

# Rural Road Development

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### ABSTRACT

Rural roads are the tertiary road system in total road network which provides accessibility for the rural habitations to market and other facility centre. In India, during the last five decades, rural roads are being planned and programed in the context of overall rural development, and tried to provide all-weather connectivity with some level of achievement. The long term road development plans for the country provided policy guidelines and priorities for rural roads, while the funds for rural roads were allocated in the Five Year Plans.

Recently, during the last five years Government of India has undertaken a dedicated program known as 'Pradhan Mantra Gram SadakYojana(PMGSY)' to provide rural connectivity to all habitations under the Ministry of Rural Development. More recently, Bharat Nirman, a time bound business plan adopted to provided rural infrastructure during 2005-09, rural roads have been to upgrade the existing rural roads for overall network development which is a more objective approach.

To achieve the targets of Bharat Nirman, 1,46,185 km length of rural roads is proposed to be constructed to benefit 66,802 unconnected eligible habitations in the country. It is also proposed to upgrade nearly 1.94 lakh km length of th existing rural roads which are identified as the through routes of the coronet work. The total investment on rural connectivity under Bharat Nirman has been estimated at Rs. 48,000 crore during 2005-2009. Since 11th Five Year Plan (2007-2011) goes beyond the targeted period of Bharat Nirman, assessment of physical targets and up gradation requirements, have been estimated based on the experiences of PMGSY.

The financial requirement during the 11th Five Year Plan is estimated based on the physical targets proposed and an amount of Rs. 79,000 crore is required to fulfill the targets estimated for new connectivity and up gradation. For new connectivity alone, total amount required is estimated as

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Rs. 50,000 crore for construction of 1.65 lakh km length benefiting approximately 78000 habitations. The total estimated amount required for the upgradation of the existing rural

roads of about 1.16 lakh km requires about Rs.29,000 crore during the 11th Five-year Plan period as per PMGSY norms. In addition, State Governments have to borne for the additional requirement of up gradation and as well as periodic renewal of about 1.2 lakh km length of core network, which may be in the order of Rs.25,000 crore. For routine maintenance and periodical renewal of the core network, an estimated length of 1.4 million km identified from the district rural road plans (DRRP) needs Rs.1,40,000 million every year during the plan period.

## 1, INTRODUCTION

### Planning and Design

The DRRP and Core Network preparation in a master plan framework to be Continued in the 11th Plan and The network planning may be revisited and optimal network may be attempted in 11th Plan, including multiple connectivity, to avail circuitry of the network and integrated development objectives.

Pilot projects should be initiated to study and incorporate the functional accessibility based planning approach in special regions like Arunachal Pradesh, Jammu and Kashmir, etc, to select optimal routes for the settlements spread over a vast geographical area. Intra-village/habitation roads also should be considered with higher priority in 11th Five Year Plan, starting with villages having more than 1000 population.

GIS based database management should be created for all the States in phased manner based on the feedback from the Pilot Project in Rajasthan and Himachal Pradesh. The planning data at the block/district level should be updated every 3-5years and maintained as geo-referenced data. for implementation of rural roads in 11<sup>th</sup> Plan.

### Meeting of Working Group

The first meeting of the working group was held on the 9th August, 2006 at 2:30pm in UNNATI, Krishi Bhawan under the Chairmanship of Secretary, Ministry of Rural Development. In order to facilitate structured deliberations, a discussion paper was prepared based on the terms of reference, highlighting issues on the development of Rural Roads in the 11th Five Year Plan.

The working group, after deliberating the issues suggested to have more focus on the three areas (i) Planning and Design; (ii) Material, Construction and Maintenance (iii) Financial Aspects and recommended for the formation of two sub-groups one on 'Planning and Design of Rural Roads' and on 'Material, Construction and Maintenance of Rural Roads'. The members of the two sub-groups are given in Annexure 3.

The meeting of the first sub-committee on Planning and Design of Rural Roads was held on 28th August 2006 and the second sub-group on Material, Construction and Maintenance of Rural Roads met twice on 28th September 2006 & 11th October 2006.

The second meeting of the Working Group was held on 13th November 2006 and the issues were discussed. The working group recommended the preparation of draft final report with the issues and incorporating their recommendations of the sub-groups. Accordingly, the Working Groups report on Rural Roads in 11th Five Year Plan is structured as detailed in the following sections.

### **Rural Roads and Socio-economic Development**

Rural roads have been proved to be catalytic for economic development and poverty alleviation in rural areas; this objective should be pursued further with more vigor. In future, the target should be to connect all habitations with all-weather rural roads instead of fair weather roads which was done earlier.

