



सत्यमेव जयते

MINISTRY OF RURAL DEVELOPMENT

# RURAL ROAD MAINTENANCE TRAINING MODULES FOR FIELD ENGINEERS

## Module-3 FINANCING RURAL ROAD MAINTENANCE







Ministry of Rural Development

# RURAL ROAD MAINTENANCE TRAINING MODULES FOR FIELD ENGINEERS

## Module-3

### Financing Rural Road Maintenance



This training module is produced through a collaborative effort between the International Labour Organization and the National Rural Road Development Agency under the technical assistance component of the World Bank supported Rural Roads Project-II of Pradhan Mantri Gram Sadak Yojana Project (PMGSY).

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### **Contents:**

- Preparation of financial plans
- Managing Funds for Road Maintenance
- Asset Management
- Routine Maintenance prioritization


### **Learning Objective:**

At the end of this Module you are expected:

- Process of assessing funds requirement
- Various funding options available for maintenance of rural roads
- Preservation of existing road assets
- Optimal utilization of available funds—prioritization of works

### **Acknowledgement**

The following publications were also used as reference materials:

- Managing Maintenance of Rural Roads in India, ILO/NRRDA, January 2015
  - Building Rural Roads, Bjorn Johannessen, International labour Organization, ILO Regional Office for Asia and the Pacific, 2008
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## Foreword

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Pradhan Mantri Gram Sadak Yojana (PMGSY), was launched in December, 2000 as a special intervention of the Government of India with the broad objective of ensuring sustainable poverty reduction. The scheme aims to provide good quality all-weather single connectivity to every eligible habitation. Rural roads are a state subject under the Constitution and as such are the basic responsibility of the states. However under the PMGSY, the construction of good quality and well-engineered roads are fully funded by the central government. Maintenance of these roads is the responsibility of the states. The year 2013 saw the launch of PMGSY-II with the objectives of consolidating the existing rural road network and upgrading existing rural roads that provide connectivity to rural growth centres. PMGSY-II envisages sharing of construction costs between the Centre and the states with maintenance costs continuing to be funded fully by the states.

Over the last 14 years, the PMGSY has carved out a place for itself as a programme characterised by creation of good quality assets, effective management and technical proficiency by the National Rural Road Development Agency (NRRDA), along with capable state road agencies. For implementation and operations, the involved agencies have been supported with detailed documentation in the form of programme guidelines, an operations manual, standard bidding documents, specifications, a standard data book, a procurement and contracts management manual and the Quality Assurance Hand Book with support from the Indian Roads Congress. These documents have also contributed significantly towards effective implementation of PMGSY and even for mainstreaming good practices in other rural roads programmes being executed by the states from their own resources.

An area of concern has been lack of regular maintenance as per the “Programme Guidelines”. However, in recent years, there has been increased awareness and commitment to maintenance by the states. The tempo needs to be sustained and further accelerated.

Under the technical assistance component of the World Bank supported Rural Roads Project-II, the International Labour Organization (ILO), in collaboration with NRRDA has prepared a manual “Managing Maintenance of Rural Roads in India”. This initiated the execution of maintenance works and the development of these training modules for engineers and contractors associated with rural road maintenance works. To strengthen such activities in the participating states of RRP-II, a series of training of trainers workshops were arranged at national and state level based on the course material developed.

The training modules broadly cover the principles for maintenance management of rural roads, planning and execution of common maintenance interventions to ensure reliable transport services and safety to users and the local communities served by the rural roads, and arrangements for monitoring the performance of contractors engaged for the task.

I would like to acknowledge the support of all those associated with the development of these training modules, especially the ILO and its technical assistance team, Mr. Htun Hlaing, Mr. Bjorn Johannessen and the project's Rural Roads Maintenance Engineers. I would also place on record the valuable suggestions of my colleagues Ms. Manju Rajpal, IAS, (ex Director – RC), Mr. R. Basavaraja, Director NRRDA, Mr. S. S. Bhatia, Deputy Director, NRRDA, Mr. A. K. Sharma, Consultant World Bank and senior engineers as well as secretaries from State Governments in bringing the document to its present shape.

I sincerely believe, the training modules would be found useful for the states in their efforts to secure adequate maintenance of all rural roads, not merely the PMGSY roads and improve maintenance practices so that benefits of access continue to remain available for our rural people on a sustainable basis.

(Rajesh Bhushan, IAS)  
JS (RC) & DG, NRRDA  
Ministry of Rural Development  
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October, 2015



# Introduction to Training Modules

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The purpose of this training manual is to provide technical management staff and contractors with appropriate guidelines for the effective management of road maintenance works. The training modules are based on the manual “Managing Maintenance of Rural Roads in India”. These modules broadly cover the principles for maintenance management of rural roads, planning and execution of common maintenance interventions to ensure reliable transport services and safety to users and the local communities served by the rural roads. The arrangements for monitoring the performance of contractors engaged for the task are also covered in these modules.

This manual is broken down into the following categories composed of different modules:

Module 1: INTRODUCTION

Module 2: TECHNICAL CONSIDERATIONS AND IMPLEMENTATION ARRANGEMENTS

Module 3: FINANCING RURAL ROAD MAINTENANCE

Module 4: PLANNING, INSPECTION, REPORTING AND MONITORING

Module 5: APPROPRIATE SETTING OUT TECHNIQUES

Module 6: HAND TOOLS, EQUIPMENT & CONSTRUCTION MATERIALS

Module 7: ROUTINE MAINTENANCE WORK METHODS

Module 8: OCCUPATIONAL HEALTH & SAFETY, ENVIRONMENTAL ISSUES AND DECENT WORK

Module 9: CONTRACT MANAGEMENT

The trainer may decide to conduct a full course consisting of all the nine modules or may selectively conduct specific modules depending on the needs of the target group.

