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Why road maintenance is important and how to get it done

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Roads, and means of transport, make a crucial contribution to economic development and growth and bring important social benefits. Poorly maintained roads constrain mobility, significantly raise vehicle operating costs, increase accident rates and their associated human and property costs, and aggravate isolation, poverty, poor health, and illiteracy in rural communities.

This Note highlights the economic and social importance of regular road maintenance and recommends ways to achieve sustainable road maintenance with scarce public resources. Its audience is not specialists but rather people who need to understand road maintenance enough to discharge their responsibilities effectively: government policy-makers, mayors, ministry staff, new World Bank staff and staff in sectors such as rural development and social funds. The reference section offers sources providing more detailed information.

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Although the need for maintenance is widely recognized, it is still not getting adequately done. Many countries spend just 20–50 percent of what they should be spending on maintenance of their road network. There are many reasons why this is so. This Note explains some of them and shows how to overcome them. The challenges include distinguishing maintenance from other types of road work; calculating how much maintenance will cost; where to get the money; and how to plan for it institutionally; and contracting maintenance work.

1. WHY IS MAINTENANCE IMPORTANT?

1.1. Roads are among the most important public assets in many countries. Road improvements bring immediate and sometimes dramatic benefits to road users through improved access to hospitals, schools, and markets; improved comfort, speed, and safety; and lower vehicle operating costs. For these benefits to be sustained, road improvements must be followed by a well-planned program of maintenance. Without regular maintenance, roads can rapidly fall into disrepair, preventing realization of the longer term impacts of road improvements on development, such as increased agricultural production and growth in school enrollment.

1.2. Postponing road maintenance results in high direct and indirect costs. If road defects are repaired promptly, the cost is usually modest. If defects are neglected, an entire road section may fail completely, requiring full reconstruction at three times or more the cost, on average, of maintenance costs. The South African National Road Agency Ltd. (SANRAL) estimates that repair costs rise to six times maintenance costs after three years of neglect and to 18 times after five years of neglect. To avoid such escalating costs, SANRAL first “allocate[s] its available funding resources to ideal maintenance actions (e.g., reseals and overlays), and thereafter to more extensive

maintenance actions (e.g., rehabilitation), and finally to new construction” (SANRAL 2004).

1.3. Delayed maintenance has indirect costs as well. Neglected roads steadily become more difficult to use, resulting in increased vehicle operating costs (more frequent repairs, more fuel use) and a reluctance by transport operators to use the roads. This imposes a heavy burden on the economy: as passenger and freight services are curtailed, there is a consequent loss of economic and social development opportunities.

1.4. Countries need a core road network that carries about 80 percent of national traffic, including key roads in urban areas and roads providing sufficient access to rural areas. Some part of the overall road budget thus has to be spent on construction and some part on maintaining the core network. But many countries have tended to favor new construction, rehabilitation, or reconstruction of roads over maintenance. This has led to a steady increase in the backlog of road repairs and a loss of development impact. In Sub-Saharan Africa for every kilometer of road rehabilitated, an estimated three kilometers of road fall into disrepair, leading to a net deterioration in the total road network (World Bank 2003). The situation is similar in many other developing country regions. Much of the capital cost of road construction is financed by donor funds, with low perceived cost to the country but high real costs, while maintenance is funded locally, requiring difficult and unpopular tax mobilization.

2. WHAT IS MAINTENANCE?

2.1. The goal of maintenance is to preserve the asset, not to upgrade it. Unlike major road works, maintenance must be done regularly. Road maintenance comprises “activities to keep pavement, shoulders, slopes, drainage facilities and all other structures and property within the

road margins as near as possible to their as-constructed or renewed condition" (PIARC 1994). It includes minor repairs and improvements to eliminate the cause of defects and to avoid excessive repetition of maintenance efforts. For management and operational convenience, road maintenance is categorized as routine, periodic, and urgent.

2.2. **Routine maintenance**, which comprises small-scale works conducted regularly, aims "to ensure the daily passability and safety of existing roads in the short-run and to prevent premature deterioration of the roads" (PIARC 1994). Frequency of activities varies but is generally once or more a week or month. Typical activities include roadside verge clearing and grass cutting, cleaning of silted ditches and culverts, patching, and pothole repair. For gravel roads it may include regrading every six months.