In the context of formulation of the 11th Five Year Plan, it was decided by the Planning Commission to set up a working group on Rural Roads. Planning Commission (Transportation Division), Government of India vide memo No.18/3/2006 –TPT, dated 24th April, 2006 constituted the committee with Secretary, Ministry of Rural Development as Chairman and Joint Secretary, Ministry of Rural Development as Convener. The other committee members are given in Annexure 1.

Along with the constitution of the Working Group the Planning Commission has indicated the terms of reference whose details are given in Annexure

## **2, Overview of Development of Rural Roads**

During the early part of the century, it was realized that in order to achieve sustainable growth in agriculture and industrial sectors in India, the then Government of India appointed Jaykar Committee to advise suitable road policy for India. It was in the year 1943, a group of Engineers formulated the First Twenty Year Road Development Plan popularly known as Nagpur Plan (1943-1961) towards planning of the road system in India. Subsequently Bombay Plan, the Second Twenty Year Road Development Plan (1961-81) was formulated and recommended for implementation. In continuation, third Twenty Year Road Development Plan, known as Lucknow Plan (1981-2001) was conceived and implemented. The criteria, targets and achievement for road development laid down during these plans are

### **Historical Development**

Since 1940's the Government of India and the State Government had drawn several policies, programmers and conceived various schemes for the development of rural roads in India. The policies framed and targets were set under the long-term road development plans and accordingly funds were allocated in various rural development programmers/schemes under the Five Year Plans.

### **Socio-Economic Development by Rural Roads**

Rural roads are the basic infrastructure requirement and play a vital role unsocial-economic up liftmen of rural community. They contribute significantly in rural development by creating opportunities to access goods and services located in nearby villages or major town/market centers. Provision of rural roads increases mobility of men and materials thus facilitating economic growth. These, in turn, assist in reducing poverty and leads over all social development.

Several studies have already established that there exist a strong relationship between rural roads and socio-economic development. Hine (1982) reviewed several impact studies conducted in about 16 countries. Most of these case studies considered are optimistic about the relationship between road investment and agricultural development.

In India, even during the '80s, studies on socio-economic aspects of rural roads were conducted in selected nine districts under the aegis of Indian Roads Congress. The objective of these studies was to find out and quantify the possible impact of roads on socio-economic development in rural areas.

CRRRI(1987) carried out the compilation and analysis of the data for the nine districts, to quantify the aggregate impacts. Some of the findings are: (a) increase in agricultural production due to road facility, (b) increase in fertilizer consumption,(c) increase in non-agricultural activities, and (d) better utilization of existing facilities like, school, health, banks and post offices. Similarly, a socio-economic survey conducted in a remote area in India by CRRRI in 1989, showed that the villages located on the main road are comparatively well developed than those away from the road. The rural transport study carried out (NCAER and IIMB,1989) for two different periods in 1979 and 1989 revealed that after the development of rural roads, there was a change in transport modes in rural areas and also an increase in economic activities.

The economic analysis of rural roads carried out for selected rural road projects financed by World Bank in Morocco (World Bank, 1996) is one of the major studies which attempted to find out the rate of return on the investment made. The study quantified the benefits based on savings in vehicle operating cost(VOC) compared to the original i.e. unpaved roads. The economic analysis carried out for rural access project (World Bank, 1999) in Bhutan has shown significant transport cost saving. The mule transport costs are as high as 6times of truck transport cost. The net agricultural benefits, educational benefits and health benefits were calculated and added in the benefit stream. Recently, similar study by CRRRI (2001) has been carried out to conduct the comparative evaluation of rural roads. The major aim of the study was to compute the Internal Rate of Return (IRR) for the investment made on project roads constructed under the Agricultural Development Program (ADP) in Rajasthan. The benefits are estimated by taking net incremental agricultural production value, net agricultural transport cost savings and non-agricultural vehicle operating cost savings. The overall average IRR for the selected 21 road projects was found to be 15.64 per cent. In addition, this study results also showed positive Relationship between the road improvement interventions with socio-economic parameters.

### **Recommendations of National Rural Road Development Committee (NRRDC)**

Government of India constituted a National Rural Road Development Committee (NRRDC) during the year 2000 with an aim to provide connectivity to all unconnected villages. The Committee has also been

assigned to identify the road length required for total connectivity, the detailed specifications for construction of all-weather rural road, fund requirement and suggestions for implementation mechanism.

