ADB

Community-Based Routine Maintenance of Roads by Women's Groups

Guide for Communications Bureaus

Asian Development Bank

Community-Based Routine Maintenance of Roads by Women's Groups

Guide for Communications Bureaus

Asian Development Bank

Printed in the Philippines

ISBN 978-92-9092-361-9
Publication Stock No. TIM113426

Cataloging-In-Publication Data

Asian Development Bank.
Community-based routine maintenance of roads by women's groups: Guide for communications bureaus.
Mandaluyong City, Philippines: Asian Development Bank, 2011.

1. Roads. 2. Women's participation. I. Asian Development Bank.

Note: In this report, "$" refers to US dollars.

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
Tel +63 2 632 4444
Fax +63 2 636 2444
www.adb.org

For orders, please contact:
Department of External Relations
Fax +63 2 636 2648
adbpub@adb.org

Printed on recycled paper

Developed under a pilot project in Dehong Prefecture, Yunnan Province, People's Republic of China

Contents

Tables and Figures

Foreword

Traditionally, rural road maintenance in Dehong Prefecture, Yunnan Province is carried out during 1 or 2 days a year through voluntary contributions from communities along the road. This is complemented by provincial and local maintenance subsidies for the purchase of materials to be used. In practice, the burden tends to fall disproportionately on women and the poor. Due to limited labor inputs and a lack of skills training, maintenance quality is generally suboptimal, hence, roads continue to deteriorate.

Through the Gender and Development Cooperation Fund (GDCF) pilot demonstration project, the Asian Development Bank reached an agreement with the Yunnan Provincial Department of Transport and the Dehong Prefecture Communications Bureau, to increase the funding for routine maintenance of rural roads and change the way it is used. This makes it possible to finance the remuneration of maintenance groups that work year-round to keep the roads open and to slow down road deterioration. Apart from improving the road conditions, this pilot project also provides a rare opportunity for off-farm employment in rural areas that tend to fall far behind urban areas in terms of job options, especially for women and ethnic minority groups.

The GDCF pilot project has achieved the following:

- Some 165 kilometers of rural roads were successfully maintained by women's road maintenance groups. This resulted in continued access throughout the rainy season as well as improved road conditions, benefiting transport services and facilitating access to markets, schools, and health facilities.
- A total of 490 people was provided with technical and management skills training in routine rural road maintenance, and was taught other income-generating activities. Some 163 women, mainly from ethnic minority groups, were employed in rural road maintenance. For the first time, the women were paid for their maintenance work. The flexible nature of the output-based payment system has enabled them to easily combine this work with other household and farm responsibilities.
- Wages obtained from the maintenance work have provided a major boost to household incomes, raising these beyond the official poverty

line and providing the women with greater decision-making power in their households.

- The skills acquired to operate as maintenance groups and the quality of the maintenance work carried out, have demonstrated the potential of ethnic minority women. The status of these women within the community has improved and there is now a greater acceptance of their ability to participate in the management of public infrastructure.
- The pilot project has also improved gender awareness at different levels and has provided complementary training on economic activities with the aim of increasing the livelihood options for women.

This approach to road maintenance by women's groups has the potential for wider replication in the People's Republic of China and in other developing countries. This guide provides a way to share the approach and methods used.

Tyrrell Duncan
Director, concurrently Practice Leader (Transport)
East Asia Transport and Communications Division

Preface

The physical condition of roads is critical to any transport network. Unless roads are adequately maintained, they inevitably deteriorate, leading to higher road user costs and longer travel times. When simple routine maintenance is postponed for long periods, there is often a need for more extensive rehabilitation, which is much more costly.

Routine maintenance is often delayed due to various factors, such as lack of funds or insufficient technical knowledge.

The purpose of this guide is to assist the prefecture and county communications bureaus in Yunnan Province, People's Republic of China, in managing and implementing the routine maintenance of unpaved township and village roads.

This guide is the outcome of a pilot project on Community-Based Routine Road Maintenance by Women's Groups that was financed by the Gender and Development Cooperation Fund of the Asian Development Bank. The pilot project sought to involve women and other vulnerable populations (such as indigenous peoples) in rural road maintenance projects—both to undertake badly needed improvements in rural roads, and to provide employment opportunities for women and ethnic minority groups.

This guide explains how to organize, train, and contract community-based groups for routine maintenance of roads in rural areas, using as an example the maintenance work carried out by women's groups under the pilot project in Dehong Prefecture, Yunnan Province.

Klaus Gerhaeusser
Director General
East Asia Department

Acknowledgments

This guide was developed as part of a pilot project, funded by the Asian Development Bank (ADB), on community-based routine maintenance of village and township roads in Dehong Prefecture, Yunnan Province, People's Republic of China. The project was funded by a grant from ADB's multidonor Gender and Development Cooperation Fund. The task manager was Xiaohong Yang, principal transport economist, East Asia Transport and Communications Division. Overall guidance and support was provided by Tyrrell Duncan, director and concurrently practice leader (Transport), East Asia Transport and Communications Division; Bartlet Edes, director, Poverty Reduction, Gender and Social Development Division; Scott Ferguson, principal social development specialist (Safeguards), East Asia Office of the Director General; and Shireen Lateef, senior advisor (Gender) to the Vice-President (Operations 2).

The contributions of the following are acknowledged with gratitude: Serge Cartier van Dissel, international maintenance specialist, for preparing the main text and supervising the preparation of the drawings; Chenglong Chu, project management officer, People's Republic of China Resident Mission, for the review of the translation; Dajiang Sun, national gender development expert, for the Chinese translation of the text; Gloria Gerilla–Teknomo and Ma. Concepcion Jea Macrohon of the East Asia Transport and Communications Division for assisting in proofreading and coordinating the final production of this guide; Sri Wening Handayani, senior social development specialist of the Poverty Reduction, Gender and Social Development Division for her advice; Kasthamandap Art Studio for the drawings rendered; Pai Xuemei, division director, Dehong Prefecture Women's Committee and Yang Lingyan, deputy president, Dehong Prefecture Women's Federation, for their inputs and important observations; Charles David Salter for his valuable comments; and Sonomi Tanaka, principal social development specialist (Gender and Development), Poverty Reduction, Gender and Social Development Division, for her support.

The authors are also grateful to the Yunnan Provincial Department of Transport: Yang Yan, deputy director general; Xu Shaoneng, director, Planning Division; Zhan Xiaolin, deputy director, Planning Division; and

Xu Caijian, director, IFI-financed Project Office; and to the Dehong Prefecture Communications Bureau and Dehong Prefecture Traffic Bureau for their guidance and institutional support: Yan Xintong, director; Jin Chu, director of Maintenance Division; and Yi Tiansong, deputy director of Maintenance Division.

Abbreviations

ADB	–	Asian Development Bank
GDCF	–	Gender and Development Cooperation Fund

Currency Unit
(as of 30 March 2011)

Currency unit	–	yuan (CNY)
CNY1.00	=	$0.152
$1.00	=	CNY6.560

Weights and Measures

cm	–	centimeter
km	–	kilometer
m	–	meter
m^2	–	square meter
m^3	–	cubic meter

Routine Maintenance of Rural Roads

According to 2008 road data, there are 99,080 kilometers (km) of township roads and 33,406 km of village roads in Yunnan Province. Of these roads, less than 4% has either concrete or (simple) asphalt pavement while just over 96% is classified as unpaved, including 3% with stone-paved surfaces, 43% with gravel surfaces (47% of township roads and 28% of village roads), and 51% with earthen surfaces (45% of township roads and 67% of village roads). The unpaved township and village roads are 127,275 km long and comprise 62% of the total road network in Yunnan. The maintenance of these unpaved roads is, therefore, very important for ensuring continued access to the province's rural areas and for economic development in these areas. Many roads are currently impassable for a number of months each year, in part due to a lack of timely maintenance. This chapter will look at the deterioration process of these unpaved roads, identifying a suitable maintenance strategy to address this deterioration, and to ensure better road condition as well as more continuous access.

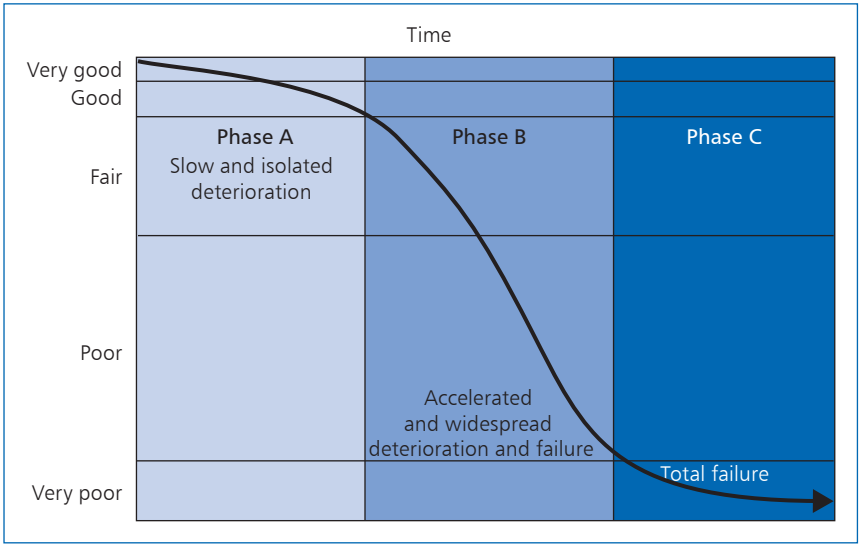
Road Deterioration

Roads deteriorate over time, mainly through the forces of water and traffic. Of these two, water is by far the most important, especially for unpaved roads. Water can cause damage through erosion, where the flow of water removes material, resulting in rills in the road surface, cuts in the road shoulder, and gullies in the drainage system, as well as undermining the road structures. However, stagnant water can also cause damage by penetrating the road surface, road base, and slopes, resulting in potholes and muddy areas, slumping and landslides, or collapse of the road. Traffic also causes road deterioration through material loss and road deformation as a result of the forces of the tires, resulting in ruts, potholes, and corrugations. These two main causes of road deterioration aggravate each other, as a road weakened by water is more susceptible to damage by vehicles, and a road surface deformed by vehicles can prevent water from leaving the road, leading to increased erosion and weakening of the road.