2.3. **Periodic maintenance**, which covers activities on a section of road at regular and relatively long intervals, aims "to preserve the structural integrity of the road" (WB Maintenance website). These operations tend to be large scale, requiring specialized equipment and skilled personnel. They cost more than routine maintenance works and require specific identification and planning for implementation and often even design. Activities can be classified as preventive, resurfacing, overlay, and pavement reconstruction. Resealing and overlay works are generally undertaken in response to measured deterioration in road conditions. For a paved road repaving is needed about every eight years; for a gravel road re-graveling is needed about every three years.

2.4. **Urgent maintenance** is undertaken for repairs that cannot be foreseen but require immediate attention, such as collapsed culverts or landslides that block a road.

2.5. Maintenance does not include rehabilitation, building shoulders, or widening roads. If the sections to be rebuilt constitute more than 25 percent of the road's length, the work is rehabilitation, not maintenance.

3. HOW TO INCORPORATE MAINTENANCE INTO PROJECT AND SECTOR STRATEGIES

3.1. To be sure that road maintenance is not neglected, it needs to be incorporated into project and sector strategies. That requires a clear and realistic strategy for road network management that attends to the following key principles:

- ❑ **Use the core network concept.** As a rule of thumb, 80 percent of traffic flows over 20 percent of the road network. This core network is often the responsibility of the national government's highways ministry. These most heavily trafficked roads should receive priority for full routine and periodic maintenance.
- ❑ **Clearly assign to specific institutions "ownership" of roads and responsibilities** for development, maintenance, and priority-setting. Often, when construction or upgrading has been completed by the national road agency through a loan or grant, responsibility for maintenance remains unclear or is handed over to the "community." Good practice indicates that the agency that implements the road construction or rehabilitation be responsible for subsequent routine and periodic maintenance

(Malmberg Calvo 1998). For example in India the national highways (about 65,000 km) are the responsibility of the Ministry of Roads and Highways, while state highways (about 124,300 km) are the responsibility of the states. At each level the same agency is responsible for development as well as maintenances of its "own" network.

- ❑ **Involve all agencies and institutions** associated with roads at national, regional, district, and local community levels as well as **road users and other stakeholders** in identifying road issues and planning road interventions. Other stakeholders include organizations dealing with tourism, health care, rural development, agriculture, and mining; road user associations; community organizations; nongovernmental organizations; and businesses.
- ❑ **Determine the overall level of funding required** and the balance among construction, rehabilitation, and maintenance. Priority for maintenance funds should go to roads that are functionally important and in reasonably good condition. Routine maintenance should be included as a cost component in donor-funded road construction projects even if maintenance is fully funded by government resources, to ensure that it is not neglected.
- ❑ **Develop standards for improving roads.** Design standards and maintenance practices should be reviewed to ensure the sustainability of the entire road network. For instance, for low-volume roads design standards may stress accessibility and durability rather than width and speed.
- ❑ **Include maintenance of bridges, road signs, sidewalks, and other road structures.** Neglected road structures and signs lead to increased road accidents and, in the case of bridge deterioration, can lead to road closures and network disruptions.
- ❑ **Assess capacity to fund, manage, and supervise** road maintenance. International donors have become increasingly involved in road maintenance programs, and this can be a good if temporary solution for some road agencies. For the longer term, donors should help to create a more stable source of funds.
- ❑ **Assess the capacities of municipal, district, and provincial road agencies** to perform any management and supervision responsibilities delegated by the central road department.
- ❑ **Define objectives and develop plans** for road maintenance capacity building, including training, technical assistance, and local revenue generation.

4. WHAT WILL IT COST TO MAINTAIN THE ROAD NETWORK?

4.1. Maintenance costs vary with road conditions, traffic volume, geographic location, climate conditions, work methods, technical equipment, and other factors.

4.2. Where no maintenance program is in place, cost calculations do not have to be precise at the beginning. The main point is to get started. If calculations of road maintenance need using sophisticated road management systems or complicated formulas seem overwhelming,