As a general advice the trainer should:

- **Encourage active participation**

There is sometimes a tendency of the trainer to act like a teacher in school and to read or lecture directly from the course material. This behaviour should be avoided. Trainees remember information better if they participate actively in discussions and if there is a free exchange of views and of questions between everyone participating in the course.

- **Guiding the discussion**

There are times during a discussion when everyone wants to speak at the same time. When such situations arise, the trainer should insist that the group listen to one person at the time. If one speaker hijacks the floor too long, the trainer needs to interrupt, pointing out that other participants may also want to speak.

- **Listen attentively**

Equal attention should be paid to each speaker. Listen attentively and let the speaker understand that ideas and opinions expressed are both interesting and relevant. It is sometimes useful to take a brief note of participants' suggestions while they are speaking, noting them down on a flipchart or blackboard. A summary of these notes may prove useful for later discussions.

- **Emphasise important points**

Each time the participants make an important point or expresses an interesting opinion, the trainer should draw the group's attention to it by repeating the idea in simple terms which are understood by the majority of the trainees.

- **Preparing the sessions**

When trainees only listen to a description of how a particular job should be done, they are likely to forget what they heard. If however, they actually carry out the task concerned, they will remember how to do it. For this reason, every effort should be made to include as many practical exercises and demonstrations as possible, be they carried out on the worksite or in the training room. Practical sessions should always be carefully planned in advance.

- **Recapping**

A discussion is more than just a conversation. A subject is discussed with an aim in mind. It may occasionally be worthwhile recapping the topic considered and recalling the aim of the discussion by intervening from time to time to give a brief summary of the main points dealt with so far.

- **Questioning**

An important role of the trainer is to ensure that the atmosphere during training is sufficiently relaxed to allow participants to feel at ease to speak freely. Questions set by the trainer should not be regarded by the trainees as tests. Often there is no strict "right or wrong" answer to a question, except for mathematics. Questions should simply give your trainees the opportunity to put forward their individual points of view.



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# Financing Rural Road Maintenance

## 3.1 INTRODUCTION

Assisted by the PMGSY program of NRRDA, most of the States in the country can now boast of a geographically wide spread rural road network. This includes a sizable contribution from the State sponsored schemes or programs also. Timely and regular maintenance of rural roads is required in order to keep the established rural road network in traffic worthy condition. Otherwise it will deteriorate and effectively lose the intended purpose of continuous mode of access to the rural areas. Regular maintenance requires securing sufficient and timely funding.

The rural roads in the country are responsibility of the respective States. Compared to other higher category roads such as State highways or National highways, private sector participation in the rural road sector is almost nil, save for recent efforts being made in Rajasthan to procure maintenance contracts on Output and Performance (OPRC) mode. Hence, the entire responsibility of arranging finances for the maintenance of rural roads lies with the Government.

In most instances, State governments tap the resources within the State to fund rural roads maintenance. This can be in the form of cess on agricultural produce, fuel, mining etc. or through the regular budget of the government. Generally this is done for the roads constructed by State funding. For the roads constructed through central programs such as PMGSY, the funding of post construction maintenance is ensured by the central government from the State budgets, by putting binding conditions on disbursement of funds to State for main construction program. In case of PMGSY this period is of 5 years after construction, and the support is limited to only routine maintenance works. In case of States which do not have sufficient financing options or are constrained to mobilise these funds, again the central government tries to fill in the gap using options such as finance commission grant (FC Grant), made available to States on annual basis for maintenance of roads, though this grant is not limited to rural roads and is mostly used for maintenance of primary road network of State i.e. State Highways and Major District Roads.

Assessment of the requirement of funds, to maintain the rural road network in the constructed or improved state to the extent possible is very important. This facilitates projection and allocation of funds, from the funding source whether at State level or at Central level. This is only possible if the responsible road agency has maintained its road inventory, carries out its road condition surveys and make correct estimation of required works.

## 3.2 PREPARATION OF FINANCIAL PLANS

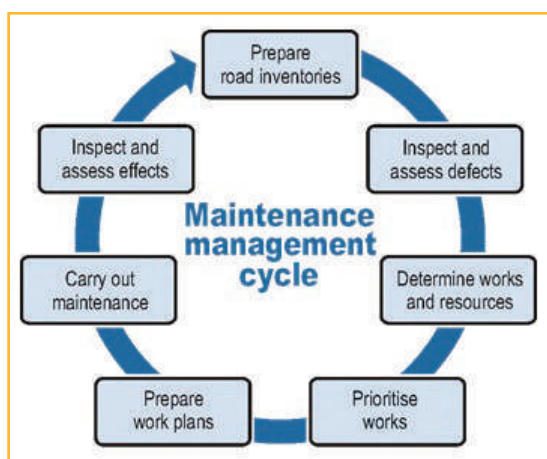
Like any civil works, road maintenance require careful planning, supervision and control. Before these planning and implementation activities commence, there is a need for a detailed survey of the road condition during which all defects and damages to the road are carefully assessed. This survey provides the basis for the planning of the consecutive maintenance works. Proper monitoring of outputs and the resources required to achieve these outputs provide the basic information needed for planning and estimating of future maintenance works.

In order to assess the scope of maintenance work, in a certain period or section it is very important that the planning (Activity: Prepare Work Plans) reflects the site requirements and takes into account the available funds.

Figure 1 shows the maintenance management cycle with the various steps and their logical sequence necessary for achieving an effective maintenance management system. There are several stages of preparations before execution of works. A schedule of events defining when survey works, design, preparation of bidding documents and the tendering of works will take place is prepared by the road agency. One such good example is the Standard operation Procedures (SoP) of Himachal Pradesh for rural roads maintenance. It covers the time

schedule of the entire period maintenance cycle starting from when the initial surveys will take place until contract award and works implementation.

