

DEVELOPMENT OF A SUSTAINABLE RURAL ROADS MAINTENANCE SYSTEM IN INDIA: KEY ISSUES

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ABSTRACT

Rural road sector in India got a major boost with the introduction of the Prime Minister Rural Roads Programme of 2000. The programme is going to be in existence until the goal of connecting all habitations with populations over 250 by all-weather roads is achieved. The major challenge now is to both expand the existing network of roads to include access to remote areas and to upgrade and maintain already existing roads. It has been suggested in this article to consider maintenance as a part of the overall road asset management system. Considering that the process would be fairly complex, it has been proposed to take a step-by-step approach. To that end, an outline has been presented for developing rural road management in India. An institutional arrangement has also been proposed on the basis of three types of maintenance- routine, periodic and emergency. Keeping in mind that community participation is the key to the success of any future maintenance strategy, good practices of involving community in a few selected countries have been discussed which may help in developing an appropriate participatory approach in India. There are many issues to be addressed for the successful implementation of a rural roads maintenance system. A few of the major ones have been highlighted here, such as the classification of rural roads and the managing of them all under one umbrella administration; the decentralization of responsibilities; the availability of relevant data; the development of manuals for road maintenance; the shortage of man-power; the critical involvement of the community and schemes to include social development issues.

INTRODUCTION

The necessity of a proper road network for the development of the country was understood quite early in India. The first road development plan (1943-61), popularly known as the Nagpur Plan, looked at the road needs of the country on a long term basis, and for the first time, classified the road system into a functional hierarchy comprised of National Highways (NH), State Highways (SH), Major District Roads (MDR), Other District Roads (ODR) and Village Roads (VR). The last two classes form the rural road system. Sufficient emphasis was given in the subsequent 20-year road development plan to increase road density by constructing roads of all categories. The latest rural road development plan vision 2025 has emphasized a planned rural road network development at the district level with the goal of connecting all habitations with populations over 250 by all-weather roads by the year 2021-22.

Constitutionally, the development of rural roads is the responsibility of the state government in India and thus the central government was not directly involved in the funding of rural road projects. However, from the fifth five-year plan of India,

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the central government started funding rural road projects through various programmes such as the Minimum Needs Programme (MNP), the National Rural Employment Programme (NREP), the Rural Landless Employment Guarantee Programme (RLEGP) and Jawahar Rozgar Yojana (JRY). There is overwhelming evidence that the provision of rural roads is a crucial factor in reducing poverty in rural areas (Ministry of Rural Development, 2007). Keeping this fact in mind, the Government of India initiated a programme in the year 2000 solely for rural road development, popularly known as the Prime Minister Gram Sadak Yojana Programme (PMGSY), with the objective of connecting all villages having populations over 500 by the end of 2007. Recently, Bharat Nirman, a time bound business plan was initiated to provide rural infrastructure during 2005-2009, in which rural roads was made one of the components and blended with the PMGSY programme. Besides providing connectivity to unconnected villages, it also aims to upgrade existing rural roads for overall road network development.

The major challenge before the country is both expansion of the network to connect all unconnected villages and to upgrade and maintain the existing village road network. As a strategy it has been suggested in the Rural Road Development Plan: Vision 2025 to introduce a Rural Road Management Act, which emphasizes:

- defining the powers, functions and obligations of the departments in charge of rural roads;
- creating a detailed data-base in the form of a register of all public roads at the block level;
- establishing serviceability standards of roads; and
- requiring an asset management system to be instituted

The PMGSY roads constitute only a small percentage of the total rural road network in the country. It is well known that rural roads are not properly maintained due to lack of funds and because they are not given the importance they deserve. Thus, while discussing sustainable rural roads maintenance, a number of issues are to be resolved with respect to how future maintenance can be funded and organized. Logically, the entire network should be considered, but the question becomes whether sufficient funds will be available over the years to maintain such a huge network. If only the PMGSY roads are maintained, the goal of providing complete access to rural areas is not achieved because very often accessibility to National Highways, State Highways, Major District Roads or the nearest towns is provided by PMGSY roads through Other District Roads, panchayat and various other kinds of local rural roads. Secondly, this lack of consistency regarding roads might create dissatisfaction in villages that are not connected by PMGSY roads. Thus, a number of issues need to be resolved before a proper sustainable rural road maintenance system is developed.