Such road deterioration is generally slow at first (Phase A, Figure 1), as road conditions tend to be good just after construction or rehabilitation. The road surface is not yet deformed, allows the water to easily flow off the road, and the drainage system is working properly and safely guides the water away from the road. With time, however, isolated damage to the road will start to appear, as a result of general wear and tear and minor damages to the road. Deformation of the road surface by traffic appears in the form of potholes and ruts, and the drainage system may become partially blocked, limiting its ability to guide the water away from the road. During this initial deterioration phase, however, the road still appears to be in good condition and the road user tends not to notice the deterioration despite the gradual increase in isolated, minor failures. As a result, the deterioration may remain unchecked in this phase.

As such minor failures become more numerous and serious, the deterioration tends to increase in speed (Phase B, Figure 1), mainly due to water flowing over the road or remaining on the road. The deformation of the road surface prevents the water from flowing off the road and causes it to flow over the road causing erosion, resulting in rills, and exposing the road base. This is worsened by the blockage of the drainage system, which is no longer able to guide the water safely away from the road, and causes the water to flow over the road. Potholes cause water to remain on the road surface, weakening the road surface and road base, making it more susceptible to damage by vehicles. The foundations of road structures, such as headwalls and retaining walls, also become affected, leading to their

Figure 1 **Road Deterioration**



Source: Author.

possible collapse. Although road damage is more localized at the beginning of this phase, it spreads until the entire road can be said to be in poor condition. During this phase, the road becomes more difficult to pass and travel times and costs tend to increase significantly.

Once the road condition has become very poor, the deterioration tends to decrease in speed (Phase C, Figure 1), as traffic levels go down severely and because there is little left to deteriorate. At the end of this final stage of deterioration, the road becomes impassable and traffic ceases altogether.

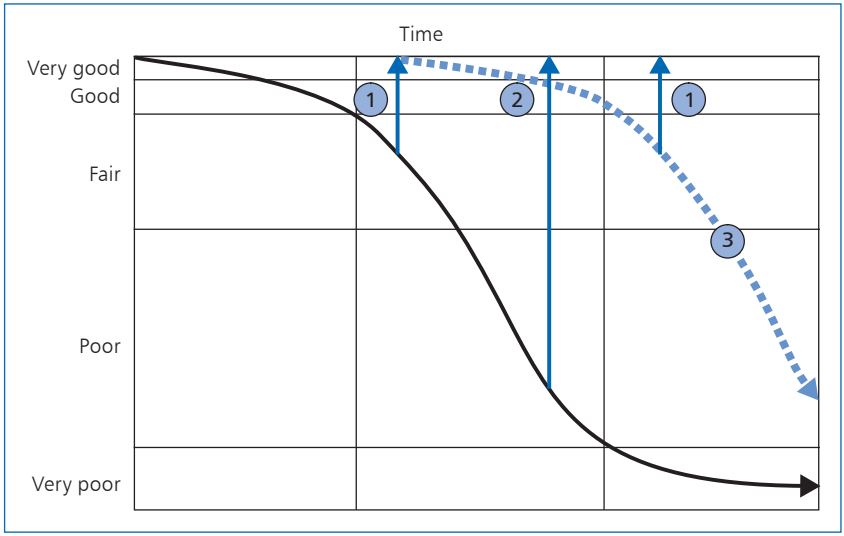
Road Maintenance

To counter the deterioration process, road maintenance is carried out. One type is corrective maintenance—which aims to repair the damage that has occurred. Repairs are made to the road surface and shoulder, the drainage system, and the road structures, generally bringing back the road to a good condition. An improved road condition results in shorter travel times and lower costs, and a decrease in speed of deterioration as the deterioration process starts from scratch. The more deteriorated the road is, the more intensive and thus costly the required repairs will be. Corrective maintenance—when the road is still in fair condition—may simply entail patching of potholes, reforming of the road surface, and minor repairs to the drainage system and road structures (arrow 1, Figure 2). If the road has already deteriorated to a poor condition, corrective maintenance will include complete resurfacing of large stretches of road, replacement or reconstruction of the drainage system and road structures, and possible reconstruction of the road base (arrow 2, Figure 2). Depending on the type of activities required, such maintenance is generally referred to as periodic maintenance (medium maintenance) or rehabilitation (major maintenance).

The distance from the black line indicating the road condition, to the desired good or very good condition indicates the level of corrective maintenance required, and thus the cost of such maintenance. After bringing back a road to good condition, the deterioration process starts anew (arrow 3, Figure 2), hence, corrective maintenance needs to be done repeatedly. Although corrective maintenance, carried out when the road is still in fair condition, will have to be repeated more frequently than when this is only done once the road is already in poor condition, this results in lower overall maintenance costs and a better overall road condition.

Maintenance can be corrective and done once the road has already deteriorated, yet, maintenance can also be carried out in a preventive manner to stop or slow down road deterioration. Preventive maintenance is generally carried out continuously throughout the year. This will ensure

Figure 2 **Corrective Maintenance**



Source: Author.

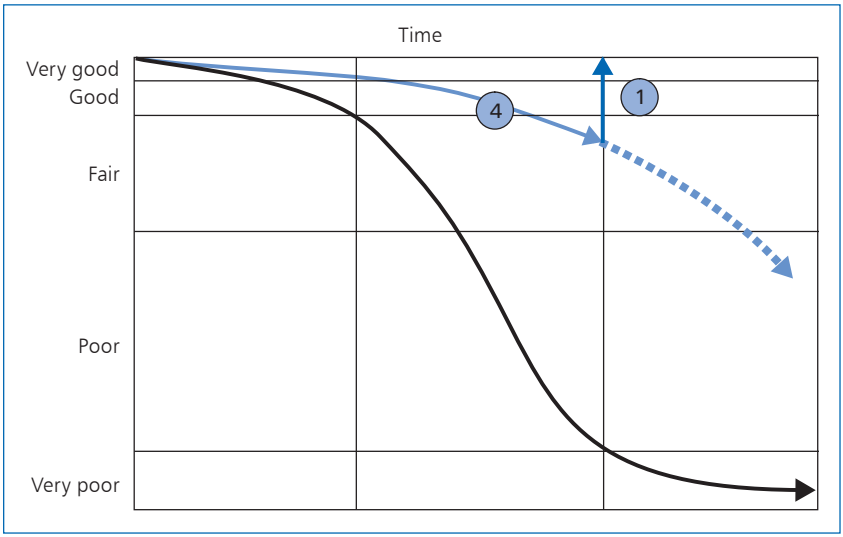
effective and timely response to maintenance needs and avoid (further) road damage and is generally referred to as routine maintenance (minor maintenance).

A significant part of preventive maintenance consists of cleaning and clearing of the road elements to ensure these work properly, especially the drainage system, to avoid damage by water. Through preventive maintenance, the deterioration process is slowed down considerably, as shown in Figure 3 (arrow 4).

Although the deterioration process is slowed down by preventive maintenance, it is not stopped and corrective maintenance will still be required (arrow 1, Figure 3). However, the need for such corrective maintenance will be less frequent as can be seen by comparing Figures 2 and 3. Such maintenance can be carried out periodically as depicted in the graph, but some corrective activities may also be included as part of the routine maintenance to prevent or slow down deterioration. Such minor repairs not only aim to bring the road back to a better condition, but will specifically try to avoid more serious damages by ensuring that the different road elements work properly, resulting in reduced overall maintenance costs and better average road condition.

Examples of minor repairs include patching of potholes and filling of ruts and rills to ensure that water can easily flow off the road, repairs

Figure 3 **Preventive Maintenance**



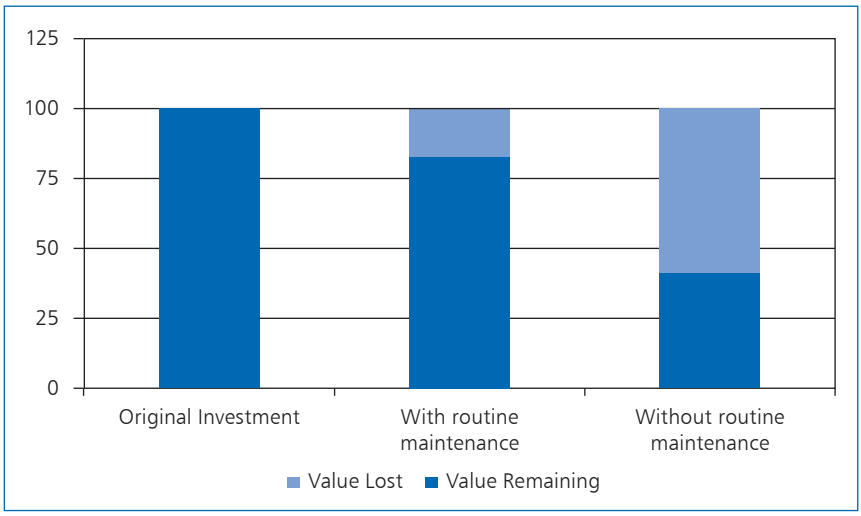
Source: Author.

to the drainage system so the water can be guided safely away from the road, and fixing of road structures so these do not collapse. Where possible and required, such repairs are combined with additional basic protection measures to prevent the damage from recurring, specifically where damage is caused by water. By doing so, the road is brought back to a better condition and the deterioration process is further slowed down.