The committee has estimated that there are 2,90,480 unconnected villages arson 31-3-2000 and assuming a required length of 4.0 km per village, calculated the total road length required would be around 11,62,000 km to provide at least one connectivity to each of these villages. The estimated cost of connecting only the unconnected villages with black topped roads is about Rs.1, 11,000crore. A sum of Rs.1,79,200 crore was estimated for providing black topped road to the existing unconnected villages, black topping of present metal led all-weather road and for provision of major and minor bridges. Since a huge amount of fund is required, the Committee suggested phasing out the works.

The Committee has also suggested constituting a centralized agency at national level for raising and allocating of funds and a separate cell for managing the actual construction of rural roads in each district. The funds to be raised for the program are based on diesel cress, from development activities, issuing of tax-free bonds, and loans from domestic and external sources. It also suggested launching an Online Management and Monitoring System (OMMS) for effective implementation and monitoring of the program. In order to ensure speedy and systematic execution of the program, the Committee has suggested to the Union Government to set up 'National Rural Road Development Agency' (NRRDA).

The government accepted most of the recommendations and constituted a body empowered to chalk out the detailed program for development of rural roads. A special rural road development program known as 'Pradhan Mantri GramSadakYojana' was launched in December 2000 with an objective of connecting the unconnected habitations in a phased manner. The unit for connectivity has-been shifted from village to habitation to cover more people with accessibility

### **Recommendations**

Rural roads have been proved to be catalytic for economic development and poverty alleviation in rural areas this objective should be pursued further with more vigor. They are also essential for providing basic access to the services like health, education, administration, etc.



In future, the target should be to connect all habitations with all-weather rural roads instead of fair weather roads as was done earlier.

### 3, PLANNING, DESIGN AND MAINTENANCE MANAGEMENT FOR RURAL ROADS

#### Network Planning for Rural Roads

Rural roads are part of total road network system and basically consist of various categories such as National Highways, State Highways, Major District Roads, Other District Roads and Village Roads. As per the definition of Indian Roads Congress (IRC: SP: 20:2002) rural roads includes Other District Roads (ODR) and Village Roads as tertiary system for providing accessibility in rural areas. Rural roads, therefore, become links of a network, which facilitate the movements of persons and goods in an area. There are several other interconnecting routes also exists in rural areas. A road network, therefore, needs to be developed in such a way that the travel needs of the people in an area are met to the maximum extent in a collective way at the lowest cost of development. In rural areas major part of travel needs comprises of travel to market place, education and health centers. Planning of road system should always focus on spatial aspect of planning and should be integrated with other on-spatial socio-economic activities. Roads have to be planned and programd in such a way that all villages/habitations are connected in an Optimal way to achieve efficient flow of traffic and accessibility. The National Transport Policy Committee (NTPC, 1978) also proposed a network approach for planning and development of rural roads.

#### Intra-village Roads

Generally, it is known that travel needs of the different segment of rural population are different, and for poor and women the travel needs are mostly concentrated with the village/habitations to fulfill their basic requirements. These movements can be classified as intra-habitation and intra-village movements. The intra village/habitation road serves these purposes. Intra village road include the roads/tracks connecting different habitations within a revenue/census village, roads in the built up areas of a habitation and road leading to a facility location such as school, dispensary, drinking water, community centre,

etc located in the village. Therefore, the rural roads network development should also consider this component. Appropriate techniques and standardization for network planning, design, standards, specifications and quality assurance system should be separately identified since these roads are expected to carry very low traffic.

In some of the States, the Panchayat institutions are developing these roads under various wage employment/rural development program without adopting proper standards and design procedures. It is necessary to develop appropriate standards and specifications by keeping in mind that the roads constructed are amenable for stage constructing facilitating upgrading them at a future date.

It is suggested that the intra-village/habitation roads should be given priority in 11th Five Year Plan, starting the villages having more than 1000 population. The carriage way could be limited to 3 m with preferably cement concrete/brick pavement/block pavement depending upon the local conditions. Drainage should be give primary importance while constructing of these roads. On an average 3 km length may be taken per village with a cost of Rs.10-15 lakh per km for macro level estimation of resources.