Figure 1: *Maintenance management cycle*



### 3.2.1 Prepare Road Inventory

In order to make rational decisions on how a road network can be maintained and improved, it is important to assemble adequate information about its current extent and condition and how it serves the transport needs in the area in which it is located. Like any other assets owned by the government, it is important to keep records of its components to ensure that they are adequately protected and maintained.

**Table 1:** *Information gathered during road inventory*

Road Inventory Information	
Geometry	<ul style="list-style-type: none"> <li>• alignment</li> <li>• profile</li> <li>• cross-section</li> </ul>
Pavement	<ul style="list-style-type: none"> <li>• soil conditions</li> <li>• type of pavement</li> </ul>
Drainage	<ul style="list-style-type: none"> <li>• culverts and drifts</li> <li>• mitre drains</li> <li>• catch water and cut-off drains</li> </ul>
Structures	<ul style="list-style-type: none"> <li>• type and size</li> <li>• location</li> </ul>
Condition	<ul style="list-style-type: none"> <li>• Overall condition of the road and its main structures</li> </ul>
Junctions	<ul style="list-style-type: none"> <li>• location</li> <li>• type of connected road</li> </ul>
Climate	<ul style="list-style-type: none"> <li>• rainfall</li> <li>• flood patterns</li> <li>• adjacent water management</li> </ul>
Traffic	<ul style="list-style-type: none"> <li>• annual average daily traffic</li> </ul>
Maintenance	<ul style="list-style-type: none"> <li>• details of routine maintenance i.e. names of petty contractors</li> <li>• details on rehabilitation and urgent maintenance works, e.g. date, location</li> </ul>

An inventory forms the basis for any asset management of the road network. Combining this inventory with a regular assessment of its condition provides the basic justification for any road improvement and maintenance programme. Through a road condition inventory, it is possible to monitor the wear and tear of roads and bridges and on this basis plan and implement timely works inputs to protect and improve the infrastructure.

Like any asset register, a road inventory provides details relating to the general features of the infrastructure, including geometrical dimensions, alignment, pavement type, traffic volumes and the location of major structures. It may also contain information pertaining to the function and importance of the road, such as the villages served, population numbers and other important infrastructure in the vicinity of the road, such as clinics, schools, irrigation systems, agricultural service centres, government offices, markets, etc.

Road inventories are often described through the use of standard forms in which this information can be recorded. The Operations Manual for the PMGSY provides a good inventory form and also includes useful information on how it is used.

With the increasing application of GIS, it is also possible to depict road network on digital maps. In such case attributes of any road can be also linked digitally to that road, facilitating offline and online information of the road inventory.

This exercise is carried out at Division level, with basic inputs from the Sub-Divisional offices.

### 3.2.2 Inspect and Assess Defects (Road Condition Surveys)

In order to assess the needs for and to plan future improvement and maintenance works, it is necessary to maintain an intimate and up-to-date knowledge of the condition of the road network and for this reason it is good practice to carry out regular road condition surveys. Such surveys form a solid basis for future work programming and budgeting.

Road condition surveys allow the road authority to:

- become thoroughly familiar with the road network and its maintenance challenges and on this basis make objective and quantified assessments of the condition of each road,
- make objective prioritisations of maintenance and improvement works in line with sound asset management principles,
- review the effectiveness of maintenance activities carried out since the previous surveys, and
- programme in detail the improvement and maintenance works to be carried out during the next construction season.

Road agencies are in charge of an extensive road network and with limited resources it is necessary to assess the condition of the roads in an accurate and timesaving manner. Therefore, it is useful to concentrate on the identification of defects using a set of well-defined key indicators describing the roads. These indicators may change, depending on the environment and topography in which the road is located and also the standards to which it has been built. However, there are some features that need attention on all roads:

- overall performance of the road (i.e. providing all-year access),
- drainage features and performance of cross-drainage structures such as bridges, culverts and causeways,
- quality and performance of pavement,
- extent to which the current design is effective in terms of dealing with weather and traffic without causing excessive maintenance demands,
- containing possible environmental problems such as flooding and soil erosion, and
- road safety problem spots.



The main purpose of the condition surveys is to establish a sound basis for planning of maintenance works. Maintenance is carried out at different times of the year, i.e. before, during and after the seasonal rains. Road condition surveys need to be organised in advance, thereby allowing for the actual works to take place at the right time. Once a practice of regular surveys and maintenance works has been established, the surveys become less time-consuming as there are fewer defects to record.

For rural roads three degrees of pavement condition is used in assessing road condition:

1. **Good:** New roads and roads or sections of road that have only occasional occurrence of minor pavement and surfacing defects.
2. **Fair:** Roads or sections of road that are still in reasonable shape with only limited occurrence of pavement failures and surface defects. These will have second priority for maintenance interventions, but should be attended to as far as possible within the available budgets.
3. **Poor:** Roads or sections of a road that show severe signs of structural failure, usually identified by severe loss of shape, extensive occurrence of potholes, deep ruts and potholes, surface cracks and old patches. These roads or sections are deemed to be unmaintainable and should be rehabilitated and not considered for routine or periodic maintenance.

The road condition surveys also collect relevant information on the type and location of the required maintenance work. Once a road is surveyed, the exact quantities of work and costs can be estimated. (Refer Annex 1)

This exercise is carried out at the level of Sub-Division office.

### 3.2.3 Determine Works and Resources (Estimation of Works)

The road authority prepares a cost estimate for the works before inviting bids. This is commonly referred to as the Engineer's Estimate.

Accurate cost estimates are essential when planning and managing road maintenance. The road authority needs reliable estimates and cost norms for several reasons. Accurate information on costs, allow technical staff to value and compare alternative remedial measures. The estimates forms the basis for proper budgeting and financial planning, and it allows for proper accounting, and may avoid serious cost under- or over-runs during works implementation.

