

TEAM-BASED ROUTINE MAINTENANCE OF RURAL ROADS



A STUDY ON THE POTENTIAL FOR IMPLEMENTATION IN CHINA - SUMMARY -

The concept of team-based routine maintenance was first introduced in Latin America, where experiences with routine maintenance microenterprises have resulted in improved road conditions, lower overall maintenance costs, and the creation of employment, incomes and skills in local communities. Given the many positive results of this approach, the World Bank is interested in introducing it in other regions and countries. It therefore obtained funding from the Public-Private Infrastructure Advisory Facility (PPIAF) for the adaptation of the concept and its implementation in a number of pilots in China.

As a first step, a comparative study was carried out on the different experiences with road maintenance microenterprises in Latin America, identifying the main characteristics, problems and solutions. Subsequently, the first of a total of four visits to China was carried out, during which the Latin American model was presented and the existing road maintenance arrangements in Ganzhou municipality, Jiangxi province and in Guiyang municipality, Guizhou province were studied. The field visits and discussions with maintenance workers and Municipal and County Communication Bureaus led to the conclusion that the Latin American experiences could be used to improve existing maintenance arrangements in China, especially regarding the organization of individual maintenance workers into maintenance teams, the improvement and expansion of the maintenance activities, the introduction of differentiated productivity rates and maintenance costs per kilometer, and the development of an adequate system for financing routine road maintenance. It was therefore decided to focus the study on these issues.

Based on the initial findings, a team-based routine maintenance system for rural roads in China was developed based on existing maintenance arrangements and best practices from Latin America. For this purpose, a technical and managerial training manual were developed for the maintenance teams, as well as a general guide for the Communication Bureaus, which were presented and subsequently improved during a second visit to China. During a third visit, two pilots were initiated in Ganxian County in Ganzhou Municipality and training was provided to the maintenance teams. These pilots were subsequently evaluated during a fourth and final visit.

The current study has been a first step in the introduction of the team-based routine road maintenance concept in China. Further work is still needed, however, in order to ensure the successful introduction of the concept on a larger scale, especially regarding the prioritization and sustainable financing of routine maintenance. The following sections describe the concept as applied in the pilots, explaining the modifications made with regard to the Latin American model and the problems faced in implementation.

WHAT TYPE OF MAINTENANCE DO THE TEAMS CARRY OUT?

Road maintenance can basically be divided into preventive and corrective maintenance. Preventive maintenance is aimed at avoiding damage to the road by ensuring the proper working of the drainage system and by avoiding seepage into the road base, as well as at preventing traffic accidents by clearing obstacles and ensuring good visibility. Corrective maintenance, on the other hand, aims to repair existing damage to the road, thus returning the road to a better condition. Preventive maintenance has proven to be very cost-effective, as the relatively cheap interventions delay the need for more costly corrective conservation measures, resulting in lower overall conservation costs and better average road conditions. It is this preventative maintenance that is carried out by the maintenance teams, although some minor corrective maintenance is also included in their contract. Such maintenance is generally carried out on a continuous basis throughout the year, and is therefore also referred to as routine maintenance, as opposed to periodic corrective maintenance that is only carried out every few years.

Despite the demonstrated benefits of routine preventive maintenance, however, appropriate prioritisation, financing and implementation mechanisms are often lacking. This was also evident in China where funding, personnel and equipment are often used for corrective maintenance at the expense of preventive maintenance. Throughout the study particular attention has therefore been given to explaining the economic and physical benefits of preventive maintenance and the need for its prioritisation.

WHAT ACTIVITIES ARE INCLUDED AND HOW ARE THEY CARRIED OUT?

The routine maintenance contract as developed for the pilot projects in China consists of 11 different activities. These are aimed at improving road safety (removing landslides and other obstacles from the road, removing loose material from slopes and cutting vegetation) and at preventing damage to the road (clearing of drainage ditches, culverts, and bridges). Some minor corrective activities are also included, which are aimed at avoiding more serious damage to the road as a result of seepage (filling potholes, sealing joints and cracks and repairing the road shoulder and retaining walls). These maintenance activities require only simple skills and little to no equipment or materials, making them extremely suitable for execution by members of communities along the road. It is these community members that form the maintenance teams and carry out the routine maintenance activities using simple hand tools.

This study has sought the improvement and expansion of existing routine maintenance activities through the inclusion of minor repairs and by better defining the tasks and objectives of the preventive maintenance activities. Attention has also been paid to providing adequate and sufficient tools and safety measures to the maintenance teams to improve the quality and productivity of their work. The evaluation showed, however, that the quality of routine maintenance still requires further work, both with the maintenance workers and the Communication Bureaus.

WHY ARE THE WORKERS ORGANIZED INTO MAINTENANCE TEAMS?