#### Integrated Development of Road Network

The total road network of an area needs proper integration with necessary interfacing befitting the functionality assigned to a type of road otherwise the continuity of transport flows may get affected. Currently lot of emphasis is given for the roads providing mobility through program like NHDP for selected national highways, some state road program and rural access through PMGSY/Bharat Nirman. However, the intermediate category of roads belongs to State Highways (SH) and Major District Roads (MDR) are not receiving the emphasis they deserve. There should a balanced development approach for all type of road in order to achieve continuity in movement from rural habitations to market centers at local, regional and national level. The state agencies responsible for development of these roads should identify the gaps in the existing systems of roads and generally adopt the master plan (DRRP and Core Network), in order to achieve the integration. There is need for network structural analysis with assigned traffic flows for the



development of regional level roads comprising of Highways, MDRs and rural roads.

### Maintenance Needs and Criteria

Road maintenance is a routine work performed for upkeep of pavement, shoulder and other facilities provided for road users. The maintenance is essential to get optimum service from the pavement structure during its designed life. Time to time rational maintenance norms are evolved for rural roads these norms should be followed by the rural road executing agencies for better management of rural roads.

The current replacement cost of existing rural roads network according to the Rural Road development Plan Vision 2025 (draft), is estimated to be Rs.2,00,000 crore. Resulting loss in value of road assets due to non maintenance would be as high as Rs.10,000 crore per year equivalent to 50,000 km of road being eroded each year. Therefore the assets created have to be maintain still its design life. Routine Maintenance Priority will be based on the following criteria.

## 4, MATERIALS, CONSTRUCTION AND QUALITY ASSURANCE TECHNOLOGY

### Pavement Materials

Recognizing that the rural roads are essentially low cost roads, the specifications for pavement materials in various layers should be as economic as possible, consistent with the traffic expected to use the road and the climatic condition. In this angle, the local materials which are cheaper and involve minimum haulage should be used to maximum extent feasible. A detailed mapping of these local materials has to be carried out using the satellite image processing and remote sensing technologies. The soil and materials maps further can be updated based on the data obtained from the DPRs prepared for the implementation of PMGSY projects since 2001.

### Construction Methods and Technology

Road construction techniques have been constantly upgraded and use of new and alternative materials as well as modern equipments is advocated for all types of roads. It is logical to see that the purpose of road construction is to provide a firm, durable and even surface of pavement, which could stand the stresses imparted due to traffic and climatic conditions. The construction techniques for rural roads could be

broadly classified as: (i) conventional, (ii) mechanized and (iii) intermediate.

Since rural roads are to be considered as engineering assets, they are required to be properly designed and constructed with high quality. This can be achieved only if proper use of high end equipment for bulk construction of road works.

### Need of Quality Control in Rural Roads

Quality control refers to the practice of checking the quality of a product by testing samples. Since large investments are being made in the rural roads now, it is desirable that good quality roads are constructed meeting the laid-down standards and specifications for durable assets. State Governments should develop a Quality Assurance system covering all the aspects of Rural Roads. Over a period of time, the sector should move towards Total Quality Management (TQM) as practiced universally.

Quality is always appreciated at citizens' level also, and a mechanism may be evolved for their participation in this effort. This, in turn, will bring in more transparency and objectivity to the effort of quality assurance.

### Quality in Planning, Design and Construction

In order to get a rural road of good quality, it is necessary to plan for quality right from the stage of surveys, investigations, design and preparation of Detailed Project Report (DPR). The engagement of the right personnel trained for the job and the use of the right survey and investigation equipment is a pre-requisite for obtaining a good quality DPR. As a part of the quality check, the DPR prepared are thoroughly scrutinized by the State Technical Agencies and are assured in convenience with the set guidelines, design standards and procedures. The construction of rural roads is generally taken up in stages depending upon different layers designed. In each stage the designated authorities are carrying out the quality control.

### Quality Control System

The Ministry of Rural Development has given a push to quality culture in rural roads construction by establishment of a three-tier system of quality control for the PMGSY roads during construction detailed as under:

(i) First Tier: At the local level, involving the contractor and the supervisory staff of Project Implementation Unit (PIU)



(ii) Second Tier: An independent check of the quality through periodic checks by State Quality Monitors (SQM), officers and agencies engaged by the State Government, independent of the PIU.

(iii) Third Tier: Independent inspection of works by National Quality Monitors (NQM), appointed by the Central Government out of experienced retired Engineers from the states.

For checking the quality of works, the standard bidding document clearly specifies establishment of field laboratories by the contractor, with the specified minimum testing equipment and facilities. Most of States have established the field laboratory, quality control laboratory and district level laboratories as per the provisions of the Rural Roads Manual. These laboratories are to be used hierarchically at district, region and state level for strict quality control regime. However, these laboratories are required to be strengthened with proper trained manpower and modern testing equipments.