Estimating costs is not a one-time exercise but a continuous process from the initial inception to the final completion of a works project. At various stages of the project, estimates are produced to varying degrees of detail.

During the initial planning and budgeting stage, estimates are often based on general cost norms prepared on the basis of the most common maintenance activities. Average cost norms for various types of maintenance are updated



on a regular basis by a dedicated committee at federal level. In addition, several state road agencies prepare their own cost norms, taking into account prevailing conditions in their respective states.

When works are planned in detail, more accurate estimates are required based on field surveys during which the specific maintenance requirements are assessed. On this basis it is possible to prepare detailed work plans and budgets.

This exercise is carried out at Sub-division level, and there after accepted at Division level.

### 3.2.4 Cost Calculations

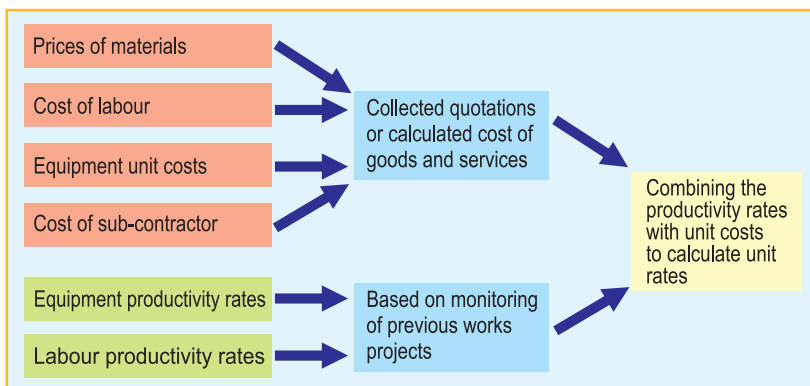
The cost of construction works consists of (i) the direct costs of the works, and (ii) the indirect costs related to preparing and managing the works. Both direct and indirect costs are in principle expenses that occur as a result of carrying out the works.

There are various methods for presenting costs. The most common method used in a civil works project is to prepare a Bill of Quantities in which each of the main work activities are quantified and then priced, based on a cost per unit. So-called ad-measure contracts are the most common method of estimating and agreeing on the price of civil works.

The activities listed in the Bill of Quantities usually only present the direct works activities taking place on site. At best, the BoQ only includes some very few indirect cost items (also termed as incidental items) such as site mobilisation, insurances and final demobilisation.

Any other costs, which are not itemised, need to be added to the activities listed in the BoQ. It is therefore common practice to add expenses such as supervision, management, insurances and other overheads as a percentage overhead to the direct costs. This is commonly referred to as all-inclusive unit costs.

**Figure 2:** *Diagram showing build-up of unit rates*



It is important that the unit rates established when estimating costs are at levels which:

- (i) cover all costs relating to materials inputs, use of equipment and labour,
- (ii) are sufficient to provide for current labour wages, attractive enough to secure the required recruitment of labour and provide the incentives necessary to achieve good work outputs,
- (iii) cost are based on realistic production rates and equipment availability (or down-time),
- (iv) for material costs, have been confirmed by suppliers for the prescribed quality specifications.

### 3.2.5 Prioritise Works

After estimation of the cost of the planned works, a priority list of the roads to be finally selected and the type of maintenance activities to be planned on each road in a certain period of time is prepared. The basis of this prioritization is the available (or expected) funds with the road agency. States have framed their own criteria for prioritization, and in general this criteria is specified in the policy adopted by the State for rural roads maintenance. The State of Bihar carries out its prioritisation on the basis of importance of the connectivity of subjected rural road.

In general the proposed priority is submitted by Division office through Superintending Engineer office, and finalised by the Head Office at the level of Chief Engineer.

### 3.2.6 Prepare Work Plans

Annual Work Plans for the entire State are prepared at headquarter level, and approval is sought from the concerned Administrative Secretary. These are first set of concrete plans against which specific financial resources are allocated after securing the inputs of all stakeholders. These plans outline the general features of a maintenance programme including information on which roads are to be selected, annual targets, programme budgets, who will carry out the works and the type and amount of resources required.

Procurement of works, carried out at the Division level, is guided by the Annual Plans approved at the Head Quarter.

### *Packaging of Works for Procurement*

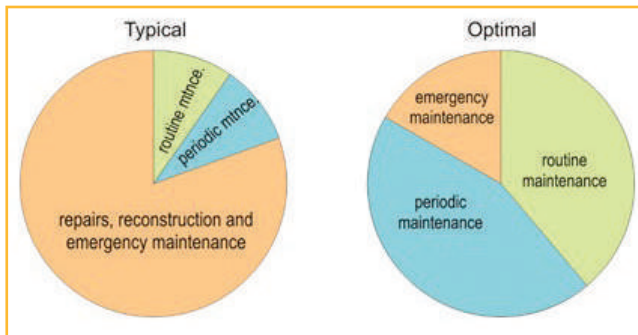
When road maintenance is carried out by private contractors, works need to be packaged into appropriate sizes and content that matches the capacity and skills of the contracting firms. The distribution of various size contracts can also be used as an active means for utilising the full capacity of the local construction industry. With an appropriate share of large and small

contracts, it may be possible to utilise the full capacity of both large and small construction firms. Works on a cluster of roads may be packaged together into one contract thereby saving mobilisation costs.

### 3.3 MANAGING FUNDS FOR ROAD MAINTENANCE

Maintenance funding is a major problem in the road sector. Even where there is a budget for rural road maintenance often little is spent on maintenance activities as such. The result is that major parts of the road network receive little or no maintenance from one year to the next. The further down the network one goes, the lower the amount of funds that are available. The funding of road maintenance is concentrated on the top tier of the network. Thus the State highways and Major District Roads receive the lion's share of any maintenance funding that is available with the State, and the amount of available funds get reduced at each level down to local village roads.