An attempt has been made in this article to suggest an institutional structure for the development and implementation of a rural road management system in India. Related issues have also been discussed.

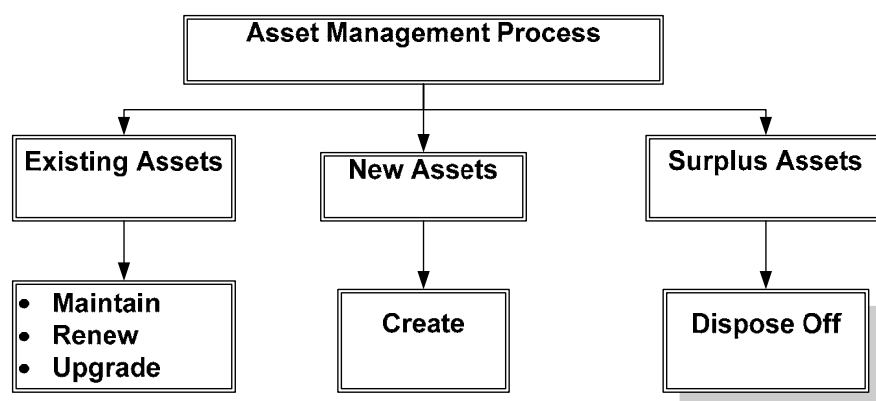
I. NEED FOR PROPER MANAGEMENT OF RURAL ROADS

The government has provided substantial funding for the development of a rural road infrastructure through various programmes since independence. Since 2000, high quality all-weather roads have been constructed under the PMGSY and the Bart Norman programmes. One of the conditions for the construction of these roads was that the maintenance for the first five years would be the responsibility of the concerned contractor. The state government had to give guarantees that they would be responsible for the maintenance of these roads after the initial five years. However, most of the state governments in India have problems in providing funds for road maintenance. The need for such maintenance has increased further as the newly constructed PMGSY roads are deteriorating faster than expected due to the diversion of heavily loaded vehicles on to these roads.

There were over 2.9 million km of rural roads in India in 2001. The huge wealth created in the country, at a heavy cost to the society, should be maintained and preserved adequately. The agencies responsible for providing these roads must maintain, improve and preserve this asset. At the same time, the financial and human resources needed to achieve the performance objectives of the road network are scarce and must therefore be managed carefully. Since these roads are under the scrutiny of the public and particularly the users of the asset, who increasingly demand improved levels of service, there is a need to develop an effective management system to improve efficiency, transparency and accountability in the management of rural roads. Some estimates put the replacement value of the existing rural road infrastructure in India at Rs.2000 billion (US\$46 billion). These assets are deteriorating every year. 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 per cent of the asset value (ILO 2005).

Maintenance of roads should be considered a part of the overall road asset management system. Asset Management may be defined as minimizing the life cycle cost of managing deteriorating road facilities, including construction costs, while maintaining the level of service provided to road users with limited financial and human resources, maintaining the existing road assets in good condition, and clearly explaining these activities to the public. The asset management process includes the maintenance, renewal and up-grading of existing assets; the creation of new assets and the disposal of surplus assets (Fig. 1). However, surplus assets are usually not observed in rural roads sectors in India where there is tremendous demand for the construction of new roads.

Figure 1. Maintenance as a component of Asset Management Process



II. OUTLINE FOR THE DEVELOPMENT OF A RURAL ROADS MANAGEMENT IN INDIA

Since the development of a rural roads management system would have complexities, attempts are to be made to take it step by step so that at the end an effective and robust system might be obtained. The possible steps involved in the development of such a system are shown in Figure 2.

Considering the fact that rural roads comprise a variety of roads under various departments of the government, the first thing to be decided for developing the maintenance management system is the smallest unit to be considered for this purpose. It may be at the block or panchayat or district level. However, for the effective implementation, a mechanism needs to be developed to integrate the smallest units to a larger unit to ensure uniformity and to guarantee the equitable distribution of funds. Sometimes, there is confusion as to whether a road is under the jurisdiction of the state PWD or the Panchayat or the municipality. The categories of roads to be included in the management system must be clearly defined and managed under the same administrative set-up.

Initially, it might be difficult to incorporate all of the various types of roads into the development of a rural roads management system. Therefore, the order in which each type of road is incorporated should be clearly identified. In the beginning, it would be wise to incorporate only those roads for which the organization already has a management system in place or such systems have been developed and applied in other places successfully. For example, extensive studies have been carried out all over the world on flexible pavement management systems, whereas enough work has not yet been done on the management systems for gravel roads, earth roads, shoulders, road side drains, road markings and other utilities.