Despite combined efforts, the road's deterioration will at some stage be such that more intensive corrective maintenance will be required. This is especially the case for roads with improved road surfaces, where regravelling or a rehabilitation of the stone pavement may be required. Where road structures have collapsed, these may also require more intensive corrective maintenance to bring them back into order. However, for unpaved roads, routine maintenance—consisting of preventive maintenance, minor repairs, and additional protection measures—will result in a significant decrease in the loss of asset value or investment, and the corrective maintenance required to bring the road back to its original condition will be significantly less costly (Figure 4).

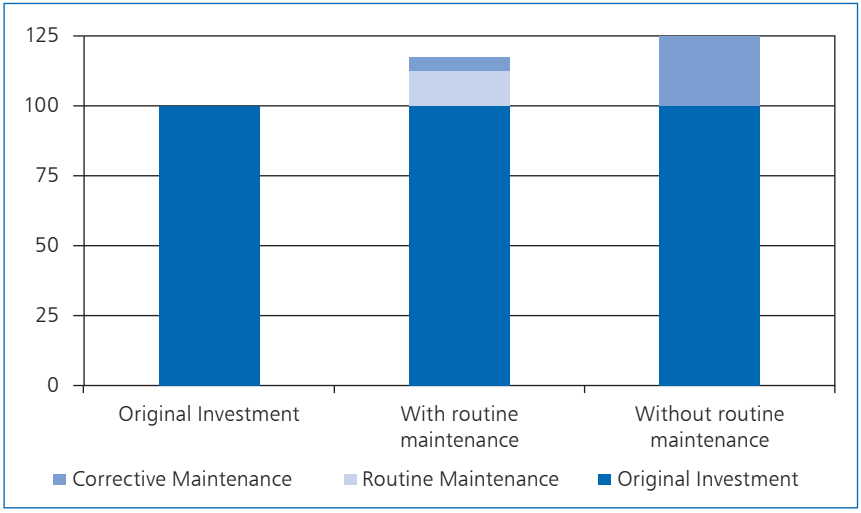
The additional costs of a continuous routine maintenance are generally more than compensated by the cost savings because the need for more intensive and costly corrective maintenance is postponed. As a result, the overall conservation costs tend to be lower, while ensuring a better average road condition (Figure 5).

Figure 4 **Impact of Routine Maintenance on Asset Value** (%)



Source: Author.

Figure 5 **Impact of Routine Maintenance on Overall Conservation Costs** (%)



Source: Author.

Maintenance Activities

This guide focuses on the routine maintenance of unpaved rural roads, especially the unpaved township and village roads of Yunnan Province that make up 62% of its total road network. The routine maintenance carried out on a continuous basis prevents needless aggravation of road deterioration.

Since protection measures in Yunnan's rural roads are often inadequate, this guide includes under the rubric of "routine maintenance" the creation of additional basic measures to protect the roads, especially from water. The three categories of routine maintenance activities, which are explained below, are clearing road elements, repairing road elements, and creating protection measures.

Clearing Road Elements

The first type of routine maintenance involves clearing road elements to ensure that roads function properly. As the most basic type of routine maintenance, this is included in almost all routine maintenance systems. This includes the following:

1. **Clearing landslides**—Any landslide material or obstacle smaller than 5 cubic meters (m^3) that blocks the road surface, road shoulders, or side drains is removed. Larger landslides or obstacles are reported to the communications bureau, which will arrange their removal.
2. **Clearing side drains**—Any earth, stone, vegetation, garbage, or other material in the side drains is removed, and the drains are restored to their proper shape so water can flow easily.
3. **Clearing culverts**—Any earth, stone, vegetation, garbage, or other material inside culverts or at the inlets and outlets of culverts is removed so water can flow easily.
4. **Clearing bridges**—Earth, rocks, branches, vegetation, garbage, or other materials under or near bridges are removed so water can flow easily underneath them.
5. **Clearing vegetation**—Any vegetation that hinders visibility, traffic, or the flow of water away from the road and through a drainage system, or which is damaging road elements, is removed.

Repairing Road Elements

The second type of maintenance activities aims to repair minor road damages that have occurred, bringing the different road elements back into good condition. This set of routine maintenance activities seeks to avoid more serious damages and ensures that the different road elements work properly. This type is not always included in routine maintenance systems, except for unpaved roads. For the unpaved township and village roads, the following activities are included:

6. **Repairing unpaved roads**—Ruts, rills, and potholes in the road surface of earthen or gravel roads are repaired by filling in the deformations,

ensuring that protection measures are in place to avoid repetition of the damage (*see also activities 11, 12, and 13*).

7. **Repairing stone pavements**—Loose or missing stones are replaced and the road shoulder is filled up to avoid stones becoming loose.
8. **Repairing the road shoulder**—Cuts or depressions in the road shoulder are filled up and compacted, ensuring that protection measures are in place to avoid repetition of the damage (*see also activities 11, 13, 14, and 15*).
9. **Repairing the drainage system**—Any erosion or damage to side drains, culverts, and bridges is repaired, ensuring that protection measures are in place to avoid repetition of the damage.
10. **Repairing retaining walls**—Loose or missing stones in retaining walls are replaced, using cement or gabion wiring where needed, and weep holes are cleared.

Creating Protection Measures

The third type of maintenance activities aims to create additional road protection measures where these are not sufficient, further protecting the road from damage. This is often done in combination with repairs, to ensure that the damage does not happen again. This set of maintenance activities is not commonly included in routine maintenance systems, but experience has shown that its application is very helpful in unpaved roads with insufficient road protection measures, especially if damage due to water is widespread. By creating basic road protection measures, the deterioration process can be significantly slowed down, resulting in much lesser need for repairs and overall maintenance.

11. **Creating side drains**—Where water flowing along the road is causing damage to the road surface or shoulder, side drains are constructed to guide the water safely away from the road.
12. **Creating water bars**—Where water is flowing through ruts and rills in the road, water bars are constructed across the road to guide the water away from the road surface, as a temporary measure until road surface repairs can be carried out.
13. **Creating paved crossings**—Where water flowing across the road is causing damage to the road surface or shoulder, stone-paved splashes are constructed to protect the road surface from damage.
14. **Creating retaining walls**—Where the slope is very unstable or is severely eroded by water, resulting in cuts or landslides, dry-stone retaining walls are constructed to stabilize the slope.

15. **Planting vegetation**—Where the slope is mildly unstable or is lightly eroded by water, vegetation is planted to protect the soil.

Together, these 15 routine maintenance activities ensure that road deterioration is decreased, and that the road condition is continuously good to fair. Additional activities may be required for very specific cases, such as an emergency maintenance when a river is cutting away the road (in case of washouts).

16. **Additional activities**—These are specific activities agreed upon between the communications bureau and the maintenance group according to need.

Despite continued routine maintenance of the road, there will be deterioration beyond the scope of these routine maintenance activities, which will need to be addressed through corrective maintenance at certain intervals. But such corrective maintenance and frequency will be significantly reduced because of routine maintenance activities, thus reducing overall maintenance costs while ensuring better average road condition.

Tools, Safety Equipment, and Materials

The maintenance activities discussed above are mostly labor-based, requiring very little material inputs or use of equipment. Only hand tools and safety equipment are generally required, and for some of the activities, only basic materials are needed. This section looks into those tools, safety equipment, and materials that are required to carry out routine maintenance activities.

Tools

The basic tools listed below are required for excavation, cutting, transport, spreading, and compaction. These should be provided by the communications bureau and should be of good quality and available in sufficient numbers for the maintenance workers to ensure high productivity. Maintenance groups should be provided with a tool maintenance allowance for the sharpening and repair of these tools to ensure continued high productivity. It is also important that workers use the right tool for the job at hand as the proper use of tools can lead to significant productivity increases. For instance, baskets are useful tools for transporting material over short distances, however, for longer distances, wheelbarrows are more appropriate, and for large quantities over long distances, two-wheeled tractors and trailers or trucks are more efficient. Similarly, a hoe can be very useful for excavation, but for hard, stony materials, a pickax may be more

efficient and effective, while for very loose materials, a shovel can be more appropriate.

- **Pickax**—to loosen hard or stony material
- **Hoe**—to loosen or excavate soft material
- **Shovel**—to excavate and throw soft or loosened material
- **Rake**—to spread out loose material
- **Bush knife**—to cut vegetation
- **Earth rammer**—to compact material in a small area
- **Watering can**—to spread water before soil compaction
- **Basket**—to transport material over a short distance
- **Wheelbarrow**—to transport material over a medium distance
- **Tractor and trailer**—to transport material over a larger distance

Safety Equipment

Safety equipment ensures the safety and health of the maintenance workers and should be used at all times. Safety equipment should be provided by the communications bureau.