| Work class | Work type | Predominant work activity | Minimum | Maximum | Mean |
|------------|---------------------|-------------------------------|--------------------------|---------|--------|
| Routine | Routine maintenance | Unsealed 2L Highway | 277 | 1,740 | 989 |
| | | Bituminous 2L Highway | 656 | 5,580 | 2,199 |
| Periodic | Grading | Light Grading | 51 | 205 | 110 |
| | | Heavy Grading | 323 | 876 | 522 |
| | Gravel resurfacing | Regravelling | 1,997 | 65,038 | 15,326 |
| | Bituminous pavement | Fog Seal | 2,805 | 15,783 | 8,946 |
| | Unsealed | Unsealed Preventive Treatment | 2,009 | 6,965 | 4,266 |
| | Surface treatment | Slurry Seal or Cape Seal | 4,452 | 27,520 | 9,780 |
| | | Resurfacing | Single Surface Treatment | 5,295 | 38,607 |
| | | Double Surface Treatment | 10,684 | 45,277 | 27,039 |
| | Asphalt mix | Asphalt Overlay < 40 mm | 12,878 | 82,320 | 38,095 |
| | Resurfacing | Asphalt Overlay 40 to 59 mm | 21,021 | 126,131 | 68,713 |

Source: World Bank ROCKS website.

| Surface/Type of maintenance | Work type | Description | Financial unit cost (US dollars) |
|-------------------------------|---|--|---|
| Paved/ routine maintenance | Routine maintenance off carriageway | Grass Cutting, ditch cleaning, culvert cleaning, slopes, etc. | 195 per km |
| | Crack sealing | Bituminous sealing of cracks wider than 3 mm. | 1.5 per m ² |
| | Patching | Patching of potholes by filling with base material and patch with surface dressing | 5.8 per m ² |
| | Edge Repair | Repair of pavement edges | 2.2 per m ² |
| Paved/ periodic maintenance | Surface dressing | Resurfacing the pavement surface with a single bituminous surface dressing | 1.5 per m ² ~12,500 per km |
| | Spot rehabilitation | New single surface treatment by scarifying the old surface | ~25,000 per km |
| | Overlay | Resurfacing and reshaping the surface with 30 mm asphalt concrete overlay | 6.6 per m ² |
| | Reconstruction | Reconstruction of the whole pavement structure including new sandy subbase, gravel base and a double bituminous surface dressing | ~120,000 per km ~21 per m ² |
| Unpaved/ routine maintenance | Routine maintenance | Grass cutting, ditch cleaning, culvert cleaning | 180 per km |
| | Grading | Reshaping and leveling of the pavement surface | 125 per km |
| Unpaved/ periodic maintenance | Spot regravelling | Spot regravelling in affected areas | 5.8 per m ³ |
| | Regravelling including scarifying and reshaping | Regravelling of the pavement surface by applying 150 mm gravel including scarifying and reshaping the road surface | 8.0 per m ³ ~7,750 per km |
| | Rehabilitation | Same as for paved roads except bitumen works | ~15,000 per km |
| | Upgrade | Upgrade the pavement to sealed standard with new sub-base, base and surface dressing | ~170,000 per km |

Source: Ministry of Communication, Transport, Post and Construction of the Lao People's Democratic Republic 2003.

start with simple rules of thumb. Thus, for a road network in reasonable condition, assume costs of about USD500 per kilometer per year for routine maintenance at the municipal level and USD500–USD750 per kilometer per

year for maintenance at the national level. Thus if a municipality in, say, the Philippines owns a 50 km road network in reasonable condition, the minimum required annual budget for routine maintenance would be about

USD25,000 at USD500 per kilometer. Or, at the national level, if a country such as Cambodia has recently undertaken major rehabilitation and now has a core national road network of 4,000 km in good condition, the required annual budget for routine maintenance would be about USD2–USD3 million at USD500–USD750 per kilometer. These budgets do not cover the costs of periodic maintenance, but they are more than is actually being spent on maintenance today in many countries. Another simple rule of thumb is that 80 percent of the road budget should be spent on the 20 percent of the network that carries 80 percent of the national traffic, remembering to include urban, rural, and interurban roads in the network.

4.3. Once a maintenance program is in place, road maintenance needs can be estimated more accurately through direct or indirect assessments:

- A **direct assessment** can be based on the output of a standardized road management system such as the World Bank's HDM-4 (WB HDM-4 website). The road agency needs strong technical capacity to operate such models and to modify them appropriately in calculating costs for subnational-level roads.
- An **indirect assessment** uses formulas related to road length, traffic, and other variables affecting maintenance needs. This approach requires less technical capacity than the direct assessment approach. Estimates can be based on available average maintenance costs per kilometer for different types of road. In Peru, Provincial Road Institutes prepare Participatory Provincial Road Plans that estimate maintenance costs based on road classifications, climate, geography, traffic, and other influencing factors, as well as data on costs incurred in past maintenance works (Supplement, box 3).