One of the major steps for the development of a management system is to generate a comprehensive inventory of existing infrastructures, conditions and data collection and evaluation of assets. The success of the system will depend on effective data collection and analysis strategies. A comprehensive database can provide crucial historical information which includes year and cost of construction, materials used and other details including information on the asset's design, construction, repair and reconstruction. It might be difficult to gather historical information in the absence of well documented records. Therefore, in lieu of a highly sophisticated data-intensive management system, it may be more effective to utilize a simple system which can make use of the scant data which is available. The Geographical Information System (GIS) has been effectively used in various aspects of asset management, and can be used for the development of a spatial database and for the provision of a complete inventory of existing infrastructure. Spatial data would be collected from secondary sources and from surveys. This data would then be stored in the GIS database. The GIS provides the necessary programmes and tools for handling spatial data. Rajasthan and Himachal Pradesh, in India have already prepared detailed road inventories using the GIS platform. Since the road system of India has a large number of links and nodes, care should be taken to develop a standard method of labelling and numbering. In this way, even a small stretch of a minor road can be identified easily. The information regarding different elements of the assets should be entered in separate layers in GIS. This will allow each element to be studied independently, or compared and contrasted with other elements by integrating them using GIS. Facilities should also be encouraged to record data using popular software applications such as Microsoft Excel and Microsoft Access database, after they are made compatible with GIS software. A

simple flow diagram has been developed connecting the GIS data-base, model-base and the user-friendly interface as shown in Fig.3. The software should be developed in such a way that it would be easy for users to input the required data, understand the displayed output, and generate reports whenever required.

Since any road management system involves a variety of assets and a large amount of data, a platform should be developed, or chosen from an existing set of platforms, for clustering the components based on a few chosen factors. This will make the analysis simpler as a set of components would be represented by one factor. Different parameters would be used for clustering different assets or their components.

A rural roads management system should have; (a) relevant data to predict road performance, (b) access to estimated and actual costs of various assets, (c) the authority to make decisions regarding management and maintenance activities, and (d) a voice in projecting future budgets. Thus, it is necessary to develop a management system for each asset separately using the concept of life-cycle assessment. This would necessitate the development of performance models for each element. Theoretical scenarios would be generated to plan for the management of the assets on a long-term basis. The most challenging task would be to integrate all these individual management systems into a single management system when needed, in order to examine all the elements of the system. Currently, a number of methods, such as multi-criteria decision analysis, are being successfully used for decision making in such situations and should be used for the management system. The condition of cracks and potholes may be difficult to quantify accurately in the field and may be rated subjectively. Similarly, while making decisions, the importance or weight of various parameters may not be represented in absolute terms. As a result, some subjectivity is likely to be present. Thus, to make the management system realistic and effective, fuzzy multi-criteria analysis may be a more appropriate tool. While such techniques are currently quite common, their success and effectiveness depend primarily on how accurately input data has been collected. While developing the tools, there must be scope for continuous refinement and for the inclusion of the elements of the asset which were not included in the beginning.