- **Safety vest**—To ensure drivers can clearly see the maintenance workers and so avoid accidents. These should be worn by all maintenance workers at all times.
- **Safety cones**—To warn drivers that people are working on the road and so avoid accidents. These should be placed 100 meters on each side of the working area.
- **Warning signs**—To adequately warn drivers of the ongoing maintenance or dangerous situations and avoid accidents. These should be used during maintenance work that lasts more than 1 day, and should be placed 250 meters on each side of the working area.
- **First-aid kit**—To treat minor injuries incurred during maintenance work and to avoid infection. The kit should contain disinfectant soap, adhesive bandages, sterile gauze, bandages and clamps, scissors, alcohol wipes, antiseptic solution (iodine or similar) and/or cream, tweezers, and painkillers (paracetamol, ibuprofen). Minor injuries should be washed with soap and water, treated with antiseptic cream, and covered with plasters or bandages. For more serious injuries, a doctor should be consulted.

Materials

Some of the maintenance activities require materials, especially during repairs and when adding basic road protection measures. To a certain extent, these can be obtained locally, but in some cases these may have to be transported. If transport distances are short, the maintenance workers can use wheelbarrows or hire two-wheeled tractors or trucks. The maintenance groups will receive a transport allowance to cover such costs. Where distances are long, however, it is recommended that the communications bureaus be responsible for organizing the transport, leaving stores of the required materials along the road for further distribution by the maintenance workers.

The materials required for the routine maintenance of rural roads include the following:

- **Gravel**—for road repairs with a gravel surface. In some cases, this can be obtained locally, but often this will have to be transported to the area.
- **Paving stones**—for road repairs with a stone surface. This material is recommended to ensure the provision of suitable pre-cut paving stones for easy repairs to stone-paved roads.
- **Stones**—for repairs on retaining walls, the drainage system, and in some cases, as a base for repairs to road surface and shoulder, and for making stone-paved crossings and retaining walls. Generally, these can be obtained locally.
- **Cement**—for repairs on concrete or cement mortar retaining walls and other road structures. It is recommended that this be provided to the maintenance workers where required.
- **Binding wire**—for repairs on gabion walls. It is recommended that this be provided to the maintenance workers where required.

Community-Based Maintenance Groups

The routine maintenance activities described in the previous chapter are best carried out on a continuous basis throughout the year. This will ensure that maintenance needs are addressed in a timely manner, decreasing the costs involved and limiting the loss of asset value to the road. This approach also results in minimal road deterioration, and an improved overall road condition leading to lower travel costs and shorter travel times, and resulting in increased access and development of the rural areas.

The maintenance activities listed earlier are labor-based and quite simple in nature, and could be implemented by unskilled labor after receiving some basic training. These two aspects of routine maintenance make it very suitable for implementation by members of the communities located along the road, who are able to do maintenance work on a continuing basis and generally have ample experience with agricultural activities that are very similar to the routine maintenance activities.

This chapter focuses on the community-based maintenance groups that will be responsible for the routine maintenance activities described in the previous chapter, including the formation, registration, and training of these groups.

Maintenance Groups

Some routine maintenance activities are already being carried out by the community members along the road, however, this is currently done on a voluntary basis, which has a number of drawbacks.

First, due to its voluntary nature, the supply of labor is governed more by its availability than by the need for it. As a result, much of the maintenance work is not carried out on a timely basis due to insufficient labor. Road maintenance is generally carried out only once or twice a year—and for the rest of the year, little or no attention is being given, while the deterioration process runs unchallenged.

A second drawback is that the voluntary nature of the maintenance work tends to result in the poor and the women carrying out the maintenance activities, with all-women groups being common under such a system. Their motivation is limited and their aim is mainly to bring the road back to a passable condition or to provide the minimum contribution required.

The third drawback is the fact that the persons providing the voluntary labor contributions generally lack the required skills and tools, resulting in a lower quality of the maintenance work. Although the costs of such a voluntary system to the communications bureau are very low, the benefits in terms of improved road conditions are also very limited.

In many countries, there is therefore a tendency to formalize the implementation of routine road maintenance through contracted and remunerated maintenance workers for a more timely response to maintenance needs. These workers also receive basic training and tools to ensure the quality of their work, and are selected from interested candidates according to selection criteria to ensure fairness. Apart from ensuring better maintenance, this approach also leads to income and employment generation, which contributes to poverty alleviation and general development of the rural areas, with the maintenance workers easily spending 70% of their incomes locally, creating indirect employment opportunities.

Different experiences exist with the organization of such maintenance workers— ranging from individual lengthworkers to formalized maintenance microenterprises. In the case of lengthworkers, each maintenance worker is responsible for a specific length of road. This system has lost ground, however, due to the high administrative requirements, the problems in balancing the workloads between workers, and the effective response to larger, localized maintenance needs. There is now a tendency to work more with group-based systems, whereby these groups can be formalized to different degrees, individually or associatively managed, and either open to temporary workers or closed and limited to only the group members. The most significant experience is that of Latin America, where in the majority of the countries, a system of associative microenterprises exists, where the workers are co-owners (managers) of the microenterprises, and these are closed and only members can participate. These microenterprises are formally registered as associations, cooperatives, or even limited liability companies.

This guide, however, focuses on less formal, associative, open-ended maintenance groups. In the People's Republic of China and especially the rural areas in Yunnan where many ethnic minority groups live, little entrepreneurial experience exists, and the registration and management of enterprises would therefore form a serious difficulty. To facilitate this process, a less formal registration of the maintenance workers with the

communications bureau has been chosen. The maintenance groups remain associative, and although the workers' individual skill levels may be low, collectively, they generally have the basic skills required for the maintenance activities and the management of the group. The use of open-ended maintenance groups was also chosen, so that additional maintenance workers can be contracted when needed, spreading the benefits of employment and income generation, and allowing the labor input to vary significantly in different months in response to the maintenance demand.

Group Size

The size of the maintenance group depends on the length of the road to be maintained and the number of workdays required per kilometer per year (workdays/km/yr). Most international experiences vary from approximately 50 workdays/km/year (equivalent to one full-time person for 5 km of road) to 130 workdays/km/year (equivalent to one full-time person for 2 km of road). This variation depends mainly on the maintenance activities included under the responsibility of the maintenance workers and the characteristics of the road. Unpaved roads, roads in steep terrain, roads with high traffic levels, and roads in areas with high vegetation growth require a higher level of inputs than paved roads, roads in flat terrain, roads with low traffic levels, and roads in areas with low vegetation growth.

In this pilot project, an average productivity rate of 130 workdays/km/yr was selected (or one full-time person for every 2 km). This is because the unpaved rural roads in Yunnan are generally in poor condition and require significant repairs while the maintenance activities were expanded to include the construction of basic protection measures, resulting in higher labor requirements. For recently constructed or rehabilitated roads with adequate road protection measures, and for roads that have been significantly improved due to previous routine maintenance activities, lower inputs will suffice of between 50 and 90 workdays/km/yr (equivalent to one full-time person for every 3–5 km). The required inputs for such roads will be determined by traffic levels, the surface type, and the topography. A second Asian Development Bank pilot project was initiated in 2011 to look at the impact of reducing the labor inputs per kilometer.

Although the pilot project has decided to apply a productivity rate of 130 workdays/km/yr, it also decided to contract the maintenance workers on a more or less half-time basis, to allow them to also carry out other household activities and agricultural responsibilities. For this pilot project—which targeted women as maintenance workers—this aspect is important as women generally have multiple responsibilities in caring for the household, the family, livestock, and agricultural land, which do not allow them to

have full-time employment. Hence, one maintenance worker was required for each kilometer of road. The group's size is, therefore, the same as the kilometers of road(s) under its responsibility. Certain roads close together may be packaged and given to one single group to facilitate the contract administration. Alternatively, very long roads may be split and given to two different groups.

Selection of Group Members

Once the required number of maintenance workers has been determined—based on the road length to be maintained—these workers are to be selected from interested candidates. The selection criteria generally include technical requirements (those with the most experience and best skills), as well as social objectives (to provide income and employment to certain underprivileged groups). In this pilot project, the focus was on women from ethnic minority groups (Dehong Prefecture has a large ethnic minority population), with poverty as the second important criterion. The criteria used in this pilot project are listed below.

- **Interest**—Candidates must be actively interested in joining.
- **Gender**—Candidates must be female.
- **Age**—Candidates must be between 18 and 55 years old.
- **Residence**—Candidates must live near the road.
- **Ethnic Group**—Candidates from ethnic minority groups are given preference and at least 40% of selected candidates should be from ethnic minority groups.
- **Poverty**—Candidates from poor households (under the poverty line of CNY1,160 per capita) are given preference and at least 50% of selected candidates should be from poor households.
- **Leadership skills**—Candidates with leadership experience are given preference.
- **Other skills**—Candidates with basic reading, writing, and math skills are given preference.

It may be noted that some of these criteria are eligibility criteria, which all applicants must comply with, while others are preferential criteria, where preference is given to some candidates by virtue of their ethnicity, economic status, or skills, sometimes with quota on the final makeup of the group. Although these criteria were used in the pilot project, these may be adapted for other areas or merged with other objectives. It is strongly recommended,

however, to have the selection criteria formalized in order to keep the process transparent.

Information on the employment opportunities should be disseminated as widely as possible before maintenance workers are selected. Mass media forms, such as radio or television, or simple methods such as flyers and posters can be used, while local leaders and organizations need to be informed. What is important is that efforts are made to inform the vulnerable groups—especially women, the poor, and ethnic minority groups—who generally have less access to common means of communication and information. By ensuring that they are also informed, their chances of being able to participate in the selection process and obtaining employment are increased significantly.

