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The Significance of Rural Road Constructions and their Importance in India

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Abstract: In this paper, the author has discussed the significance and importance of Rural Road constructions and development in India. 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.

1. INTRODUCTION

About 600 million people of India live in nearly 6 lakh villages scattered all over the country. Access roads provide the means to bring the rural population on to the main stream. Notwithstanding the efforts made, over the years, at the State and Central level, through different programmes, about 40% of habitations in the country are still not connected by all weather roads. As a Poverty reduction strategy, PMGY was launched as a 100% centrally funded programme for Rural Roads Development in India. The rural connectivity is expected to have many positive impacts on economy, agricultural, employment and social services to rural masses. India is distinguished for its geographical diversities with mountains, hills, rivers terrains, forest, wet lands, deserts and scattered habitations in remote areas. Also, there exists a wide range in the sub-grade soil types, rainfall, traffic pattern and availability of construction materials. These natural barriers create problems for developing a standard uniform technique to serve the requirements at all the sites. This requires adoption of different technologies based on site specific conditions.

For the construction of Rural Roads, Indian Roads Congress has brought out Rural Road Manual IRC SP: 20-2002 for design and construction. The design is based on the CBR value of the soil sub-grade and the 10 years projected cumulative traffic with an assumed 6% traffic growth per year. Based on this concept, normally two layers of WBM with 75 mm thickness is laid over the granular sub-base with suitable material having minimum 15% CBR. However, there are situations in many states where the prescribed standards are not available at normal leads resulting in longer haulage and higher costs. If the locally available materials, including marginal and industrial waste materials are utilized, it could be possible to reduce the cost of road construction. Several types of new materials are tried to establish the efficacy of new materials in road construction. However, the use of new materials and technologies is not becoming popular owing to certain procedural constraints as well as lack of awareness and therefore appropriate steps may have to be taken for popularizing the new technologies for building better rural roads with less cost. Adoption of such technique may also result in the conservation of natural resources, energy environment.

2. Importance of Proper Management of Rural Roads

The government has provided substantial funding for the development of a rural road infrastructure though 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.

Figure 1: A siteview of rural road in India

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.

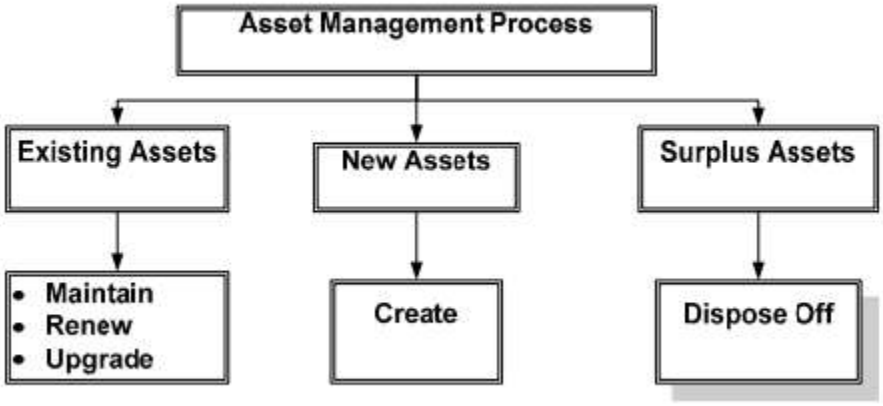

Figure 2: Maintenance as a component of Asset Management Process

3. Improvement Techniques for Rural Roads

One of the proven technologies for the use of local soil and marginal aggregates is stabilization. The stabilization can be mechanical or chemical and several types of stabilizing agents have proved to be suitable under different conditions of soil and environment. The soil stabilization techniques include:

- Stabilization with lime.
- Stabilization with cement.
- Stabilization with a combination of lime and cement

Even though specifications for soil stabilization are included in both MORT & H and MORD book of specifications their adoption is not getting popular, due to problems associated in attaining homogeneity of soil-stabilizer mix in the field and achieving the desired results. The only constraint in the use of the above techniques lies on the procedures adopted in the field. It is possible to popularize the use of stabilization techniques through appropriate training and capacity building of the field engineers. Further, development of low end technology equipment, for use in the rural roads also facilitates wider use of these methods. In addition to the above, several methods are being tried with the use of industrial waste by products in road building. The following are some of the important materials which have proved good.

- Fly Ash for the construction of the embankments and stabilization of sub-base and base-courses.
- Steel and copper slags for the construction of sub-base and base-courses.
- Marble dust in sub-grade and sub base.