Figure 2. Out-line for the Development of Asset Management System

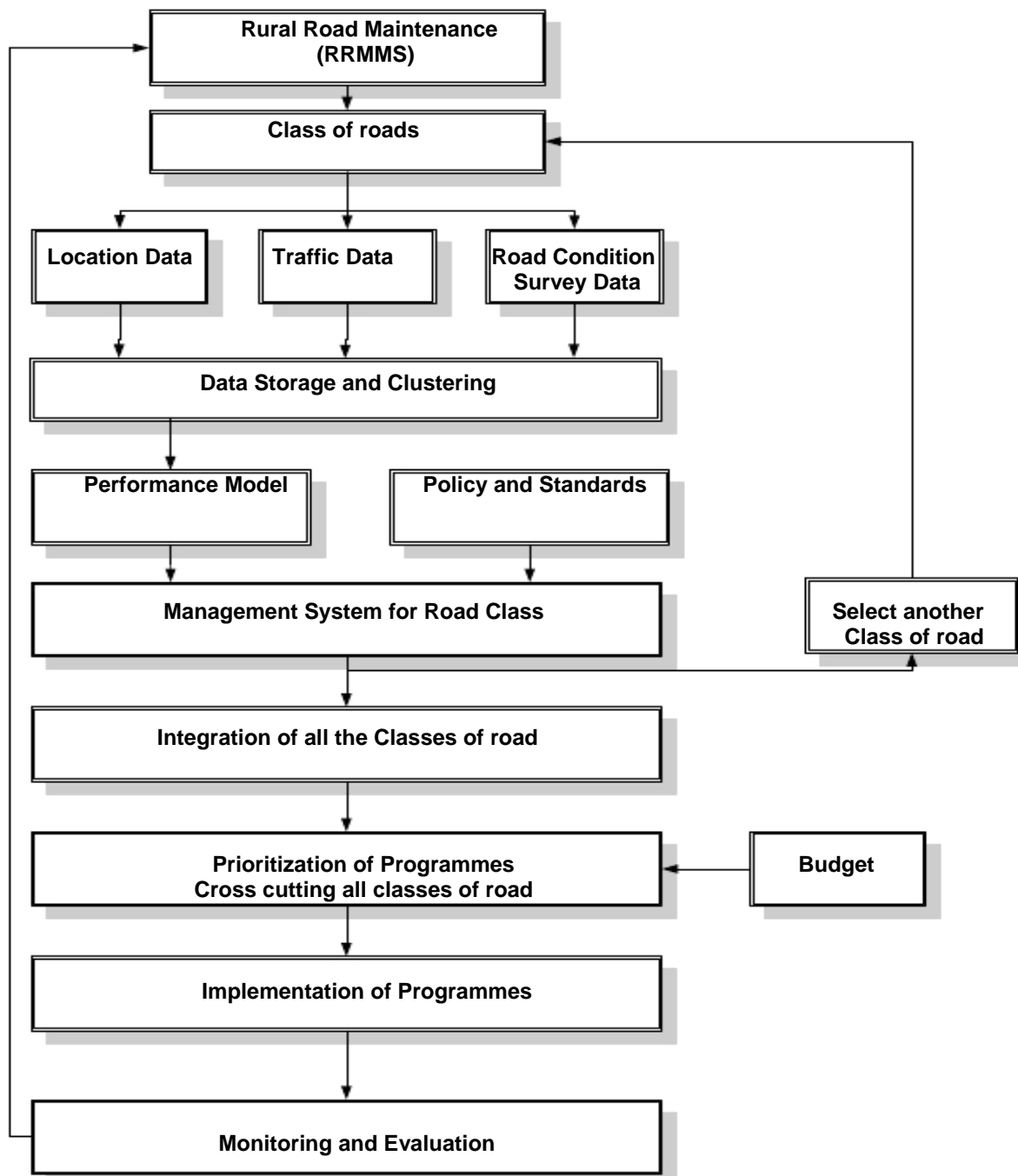
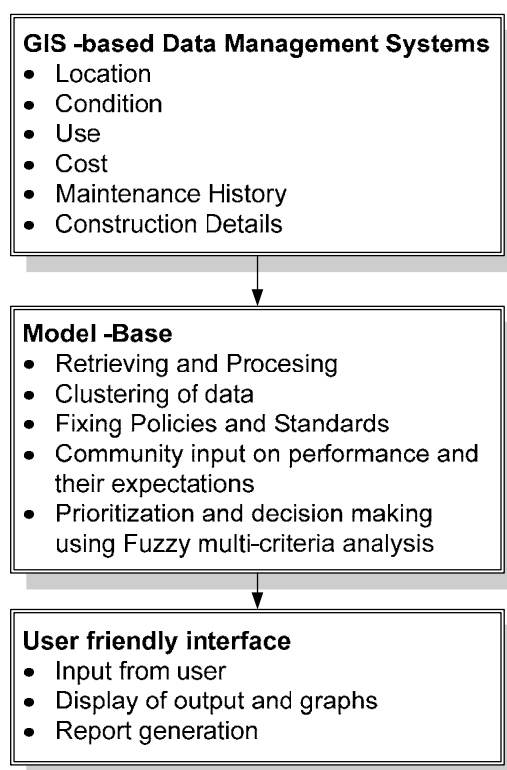