The road maintenance positions should include information on the activities to be carried out, the working hours, the remuneration levels, and means of payment. It is important to consider the reality of the target groups, indicating clearly that vulnerable groups are also requested to apply, and that the required experience and skills are within range of most persons (e.g., by stating that experience in agriculture is considered sufficient and that experience in the road sector is not required). Also, the working hours or days can influence the participation of certain groups. For instance, women are generally unable to participate in full-time employment due to numerous responsibilities in caring for the household, the young family members, the livestock, and the agricultural land. For certain ethnic minority groups, some may prefer not to work on certain days. By clearly indicating that part-time or flexible working hours and working days are allowed, this can significantly increase the participation of such groups.

Details on how to apply for the position should be indicated, as well as the date and manner in which the final selection will be made public. An application form indicating all relevant information of each candidate allows the objective selection of the best candidates. However, a simpler system where the interested candidate simply informs a local leader or organization, which already has information on them, can be just as effective and can greatly simplify the selection process. In selecting the group members, for instance, the women's organizations at the village level can be of great help.

Registration of the Maintenance Group

Once the group members have been selected, the next step is to register the group so it can enter into a contract with the communications bureau. Because of their lack of entrepreneurial, legal, and organizational

experience, in addition to high costs and other requirements involved in formal registration, it is recommended to simply register the maintenance group with the communications bureau. For this purpose, a simple form can be used (Annex 1), listing the different members and their signatures (or fingerprints), and witnessed by a representative of the communications bureau. It is important to note, however, that such an informal registration has some drawbacks, such as inability to open a bank account in the name of the group.

This registration form also identifies the leader and treasurer of the group, who need to be elected by the group members. The group leader will represent the maintenance group and is responsible for its overall management, making sure that the agreed work is completed each month and that the work is distributed to the different workers and subgroups. The group treasurer is responsible for managing the money of the group, keeping track of all the payments to the group, and all the expenditure on salaries and transport in a cashbook (Annex 2). In addition, each group or subgroup should elect a person to record the days worked by each member, both for payment and for reporting purposes. These responsibilities and requirements should be made clear before the election of these persons. It is preferable that these persons be able to read and write.

After registration, the next step is to open a bank account to receive the payments for the maintenance work. Given the informal nature of the group, a bank account in the name of the group is generally not possible, hence, the account should be opened in the name of individuals. Where possible, the account should be opened in the name of both the group leader and treasurer.

Training of the Maintenance Group

Before the maintenance group starts work, they need to undergo basic training. This training looks at both the (i) technical aspects on how to properly implement the maintenance activities, and (ii) the managerial aspects on how to manage a maintenance group and the work itself. The initial training needs to be followed up by a regular on-the-job training to further improve the workers' skills.

Technical Training

The technical training consists of a theoretical part and a practical part. The theoretical part explains the causes of road deterioration and the need for road maintenance, while introducing the different maintenance activities and explaining the role they play in slowing down or even halting the

different types of deterioration. A better understanding of the deterioration process and the purpose of the road maintenance activities will enable the maintenance group members to better respond to the different needs in a timely manner. This theoretical training is done in a classroom context, using a PowerPoint presentation showing pictures of the different road elements, the types of deterioration, and the different maintenance activities. A theoretical training takes half a day and aims to promote a discussion between the group members by asking questions regarding deterioration and maintenance based on the pictures being shown.

The objective of the practical training is to enable the group members to practice implementing the different maintenance activities. This is done along the road, preferably the road assigned to the maintenance group. It is recommended that trainers should identify suitable sites along the road beforehand, where the different maintenance activities can be practiced, preferably with visible deterioration that needs to be repaired. For the different activities, it is important to have sufficient tools so all group members can have hands-on practice without waiting too long (it is, however, not necessary to have a full complement of tools). For each activity, the different tasks involved must be explained, and the proper use of the tools and safety equipment is demonstrated. This practical training will ideally take one full day, but it can be compacted to half a day if necessary.

Managerial Training

The managerial training focuses on how to plan for and organize the work, and how to manage the maintenance group. It first looks at the monthly workplan and how the monthly payment is determined based on the amount of work to be carried out using the unit rates for the different maintenance activities. All these are to be indicated in the workplan. It also emphasizes the importance of the monthly report for recording the number of days worked by the different group members and by any additional workers, allowing the unit rates to be verified. The monthly inspection report is also introduced, explaining how this looks at the work amounts indicated in the workplan and the work quality as defined by the performance indicators listed in the contract. The result of the inspection influences the monthly payment, in case deductions are applied due to noncompliance with the workplan or with the performance indicators. Apart from the monthly payments, it also explains the allowances that are given to the maintenance group for transport and tool maintenance. This training portion also includes lessons on the actual management of the group, where the roles of the group leader and treasurer are explained, and where those responsible for recording the days worked by each group member are trained how and which records to keep. More information on these managerial aspects can be found in the next chapter and in the *Manual for Maintenance Groups*.

On-the-Job Training

Although the initial training provided at the beginning of the contract will provide the maintenance group with the basic skills required to undertake the maintenance activities and to manage the work and the maintenance group, an on-the-job training is highly recommended to provide continuous improvement in their skills and to correct beginners' errors. This can be done during the monthly visits when the workplan is prepared and the inspection is carried out, although initially it would be beneficial to arrange for more frequent visits.

During on-the-job trainings, the focus will be on the efficient and effective execution of the maintenance activities, ensuring that the productivity of the maintenance team is sufficient and that the quality of the work is in order. The central issues to be addressed are the use of proper tools, the proper use of these tools, the appropriate organization of the maintenance workers, the monitoring of work progress, and the use of the performance indicators. The management of the maintenance group, the recording of the days worked by the group members and by additional workers in the monthly report, the monthly payment of the maintenance workers, and keeping the cashbook up to date should also be monitored and additional training given where required. Although these are internal matters to the maintenance group, their proper implementation will ensure the group's continued existence, prevent internal conflicts, and lead to higher levels of efficiency and effectiveness.

Contracting Arrangements

This chapter looks at the contracting arrangements involved in community-based routine maintenance of rural roads by women's groups. It starts by looking at the core aspect of this maintenance system: performance-based contracting and the performance indicators. It then goes on to discuss the planning of maintenance work throughout the year, regular inspections to check if the work is being carried out properly, and the payments to the maintenance groups. The final section looks at the contract documents and issues regarding the replication of the system.

Performance-Based Contracting

The application of the system of community-based routine maintenance of rural roads involves a large number of small contracts, but that number is already much reduced by the practice of having contracts cover groups of workers instead of individual lengthworkers. The number can be further reduced by packaging shorter roads that are close together and contracting out their maintenance to one group of workers. However, there are still many small contracts to administer and manage, and this requires a lot of resources if the contracts are input-based.

The answer is to apply a performance-based approach, where payments are based on the performance of the maintenance group (i.e., the quality of its output) rather than on the length of time the workers spent on the job (the input). This means that only results count, making the inspection process a lot easier. The planning and budgeting process is also made easier because the budget is based on the planned output, rather than on input, which may vary from initial estimations. The monthly payment procedures can be easier, especially if the payments are in fixed amounts that only vary when deductions are made. The use of a performance-based system can thus greatly simplify the communications bureau's task of managing a large number of contracts.

Performance-based contracting is also very logical for road maintenance, where the objective is to keep the road in good condition. Since workers are paid for producing a desired outcome, i.e., a good road, it therefore makes sense to have the payment depend on the outcome rather than on the required input. This system has been seen to result in more efficient and effective work by those responsible for doing the maintenance—be they maintenance groups or larger contractors—because they can plan their activities more efficiently. Maintenance workers will tend to focus on cheaper preventive measures and avoid more costly corrective repairs, thus maximizing profits while producing better road conditions. This is especially the case when the planning of maintenance activities is the responsibility of a group of workers, and when the only criterion for payments and deductions is the condition of the road elements.

This guide does not go so far as to introduce a completely performance-based system for the pilot project in Dehong Prefecture, mainly because the poor condition of the rural roads there makes it difficult to apply such a system. Instead, the project uses workplans to determine the scope of the work each month according to volume-based criteria. This is a step away from the traditional system and toward the performance-based system, as will be discussed in the next section. In the future, however, once road conditions have improved and the groups have gained sufficient experience through this first step toward performance-based contracting, the transition to a full-fledged performance-based system will be easier.

Planning for the Maintenance Work

As pointed out earlier, it is impractical to apply a full performance-based system right away in Dehong Prefecture because the roads there are not in good condition. The extent of work needed to achieve the required road condition is so great that it resembles periodic rather than routine maintenance. One way around this problem is to carry out periodic maintenance or rehabilitation, then switching to performance-based routine maintenance when the type of work required better fits that description, as has been widely done in other countries. Where this is not possible, the answer is to use a system of service levels in which there are different maintenance standards due to the different road conditions. In this system, roads in poor condition are put under a lower maintenance standard that is easier to achieve. For instance, a "satisfactory" maintenance standard might involve only a slight improvement over initial road conditions. However, this system is complicated and does not necessarily lead to significantly better road conditions.

For the Dehong project, a third alternative was chosen—one that is based on monthly workplans agreed upon by the maintenance group and the communications bureau. The workplans define the road elements and the road sections to be worked on in a particular month, and the performance-based system is only applied to these elements and sections, allowing the maintenance group to focus its limited resources on priority needs. This approach allows road conditions to be improved significantly, but spreads the renovation process over a longer period, thus preventing major peaks in labor inputs and funding requirements.

Although this third alternative is still performance-based, the workplans limit the sections and elements of the road where it is to be applied. It is therefore not yet a genuine performance-based maintenance system, where the whole road and all road elements would be included. As a result, under this third alternative, the monthly payments also vary according to the sections and elements of the road that are included in the workplan, as opposed to a genuine performance-based system where payments are generally fixed. But as a first step, this third alternative is a good middle ground between traditional input-based and genuine performance-based contracting, and can easily be changed to a full-fledged performance-based system once the time is ripe.