## 5, RESEARCH AND DEVELOPMENT ON RURAL ROADS AND ROAD SAFETY ISSUES IN RELATION TO RURAL ROADS

### Issues in Research and Development (R&D)

Since rural roads have now been recognized as a major thrust area, in reference to rural development, the need for concerted R&D efforts aimed at evolving the most suitable and economical designs and developing appropriate technologies for construction, maintenance and rehabilitation of rural roads, cannot be overemphasized in the Indian context. The Highway Research Board (HRB) of the IRC will have to expand their activities and coordinate with the Ministry of Rural Development and CRRI to identify and priorities R&D projects in respect of rural roads. MORD can then assign area-specific R&D projects to the concerned States/UT. The task of analyzing the data obtained from the assigned R&D projects to different parts of the country can be carried out by CRRI jointly with the Regional R&D Institute/Labs in the various States. Essential pre-requisites for the success of such an R&D set-up include the needed facilities by way of well-equipped laboratories and experienced scientists carrying out the needed field and laboratory investigations, especially in the state laboratories.

### Budgetary Allocations

In view of the vital importance of R&D in the areas of planning, design, construction, maintenance and rehabilitation of rural roads, an appropriate

percentage of the amount of investment in rural roads may be set aside for R&D work. As has been the experienced in the developed parts of the World, R&D efforts do pay handsome dividends in the long-run by way of more cost-effective, performance-based designs and improved performance of rural roads, with prolonged life and reduced maintenance costs.

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An advanced center for knowledge/information on rural roads may be established within the IRC with support from MORD for facilitating development of database, further research, dissemination of knowledge and information on various aspects of rural roads (planning, engineering, construction, maintenance, etc.) The IRC should also continue to network with existing national and international agencies concerned with rural roads.

## CONCLUSION

### 1. Rural Roads and Socio-economic Development

Rural roads have been proved to be catalytic for economic development and poverty alleviation in rural areas; this objective should be pursued further with more vigor. In future, the target should be to connect all habitations with all-weather rural roads instead of fair weather roads which was done earlier.

### 2. Planning and Design

The network planning may be revisited and optimal network may be attempted in 11th Plan, including multiple connectivity, to avail circuitry of the network and integrated development objectives.

### 3. Material and construction

Low cost marginal and industrial waste materials may be promoted for rural road construction; necessary design and specifications be developed. The standard construction technology should be used for ensuring quality of construction; however, wherever possible labor based construction methods also may be adopted to create employment to the local people. But, it must be emphasized that

employment generation is not the focus of rural road programs.

Many lower cost technologies like soil stabilization is not used often due to lack of appropriate mechanical devices; such shortcomings must be removed by appropriate developments for machineries.

#### 4. Maintenance Management

Since the roads are to be owned by the Panchayat Raj Institutions (PRIs), a community based maintenance program may be adopted with hierarchical arrangement with District Program Implementation Units (PIUs) for higher level maintenance while routine maintenance being the responsibility of PRIs.

#### 5. Quality Assurance

Durable assets can be created by ensuring the quality; this has been the prime objective of PMGSY. Very high standard of quality has been set up for rural roads by this program, which must be maintained.

The three-tier quality control system adopted by PMGSY needs further strengthening for enhancing the capacity to meet the higher targets in the 11th Plan.

Both in construction and quality control, modern technology should be introduced for better results.

#### 6. Environmental and Social Issues

In all developments of rural roads the environmental issues must be safeguarded. Further, speedy construction to be ensured by direct participation of authority responsible for environmental clearances.

Impact of land acquisition, especially for the marginal farmers of specific states, be duly considered at the time of project development. The State Government may be required to compensate the affected person/family for the same in lieu of community objectives of the road.

Social impacts – both positive and negative be duly accounted in project preparation. Thus, like EMP, a SMP also be prepared with due compensation.

#### 7. Road Safety Issues

All safety engineering measures be built into the design (i.e. DPR) of the project roads. All designs must be safety audited.

A team of Road Safety Awareness Raisers (RSAR), constituted by members of village only, should be created by training so as to change the present situation to a culture of safe use of the roads in rural areas.

#### 8. Research and Development

R&D is an integral part of any development. Although rural roads were built for last 70-80 years in this country, its construction as engineering structure has just began. Therefore, huge amount of research is required for these low volume roads, which must attempt for low cost construction while ensuring quality.

It is proposed that the State Executing Agencies of rural roads shall make it possible to take at least 5% of the road works under R&D using cost- effective new materials, adoption of new technology and/ or new process which are likely to ensure R&D culture to the field engineers.

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