Figure 3: *Spending on rural road maintenance*



In case of rural roads mostly major portion of the funds is spent to keep some key links open. Thus the budget that exists for maintenance is often spent on what can be described as repairs, reconstruction and emergency works.

#### 3.3.1 Funding Confidence

Roads are resource-intensive to maintain compared to other infrastructure such as water supply and buildings. As opposed to construction works, the budgets allocated to maintenance do not create any new assets - it only preserves what is already in existence. Even if the resources are allocated to maintenance, the utilisation of funds is not truly reflected on ground and mostly rural roads networks seem to be in poor condition, mainly because of substantial maintenance backlog. It is therefore understandable that funding authorities have some reservations against allocating money to this activity.

The combination of institutionally weak recipient organisations and a lack of reporting on the use of maintenance funds may further erode confidence among the decision makers who are requested to allocate funds for this



purpose. Due to lack of proper documentation, based on condition surveys, it is difficult for those responsible to present reasonable arguments to spend some of the available budgets on preventive maintenance on the core road network instead of allocating most of the funds to reconstruction and upgrading works. With proper road condition inventories, it is possible to draw up comprehensive and detailed work programmes clearly defining the work activities against which budgets are allocated.

Those in the technical units also have a tendency to favour new construction rather than placing importance on maintenance. This may not be their fault. If maintenance budgets are not clearly defined and supported by sound asset management policies, available funds tend to be used to repair or rehabilitate roads that have been left to deteriorate and eventually reached the stage that they are in effect unmaintainable. When roads fall into serious disrepair, road agencies tend to receive more attention and pressure to take action.

A team of competent staff with the relevant technical, financial and administrative skills and the logistical means to supervise the works, thereby achieving the level of transparency and good governance which is expected by funding authorities. Without this capacity within the executing agencies, releasing the required funds for maintenance runs the risk of money not being spent on its intended purpose.

### 3.3.2 Funding Sources

Finance, or the lack of it, has traditionally been the main excuse or reason for roads not being maintained. Lack of funds is certainly a major obstacle in many places. However, recent studies show that the ineffective use of available funds can also be a major contributor to the deterioration of the road network. Rather than giving preventive maintenance its due recognition and prioritising funding to the maintenance of roads still in good condition, the trend is often to spend available funds on repairing roads which have been left unattended too long and which has deteriorated into a poor condition – at which time maintenance becomes very expensive.

Funding for road maintenance can be generated from a variety of sources. In most cases, the funding for maintaining highways and local roads is provided through subventions from state or federal government, using revenue from the regular taxation system. The ability to raise sufficient taxes and revenue at local level is limited and in recognition of this, State Governments are in most places the main financier of local roads.

Unfortunately, experience shows that budget allocations for road maintenance are often insufficient. For this reason, various arrangements have been devised to seek additional revenue that is specifically earmarked for the financing of road works. To address funding shortages there are some alternative financing sources that can be utilised, such as cess on agricultural goods

and earmarked taxes on fuel. Some states have established arrangements in which specific tax revenue is collected in dedicated road funds, thereby providing additional funding to maintain roads.

### ***Cess on Agriculture Produce***

The main economic beneficiary of rural roads is the farming sector. In several states, arrangements have been put in place to tax the sale of agricultural products, specifically to finance the development and upkeep of rural roads.

As a result, agricultural marketing boards and similar institutions are involved in building or financing rural roads. In rich farming areas, the provision of rural roads is recognised by its users as an important support service for the effective transport of produce to local markets centres.

Since the 1970s, the states of Punjab and Haryana have financed rural road construction and maintenance works from taxes on agricultural goods. In these two States and also in Uttar Pradesh and Madhya Pradesh, the state agriculture marketing boards or Mandi Parishads manage the distribution centres for farm products and in some cases also act as the technical agencies for rural road works.

In some places, where commercial crops are grown at a large scale, the estate holders contribute to paying for the maintenance of the local roads used for this purpose. These roads, located in the areas where the commercial farming of cash crops takes place, form part of the public road network, however their maintenance is funded through dedicated taxes on the cash crops being produced. In UP, the Sugar Cane Production Board (Ganna Parishad) uses the tax collected Sale of Sugarcane for construction and maintenance of roads in that area.

Such arrangements are feasible in areas with a wealthy farming sector with a significant surplus of agricultural goods. Farmers and plantation owners are then prepared to invest in improved road access as it allows them to fetch better prices for their produce and easier access inputs such as equipment, fertilisers and extension services. In areas with limited agricultural yields, the upkeep of rural roads needs to be financed from other sources.

### ***Cess on Mining Operations***

There is a significant amount of rural roads that caters to heavy commercial vehicles engaged in transporting materials from mining areas and stone quarries. This type of traffic causes a heavy wear on the local road network. Systems have been introduced in which the government have imposed a levy on the minerals or the trucks involved to finance the maintenance of local roads.

Similar arrangements are also worthwhile considering on rural roads into forest areas and used for the transport of timber.

## Road Funds

Road funds are based on the argument that road users should pay for the services provided in the form of a well-maintained road network. Whilst the actual organisation of the road funds may vary, the basic principles apply to all. A specific levy is applied on fuel and is used to finance road works. The major source of fund for development of rural roads is now the Central Road Fund. As per the current Act regulating the Fund, 50 percent of the cess on diesel is earmarked for development of rural roads. The money is placed in a dedicated account and administered by an independent body with representation from road users, government and private sector. Several states have already established such a funding mechanism and more states have recently taken the initiative of setting up similar funds for roads. Some states, such as Uttar Pradesh and Karnataka have road funds dedicated for maintenance only. Other states have set up funds for both road construction and maintenance.