Figure 3. Interface between data base and output

III. TYPE OF MAINTENANCE OF RURAL ROADS

Rural roads may also be classified based on their surface composition, such as black-top, concrete, gravel and earth. Decisions will have to be made regarding whether these different types of roads should be put under the same management system. It may be appropriate to consider them separately and to develop separate maintenance management systems for them. Funds may be allocated separately for each one of them depending on length and requirements. This article has concentrated on black-top roads, the maintenance of which may be classified into categories such as routine, recurrent, periodic and emergency (World Bank, 1988; Lebo and Schelling, 2001; CNB, 2002). Routine maintenance involves small scale work carried out regularly with an objective to ensure passibility and safety of the existing roads in the short run and to prevent premature deterioration (Transport Research Laboratory, 1994). Typical activities in routine maintenance include drainage cleaning, carriageway repair, cleaning of silted ditches, grass cutting, pothole repair and bridge and culvert maintenance. The frequency of routine maintenance normally ranges between a week and a month.

Recurrent maintenance is required at intervals during the year depending on the topographic and climatic characteristics of the area as well as traffic volume. It mainly involves the maintenance of pavement, the filling of potholes and grading for unpaved roads.

Periodic maintenance covers activities on the road at regular but relatively long intervals. The aim is to maintain the structural integrity of the road (Burningham and Stankevich, 2005). Since these operations usually are large scale, requiring specialized equipment and skilled personnel, they require a proper system for identification, prioritization, planning and design.

Emergency repair is needed when roads are damaged due to disasters such as floods and earthquakes. Such repairs sometimes require special measures and skills as the damage needs to be repaired quickly in order to maintain supply in the affected area.

IV. STATUS OF RURAL ROADS MAINTENANCE IN INDIA

Maintenance of rural roads has never been a priority with most of the states in India, due primarily to a lack of adequate funds and the absence of maintenance management systems. A situational analysis conducted in Madhya Pradesh has concluded that very little road maintenance was possible due to lack of three elements – (a) proper funds, (b) proper policy and (c) a strong institutional framework. While the need for adequate funds was not in doubt, more critical institutional issues such as maintenance planning, maintenance management, the effective delivery of maintenance work and accountability of expenditure in maintenance needed attention (ILO, 2005). The situation is similar in nearly all the other states.

The Central Road Fund (CRF) established in 1930, and revitalized under the Central Road Fund Act of 2000, is targeted primarily towards the development and maintenance of National and State Highway networks and the construction of new rural roads. There have been efforts to create a State Road Fund (SRF) by states such as Assam, Kerala, Maharashtra, Rajasthan and Uttar Pradesh, with most of the remaining states moving towards the setting up of such funds. The SRFs are financed by multiple resources such as budgetary support from the central government, direct road user charges for access to fuel, motor vehicle taxes, fees and tolls, indirect road user charges and levies on agricultural products. Similar to the CRF, these road funds are normally used for both development and maintenance of road networks. However, considering the poor connectivity in rural areas, emphasis is usually given to road development and maintenance is neglected. Uttar Pradesh is the first state in India that has dedicated funds for road maintenance. It was established in 1998 and clearly specifies the source, collection, mechanism and management of the maintenance funds (Chandrasekhar and others, 2006).

Rajasthan has taken the lead in developing a system for the maintenance of rural roads. Total funds required for the period of 2005-10 was estimated and yearly budgetary allocations were provided from the SRF, non-plan heads of the state government and loans from the National Bank for Agricultural and Rural Development. The Public Works Department has also been developing a road maintenance management system and accordingly a package called the Road Maintenance, Planning, Budgeting and Programming System (ROMAPS) that has been installed in all the thirty three districts of the state. Necessary base data has been collected and a process developed to collect road distress data periodically. However, it will take some more time to become effectively functional.

V. INSTITUTIONAL ARRANGEMENTS FOR RURAL ROAD MAINTENANCE

Until now, various state governments have primarily given emphasis to the construction of rural roads under the PMGSY programme. It may be mentioned here that the programme developed is an in-built maintenance plan for five years, as the respective contractors were responsible for the upkeep of the road during that period. However, roads constructed during the initial phases have been completed for five years. There is now an urgent need to have a maintenance system in place so that these roads can serve the population satisfactorily until the end of their design life and so that funds are available for the rehabilitation or reconstruction of these roads in a timely manner. It is expected that the Panchayati Raj Institutions would maintain these roads.