In China experience already exists with individual routine maintenance workers. However, experience in other countries has shown that maintenance teams are more effective and efficient. This is especially due to the fact that as a team they are better able to respond to larger problems such as landslides, but also because teamwork leads to greater motivation and thus higher productivity rates, especially regarding laborious activities such as vegetation control. Furthermore, the contract administration and inspection of the maintenance work is also simplified, as an entire road section can be contracted to a single team and monthly inspections can be carried out for the whole road section at once.

The grouping of maintenance workers into teams has been one of the major achievements of this study, resulting in the acceptance by both Communication Bureaus and maintenance workers. The main difficulty has been the identification of a suitable legal organizational modality enabling the maintenance teams to enter into a contract with the contracting agency. The microenterprise model used in Latin America, based on companies or associations, was considered unsuitable in China and a different mechanism was therefore introduced, whereby the maintenance team is formalized through the maintenance contract document itself. Although the selected modality appears to be working well, the evaluation has shown that the autonomous nature of the maintenance teams and the contractual relationship with the Communication Bureaus need to be strengthened, as currently the teams are seen as an extension of the Communication Bureau rather than an autonomous entity contracted to carry out specific maintenance activities.

HOW LARGE SHOULD THE MAINTENANCE TEAMS BE?

The size of the team depends on the length of road and on the number of kilometres a single worker is able to maintain throughout the year, the so-called productivity rate. The productivity rate is determined by the characteristics of the road: topography, rainfall, traffic, number of roadworks and size of the road reserve - higher values for these characteristics result lower productivity rates. In order to simplify the determination of the productivity rate, it is recommended to develop between 3 and 5 road categories based on the road characteristics, whereby for each road category an average (standard) productivity rate is determined. The correct determination of the road categories and their differentiated productivity rates should be based on experience, however, and as such experience with maintenance teams is lacking in China, it was decided to initially apply an average productivity rate of 4 km/worker, taking into account that this value may be lower (approximately 3 km/worker) or higher (up to 5 km/worker) depending on the actual characteristics of the road sections concerned.

Although the objective of introducing road categories has not yet been achieved during the implementation of this study, the maintenance teams are required to submit monthly reports regarding the time spent on different activities, thus enabling the definition of appropriate road categories and differentiated productivity rates in the future. The evaluation further showed that continued attention is

required regarding the identification of clearly distinguishable road sections and the use of productivity rates as a means of determining the required team size for each section.

HOW ARE THE MAINTENANCE TEAMS FORMED?

The maintenance teams are generally formed with the assistance of the contracting agency, in this case the Communication Bureaus. To this end a call for candidates is carried out with the help of radio, TV and the Village Committees. Interested candidates are requested to fill in a registration form with personal data that is used in the selection procedure. The selection procedure is carried out by the Communication Bureau together with the Village Committees using transparent selection criteria. These selection criteria consist of eligibility criteria that determine the minimum requirements the candidates should comply with, and prioritisation criteria that are used to identify the most suitable candidates. The selected candidates form the maintenance team which will subsequently receive training and be contracted by the Communication Bureau.

The selection procedure has been greatly simplified compared to Latin American experiences, giving an important role to the Village Committees, especially regarding the call for candidates and the validation of the skills and experience of the different candidates. The selection criteria have been based on existing eligibility criteria used by the Communication Bureau, to which additional prioritisation criteria were added as well as a simple scoring system. The result is an efficient and transparent selection system allowing for the easy identification of the most suitable candidates. The Communication Bureaus have expressed their content with the system and intend to replicate it in other roads.

WHAT TYPE OF TRAINING DO THE MAINTENANCE TEAMS REQUIRE?

The maintenance activities are relatively simple and a basic training in their daily implementation usually suffices. More complicated is the planning and prioritisation of the different activities throughout the year. Specific attention is therefore paid during the technical training to developing yearly and monthly maintenance plans and to the function and importance of the different road elements. The training is followed by a technical accompaniment during the first 6 months – 1 year of operation.

Apart from the technical aspects, the maintenance teams also require skills in the management of the maintenance team. To this end, they receive a managerial training that looks at team and conflict management and pays attention to the content of the maintenance contract, as well as dealing with the financial administration of the team income (salaries and allowances). The managerial training also pays attention to the organization of the team members, tools and other team assets in the execution of the maintenance plans. The initial training is again complemented by a managerial accompaniment during the first 6 months – 1 year of operation.

