors in the program developing of the process. This is important to achieve credibility in the program and increase the participation of potential contractors.

9.2. Potential Challenges

Although in general the studied programs have been successful, there have been many roadblocks that have required changes and adjustments over the years. The main challenges faced by agencies developing programs for contracting road maintenance with micro- and small enterprises are summarized as follows:

- Determining the best juridical and organizational model for the micro or small enterprises. For example, problems in this area include the following:
 - Colombia faced some problems with the multi-active cooperatives that can be constituted with a minimum of three people and can subcontract additional people as needed to do the work. The benefits in this kind of enterprise were not equally distributed, and in some cases the workers were paid less than the minimum salary.
 - Peru initially used non-profit enterprises, which created a serious problem when the contracts were later subjected to a tendering process. Therefore, Peruvian authorities strongly recommended the use of true enterprises or business.
- Securing enough sustained resources for maintenance is difficult because maintenance activities lack the visibility of new construction or rehabilitation projects and consequently do not generally provide a high political payoff. Furthermore, the local governments' lack of the technical, administrative, and financial resources to properly administer the program has often resulted in delays in payments and other problems.
- Determination of fair costs per kilometer. When the programs are started, there is commonly not enough experience, and consequently no good historical records about production rates in different areas. Thus, the contract costs are approximate at best. For example, Peru adopted a flat rate in the first phase and then established

differential costs as more information became available. In addition, several agencies originally failed to consider indirect cost such as taxes, social benefits, and insurance. These costs have a significant impact on the functioning and productivity of the enterprises.

- Developing TORs, contracts, and manuals that include all the required information and standards requirements but are consistent with the education and skill levels of the maintenance workers. For example, the UCV in Ecuador requires TORs that are several pages long, which intimidates the potential micro-entrepreneurs, making it difficult to recruit workers. The materials should be very clear on the fact that the entrepreneurs are not government employees but rather their own bosses.
- Building the technical, administrative, and financial expertise so that the enterprise can do the work effectively and efficiently and are able to successfully compete once the contracts are subject to tendering.
- Minimizing the potential risk that the worker selection is used to pay political favors. This is especially critical in those programs in which the community and local authorities are heavily involved in the selection of the members and the selection of the roads to be included in the program. Opposition from government employees can also be a problem if the contracting is done in areas where the highway agency has maintenance personnel.
- Breaking social and cultural prejudices against the participation of women in road maintenance activities.
- Building credibility of the programs among a population that is used to abandonment of the roads and institutionally debilitated road maintenance agencies.
- Selecting appropriate candidate road sections in areas where there are enough workers living in the proximity of the road to maintain it.
- Finding an appropriate balance between permanent and rotated positions (when needed) in the enterprises to ensure appropriate quality of the work and continuity in the administration while providing opportunities to the larger segment of the population in need as possible.
- Finding an appropriate balance of risks and responsibilities between the various agents involved in the process by optimizing the collaboration between the entrepreneurs, supervisors, and communities.
- Obtaining appropriate legislative changes if necessary. A common problem faced by several of the programs (e.g., Honduras) is that the thresholds for direct contracting were low and in many cases had not allowed contracts that were long enough to consolidate the enterprises. In other cases agencies were able to sign the contracts under the agreements with the international organizations but not once the programs had been transferred to the municipal governments. These direct contracts are generally necessary in the first stages of the programs to create the entrepreneurial

expertise that would later allow the micro or small enterprises to successfully compete for the maintenance contracts when they are subjected to a tendering process.

9.3. Conclusions

The main conclusions of the study are summarized following:

- **Micro-enterprises are a viable option for providing an effective approach for maintaining roads and creating local contracting capacity, especially in remote areas.** This practice: (1) improves road maintenance with the consequent increase in service life and improvement in transportation efficiency and in the quality of service to the users; (2) generally results in cost of the routine maintenance somewhat lower than that of conducting the work by force account, (3) directly and indirectly generates attractive jobs in economically depressed areas, which has resulted in an improvement in the quality of life; (4) help secure maintenance funding; (5) rewards initiative; and (6) creates a sense of ownership of the road in the communities adjacent to the road.
- **Performance-based contracts are a practical mechanism for contracting the maintenance of sub-national rural road networks to micro-enterprises.** Although many of the benefits and positive impacts of the various programs investigated can be attributed mostly to the contracting of the maintenance activities, all the agencies investigated agreed that the use of PBCs is probably the most practical approach, especially for rural road and remote areas. The type of work performed and the remote location of the road segment under consideration make it difficult to measure and control quantities. In these rural programs, it is important that the selected performance indicators match the technical level of the work force. Furthermore, road management and planning of the maintenance activities is generally a collaborative effort between the micro-enterprises, the supervisor, and the local communities served by the road. The use of road management units such as the ones implemented in Ecuador and Peru appeared to be an effective practice.
- **Performance-based contracts have also been implemented successfully for the maintenance of urban street networks to enterprises of different sizes.** The use of PBCs with micro or small enterprises appears to be a practical alternative in the programs where the contracts include only routine maintenance. Hybrid contracts are more commonly used in the programs where street rehabilitation is also included. These contracts typically involve medium- to large-sized contractors. The rehabilitation items are paid based on unit prices, and the routine maintenance is based on outcomes or performance.