A key to the allocation of the fund on the various parts of the network thus has to be determined. The rural road network is invariably the more extensive in terms of length but carry a much smaller percentage of the total traffic. Many countries therefore allocate funds to rural roads in recognition of the socio-economic benefits that they provide. In Zambia and Kenya for example 30% of the road fund is allocated for maintaining rural roads.

## Rural Development Schemes

To draw a full picture of the funding situation for rural and local roads, it is also important to mention large-scale rural development programmes. Although these programmes do not provide much sustainable sources of maintenance funding, they have a major impact on the sector as a whole. They often have a rural road improvement component, however they seldom consider road maintenance as a viable development measure. As a result, they often significantly increase the maintenance burden due to the resulting expansion of the local road network.

Poverty alleviation and employment creation schemes can also be used as a source of funding for maintenance, and in particular routine maintenance works as it involves many work activities that are best carried out using manual labour. The National Rural Employment Guarantee Scheme, NREGS, offers temporary jobs for unemployed people in the rural areas. Through collaboration with such schemes, public works departments can enter into co-financing arrangements in which they provide inputs of materials and equipment while the employment schemes fund the labour input. Equally, if the technical agencies provide adequate technical support, it is possible to ensure that works are well organised and produce tangible outputs.

## **Community Pays**

Much has been said regarding the willingness of rural communities to pay for maintenance. The argument is that if local people are prepared to use their own resources to maintain certain roads then support should be given to ensure that these roads remain in a maintainable condition. Regardless of the fact that this is a form of regressive taxation, the important question is whether local communities would be able to afford and also willing to contribute to the maintenance of the roads.

Clearly it is in the interests of the local population to see that their roads are maintained, however, incomes are generally very low and there is little available to pay for maintenance. If the benefits are considerable it is argued that the villagers may then be persuaded to contribute. It is fair to point out that self-help schemes for maintenance of public roads have been distinguished by their lack of success. Despite major efforts in pilot projects to mobilize communities for this purpose, experience has shown that it is difficult to sustain such arrangements in the long term without relying on external assistance. The problem that remains is that poor communities which most need access are the least likely to be able to pay for sustained access.

In this context, it is important to acknowledge the issue of equity. Rural communities similar to people living in the cities expect that the government provide basic infrastructure services including local roads. On the same basis, people living in rural areas would expect that the responsible government departments maintain roads serving their communities similar to how such services are provided elsewhere.

## **Finance Commission Grant**

In recent years, the Finance Commission, of Government of India, has recognised the need for external assistance to the States for financing rural road maintenance and made significant allocations for this specific purpose. In recognition of the need to protect investments in rural roads, through the PMGSY and other rural road programmes, the Finance Commission has earmarked funds for rural road maintenance. This central grant comes with a requirement of matching State share of equal amount or agreed percentage, before release of next tranche.

### **3.3.3 Solution**

Acknowledging the fact that funding is limited, a better way of approaching the problem would be to start with what is affordable both at national and local level. Naturally this depends on a host of factors including tax revenues, levies and competing demands from other sectors. Rather than looking at the financing from the point of view of what in theory needs maintaining,





one should first look at what is maintainable. The next step would then be to look at the most effective use of available funds and finally assess whether the funding discrepancy can be covered by the various sources already identified and in use - before looking for new funding mechanisms. As a start, a pragmatic approach would be to redirect funds away from ad-hoc repair works to preventive maintenance. This may actually result in funds being spent on a reliable and known road network.

Several states have already established a variety of arrangements to source funding for road sector activities outside the general taxes collected by government (i.e. market taxes, fuel levies, road tolls, fees on particular industrial goods, etc.). In many cases, these alternative revenue sources provide substantial funding for the road sector. At this point, the challenge in some of the more wealthy states is therefore to establish a viable financing plan which is matched with the total needs for maintenance - including the needs of the rural road network. For this to take place however, there is a need to (i) establish the demand for road maintenance based on sound asset management principles and (ii) institute sound procedures for maintaining roads based on the same approach.

When funds are generated from alternative sources, it is important that existing allocations from regular government funding sources are maintained and not reduced when other means of financing maintenance are introduced. The main purpose of establishing new sources of funding for maintenance is essentially to cover a shortfall and thus protect existing road assets.

Not all states are blessed with the same wealth of resources and thus warrant continued support from central government to provide and maintain adequate access in rural areas. In effect, the Union Government has been the main financier of rural road construction through various rural development programmes and in more recent years through the PMGSY. Once the network matures in the poorer states, there will probably be a need for continued support from the centre, shifting the emphasis from new construction and upgrading works to maintenance.

### **3.4** ASSET MANAGEMENT

Authorities often underestimate the importance of road maintenance and consequently budgets for maintenance are usually severely constrained. Introducing an asset management approach to local decision-makers may generate more political and local support for road maintenance activities.

The asset management approach tries to move the debate over road maintenance away from the purely technocratic and even political to concentrate on the inherent value of the network expressed in money terms. The idea is relatively simple. It is possible to estimate reasonably accurately the asset value of the existing road network.

Lack of maintenance causes roads to deteriorate over a comparatively short period of time. Investments in rehabilitation and/or new construction increase the asset value of individual roads but this is likely to be more than offset by the deterioration of the overall network due to lack of maintenance. It is therefore possible to compare in money terms a strategy which gives low priority to maintenance and higher to rehabilitation and construction and one which places higher priority on preserving the existing network.

These calculations are not complicated and local decision makers can make them. This means that they themselves can see the financial consequences of their decisions whether to invest in maintenance or rehabilitation. This approach is likely to give first priority to maintenance tasks and lesser priority to investments in rehabilitation and new construction.