4.4. As a guide to road agencies using indirect assessment to calculate their maintenance needs, table 1 provides a worldwide picture of routine and periodic maintenance costs for 2000 from the World Bank's ROCKS Database (WB ROCKS website). Table 2 provides more recent data, as of 2003, on unit costs of different types of maintenance work in Lao PDR.

5. HOW TO ENSURE A STEADY FLOW OF MAINTENANCE FUNDS

5.1. Good maintenance requires a steady and reliable flow of funds. There are several reasons why this often fails to materialize. Those responsible for allocating the budget may have little understanding of the economic and social importance of maintenance; they may have allowed the budget process to become politicized, favoring construction, which is more visible and popular, over maintenance; or they may believe that fiscal constraints justify deferring maintenance, which only raises future costs.

5.2. There are several ways to address these problems:

- Rely on a **single annual allocation from the national budget** to the road sector, with the road agency responsible for allocating appropriate funds for maintenance. This only works where the road agency recognizes the importance of maintenance and is not under pressure to prioritize new construction.

- Create a ring-fenced **road maintenance line item** in the national budget. The ministry of finance would thus be responsible for the allocation. This is not always a secure and stable financing source, but it has the advantage of being designated under the budget law.
- Set up a **dedicated road fund** that receives resources directly from road user charges. The road fund can be included in the budget, as in Kenya, or it can be off-budget and managed by an independent roads fund board established by relevant ministries and road user associations. Though a dedicated fund provides a more stable source of financing and is managed by an administration dedicated to roads maintenance, the ministry of finance may oppose this method because of perceptions of earmarking and the proliferation of off-budget funds. Sometimes road funds accumulate too much money, which can encourage spending on new roads, which may not be in the national interest.
- Give the road agency more discretion in concessioning maintenance activities to **private sector providers**, which could be allowed to charge tolls to cover the cost of maintenance. This option could be combined with any of the other options.

5.3 External funding sources can also complement local resources on a declining basis, to give local funding time to develop. In general, external funding should not be used for routine maintenance. Rather, an overall program should be developed that includes both construction and maintenance, with external sources allocated to construction and local resources to maintenance.

5.4. Each country should develop an approach that suits local conditions. In Bolivia, the Road Maintenance Account receives funds from road user revenues, but the account is managed by the road agency rather than an independent board. The amount of funds allocated to the account is determined by a Supreme Decree. External funding was provided by international donor agencies to get the account started and then was phased out as road user charges accumulated. In Lesotho, 60–70 percent of routine and periodic maintenance needs are covered by the Road Fund financed by road toll revenue, a fuel levy, license fees, and the Ministry of Finance (Supplement, box 1).

5.5. Essential to all this is government commitment to road maintenance. Without it, no funding mechanism will work and the funds will simply be "borrowed" or shifted to other purposes

6. HOW SHOULD ROAD AGENCIES ENGAGE WITH THE MINISTRY OF FINANCE AND PRESENT ANNUAL MAINTENANCE BUDGETS?

6.1. Road agencies need a system for requesting budget funds, and they need accountability and audit mechanisms to account for the funds' use.

6.2. Once maintenance needs have been estimated, the road agency finalizes and submits its annual budget for consideration to a funding source. At the central level that would be the ministry of finance or a road fund; at the regional or local level, it would be the funding authority at that level. Each country's institutional and financial systems affect how the budget submission is presented.

6.3. Some funding sources are satisfied with a single, total figure, while others demand more detailed information, including work methods and technology choice. Routine and periodic maintenance costs may need to be separated. Enough detail should be provided to permit later auditing against planned works. The budget may include such additional costs as overhead and contingencies for inflation and emergency works. Provisions for inflation are important in contracts of longer than a year and in short-term contracts in countries where inflation is high.

6.4. The funding source then allocates resources following standard procedures. When funds are allocated by the ministry of finance, the road agency's requests would be assessed against those of other sectors as well. Other factors influencing funding decisions include quality of submission, network size, historical precedent, and technology choices. When regional and local level agencies depend on transfers from the central government, the ministry of finance determines the allocation for the entire road sector. In some Latin American countries with unitary systems and stringent fiscal constraints, the ministry of finance limits the overall allocation to each sector. In that case the road agency would need to work within that budget envelope, apportioning funds among maintenance, rehabilitation, and new construction.