9.4. Recommendations

Following is a list of developed recommendations based on the input of the several experts interviewed and the literature reviewed that may help avoid some of the most common

potential problems and develop a successful program for contracting road maintenance at the sub-national level.

- **Secure commitment from the local communities:** It is important to have significant buy-in from the local communities before starting the program. Their input is important for identifying the projects and the potential entrepreneurs, defining the expected performance standards, and controlling the achievement of these standards. Most of the rural road maintenance programs have been made possible thanks to initial funding provided by international organizations. This external funding allowed development and implementation of the pilot programs that demonstrated to the communities that the approach does work.
- **Use performance-based contracts:** This practice appears to be the most practical mechanism for contracting routine road maintenance. The type of work conducted, and often also the remote location of the road segment considered, makes it difficult to measure executed quantities. For example, in Colombia INVIAS used admeasure payments early in the program but soon realized that PBCs worked better; they strongly recommend the use of PBCs instead of unit quantities.

For micro-enterprises in rural areas:

- **Select an appropriate juridical framework for the micro- and small enterprises:** The definition of the appropriate legal framework for the creation and constitution of the micro-enterprises is very important. Examples of the models used include non-profit cooperatives, associate work cooperatives, associate work enterprises, and multi-active cooperatives among others. In general, true corporate models or enterprises appear to work better. Tailor-made laws or administrative dispositions may be needed to allow more flexible mechanisms that facilitate fair treatment of micro-enterprises that have limited technical, administrative, and finance capabilities.
- **Provide technical, administrative, and financial training and support:** If the program is run and managed by local governments (e.g., because of decentralization efforts), the availability of an agency that provides technical, administrative, and financial management training and support to the local governments is very important. Training of micro-entrepreneurs, members of the decentralized road maintenance units, and supervisors and monitors is needed for the sustainability of the program.
- **Develop a promotion program to create the micro- or small enterprises:** A thorough program that identifies and evaluates candidates, informs them appropriately about the rights and responsibilities of the contracts, provides technical, administrative, financial, and administrative training, and helps organize and constitute the enterprises is important for the proper functioning of the enterprises.

- **Develop a step by step implementation plan** that starts with a pilot implementation. The success of the initial contract would show stakeholders that participation can be rewarding and increase the credibility of the program.
- **Provide equal gender opportunities:** Experiences in several countries have proven that women can successfully do the road maintenance works and can contribute positively to the performance of the enterprises. Furthermore, their employment has generated other indirect social and economic benefits.
- **Develop an appropriate and fair cost scheme:** The cost per kilometer used in the PBCs should reflect the level of effort required based on the geographical and climatic condition and type of road and traffic; use a fair salary that is consistent with the minimum standards for the country and the other job opportunities in the region (usually minimum wage); and consider indirect costs such as transportation, insurance, social benefits, taxes, etc.
- **Enforce micro-enterprises' compliance with performance standards:** There has to be some enforcement, including penalties when appropriate, to keep the workers from becoming accustomed to relaxing their responsibilities. This is very important to assure the long-term quality of the work.

For Small and Medium-size enterprises in urban areas:

- **Conduct a complete condition evaluation of the network** before starting the contracting process. This is very important to establish a good baseline, develop appropriate standards or level of service, and rational street management plans.
- **Communicate with the potential contractors** the objectives, basic concepts, and philosophy of the program through pre-binding conferences. This will allow adjusting the program to the capabilities of the local contractors and increases the acceptance of and participation in the program.
- **Conduct quality assurance and control tests** on the evaluation teams, evaluation equipment, and procedures to assure that the criteria are uniform and fair.

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Appendix I Survey Questionnaire

Appendix II

Example of Contracts

Appendix III Annotated Literature Review