There are different implementation arrangements developed in different countries for executing rural road maintenance. The effective execution of any of these arrangements requires an efficient management organization. There are a few possible solutions to finding an institutional framework for the provision and maintenance of rural roads:

National authority which delegates responsibility to states, districts and panchayats

The strength of this arrangement is that scarce resources for the maintenance of rural roads are consolidated into one organization. With limited budget and logistical support, this arrangement will succeed if local offices are set up at strategic locations along the network. This set up may be difficult to implement in a vast country like India. However, the same structure may be adopted at the state level with the responsibilities delegated to districts and panchayats.

Decentralized to local government authorities with technical unit in the local government administration

In such an arrangement a road works section would be established in each panchayat samithi or a panchayat. This would require the development of tremendous amounts of capacity building exercises. When works are managed at the local level, pressure from the local public holds authorities accountable and forces them to deliver.

Communities responsible for rural roads maintenance

Attempts have been made in this regard, mainly on a project basis, with mixed results. It would be possible to utilize workers in the community to perform preliminary level maintenance work. However, for slightly specialized work, there would be the need for a technically competent agency.

Suggested structure

Over the years, the planning, construction and maintenance of rural roads has been the responsibility of local governments. The PMGSY is the first centrally funded rural road development project being executed by state governments. This was a special scheme launched to provide accessibility to remote villages. However, the understanding was that the state governments would take up the maintenance of these roads. There are two problems in such an arrangement. The most important point is that the state governments do not have sufficient funds to maintain the

existing rural roads and the new roads will add extra burden on them. Secondly, the lack of man-power at the local government level makes the physical maintenance problematic. Thus before assigning the responsibility of maintaining the roads to the local or state governments, it is necessary to determine their fund generation capacity as well as the availability of man-power and expertise.

To make the process realistic, Merrilees and Huong, 2003 have suggested that routine and periodic maintenance may each be divided into two levels. Accordingly, Routine I is mostly labour-based, while Routine II requires a plant, materials and skills. Similarly, Periodic I is mainly concerned with spot improvement, where Periodic II involves full re-gravelling, re-sealing and major repairs. In this process, it may be possible at the local level to perform Routine I or even Routine II maintenance. However, periodic or emergency maintenance maybe need to be managed and funded from higher levels.

Such arrangements would require understanding between governmental departments at various levels, with the responsibilities of each clearly specified. A maintenance management system would be required in order to prioritize those stretches of roads involving all stakeholders.

A structure for rural road maintenance is being suggested (Table-1) in which Routine I maintenance, which is primarily labour-based and does not require any equipment or skill, has been assigned at the village level. The Panchayat would be responsible for Routine II maintenance. Similarly, Periodic I has been assigned to Panchayat Samity while Periodic II has been assigned to Zilla Parishad. Emergency maintenance may be taken up by Zila Parishad or the State Government, depending on the severity of damage and the funds required. Presently, the local level governments might not have the expertise or man-power to take on this work. However, assigning responsibility does not necessarily mean that the work must be completed by conventional means. Local level governments should investigate creative and innovative methods for accomplishing the work. Periodic and emergency maintenance require specialized equipment and skilled personnel. Therefore, Panchayat Samity and Zila Parishad may have to work closely with the Public Works Department. This arrangement is only a suggestion and may be finalized by the state authority based on discussions with the different levels of the Government and depending on the available competencies at each level.

Table 1. Proposed Maintenance Responsibilities of Rural Roads¹

Maintenance type	Responsibility
Routine I	Village
Routine II	Panchayat
Periodic I	Panchayat Samity
Periodic II	Zila Parishad
Emergency	Zila Parishad/ State Government

¹ In India the local grass-root level government system is known as Panchayati Raj system. The Panchayats are the basic units of administration and consists of a few villages. The Panchayat Samiti is local government body at the block level (consisting of a few panchayats) and at the district level it is called Zilla Parishad, All these local bodies are run by directly elected representatives at the respective levels with election being held every five years.