6.5. Accountability mechanisms are also important. National treasuries are reluctant to release funds unless road agencies can demonstrate how the funds are used and with what effectiveness. For instance, in Cambodia, funds collected by the Road Fund are not being released for road maintenance because of shortcomings in the budgeting and accounting mechanisms (WB and ADB 2003). When internal accountability structures are weak, independent parties can be called in to evaluate the maintenance program. External audits can demonstrate the road agency's willingness to be held accountable for program management and may be more convincing to national treasuries than internal systems.

6.6. Again, strong support from political leaders and national treasuries is crucial. A road board and road fund will not achieve the desired results unless there is a strong political will to support them. In India, for example, although the Central Road Fund allocations are assured and are not constrained by annual budgeting, in practice the funds go to upgrading rather than maintenance. In Ghana, despite clearly acknowledged past failures to allocate adequate funds for maintenance from a substantial roads budget, the 1997 Ghana Road Fund Act does not clearly prioritize maintenance in its list of activities eligible for funding (Ghana Road Fund 1997). As a result, maintenance remains compromised, and a credible maintenance program for roads has yet to be developed.

7. HOW WOULD MAINTENANCE PROGRAMS BE IMPLEMENTED?

7.1. Maintenance operations can be outsourced to private organizations or carried out using force accounts (in-house units and equipment). Responsible road agencies need competent maintenance program management, a good monitoring system, and clear and transparent procurement procedures.

7.2. Several types of road maintenance contracts can be used. Table 3 shows the most common types and can help road agencies select the type that meets their needs and capacities.

7.3. Procedures for contract management vary, but most have these four steps:

- Invitation for bids.
- Assessment of bids and contract award.
- Management of ongoing contract.
- Auditing and evaluation of completed work.

7.4. Aspects of effective contracting include efficient designs informed by local knowledge, use of local contractors and consultants, generation of local employment and income, capacity building, use of appropriate technology, and simplified contract forms. In addition, effective contracting requires:

- Capacity to prepare bid documents, arrange contracting procedures, process contracts, supervise work, and deal with arbitration issues.
- Straightforward procurement procedures. Use of e-procurement is strongly recommended.
- A steady flow of funds to pay contractors.
- A quality assurance plan developed in close collaboration with quality control engineers that assigns clear responsibilities to contractors, consultants, and road agency and spells out expected road maintenance outcomes for contractors and technical audits for consultants.

7.5. Private contractors are increasingly being used in place of in-house units, for reasons of cost effectiveness and efficiency. Claims that in-house units are cheaper are often based on improper costing of the force account activities. Maintenance activities are easy to learn, so that a system that combines microenterprises for routine maintenance and larger contractors for periodic maintenance can be established quickly. Redundant force account crews—and their equipment—can be reorganized to become contractors, with some training and supervision. They should not be retained as agency staff.

7.6. The same firm contracted to do routine maintenance can also handle emergency work. If maintenance is carried out regularly and properly, the need for emergency work will reduce substantially. A limited number of in-house units can be retained to allow emergency work under force-majeure circumstances, such as earthquake and flooding.

8. WHAT TYPES OF CONTRACTORS COULD BE USED?

8.1. Routine maintenance contracts are often short term (6–12 months) and low value, with little appeal to contractors from other countries. Many countries therefore use domestic contractors to implement maintenance works. A strongly developed local contracting sector has several advantages, from works methods tailored to local conditions and improved productivity to greater accountability and lower cost. The

creation of direct and indirect employment opportunities also contributes to poverty reduction.

8.2. Maintenance of South Africa's entire national road network is covered by routine road maintenance contracts. A managing contractor is paid a fee to manage the work of historically disadvantaged enterprises and micro, small, and medium-size enterprises, which perform 80% of all maintenance work. This system ensures that the entire national road network is maintained by contractors responsible for maintenance and any emergencies that arise.