Figure 3: Widening of rural roads

Though the construction of different elements of the road with Fly Ash has been successfully implemented, the use of other materials is not so widely adopted except for in plant roads. However, construction technologies with the use of such materials can also be successfully adopted, if the field engineers are properly trained. Studies were carried out on the use of waste materials like rice husk ash and lime sludge. These materials, if left un-used, may affect the surroundings and also create problem for their disposal. Use of those waste materials in road construction can alleviate the problem of their disposal to great extent. In India, studies were conducted at CRRI, IIT Roorkee and several other places for their use in stabilizing the soil. The results indicated that heir usage has great impact on the improvement of soil properties. The studies suggested that they are very useful for stabilizing clayey soils. The summary of the results indicate the following.

- Improve Atterberg limits to make soil suitable for road building.
- Increase the unconfined compressive strength of soil as well as CBR.

4. Various Technologies in Rural Roads Construction

There are several other techniques that can be adopted in conditions of low bearing capacity soils, marshy lands and location with drainage problems such as the use of geotextiles. Several types of geo-textiles including synthetic, jute coir etc. are proved to give good results and provide cost effectiveness for rural roads.

4.1 Use of Jute Geo-textile

Jute Geo-textile (JGT) is a kind of natural technical textile laid in or on soil to improve its engineering properties. It is made out of yarns obtained form the jute plant. Jute Geo Textiles have high moisture absorption, excellent dropability, high initial tensile strength, biodegradable and improved soil structure on degradation. The basic functions of JGT are separation, filtration, drainage and initial reinforcement. It is environment friendly. Jute Geotextiles can be more effective, eco-friendly and economical if used judiciously and jointly with other measures.

4.2 Flexible-Concrete Pavement Technology

IIT Kharagpur has developed a new technology for low cost cement concrete road construction, which has proved to be suitable in place of conventional CC roads for low volume traffic. Even though the initial cost of flexible-concrete road is high compared to cost of conventional flexible pavement, the life cycle cost with maintenance costs over a period of 10-20 years is less compared to the conventional one. The technology consists of placing a form work of plastic cells 150 x 150mm and 100mm deep over the prepared foundation of road and placing zero slump concrete in the cells and compacting with road roller/ plate compactor / earth rammer. On curing, a flexible-concrete pavement is obtained which will not wear even under iron tyred carts if aggregates of good quality are used. A model rode has already been constructed in a village close to IIT Kharagpur using the technology "IITGP_ROAD" Experimentation through pilot project for the "IITGP_ROAD" technology is being tried I the construction of the rural rods under PMGSY, so as to enable standardization and popularization of this cost effective solution.

4.3 Use of Waster Plastic Blended Bitumen

It is possible to improve the performance of bituminous mixed used in the surfacing course of roads. Studies reported in the used of re-cycled plastic, mainly polyethylene, in the manufacture of blended indicated reduced permanent deformation in the form of rutting and reduced low – temperature cracking of the pavement surfacing. Laboratory studies were carried out at the Centre for Transportation Engineering of Bangalore University, in which the plastic was used as an additive with heated bitumen n different proportions (ranging from zero to 12% by weight of bitumen) The results of the laboratory investigations indicated that, the addition of processed plastic of about 8.8% by weight of bitumen, helps in substantially improving the stability, strength, fatigue life and other desirable properties of bituminous concrete mix, even under adverse water-logging conditions. The additions of 8% by weight of processed plastic for the preparation of modified bitumen results in a saving of 0.4% bitumen by weight of the mix or about 9.6% bitumen per cubic meter of BC mix.

5. Role of 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. 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. In Haryana, the routine maintenance of rural road networks is carried out by micro-enterprises. They are created, trained and contracted by the autonomous Rural Road Programme 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 lengthman 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.

CONCLUSIONS

From the above discussions, the following conclusions can be drawn:

1. Simple tractor mounted agriculture equipment can be employed for construction and Economy in construction when aggregates are to be brought from far off distance as well as due to reduced thickness of sub base / base course.

2. Impedes widespread occurrence of dust from loose fine material in the surface of the soil roadways and reduces cost of construction by 15-20%. The roads constructed using Terrazyme minimizes the material loss of gravel from erosion or abrasion by the traffic on the soil roadways preserving original transverse section and slopes and impedes widespread occurrence of dust from loose fine material in the surface of the soil roadways.

3. The noteworthy feature of soil-Cement-Renolith Stabilization that it requires very little amount of aggregate, performs with increased life and reduced maintenance cost provide a good base for the field Engineers to experiment the construction of unsealed roads in rural areas and also in localities where aggregate are not available in normal leads.

4. The Jute Geo-textile strengthens the soil sub-grade by preventing intermixing of sub-grade and sub-base by acting as a separation layer and further it prevents migration of fines of a sub-grade by acting as a filtration materials. By the pilot project taken up under PMGSY, it is found that there is cost saving of about 12% in road construction.

5. The use of modified bitumen with the addition of processed waste plastic of about 8.0% by weight of bitumen helps in substantially improving the stability, strength, fatigue life and other desirable properties of bituminous concrete mix, resulting which improves the longevity and pavement performance with marginal saving in bitumen usage.

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