VI. METHODS OF ENGAGING THE COMMUNITY IN RURAL ROADS MAINTENANCE

While the responsibility of maintenance may be assigned to different levels of the Government, they may use innovative methods to perform their duties. However, it is always useful to involve community in the maintenance process, as they understand the need for well-maintained roads. Different methods have been used in a number of countries to cultivate this interest. For routine types of maintenance, the length man system, where small and manageable tasks are allocated to individual workers, has been tried successfully in a number of African countries. In this system, a labourer is hired for each section of road between one and two kilometres in length. A supervisor provides the worker with tools, while at the same time monitors the condition of roads, directs operations, makes reports and authorizes payment for satisfactory work. The lengthman system is desirable because continuous maintenance of the entire road may be guaranteed at all times. The system has been successfully used in a few African countries. A similar system has been adopted successfully in Bangladesh, where the work has been assigned to destitute women from the locality for a period of three years. A portion of each worker's daily wage is deposited into a bank account, and at the end of the three-year term the women are given their accumulated wages. This not only helps maintain the roads, it also serves society since these women usually start small businesses with the money they receive at the end of their term of work. Experiences from many parts of the world show that small private enterprises can produce quality maintenance work at lower cost than traditional direct labour forces employed by the state (ADB, 2005). In Peru, the routine maintenance of rural road networks is carried out by micro-enterprises (Ipingbemi, 2008). They are created, trained and contracted by the autonomous Rural Road Programme of Peru with the objective of guaranteeing year-round sustainability of the rural road network. The workers are selected from communities close to the stretch of the road concerned. They are responsible for routine maintenance such as the filling of potholes, the clearing of drains, culverts and other elements of the drainage system using basic hand tools. Major concerns when considering length man or other community contracting arrangements are; (a) the legal status of the individual workers and/or the communities, and (b) to what extent these workers can be held responsible when things go wrong. Integration of poverty-reduction objectives with rural roads maintenance will lead to a demand-driven participatory approach. When utilizing local workers in road repairs, scheduling of the work needs to be done with consideration for the rural labour cycle by scheduling work during periods when the poor labourers are not involved in agricultural or other activities. This will ensure that community participation is genuinely pro-poor and inclusive and will contribute to the sustainability of investment (ADB, 2005).

VII. ENSURING SUSTAINABILITY IN RURAL ROADS MAINTENANCE

When developing a sustainable system of road maintenance, it is necessary to approach the system from two different angles. The first is to develop guidelines, manuals, standards and policies that clear and well defined. This would ensure uniformity and eliminate confusion on the part of field engineers which would in turn minimize the time needed for decision making. Efforts have been made by the National Rural Roads Development Agency (NRRDA) and the Indian Roads Congress (IRC) in the construction of rural roads, but there is need for similar efforts towards the maintenance of roads. While sharing the experience of developing a rural roads maintenance programme in Viet Nam, Merrilees and Huong, 2003 suggested attacking the problem from two directions simultaneously; (a) top down support to the agencies towards improving guidelines, standards and policies, and

(b) bottom up support in building the ability of agencies to manage rural road networks.

Top-down support would require the following systems and procedures to be put in place:

- Maintenance manuals would be developed by the IRC in collaboration with the NRRDA and the Public Works Departments of various states. Considering the topographic, climatic and other variations of a vast country like India, special care would be taken to incorporate local issues into the manual.
- Technical training including training of trainers would be organized for disseminating the contents of the maintenance manual.
- A road asset management system for rural roads and a simple format for data collection would be developed.
- A communication network linking state agencies and panchayats would be created and implemented.
- Local level engineers would receive institutional support to design products with advice and support from technical support teams.

Bottom-up support would require the following systems and procedures to be put in place:

- A regional support system to deliver training, advice and capacity building to local authorities would be created.
- A situational review would be conducted, summarizing existing rural road networks, road management and maintenance policies.
- Maintenance workshops would be instituted for discussing existing situations/problems and suggesting solutions.

The most important aspect of ensuring sustainability is to develop ownership among the users of the rural roads. It is essential to involve the community in every aspect of a new road, from planning and design, to construction and maintenance. Efforts have been made in this direction in the case of the PMGSY roads with mixed success. Unfortunately, this degree of community involvement is usually not considered to be of value. However, if it was encouraged early on, perhaps less effort would be required later to elicit support from the community regarding road maintenance.

In India, it would be possible to implement the rural roads maintenance system provided it be linked with various poverty alleviation programmes initiated by the Government of India. A few years ago a massive poverty reduction scheme has been launched known as Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA) in which each household in the rural areas are being provided 100 days employment. The scheme has been extremely popular and thus is expected to be continued for years to come. If properly planned, rural roads maintenance may be made in-built in the scheme where the villagers will be trained in various aspects of rural road maintenance and then will be asked to maintain stretches of roads and they will be paid from the MGNREGA programme. Proper training of the villagers and monitoring of the quality of work are two vital components to make the programme successful.