8.3. Contractors can be classified by size of contract and type of work (TRL and DFID 2003):

- **Lengthworker:** an individual contracted to perform routine maintenance on a 1–2 km road section. The lengthworker often lives alongside the road and is supplied with tools and material. Since managing individual lengthworkers is inefficient, they can be encouraged to join together into small contracting organizations or to subcontract to larger contractors. Ghana and Mongolia use lengthworkers, because long distances and low population density make it hard to get other types of contractors out to the roads.
- **Community contractor:** an organization that springs up in response to emerging community needs and may then dissolve again the need is met. Any profits are returned to the community to fund future maintenance needs. Most activities in which they engage are labor-based or labor-intensive. This type of arrangement provides employment to the local population.
- **Petty contractor:** like a community contractor, uses labor-intensive methods and performs routine maintenance works in a very local area. Can be a cooperative with some 10–20 members with limited technical qualifications. Differs from a community contractor in being a private organization.
- **Microenterprise:** a cooperative or community association set up as a private enterprise and operating like a petty contractor. Peru and other Latin American countries have successfully used the microenterprise method for rural road maintenance.
- **Small scale contractor:** usually operates only in a local area, but strives to grow in size, technical capacity, and geographical range. Small-scale contractors are trained in labor-based methods and are competent to work on unsealed roads only. They have more technically qualified staff than a microenterprise.
- **Medium- and large scale contractors:** may begin as a small-scale contractor or as a merger of several small contractors. A **medium-scale contractor** often has more sophisticated equipment and wants to use that investment as much as possible. Its staff is often trained in new skills, such as the construction of improved and bituminous surfaces. A **large-scale contractor** operates nationally and, possibly, internationally and is interested in large, areawide, multiyear performance contracts, possibly subcontracting some activities to small contractors.

9. WHAT IS THE AVERAGE DURATION AND SIZE OF CONTRACTS?

9.1. The longer the contract period, the greater is the incentive for contractors to invest in specialized equipment. This allows considerable cost savings but requires well-developed contractors and a highly professional road agency to manage their work. The United Kingdom uses three- to five-year contracts, Sweden uses three- to six-year contracts, and Chile uses three-year contracts for unpaved roads and five-year contracts for paved roads.

9.2. Other developing and transition countries go for short-term contracts of a year or less, for a variety of reasons. For instance, unfavorable weather conditions may prevent contractors from conducting any road works during certain times of year, such as the monsoon season in Bangladesh or winter in Mongolia, making one-year contracts inefficient. Lesotho generally engages in three-month trial contracts with its locally developed contractors covering small sections (about 3 km) of rural road. Once they prove their competence and efficiency, they are awarded longer term contracts covering a longer road sections (see box 1).

9.3. The size of contracts depends on maintenance costs in each country (see section 4). In Peru routine maintenance costs for previously rehabilitated rural gravel roads dropped from USD1,000 per km per year and higher to USD700–USD800 once regular maintenance was introduced (see table 4 and box 3). Microenterprise contracts average 35 km of road (with a 20 km minimum and 50 km maximum, or about 3 km per person), or about USD24,200–USD27,700. The use of local labor and very simple tools keeps costs low.

9.4. Albania spends more on routine maintenance of paved rural roads (a little more than US\$3,000 per km per year) because of more sophisticated equipment and more expensive material, higher traffic loads, and other factors; contracts average one year. Periodic maintenance costs vary from USD10,000 to USD16,000 per km per year, and most contracts are for two years (see table 4).

9.5. The average length of road assigned to individual contractors generally depends on the qualification and experience of local contractors and the type of works. Periodic maintenance contracts tend to cover smaller road segments than routine maintenance contracts. For instance, in Lao PDR in 2001-02 periodic maintenance contracts covered 23 km of national roads and routine maintenance contracts covered 86 km on average.

10. CONCLUSION

10.1. To conclude, "if money is short – and it usually is – there's only one rational course of action:

- Maintain existing roads before funding new ones.
- Make sure it is done today, and even every day.

Because tomorrow, it will be much more expensive" (PIARC 1999).