In the monthly workplan (Annex 3), the details of work to be carried out is specified for each maintenance activity, together with the corresponding payment. The work required for any particular activity depends on maintenance needs, but an attempt is made, as much as possible, to assign fixed workloads (although these may be higher just before and during the rainy season and lower during the dry season). Large variations in workloads, and thus in incomes, among maintenance workers could result in less interest in this employment opportunity because of the uncertainty of income. This could also lead to the withdrawal of some workers, creating the need to recruit and train new ones. In certain seasons, when the maintenance workers must devote a large part of their time to their farms, the workloads may be reduced, but only if there are no urgent maintenance needs at the time. Such flexibility will greatly increase the possibility for women and other vulnerable groups to participate. The fact that the working hours are half-time and also flexible—allowing work to be done early in the morning or late in the afternoon, or even on alternate days—will enable the maintenance workers to combine their working hours with their other responsibilities.

The maintenance activities to be carried out are determined by the communications bureau, depending on the season and the condition of the roads. Different maintenance activities are carried out for different seasons, with a focus on drainage systems just before and during the rainy season,

Table 1 Seasonal Priority of Activities

Activity \ Month	Dry Period J	F	M	A	Rainy Period M	J	J	A	S	O	Dry Period N	D
1. Clearing landslides												
2. Clearing side drains												
3. Clearing culverts												
4. Clearing bridges												
5. Clearing vegetation												
6. Repairing unpaved roads												
7. Repairing stone pavement												
8. Repairing the road shoulder												
9. Repairing the drainage system												
10. Repairing retaining walls												
11. Creating side drains												
12. Creating water bars												
13. Creating paved crossings												
14. Creating retaining walls												
15. Planting vegetation												

High priority Rainy season Low priority

Source: Author.

and on the other repairs at the end of the rainy season and during the dry season. An overview of the timing of the different maintenance activities is given in Table 1. The seasonality of the different activities is not rigid, however, and may be brought forward or postponed according to the circumstances, such as the availability of labor and other resources.

In volume-based contracting being applied in Dehong, the activities and work required, as defined in the workplan, are linked to the payments through the use of unit rates, which are the average costs of carrying out these activities per unit of output. Actual costs may vary, depending on road conditions. An example of unit rates to be included in the workplans is shown in Table 2. These rates are based on international experience and on lessons learned from the pilot project. They are derived by taking the number of workdays required for each activity and converting that figure into a cost using an average daily wage rate of CNY40. For additional activities, a lump sum is agreed upon by the communications bureau and the maintenance group, depending on what the additional activities will entail.

The payment for each activity can be calculated based on the amount of work required and the unit rate for each activity. By adding up the amounts for all maintenance activities, one can calculate the total monthly payment, which is written at the bottom of the monthly workplan. This is the amount

Table 2 **Unit Rates for Maintenance Activities**

Maintenance Activity	Unit	Unit Rate (CNY)
1. Clearing landslides	m^3	40
2. Clearing side drains	100 m	20
3. Clearing culverts	unit	20
4. Clearing bridges	unit	40
5. Clearing vegetation	100 m^2	10
6. Repairing unpaved roads	10 m^2	25
7. Repairing stone pavement	10 m^2	20
8. Repairing the road shoulder	m^3	20
9. Repairing the drainage system	m^3	15
10. Repairing retaining walls	m^3	15
11. Creating side drains	10 m	10
12. Creating water bars	10 m	10
13. Creating paved crossings	m^2	20
14. Creating retaining walls	m^3	40
15. Planting vegetation	10 m^2	20
16. Additional activities	Lump sum	To be determined

CNY = Chinese yuan, m = meter, m^2 = square meter, m^3 = cubic meter.

Source: Pilot Project.

that will be paid to the maintenance group if the work indicated in the workplan is carried out correctly.

Although the amount of work may differ greatly between one road and another, the cost per unit of work will generally be constant. Nevertheless, it will be necessary to verify the correctness of the unit rates and monthly payments by comparing it to the number of days spent in carrying out the work. For this purpose, the maintenance groups will be required to keep monthly reports (Annex 4), recording the number of days worked by each group member and by additional workers hired by the group. The monthly report will facilitate the calculation and distribution of the monthly payments among the group members and additional workers according to the number of days they worked. The total number of workdays spent by the maintenance group and any additional workers is subsequently recorded in the inspection report at the end of each month.

The average daily rate is calculated by dividing the monthly payment by the total number of days worked by the group members and additional workers. Any significant differences between this calculated daily rate and the target rate of CNY40 per day would imply that certain posited unit rates were not accurate. These can then be checked by measuring the number of workdays required to carry out a certain amount of work. For instance, if 6 maintenance workers need 4 hours to clear a landslide of 3 cubic meters (m^3), the productivity rate can be calculated as 3 m^3/(6 persons x ½ day) = 1 m^3/person-day. The unit rate should then be CNY40/m^3. It is important that these unit rates be checked initially to guarantee that the maintenance workers are being paid the appropriate amounts for the time spent, to prevent these workers from leaving their groups because of insufficient wages, and to avoid overburdening the limited financial resources of the communications bureau because of overpayments.

Data from the monthly reports and workplans can eventually be used to determine a single standard monthly payment per kilometer for all activities. That will happen at a later stage, when the conversion takes place to a completely performance-based system, in which payments will be based on the average amount of work expected over the year.

Although the workplan indicates which activities need to be carried out and how much work must be done by the end of the month, it does not indicate where along the road these activities should be implemented. For this purpose, the places where the work must be carried out are indicated on-site during the explanation of the workplan to the maintenance group.

Inspection of the Maintenance Work

At the end of the month, the work is inspected and the payment is approved. Under a full-fledged performance-based system, the condition of all road elements would be inspected along the entire stretch of road worked on by the maintenance group. However, under this volume-based system, only those road sections and elements included in the workplan are inspected, and the amount of work completed is compared with the work completion targets indicated in the workplan.

During the inspection, the completed work is compared to the performance indicators, where each activity has an indicator that must be complied with. The performance indicators should be objective and easily measurable to allow the maintenance groups to monitor their own performance and to facilitate the inspection process.

The recommended performance indicators are listed below. In a full-fledged performance-based system, similar indicators can be applied. They could then be applied to all road elements and for the entire stretch of road under maintenance.

1. **Clearing landslides**—There are no landslides or other obstacles on the road surface, road shoulder, or side drains.
2. **Clearing side drains**—The side drains are clear and at least 20 centimeters (cm) wide and 15 cm below the road surface, and there is no stemming of water.
3. **Clearing culverts**—The culverts and their inlets and outlets are clear, and water can flow freely.
4. **Clearing bridges**—The area under the bridges is clear, and water can flow freely.
5. **Clearing vegetation**—The vegetation does not impede visibility or normal vehicle transit, nor does it restrict the flow of water away from the road.
6. **Repairing unpaved roads**—There are no potholes larger than 30 cm and no ruts or rills deeper than 5 cm, and water does not flow over or remain on the road.
7. **Repairing stone pavement**—There are no holes or loose stones, and the shoulder is not more than 2 cm below the pavement.
8. **Repairing the road shoulder**—There are no depressions or cuts in the road shoulder, and where necessary, water has been directed away, and the shoulder has been stabilized with vegetation or retaining walls.

9. **Repairing the drainage system**—Scour checks have been placed in eroded side drains, and undermined structures are protected by stones.
10. **Repairing retaining walls**—There are no loose stones in the retaining walls, and weep holes are clear.
11. **Creating side drains**—The side drains are at least 20 cm wide and 15 cm below the road surface, have no sharp curves and have a proper outlet, and water no longer flows over the road.
12. **Creating water bars**—Temporary water bars have been created at regular intervals to guide the water safely away from the road, and water no longer flows over the road.
13. **Creating paved crossings**—Where water crosses over the road, the road surface is protected from damage by stone-paved splashes.
14. **Creating retaining walls**—The created dry-stone retaining walls are stable, and the area behind it has been compacted.
15. **Planting vegetation**—The slopes and road shoulders prone to erosion are protected by vegetative material.
16. **Additional activities**—Performance indicators will be agreed upon in coordination with the communications bureau, depending on the type of work.

In the monthly inspection form (Annex 5), the inspector indicates whether each activity has been completed satisfactorily—both in terms of quantity (compared with the workplan) and quality (compared with the performance indicators). If an activity has not been carried out satisfactorily, either because the work has not been completed or because it has not been done properly, this is also indicated, and the noncompliance is explained. Any activity that has not been included in the workplan is not inspected.

When part of the work has not been carried out satisfactorily, a deduction is made from the monthly payment that is indicated in the workplan. The deduction depends on the volume of work not carried out satisfactorily or, by the volume of work that remains to be done to complete the monthly workplan. This work is multiplied by the relevant unit rates to obtain the monetary equivalent of the deduction.

The deduction amount is indicated at the bottom part of the inspection form, just below the monthly payment. When the work is satisfactory and no deduction is made, the relevant box must be checked. The approved final payment is the planned monthly payment minus the deducted amount. The total number of workdays spent by group members and additional workers

must also be recorded in the inspection form. The inspection form must be signed by both the inspector on behalf of the communications bureau and by the maintenance group leader. The payment will then be made based on the information in the inspection form.