VIII. ISSUES IN THE DEVELOPMENT OF A SUSTAINABLE RURAL ROADS MAINTENANCE SYSTEM

The following issues need to be addressed for the successful implementation of a rural road management system in India. There are many issues to be addressed and only the major ones are being highlighted below:

Classification of rural roads and bringing all of them under the same administration

In India, there are different kinds of rural roads and are being managed by various agencies and funding comes separately for each category. They may also be classified based on road surface. All the rural roads do not have the same function and do not have the same importance. Thus there is a need to classify rural roads depending on their functions and all kinds of rural roads need to be brought under one agency.

Decentralization of responsibilities

Road maintenance is a local activity and poor roads affect the local people the most. Thus it is reasonable to expect that decentralization of the responsibility for implementing maintenance of rural roads should include the local government at the lowest level. However, the responsibilities at each level must be clearly specified to avoid any confusion during implementation.

Details of asset features may not be readily available

Very often the essential features such as year of construction and the subsequent maintenance, reconstruction or rehabilitation details of the rural roads constructed long time back are not available with the concerned agencies. This makes the development of a maintenance management system quite difficult. Thus a framework is to be developed for rural roads maintenance that is simple and is based on the available data.

Development of manuals for rural roads maintenance

Since the engineers in charge of rural roads are usually not exposed to a systematic rural roads maintenance management system, simple manuals are to be developed for the field engineers, contractors and the community for different levels of maintenance work. In a diverse country like India it would help if they were made available in various regional languages.

Development of trained manpower

The government agencies responsible for the construction and maintenance of rural roads mostly do not have sufficient number of trained manpower and thus the existing engineers need to work in different sectors at the same time. Thus it becomes difficult for them to concentrate fully on one sector. Ideally separate units should be created for maintenance work only. However, at least dedicated units should be created for construction and maintenance of rural roads. They will be trained in construction and maintenance aspects of rural roads time to time. It has also been reported that the field engineers working in various departments at the state level transferred very frequently which affects the continuity of work. Thus it

must be ensured that the engineers are not transferred frequently so that their expertise gained through training programmes is gainfully utilized.

Development of small contractors at community level

Keeping in view the fact that there is shortage of skilled personnel at local government level, there will be need to involve the community in maintenance work. This will require the development of small contractors at local level. Since they are going to be the direct beneficiary of the roads, it is expected that their involvement and commitment will be of the highest order. In addition, the local community will be free to express their dissatisfaction if any to them freely and the contractors will be under pressure to perform at a desirable level.

Funding constraints and need for long-term budget strategy

Traditionally, the government agencies are not used to prepare budgetary requirements based on life-cycle cost, which takes care of maintenance and reconstruction of the asset on a long term basis. This requires a long-term budgetary strategy and keeping in view the usual funding constraints in the developing countries, proper plan must be prepared to educate the decision makers to make them aware about the importance of developing a maintenance management system for rural roads.

Involving the community

Any effort without the involvement of the community will be almost impossible to sustain and thus ensuring their involvement is going to be a big challenge. This will be particularly true for roads constructed earlier when no efforts were made to involve the community in the planning, design and construction stage. Suddenly asking for their participation at maintenance stage might not be acceptable to the villagers. Thus, special approaches must be developed of participatory planning so that the community willingly come forward for getting involved in the process of rural roads planning.

Schemes to include social development aspects

Sustainability will certainly be easier to achieve if direct and visible social benefit aspects may be included in the implementation of rural road maintenance by involving the poor people living below the poverty line. The government of India has many poverty alleviation programmes and they need to be oriented in such a way that rural roads construction and maintenance become a part of the project.

CONCLUSION

Maintenance of rural roads has been highly neglected over the years in India. However, with the huge programmes that have been undertaken in the recent years through PMGSY and Bharat Nirman programmes, it is but natural that maintenance of these assets be taken seriously, otherwise the country will lose huge amount of money in the end. The initiative has already been taken by the National Rural Roads Development Agency (NRRDA) in this regard. However, it will take some time to come up with a proper management programme as many issues are involved in terms of funding, division of responsibilities among various departments and levels of the government, training of personnel and development of manuals. There is need to learn from the experiences of other developing countries and efforts need to be made

to involve social development aspect in the maintenance of rural roads. In addition, the involvement of the community is to be ensured to make the rural roads maintenance sustainable.

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