*According to a 1988 World Bank study, allocations over a twenty year period for road maintenance in developing countries were so low that nearly 15% of the capital invested in main roads - roughly US\$43 billion equivalent to 2% of these countries' GNP - had eroded due to lack of maintenance. The same study demonstrated that reconstructing these roads - costing US\$40 to US\$45 billion worldwide - could have been avoided by spending US\$12 billion on maintenance. This is a ratio of about 3.5 to 1, not taking into consideration the time value of money. Or, one may argue that spending one Dollar (or one Rupee) on maintenance has the potential of saving 3.5 Dollars (or 3.5 Rupees) on construction works.*

Financing is often a binding constraint on securing the sustainability of infrastructure investments. The very notion of 'rehabilitation' is often indicative of failed maintenance practices, i.e. the construct - lack of maintenance - deteriorate cycle has taken place at least once (except when a well maintained road has reached the end of its design life and need to be rehabilitated or reconstructed). In order to avoid such scenarios, road management strategies need to give priority to the conservation of the inherent asset value of the existing infrastructure. The concept is based on the following ground rules:

1. First provide routine maintenance to the infrastructure assets in a good and maintainable condition. "Good" condition is regarded as when it requires a minimum of routine maintenance, consisting of preventive works measures most of which can be carried out utilising local labour, tools and materials.
2. Secondly, provide spot improvements and periodic maintenance to halt the deterioration of sections in fair condition, thereby reinstating them to a maintainable condition.
3. Rehabilitate existing assets which have fallen into serious disrepair.
4. Construction of new infrastructure assets: New projects should only be accepted when sufficient maintenance resources are available for

(i) securing existing assets and (ii) can be secured for the new assets once completed.

From the above, it is clear that effective asset management require a certain knowledge of the road network. Individual roads need to be assessed and classified according to their condition. Condition assessments of the network are carried out for several purposes and to varying degrees of detail. For general programming and budgeting purposes, it is sufficient to determine whether the roads are in good, fair or poor condition as shown in the figure below. On this basis, it is possible to establish a reasonably good picture of the budget requirements for routine and periodic maintenance works as well as rehabilitation and reconstruction works.

Roads classified as in good condition would normally only require routine maintenance in order to protect its integrity. Fair condition roads are normally due for more extensive maintenance works. This may be caused by lack of attention in the past allowing for an accelerated deterioration or a component of the road has reached the end of its economic life. In both scenarios, it is common practice to include the road in the periodic maintenance programme, thereby re-instating the road to a good condition. Roads in a poor condition have deteriorated to the extent that most maintenance inputs have limited effect on the quality of the road. This category also includes tracks and trails which were never upgraded to a fully engineered road.

Figure 4: *Road condition classification*

	Good	Fair	Poor
current situation	Pavement and drainage system in good order only requiring timely preventive maintenance	Pavement and drainage system still exists but in urgent need of overdue maintenance	No remaining drainage system. Pavement non-existent or in total disrepair, tracks and trails
History	New road or road provided with adequate and timely maintenance	Recently improved road with inadequate maintenance	Never an engineered road or very long absence of any maintenance

With this broad classification of the road network, it is possible to establish a rough estimate of the total maintenance requirements. The total distances of roads in good and fair condition indicate the amount of routine and periodic maintenance. Using average cost estimates for routine and periodic maintenance, it is then possible to prepare budgets with sufficient accuracy.

Equally, the number of roads in poor condition forms the basis for preparing an investment programme consisting of improvement and new construction works.

A condition assessment using these broad categories also allows management to monitor the total asset value of the road network over time. Condition surveys are carried out on a regular basis to plan future road works. As a result, technical staff in charge of a cluster of roads possesses the necessary information to make this assessment of the network. Compiled into a central database, the overall condition of the road network can then be compared to earlier years in order to monitor the extent to which road funding policies result in an improved condition of the network.

Equally important, this exercise is useful as a means to simulate the effect of various funding strategies. An integral part of the process of preparing a road works programme and budget is to look ahead and assess the effect of the investments proposed. As part of the process, it would be logical to make a prediction of the subsequent road condition resulting from the planned maintenance and construction works.

This exercise can be carried out to various degrees of accuracy. The preferred development is obviously to see the portion of good condition roads increasing while the portion of fair and bad condition roads is reduced. A more precise method is to apply average asset values to good, fair and poor condition roads. This approach allows planners to monitor the total depreciation or appreciation of the value of the road assets over time. It can also be used to assess the resulting asset value change resulting from combined inputs of maintenance and construction works.

The major challenge with this system is not to secure adequate funding for routine maintenance work. In most places, there are sufficient budgets to provide routine maintenance on the maintainable portion of the road network. Making sure routine maintenance takes place is more a matter of (i) installing effective systems and procedures for its application and (ii) ensuring that available budgets are used for this purpose and not diverted to other road works activities.

The real funding challenge is related to securing sufficient budgets for periodic maintenance. The various components of the road are built to last for a certain duration of time. Periodic inputs of maintenance reinstate these road components to desired service levels. Again, the scheduling of such inputs are based on an assessment of optimal timing, (i) before the defects cause serious damage and (ii) when service levels deteriorate below the standards expected by the road users.

### 3.4.1 Asset Value of Rural Roads in India

Some estimates put the replacement value of the existing rural road infrastructure at Rs 200,000 Crore. These assets are deteriorating every year. The resulting loss in value of road assets would be as high as Rs. 10,000 Crore per year equivalent of 40,000 km of roads being eroded every year due to inadequate maintenance.

In comparison with the value of the assets, the annual cost of maintaining them is estimated to be some Rs 75 billion (US\$1.7 billion) a mere 4% of the asset value. These huge national assets justify the application of sound asset management principles to sustain such services.