Payments

The monthly payment is determined in the workplan and then confirmed in the monthly inspection form, minus any deductions considered necessary. Once the inspection form is signed, the monthly payment can be transferred to the bank account of the maintenance group or paid directly through a check. The experience in the pilot project has shown that these payments are generally very quick and the maintenance workers do not experience delays in receiving their salaries.

Apart from the monthly payments, other maintenance costs need to be covered, such as the costs for the transport of materials and group members (e.g., to and from the bank) and maintenance of the tools used by the maintenance groups. To facilitate the administration of these payments, allowances are given in lump-sum increments, where the amounts are dependent on the length of the road or section of road for which the maintenance group is responsible. The proposed amounts per kilometer per year are given below.

- **Transport allowance**—A payment of CNY250 per kilometer per year will be provided to cover the costs of transporting the group members and materials (this amount may need to be adjusted depending on the volume of material transport required in each specific road).
- **Tool maintenance allowance**—A payment of CNY20 per kilometer per year will be provided to allow for the repair and sharpening of the tools used by the maintenance group.

In addition to these allowances, the communications bureau will be responsible for providing the maintenance groups with tools and safety equipment, with an average cost of CNY150–CNY250 per kilometer per year (depending mainly on the number of workers). The communications bureau will also be responsible for obtaining accident insurance for the maintenance workers at an average cost of CNY150 per kilometer per year (assuming one person per kilometer). The costs of transporting materials to the roadside will also be borne by the communications bureau. In the pilot project, CNY450 per kilometer per year was allocated for transporting these materials, although the required amount will depend very much on the type of road and the availability of suitable materials nearby.

Maintenance Contract

The contracting arrangements explained in the previous sections are reflected in the contract document that is signed between the communications bureau and the maintenance group. An example of a contract template is included in Annex 6.

The maintenance contract defines the road section to be maintained and the duration of the contract. The second clause stipulates the maintenance activities to be carried out and their performance indicators, explaining the use of monthly workplans to define the work to be carried out each month, and the need for recording workday data in the monthly reports. The third clause explains the basis of the monthly payments and stipulates the unit rates that will be used, the allowances that will be given as advance payments for transport and tool maintenance, and the tools and safety equipment that will be provided by the communications bureau. The fourth clause looks at the monthly inspections and explains the application of deductions in case of noncompliance with the workplan or with the performance indicators. Clause 5 refers to changes to the contract or its termination, and the final clause refers to procedures to be followed for matters not prescribed in the contract.

As presented, the contract document is a simple document of a few pages, with the objective of ensuring proper understanding by the maintenance groups and avoiding unnecessary complication in the contracting process.

Sustainability and Replication

In order for the maintenance of rural roads to be sustainable, the costs of maintenance must be in line with the available funding. In the pilot project, the average maintenance cost, including the costs of tools, safety equipment, insurance and material transport, was CNY5,250 per kilometer (May to December).

It must be noted that the maintenance costs for this pilot project were relatively high because the goal was to properly test the system within a short period of time. As a result, the pilot project included a lot of landslide removal (accounting for over 40% of total costs) and extensive road surface repairs (accounting for 35% of total costs). If such major landslide removal and extensive road surface repairs (limiting interventions to just

spot improvements) are excluded, this will decrease the required number of workdays per kilometer and reduce the costs for routine maintenance by at least 40%. Landslide removal and more significant road surface repairs would then be funded under emergency maintenance or periodic maintenance (medium maintenance).

Although funding for routine maintenance of rural roads has increased significantly in recent years, there is still a clear need for additional funding to meet the maintenance requirements and to ensure continued access to rural villages in Yunnan Province. A second pilot project is therefore under way to determine the appropriate investment level per kilometer per year for routine maintenance and to align this with available financing for rural road maintenance.

Annexes

Annex 1: Group Registration Form

Registration of Road Maintenance Group

This is the form used to register a road maintenance group. It serves to identify the members of the maintenance group and its representatives (leader and treasurer). It must be signed by all members of the maintenance group and witnessed by the Communications Bureau.

Name of maintenance group:

Name of district or county:

	Name	Signature
1.	.....(Leader)	.....
2.	.....(Treasurer)	.....
3.	.....	.....
4.	.....	.....
5.	.....	.....
6.	.....	.....
7.	.....	.....
8.	.....	.....
9.	.....	.....
10.	.....	.....
11.	.....	.....
12.	.....	.....
13.	.....	.....
14.	.....	.....
15.	.....	.....
16.	.....	.....
17.	.....	.....
18.	.....	.....
19.	.....	.....
20.	.....	.....

Communications Bureau

Date:

Maintenance Group

Date:

Annex 2: Cashbook

Cashbook

General Information

Name of group or subgroup:	*Guangxi Road Maintenance Group*
Month:	*June*
Balance from previous month:	*CNY 100*

Income and Expenditure

Income

Date	Description	Amount (CNY)	Receipt number
01-6	*Transport allowance*	*3,500*	*Bank receipt*
01-6	*Tool maintenance allowance*	*280*	*Bank receipt*
31-6	*Monthly payment*	*7,710*	*Bank receipt*
Total:		*11,490*	

Expenditure

Date	Description	Amount (CNY)	Receipt number
07-6	*Transport of gravel*	*385*	*June-1*
31-6	*Salary payments*	*7,710*	*June statement*
Total:		*8,095*	

All money received is noted here.

All money spent is noted here.

The total money received during the month is noted here.

The total money remaining at the end of the month is written here and is used in the cashbook for the next month.

The total money spent during the month is noted here.

Conclusion

Balance at end of month:	*CNY 3,495*

Annex 3: Monthly Workplan

Monthly Workplan General Information		
Planning period (month)	*June*	☒ Original ☐ Amendment
Road name and length	*Guangxi road, 19 km*	
Road section: Start and end	*Guangxi township to Shangxi village*	
Group leader's name	*Li Ying*	

If an amendment is required, it is indicated here.

General information on the road is written here.

Monthly Results				
Maintenance Activity	Unit	Unit Rate (CNY)	Amount of Work Planned	Approved Remuneration (CNY)
1. Clearing landslides	m^3	40*	*20 m^3*	*800*
2. Clearing side drains	100 m	20*	*8,000 m*	*1,600*
3. Clearing culverts	unit	20*	*8 units*	*160*
4. Clearing bridges	unit	40*	*4 units*	*160*
5. Clearing vegetation	100 m^2	10*	*14,000 m^2*	*1,400*
6. Repairing unpaved roads	10 m^2	25*		
7. Repairing stone pavement	10 m^2	20*		
8. Repairing the road shoulder	m^3	20*		
9. Repairing the drainage system	m^3	15*	*50 m^3*	*750*
10. Repairing retaining walls	m^3	15*		
11. Creating side drains	10 m	10*	*1,500 m*	*1,500*
12. Creating water bars	10 m	10*	*200 m*	*200*
13. Creating paved crossings	m^2	20*		
14. Creating retaining walls	m^3	40*	*5 m^3*	*200*
15. Planting vegetation	10 m^2	20*	*70 m^2*	*140*
16. Additional activities *River protection*			Lump sum	*1,200*

The different activities are listed here.

The fixed rate per unit of output is listed here.

The agreed work quantities are written here.

The agreed remuneration is written here.

Conclusion	
Agreed monthly payment (CNY)	*8,110*
Signature (inspector)	*Zhou Wen*
Signature (group leader)	*Li Ying*

The total monthly payment amount is written here.

In case of additional activities, the agreed lump sum is written here.

* The unit rates in this workplan are examples only. Actual unit rates may differ depending on the characteristics of the road and the types of maintenance activities included.

Annex 4: Monthly Report

Monthly Report
General Information

Reporting period (month)	*June*
Road name and length	*Guangxi road, 19 km*
Road section: Start and end	*Guangxi township to Shangxi village*
Group leader's name	*Li Ying*

General information on the group is written here.

Actual workdays

Name of group member or additional worker	Date																															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Li Ying		X	X	X	X			X	X	O		X			X	X	O	O	X					X								12.5
Liu Cheng		X	X	X	X			X	X	O	X	X			X	X	O	O	X				X	X	O							14
Yang Ju		X	X	X	X			X	X	O	X	X			X	X	O	O	X				X	X	O							14
Ma Lin		X	X	X	X			X	X	O	X	X			X	X	O	O	X													12.5
Hu Fang		X	X	X				X	X	O	X	X			X	X	O	O	X				X	X	O							13
Wang Luli		X	X	X	X			X	X	O	X	X			X	X	O															11
Liu Mei		X	X	X	X			X	X	O	X	X			X	X	O	O	X													12.5
Li Meifeng		X	X		X			X	X	O	X	X			X	X	O	O	X				X	X								13.5
Hu Jia		X	X	X	X			X	X	O	X	X			X	X	O	O	X				X	X	O							14
Xi Feng		X	X	X	X			X	X		X	X			X	X	O	O	X				X	X	O							13.5
Cheng Xiu		X	X	X	X			X	X	O	X	X			X	X	O	O	X				X	X	O							14
Song Qiu		X	X	X	X			X		O	X	X			X	X	O	O	X				X	X	O							13
Fu Niu		X	X	X	X			X	X	O	X	X			X	X	O	O	X				X	X	O							14
Jin Xiaoling		X	X	X	X			X	X	O	X	X			X	X	O	O	X				X	X	O							14

The days worked by each person are indicated here.

The total number of days worked by each person is written here.

Additional workers and the number of days that they worked can be written here.

Conclusion

Total workdays by group members	*185.5*
Total workdays by additional workers	*0*

The total days worked by group members and additional workers are indicated here.