Supplement

| Table 3: Types of road maintenance contract | | |
|--|--|--|
| Contract type | Definition | Suitability |
| Short-term contracts | | |
| Normal measurement contract/Adm easure contract | Required quantities of each activity are listed on a bill of quantity (BoQ). The price is submitted and used by the road agency to assess bids and award the contract. Typically, the quantity of completed work that meets the technical specification is measured monthly, and the contractor is paid for that quantity multiplied by the contract unit rate. | Periodic maintenance and rehabilitation. |
| Simple Measurement contract | For work on a larger scale, quantities are estimated, measured, and paid as usual, but the BoQ includes fewer items. Requires skilled inspectors to ensure that all necessary work is carried out under the composite activities. | Can save on measurement costs. |
| Cost plus contract | Actual costs incurred by the contractor are paid, plus an agreed percentage for profit. Generally not cost effective, and the contractor has little incentive to provide high-quality output. | For contractors undergoing training or for items of work where a specification is difficult to set. |
| Long-term contracts | | |
| Term measurement contract | Based on a schedule of unit prices and estimates of quantities listed in BoQ. Bids are assessed and contracts awarded as above. Contract specifies activities to be performed and timing and may include an emergency response capability. Payment is based on inputs (amount of physical works executed and amount of material supplied). | For routine maintenance. For all contractors. When funding is unreliable. |
| Performance-based contract | Contractor is paid monthly based on performance outputs measured against standards stated in the contract rather than inputs. Penalties are imposed if the outcomes for a specific activity fail to comply with the contract standards, and payment may be reduced or suspended until the necessary repairs are done. Less effort is spent on contract administration, and corruption tends to decline. The contractor's share of responsibility increases over time. The contractor decides whether to use innovative and more efficient methods to cut costs and meet the required performance standards. As the road agency and contractors gain more experience, the routine maintenance contract can be extended from one year to three or more. If the contract is extended to cover periodic maintenance once the contractor has the necessary skills, the contract should be issued for three years or more since periodic maintenance occurs less frequently. This type of contract can be used for roads in poor condition, but initial rehabilitation should be specified using agreed rates and measured quantities. | For routine maintenance or both rehabilitation and routine maintenance, but not for rehabilitation alone; for longer periods. For a mature road agency that can establish and follow transparent checking and auditing procedures; and a mature contractor that can innovate to meet performance standards and reduce its own costs. Unsuitable if funding cannot be ensured for the entire contract period. |
| Lengthworker contract | A type of performance contract for one person to implement routine maintenance works on an allocated length of road (normally 1–2 km). The contractor is often paid monthly based on a specified work time. Performance standards should be specified, and contractors should be paid for performance rather than attendance. Lengthworkers can be subcontracted to a larger contractor, to avoid the high costs of administering many small scale contractors. | For routine maintenance if contractors are adequately trained and supplied with needed equipment and material. |
| Community contract | Payment is based on measurement or performance. Contracts are often awarded on agreed rates rather than tendered, but if other community contractors are interested, technical proposals may also be assessed. Contract documentation should be transparent and easy to understand by those unfamiliar with contracting. A contract may provide for assistance from a road agency or assign complex work to a commercial subcontractor. As the client road agency and contractor are usually from the same community with the same incentives for success, conflicts of interest may arise. | For contractors that have emerged from the local community. |

Source: Heggie and Vickers 1998;
TRL and DFID 2003.

Table 4: Average costs, road length, and duration of a road maintenance contract in selected countries

| Country | Average cost per km per year (USD/km) | | Average road length in km per contract | | | Average cost (USD) per contract | | Average contract duration (months) | |
|-----------------------------------|---------------------------------------|---------------|--|----------|-----|---------------------------------|-----------------|------------------------------------|----------|
| | Routine | Periodic | Routine | Periodic | P+R | Routine | Periodic | Routine | Periodic |
| Albania (2002-2003) | | | | | | | | | |
| National roads (mostly all paved) | 1,985 | 16,000 | 31 | n/a | 44 | 61,535 | - | 12 | 24 |
| Paved rural roads | 3,035 | 9,850 | 6 | n/a | 19 | 18,210 | - | 12 | 24 |
| Laos (2001/2002) | | | | | | | | | |
| National roads (mostly all paved) | - | 6,000-13,000 | 86 | 23 | n/a | - | - | 12 | 12 |
| Rural roads (mostly all gravel) | - | 2,000 | - | - | - | - | - | - | - |
| Lesotho (2000) | | | | | | | | | |
| Paved rural roads | 600-700 | 20,000-40,000 | | 10-15 km | n/a | 6,000-10,500 | 200,000-600,000 | 6-12 | 6-8 |
| Gravel rural roads | 900-1,000 | 10,000-15,000 | | 10-15 km | n/a | 9,000-15,000 | 100,000-15,000 | 6-12 | 6-8 |
| Peru (2002) | | | | | | | | | |
| Gravel rural roads | 700-800 | n/a | 34,6 | n/a | n/a | 24,220-27,680 | n/a | - | - |
| Zambia (2003-2004) | | | | | | | | | |
| Main paved roads | 360 | - | 70 | - | - | 25,000 | - | 12 | - |

"n/a" means "not applicable".

"-" means "no available data".

Source: The results of the research conducted for this particular project.

Box 1. Training local road maintenance contractors in Lesotho.