Special attention was given during the study to improving and formalising the technical training in order to achieve a better quality implementation of the different maintenance activities, as well as to the introduction of a managerial training to ensure the benefits of team-based maintenance were achieved. For this purpose a technical training manual and a managerial training manual were developed especially for the maintenance teams, which serve as training material as well as reference material during subsequent operation. The training material forms an important step in improving the skills and capabilities of the maintenance teams and thus the efficiency and effectiveness of their work, and this was determined to be one of the main benefits of the study, resulting in a 20% improvement in average road conditions according to the Communications Bureaus. The evaluation made clear, however, that an improved understanding of the causes of road deterioration, both on the part of the maintenance teams and on the part of the Communication Bureaus, could result in even better road conditions.

HOW MUCH DO THE MAINTENANCE TEAMS COST?

The maintenance teams receive a yearly contract, the cost of which depends on the yearly standard cost per kilometre and the length of road to be maintained. This yearly standard cost per kilometre is based on the productivity rate (km/worker) and the cost of the worker, which consists of the prevailing salary costs, but also includes small allowances for the purchase of tools and for transport & communication. The use of standard costs facilitates the budgeting process and allows for the earmarking of funds based on the length of the road network.

In Ganzhou Municipality, it was decided to apply an increased salary level in order to attract more qualified workers and keep them for longer periods, which together with the different allowances resulted in a standard cost of 2,650 CNY/km per year. In the two pilots different costs ranging from 1,800 CNY/km to 3,000 CNY/km were applied, however, determined by available funding more than anything else, thus undermining the idea of standard costs. There is therefore a need to strengthen the use of standard

costs, although it is questionable whether the Communication Bureaus will be able implement standard costs that are attractive to maintenance workers without a change to the financing system.

HOW ARE THE MAINTENANCE TEAMS CONTRACTED?

The maintenance teams are contracted for the maintenance of a specific section of road under the modality of single-source procurement as defined in the *Government Procurement Law of the People's Republic of China*. This contracting modality is permitted for contract sums of up to 50,000 CNY, which in the case of Ganxian County is sufficient for road sections of up to approximately 19 km. Most roads are shorter in length or easily divided into readily recognisable sub-sections, thus enabling the use of this modality. The contract is signed by the County Communication Bureau and the different members of the maintenance team, and a standard contract was developed for this purpose.

The maintenance teams subsequently receive equal monthly payments upon approval of their work. The inspection of the work is carried out by the Communication Bureaus on a monthly basis, whereby use is made of performance indicators. These performance indicators are listed in the maintenance contract and stipulate the required condition of the various road elements with respect to the different maintenance activities. The evaluation showed that these performance indicators were being applied by the Communication Bureau, although penalties were applied to individuals rather than to the team as a whole, resulting in a greater administrative burden for the Communication Bureaus.

HOW ARE THE MAINTENANCE TEAMS FINANCED?

Sustainable and timely financing of routine maintenance is critical, as the maintenance workers generally lack the capital required to survive extended payment delays. Insufficient funding or delays in payments therefore often leads to the failure of the system, resulting in the loss of the investment in the maintenance teams as well as in the road infrastructure.

The funding for routine maintenance of rural roads in China is generally inadequate, although this is not so much due to insufficient funding being available, but rather how these funds are used and prioritised. Currently only some 5-10% of the *Regular Vehicle Maintenance Fee* and approximately 40% of the *Motorcycle and Farm Vehicle Maintenance Fee* is used for the maintenance of rural roads. The vast majority of these fees is used for management costs and construction (including outside the road sector) and for the maintenance of provincial roads. As for the funding directed towards rural road maintenance, the majority is used for major and medium corrective maintenance, leaving only small amounts for preventive routine maintenance.

This lack of adequate funding has been the principal problem faced during this study. In Guiyang municipality, where funding levels for routine maintenance are extremely low, it was decided to postpone the pilots due to a lack of funding. Even in Ganzhou municipality, which has significantly higher funding levels, funds had to be diverted away from other roads in order to be able to finance the pilots. There is thus a clear need to revise the funding mechanisms for (rural) road maintenance, whereby maintenance funding should be based on actual maintenance costs and the length of the road network. It is therefore strongly recommended to promote the development of a road maintenance policy that defines the allocation of adequate road maintenance funding as well as appropriate implementation strategies, giving priority to routine preventive maintenance complemented by timely corrective maintenance. The development of such a policy needs to be taken up at a higher political level (Provincial Communication Departments and Ministry of Transport), possibly even earmarking it as an issue to be taken up in the next 5-year plan.

WHERE CAN FURTHER INFORMATION BE OBTAINED?

The following documents have been developed as part of this study and are available in English and Chinese. A bilingual CD-Rom containing all the documents is also available. They can be obtained from the World Bank office in Beijing: <http://www.worldbank.org.cn/English/home.asp>.

- *Summary*
- *Study report*
- *Guide for Communication Bureaus*
- *Technical manual for routine maintenance teams*
- *Managerial manual for routine maintenance teams*
- *Potential for application in China*
- *Experiences from Latin America*