### 3.5 ROUTINE MAINTENANCE PRIORITIZATION

All road works agencies need to factor in budgetary limitations when planning their maintenance programmes. Every engineer involved in road maintenance faces the additional challenge that available funds are never sufficient. It is therefore necessary to assess the importance of the various work interventions to ensure that available resources are utilized in the most effective manner.

The first priority of the road agency is to keep all roads open throughout the year (accepting that some road sections are not passable during extreme weather conditions). Without a preventive maintenance system in place, the efforts to keep roads open very much consists of carrying out repairs after serious damage has taken place. Such interventions are much more costly than preventive maintenance. Due to the extent of damages each year, the remedial works often drain the entire road works budgets, leaving no resources left for preventive measures.

With the damages taking place during the next rainy season, road agencies are left with no alternative than to use subsequent budgets to once again repair serious damages to its roads. Although these repairs are necessary, it is obvious that this way of managing the road network is costly and ineffective. The only way of breaking this vicious circle is to introduce the concept of preventive maintenance, thus reducing the extent to which the roads require major repair works. The cost savings in repair works can then be brought forward to the next maintenance season and instead utilise for further preventive activities that may preserve the road assets.

To make the most out of available funding, emphasis should always be on preventive measures in the planning and management of road maintenance. Still, emergency events will take place and must be responded to as they relate directly to keeping the roads open to traffic and ensuring the safety of the road users.

First priority is usually given to urgent maintenance activities (i) to ensure that the road network remains passable and basic access is provided and (ii) to limit the extent of damages exerted to a road section. Critical elements of the drainage system, such as shoulders, drains and culverts, need particular attention and first priority should be given to the removal of obstacles that block the water passage away from the road. Small erosion channels should be repaired before the next rains can deepen and widen them. These tasks require regular inspection.

Lowest priority should generally be given to those tasks which require significant inputs and produce limited results in terms of prolonging the lifetime of the road (i.e. grass cutting and bush clearing).

For each maintenance operation (routine, periodic and urgent) priority lists are established. They may differ from area to area according to the prevailing conditions. When priorities are set, the climatic conditions must be considered. For example, grass cutting during the rainy season does not make sense when at the same time the ditches and culverts are left untouched and are becoming seriously silted.

The following table provides a list of priorities for routine maintenance according to the climate seasons:

**Table 2:** *Routine maintenance priority for road*

Routine Maintenance Priorities		
Season	Priority	Activity
Before the rains	1	<ul style="list-style-type: none"> <li>clean culverts and other cross-drainage</li> </ul>
	2	<ul style="list-style-type: none"> <li>clean side drains and mitre drains</li> </ul>
	3	<ul style="list-style-type: none"> <li>clean and repair shoulders</li> </ul>
	4	<ul style="list-style-type: none"> <li>repair erosion on side slopes and in drains</li> </ul>
	5	<ul style="list-style-type: none"> <li>patch potholes and seal cracks</li> </ul>
	6	<ul style="list-style-type: none"> <li>white wash road furniture</li> </ul>
During rains	1	<ul style="list-style-type: none"> <li>inspect and remove obstacles from roadway and drains</li> </ul>
	2	<ul style="list-style-type: none"> <li>clean culverts and other cross drainage</li> </ul>
	3	<ul style="list-style-type: none"> <li>clean side drains, cut-off and mitre drains</li> </ul>
	4	<ul style="list-style-type: none"> <li>repair side drain erosion</li> </ul>
End of rains	1	<ul style="list-style-type: none"> <li>repair erosion on shoulders, side slopes and in drains</li> </ul>
	2	<ul style="list-style-type: none"> <li>repair retaining walls</li> </ul>
	3	<ul style="list-style-type: none"> <li>cut grass and clear bush</li> </ul>
Dry season	1	<ul style="list-style-type: none"> <li>repair drainage structures</li> </ul>
	2	<ul style="list-style-type: none"> <li>repair road shoulders and surface edges</li> </ul>
	3	<ul style="list-style-type: none"> <li>patch potholes and seal cracks</li> </ul>

From the above Table 2 it is clear that the most important routine maintenance activities throughout the year is to keep the drainage system in good running order - any other activity is of secondary importance.

Road Condition Inventory and Maintenance Planning				Road:		Village A to Village B									
				Div.				Page:		of					
				Last major intervention: month/year											
				Chainage				0+000 2 3 4 5 6 7 8 9 1+000							
Road inventory data and condition assessment	Cross section type														
	Carriageway width		m												
	Embankment height		m												
			Type	Cond.	Description										
	Subgrade			G/F/P											
	Subbase														
	Base course		WBM	G											
	Surfacing		PC	G											
	Side drain Left (depth)		m	0.3	←-----→										
	Side drain Right (depth)		m	0.3	←-----→										
Proposed maintenance interventions				Unit	Qty										
Left side	Bush clearing (width)		m	700	←-----→										
	Clear side drains (depth)		m	500	←-----→										
	Clear mitre drains (depth)		m	150	←-----→										
	Shoulder repair		m	600	←-----→										
	Side slope repair		m												
Carriageway	Debris removal				←-----→										
	Pothole patching		m2	9	←-----→										
	Base course repair		m2												
	Crack sealing		m	400	←-----→										
	Resealing		m2	16	←-----→										
	Thin asphalt overlay		m2												
	Rejuvenation / fog spray		m2												
	Light grading		m2												
	Camber reshaping		m2												
Right side	Bush clearing		m	500	←-----→										
	Clear side drains (depth)		m												
	Clear mitre drains (depth)		m												
	Shoulder repair		m	600	←-----→										
	Side slope repair		m												
Structures, road furniture, other	Culvert/headwall repair		m												
	Repair retaining wall														
	Minor bridge repair														
	Repair of road signs		no												
	Replacement of road signs		no												
	Road marking repair		m												
	Road marking renewal		m												
Surveyed by:				Date:		Checked by:			Date:						









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