Since phasing out its force account in 1997, Lesotho has relied on local small-scale contractors for maintenance of rural roads. A nine-month Contractor Training Program has trained 65 small-scale contractors in road maintenance and rehabilitation. Classroom and technical training are followed by three-month trial contracts for routine maintenance and periodic maintenance, typically for road segments of 3 km. The program has generated temporary employment for some 4,000 workers, contributing to poverty alleviation.

Contractors who successfully complete the trial contracts are awarded a road maintenance contract, generally for a road segment of 10–15 km. Competitive bidding is avoided to keep the program focused on quality and local contractors rather than price. Several small-scale contractors have merged and formed medium-size firms to perform periodic maintenance, and medium size contractors are encouraged to consolidate to form large-scale units capable of competing in international tenders.

About 60–70 percent of routine and periodic maintenance needs are financed through the Road Fund (financed by road tolls, a fuel levy, and license fees) and Ministry of Finance budget allocations, an outstanding achievement.

Source: Interview with Subhash C. Seth, Highway Engineer in the Africa Region of the World Bank; Seth 2004.

Box 2. Contracting out routine road maintenance in Zambia.

Since 1999 small local contractors have been awarded one-year performance-based contracts to maintain road verges, ditches, and cross-drainage structures to set standards on designated sections of the main road system. A typical contract covers 70 km of rural road for US\$25,000, paid by the Road Fund. More than 6,000 km of paved main roads have received routine maintenance regularly using this system, at an annual average cost of US\$360 per km. Most operations are labor-intensive, using local laborers. An estimated 1.5 million person-days of employment per year have been created under this system. Beginning in 2005 the contracts will be extended from one year to three years and will include simple on-road maintenance such as pothole patching.

A slightly modified contract is used for routine maintenance of urban roads in Lusaka, including litter collection. Teams of five people per kilometer on one side of the road conduct routine maintenance under three-year performance-based contracts. About 108,000 person-years of employment have been created. The program is being extended to other urban areas.

Source: Gary Taylor, IT Transport Ltd.; Zambia National Roads Board: <http://www.nrb.org.zm>

Box 3. Contracting out rural road maintenance in Peru.

The Peru Rural Road Rehabilitation and Maintenance Project (jointly financed by the Inter-American Development Bank, World Bank, and government of Peru) established a microenterprise-based road maintenance program, recognizing that it was “not a welfare program but a cost-effective way of ... ensuring the benefits from improved access [following road rehabilitation] will not vanish” and of generating employment.

All rehabilitated roads were entered into the routine maintenance program. Microenterprise contractors (with 10–16 employees) received annual performance-based contracts, which could be renewed. Once microenterprises gained technical and business skills, competitive bidding was introduced.

In the second phase of the project, which began in 2002, Provincial Road Institutes were set up to estimate maintenance costs, prepare road maintenance plans, and managing contracts. There are now about 40 institutes in the 105 provinces where the project is operating. The institutes are typically staffed with one engineer, one planner or technical specialist, and one administrative support person.

Maintenance contracts cover 20–50 km of road (an average of 45 km of road or 3 km per person). Average maintenance costs fell from US\$1,000 per kilometer of rural road to US\$700–US\$800 once maintenance work was being performed regularly. The program, which began with rural roads, has been expanded to the national network.

Initially, payment was uniform, but gradually roads were classified according to road conditions, traffic load, geographic location, and climate impact. Microenterprises are now required to submit brief descriptions of types of maintenance activities implemented and expenditures incurred. All of this helps the Provincial Road Institutes to estimate maintenance costs more accurately.

In the first phase of the project, financing was handled through a maintenance cofinancing mechanism under which participating local governments covered the cost of routine maintenance activities in their jurisdictions and the Ministry of Transport and Communication financed the balance. In the second phase local governments are responsible for covering part of rural road maintenance costs (generally about a third). The new Municipal Compensation Fund allows municipalities to finance recurrent costs associated with rural road maintenance. Overall, transfers from the center cover about 62% of road financing, while local taxes, fees, and loans cover the rest.

Colombia originated the use of microenterprises as road maintenance contractors some 15 years ago. The successes in Colombia and Peru encouraged Bolivia and Honduras to adopt the same approach. Keys to success have been the strong commitment of local communities, which see road maintenance as a means of social and economic development, and the use of local microenterprises, which employ people who live alongside the roads and so have an incentive to keep the roads in good repair.

Source: Interview with Aurelio Menendez, Senior Transport Economist, LCSFT, TTL for the Peru and Bolivia projects; World Bank 2001.

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