Please indicate workdays as follows: X Full-day work O Half-day work

Annex 5: Monthly Inspection Form

Monthly Inspection Form General Information			
Inspection period (month)	*June*		
Name of inspector	*Zhou Wen*		
Date of inspection	*30 June 2010*		
Road name and length	*Guangxi road, 19 km*		
Road section: Start and end	*Guangxi township to Shangxi village*		
Group leader's name	*Li Ying*		
Inspection Results			
Maintenance Activity	**In Order**	**Deficient**	**Problems to Be Corrected**
1. Clearing landslides	☒	☐	
2. Clearing side drains	☐	☒	*Only 6,000 meters completed.*
3. Clearing culverts	☒	☐	
4. Clearing bridges	☒	☐	
5. Clearing vegetation	☒	☐	
6. Repairing unpaved roads	☐	☐	
7. Repairing stone pavement	☐	☐	
8. Repairing the road shoulder	☐	☐	
9. Repairing the drainage system	☒	☐	
10. Repairing retaining walls	☐	☐	
11. Creating side drains	☒	☐	
12. Creating water bars	☒	☐	
13. Creating paved crossings	☐	☐	
14. Creating retaining walls	☒	☐	
15. Planting vegetation	☒	☐	
16. Other activities	☒	☐	
Conclusion			
Agreed monthly payment (CNY)	*8,110*		
Deduction (CNY)	☐ None	☒ CNY*400*	
Approved monthly payment (CNY)	*7,710*		
Total workdays spent	Group members: *185.5*	Additional workers: *0*	
Signature of inspector	*Zhou Wen*		
Signature of group leader	*Li Ying*		

General information on the road is written here.

The different activities are listed here.

In case of deficient work, the reason is written here.

The inspector indicates here if the work was in order or deficient.

Any deduction to the monthly payment is written here.

The final approved payment is written here.

The number of workdays spent by the group and any additional workers is written here.

Annex 6: Maintenance Contract

Road Maintenance Agreement

This is an agreement between the communications bureau of …….. ……..(*name of county or district*), represented by …… ……..(*name of representative, position held by representative, number of identity document*), hereinafter referred to as the **Communications Bureau**; and the ……..…… (*name of maintenance group*), represented by …… (*name of representative, position held by representative, number of identity document*), hereinafter referred to as the **Maintenance Group**.

Under this agreement, the **Maintenance Group** is contracted by the **Communications Bureau** to carry out the routine maintenance of the road segment from …….. (*start of road segment*) to …….. (*end of road segment*), with a total length of …… (*length in kilometers*).

Clause 1 Terms of Agreement

1.1 The term of the agreement is from …… (*start date*) to …….. (*end date*).

1.2 When the agreement expires, if the two parties agree, the agreement can be extended.

Clause 2 Scope of Work

2.1 The **Maintenance Group** will carry out the maintenance activities in the contracted road segment as described in the table below.

2.2 Each month, the **Maintenance Group** will implement the specific activities in the specific road sections as indicated in the monthly workplan prepared by the **Communications Bureau** and agreed to by the **Maintenance Group**.

2.3 In doing so, the **Maintenance Group** will ensure compliance with the performance indicators as described in the table below for those activities and road sections indicated in the workplan.

2.4 The **Maintenance Group** will record the days worked by the group members and by any additional workers in the monthly report and provide this data to the **Communications Bureau** at the time of inspection.

2.5 The **Communications Bureau** will organize technical and managerial trainings for the **Maintenance Group** according to the requirements of road maintenance.

Maintenance Activities and Performance Indicators
1. **Clearing landslides**—There are no landslides or other obstacles on the road surface, road shoulder, or side drains.
2. **Clearing side drains**—The side drains are clear and at least 20 centimeters (cm) wide and 15 cm below the road surface, and there is no stemming of water.
3. **Clearing culverts**—The culverts and their inlets and outlets are clear, and water can flow freely.
4. **Clearing bridges**—The area under the bridges is clear, and water can flow freely.
5. **Clearing vegetation**—The vegetation does not impede visibility or normal vehicle transit, nor does it restrict the flow of water away from the road.
6. **Repairing unpaved roads**—There are no potholes larger than 30 cm and no ruts or rills deeper than 5 cm, and water does not flow over or remain on the road.
7. **Repairing stone pavement**—There are no holes or loose stones, and the shoulder is not more than 2 cm below the pavement.
8. **Repairing the road shoulder**—There are no depressions or cuts in the road shoulder, and where necessary, water has been directed away, and the shoulder has been stabilized with vegetation or retaining walls.
9. **Repairing the drainage system**—Scour checks have been placed in eroded side drains, and undermined structures are protected by stones.
10. **Repairing retaining walls**—There are no loose stones in the retaining walls, and weep holes are clear.
11. **Creating side drains**—The side drains are at least 20 cm wide and 15 cm below the road surface, have no sharp curves and have a proper outlet, and water no longer flows over the road.
12. **Creating water bars**—Temporary water bars have been created at regular intervals to guide the water safely away from the road, and water no longer flows over the road.
13. **Creating paved crossings**—Where water crosses over the road, the road surface is protected from damage by stone-paved splashes.
14. **Creating retaining walls**—The created dry-stone retaining walls are stable, and the area behind it has been compacted.
15. **Planting vegetation**—The slopes and road shoulders prone to erosion are protected by vegetative material.
16. **Additional activities**—Performance indicators will be agreed upon in coordination with the communications bureau, depending on the type of work.

Clause 3 Compensation

3.1 The planned monthly compensation for the **Maintenance Group** will be based on the monthly workplan according to the specific activities and work amounts indicated in the workplan, using the unit costs indicated in the table below.

3.2 Upon signing the contract, the **Maintenance Group** will receive tools and safety equipment from the **Communications Bureau**. The **Maintenance Group** will be responsible for replacing and repairing them if they are lost or damaged.

3.3 The **Maintenance Group** will receive an allowance of CNY20 per kilometer upon signing the contract to cover the costs of repairing and sharpening the tools.

3.4 The **Maintenance Group** will receive an allowance of CNY250 per kilometer upon signing the contract to cover the costs of communications and transport of both group members and materials.

3.5 The **Communications Bureau** will obtain accident insurance for all members of the **Maintenance Group**.

Activity	Unit	CNY/unit (average)
1. Clearing landslides	m^3	40
2. Clearing side drains	100 m	20
3. Clearing culverts	unit	20
4. Clearing bridges	unit	40
5. Clearing vegetation	100 m^2	10
6. Repairing unpaved roads	10 m^2	25
7. Repairing stone pavement	10 m^2	20
8. Repairing the road shoulder	m^3	20
9. Repairing the drainage system	m^3	15
10. Repairing retaining walls	m^3	15
11. Creating side drains	10 m	10
12. Creating water bars	10 m	10
13. Creating paved crossings	m^2	20
14. Creating retaining walls	m^3	40
15. Planting vegetation	10 m^2	20
16. Additional activities	Lump sum	To be determined

Clause 4 Work Discipline and Penalties

4.1 The **Communications Bureau** will inspect the road or road section each month and assess the condition of the road elements according to the performance indicators mentioned in Clause 2 with respect to the maintenance activities and road sections indicated in the workplan for that month.

4.2 The actual monthly compensation will be based on the percentage of the workplan completed to the satisfaction of the **Communications Bureau** (according to the performance indicators). If the **Maintenance Group** does not complete the work indicated in the workplan, or does not comply with the performance indicators as stipulated in Clause 2 (for activities and road sections indicated in the workplan), a deduction from the monthly compensation will be made based on the unfinished work and on the performance indicators not fulfilled.

4.3 The **Maintenance Group** should follow the relevant safety regulations while working on the road.

Clause 5 Agreement Variation, Termination, and Repeal

5.1 Both parties should perform the obligations of the agreement. Neither party can vary the agreement by itself.

5.2 When the agreement expires, or the promissory termination condition appears, the agreement will terminate.

5.3 If the **Communications Bureau** ceases to exist, the agreement will be terminated.

5.4 The agreement will be terminated when the two parties agree on the termination.

5.5 The **Communications Bureau** may terminate the agreement under the following conditions:

a) The **Maintenance Group** repeatedly disobeys the **Communications Bureau's** regulations and guidance.

b) The quality of the road maintenance is assessed to be below standard in three monthly inspections during the contract period.

Clause 6 Other Matters

6.1 Other related matters not covered in this agreement will be solved based on negotiations between the two parties.

6.2 This agreement will be signed in three copies, the **Communications Bureau** will keep two copies, and the **Maintenance Group** will keep one copy. The agreement will be effective after the two parties have signed it.

Communications Bureau	Maintenance Group
Date:	Date:

Community-Based Routine Maintenance of Roads by Women's Groups
Guide for Communications Bureaus

This guide describes how to implement a system of community-based rural road maintenance involving groups of women, specifically in Yunnan Province, People's Republic of China.

It was written as part of a pilot project supported by the Gender and Development Cooperation Fund of the Asian Development Bank. This pilot project aims to show that women can effectively participate in the maintenance of rural roads, resulting in improved road conditions and better access for those who rely on roads, and in creating employment opportunities and incomes for women. It also serves to identify specific issues in the participation of women in rural road maintenance, while defining solutions that facilitate their involvement.

This guide is complemented by a manual that was developed under the same Gender and Development Cooperation Fund pilot project.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two-thirds of the world's poor: 1.8 billion people who live on less than $2 a day, with 903 million struggling on less than $1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org
ISBN 978-92-9092-361-9
Publication Stock No. TIM113426

Printed on recycled paper

ISBN 978-92-9092-361-9
9 789290 923619

Printed in the Philippines